North Carolina State University

20th Annual
Undergraduate Research Symposium

April 12, 2011

10:30 a.m.-1:30 p.m.
McKimmon Center
March 21, 2011

Dear NC State Campus Community:

NC State’s faculty and students strive to solve problems and create opportunities that impact the economic development of North Carolinians, the nation and the world. One annual hallmark of how our land-grant, research extensive university contributes to the greater good of North Carolina and beyond is through the mentored research conducted by our undergraduate students. This value-added undergraduate educational benefit will be showcased at the NC State University Undergraduate Research Symposium, from 10:30 a.m. to 1:30 p.m., on Thursday, April 12, 2011 at the Jane S. McKimmon Center. Symposium participants will see first-hand how undergraduate students have created knowledge within their discipline and how, as young scholars, they have positioned themselves for advanced degrees and excellent employment opportunities.

We value the support of citizens (through tax dollars), corporate and government partners (through grants) and the support of donors which helps make possible our academic, research and extension initiatives...initiatives that have made NC State a national research power. That faculty embrace the importance of motivating young researchers in scholarly, independent work is part of the mission we embrace and applaud. We owe a tremendous debt of gratitude to the mentors (both faculty and off-campus scholars within government agencies and industry) for the leadership and guidance they provide our students each year.

Research at NC State is defined as discovery-, inquiry- and creativity-based learning. So, scholarship can and does occur in the laboratory, field, library, studio, and other settings that promote exploration. Whether creating knowledge, investigating controversy, seeking truths, or expressing new visual or performing art forms, our mentors are challenging undergraduate students in promising intellectual work. The results of their labor can be seen first-hand at this hallmark symposium.

Join me in applauding our undergraduate students’ achievements and the mentors who have guided them so well. As in the past, the quality of the students’ work and the experiences of having done it are likely to change their lives forever. We are, indeed, delighted to showcase their work in this Annual Undergraduate Research Symposium.

Sincerely,

Warwick A. Arden
 Provost and Executive Vice Chancellor
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## Poster Presentations
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**10:30 AM - 11:45 AM**

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Thomas Jackson  Integrative Physiology and Neurobiology; 
Taylor Jones  Human Biology  
Medical Assessment of Neurological Disorders: Parkinson’s Disease, Morgellons Disease, and Factitious Disorder  
Miriam Ferzli  Biology

A10  Camille Elizabeth Sluder  Chemistry and Biochemistry; 
Amanda Saad  Biology; 
James Arnold  Zoology; 
Tamara Estes  Biology  
Analysis of Haitian Clinic Files  
Gerry Lugnibuhl  CALS-Dean's Office and Staff

A11  Janet Rebecca Smith  Microbiology  
Biolog GENIII Study  
Cami Hartley  Division of Health & Human Services

A12  Celina Valletti  Polymer and Color Chemistry  
Biodegradation of PLA-based Films Under Composting Environments  
Richard Kotek  Textile Engineering Chemistry and Science

A13  Joel E Anderson  Computer Science  
A Visualization Interface Design for Wide-area Monitoring of Electric Power Systems  
Aranya Chakrabortty  Elec & Comp Engineering

A14  Alexander William Mauney  Physics  
The Effect of Finite Source Size on Supernova Neutrino Flavor Twinkling  
Jim Kneller  Physics

A15  Siddhartha Kollipara  Chemical Engineering  
Effect of High Pressure on the Gravimetric Sorption of Ethoxylated Biopolymer Blends  
Richard Spontak  Chemical and Biomolecular Engineering

A16  Kimberly Anne Phillips  Chemical Engineering, Paper Science Engineering  
Creation of a Plastic-like Material from Tobacco Stalks  
Med Byrd  Forest Biomaterials

A17  Katelyn Tracy Molloy  Biological Sciences  
Characterization of a novel ovary lipoprotein receptor that binds vitellogenins in fishes  
Craig Sullivan  Biology

A18  Hayley L Hedges  Microbiology  
Characterization of transgenic tomato plants with reduced inositol trisphosphate signaling  
Imara Perera  Plant Biology

A19  Kelly A Fitzwater  Paper Science Engineering, Chemical Engineering  
Investigation of the conversion of waste paper material to fermentable sugars for ethanol production  
Richard Venditti  Wood And Paper Science

A20  Heidi Elizabeth Klumpe  Chemical Engineering  
Histamine as potential intercellular signaling agent for stem cells  
Robert Grossfeld  Biology

A21  Julia Carina Frei  Biochemistry  
Troubleshooting Expression and Purification of Bacillus subtilis Regulatory Protein, YwcC  
John Cavanagh  Biochemistry

A22  Alyssa Ann Abramsky  Biochemistry  
Mouse IgG2b monoclonal antibody in prevention of IgE binding to canine mast cells  
Bruce Hammerberg  Department of Population Health and Pathobiology

A23  Margaret Elaine Anderson  Animal Science  
Identification of Important Human Birth Defects in Pigs  
Joe Cassady  Animal Science

A24  Myrna Janay Braxton  Animal Science  Laboratory Stress in the Rat  
Tammy Stoker  Endocrine Toxicology
A25  Matthew Kyle Tucker  Human Biology  Synthesis of Alkyne Functionalized Polycarbodiimides to Incorporate Bioactive Molecules by Click Chemistry  Bruce Novak  Chemistry

B1  Kelsey Marie Sikes  Microbiology  Sarah Whalley  Biological Sciences; Alexa Martin  Human Biology; Hanan Busealah  Biochemistry; Khryystyna Stolyarchuk  Biochemistry; Bishal Johal  Human Biology  Malnutrition in Haiti  Gerry Luginbuhl  CALS-Dean's Office and Staff

B2  Kayla Nicole Claassen  Biochemistry  Emma Craven  Biology/Nutrition; Amanda Antono  Biological Sciences; De'Ja Alexander  Biological Sciences; Brittany Lang  Human Biology; Allison Hofmann  Applied Nutrition Science; Sydney Riggsbee  Nutrition Science applied; Tayyaba Rayyast  Biological Sciences; Mariam Rashid  Human Biology; Lindsay Speir  Human Biology; Mark Herring  Biology; Alex Perez  Human Biology; Grace Lee  Human Biology; Lauren Little  Human Biology; Allion Rhodes  Human Biology; Hope Hendricks  Biology; Stacey Neil  Nutrition Science applied  Who's responsible for your health? Influences on the Health Behaviors of NCSU Students  Suzie Goodell  Food, Bioprocessing & Nutrition Sciences

B3  Jessica Hansen Kruse  Microbiology  Determining how Preschool-age Children Express Meal Termination Cues  Suzie Goodell  Food, Bioprocessing & Nutrition Sciences

B4  Kennedi Nichole Miller  Human Biology  Campylobacter jejuni motility  Jonathan Olson  Microbiology


B6  Garrett Richard Wydysh  Biology  Inorganic and Organic Compounds Affect the Body in Dynamic Ways  Miriam Ferzli  Biology

B7  Ryan Andrew Jones  Sport Management  Health and Well-Being of Southeastern Conference Football Fans  Michelle Harrolle  Parks, Recreation & Tourism Mgt

B8  William Henry Kohlway IV  Microbiology  Potential Effect of Homing Endonucleases on Genome Heterogeneity in Mycobacteriophage Mutaforma13  Eric Miller  Microbiology; Eric Mayer  Microbiology; Susan Carson  Plant Biology

B9  Matthew S Geisz  Biology  Examples of Genetic Research: Impacts and Applications  Miriam Ferzli  Biology

B10  Christopher Allen Kilgore  Chemical Engineering  Template Polymerizations on a Surface  Jan Genzer  Chemical and Biomolecular Engineering

B11  Asia Jacqueline Murphy  Wildlife Sciences  Small Mammal Community Response to Climate Change  Rob Dunn  Biology
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C2  Allison Katherine Dipper, Biological Sciences - Human Biology, Biological Sciences - Nutrition Sciences; Christopher Dunham, Nutrition Sciences; Sydney Riggins, Nutrition Science  Preschool Education in Agriculture/Nutrition Sciences (PEAS): The Development of Early Childhood Nutrition Intervention Curriculum  Suzie Goodell, Food, Bioprocessing & Nutrition Sciences

C3  Eric Scott Rountree, Chemistry  Liquid-Liquid Phase Transitions: Hydrates of Copper(II) Chloride  James Martin, Chemistry

C4  Kayla Melissa Fleetwood, Animal Science  Scrotal Circumference has Slight Correlation Between Weaning and Yearling age in Beef Cattle  Joe Cassady, Animal Science

C5  Sally Jane Petre, Environmental Science: Ecology  An assessment of mercury in economically important fishes commonly landed off the coast of North Carolina  Derek Aday, Biology

C6  Cody Allen Melton, Physics  What Drives the SASI in Core-Collapse Supernova?  John Blondin, Physics

C7  Brittany N Balhouse, Biomedical Engineering  Multiscale interactions of Mechanics, Microstructures, and Composition of Heart Valve Tissues  Hsiao-Ying Shadow Huang, Mechanical & Aerospace Engr; Lianne Cartee, Bio & Agri Engineering

C8  Mary Hunt Lewis, Plant Biology  The role of sexual reproduction in natural populations of Aspergillus flavus  Ignazio Carbone, Plant Pathology

C9  Daniel David Wooten, Nuclear Engineering  RF Atmospheric Plasma Based Air Filtration Using Porous Metals  Steven Shannon, Nuclear Engineering

C10  Caitlin Chandler Vincent, Interdisciplinary Studies  Converging Diets: The Influence of Globalization on Human Nutrition  Nora Haenn, Interdisciplinary Studies

C11  Kristen Ashley Bogue, Biology  Training Procedures and Application of Supplemental Information for Teaching Assistants  Sarah Ash, Food, Bioprocessing & Nutrition Sciences

C12  Sarah Kaitlyn Long, Chemical Engineering  Comparison of Gene Regulation in Drosophila CNS and Trachea  Patricia Estes, Genetics; Eric Fulkerson, Genetics

C13  Miranda Lynn Mikesh, Geology  Geophysical Analysis & Hazard Assessment of the Hunga Volcanic Province, Tonga  DelWayne Bohnenstiehl, Marine, Earth & Atmospheric Sci

C14  Heather Christine Vaughn, Electrical & Computer Engr  Characterization and Emulation of the Memristor  Subhashish Bhattacharya, Elec & Comp Engineering

C15  Phillip Harvey Phipps, Physics  'Tidal' hypothesis and Superhump Phenomenon  John Blondin, Physics

C16  Andrew David McEachran, Environmental Technology  Toxicity of Weathered Fuel Product to Hydroponic Trees  Elizabeth Nichols, Environmental Technology
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D9  Tracy Lynn Turnbull  Agricultural Education & International Studies  Globally Engaged Agriculture  Ron Campbell  Agri & Resource Economics

D10  Thea Esme Roper  Chemical Engineering  Cell Culture Techniques  Christine Grant  College of Engineering-Dean's Office

D11  Matthew Riley Huston  Graphic Design  Human-Centric Design: Observations Within Community  Denise Crisp  Graphic Design


D13  Donna Kimberly Dang  Biochemistry  Kinetic Activity and Stability of Dehaloperoxidase Mutant, F21Q  Stefan Franzen  Chemistry

D14  Kareem Carrington Clark  Biochemistry  The Role of ATP in Axon-Glia Intercellular Signaling in Optic Nerve  Robert Grossfeld  Biology

D15  Shana T. Wilson  Biology  An Environmental Justice Case Study of the New Hill Wastewater Treatment Plant  Tuere Bowles  Education

D16  Miranda Croft Lemyre  Poultry Science  Development of Recombinant Turkey Astrovirus Expression System  Matthew Koci  Poultry Science

D17  Ryan John Blair  Civil Engineering  Fat, Oil, and Grease (FOG) Abatement from Food Service Establishment Wastewater: Comparing Current Practices with Engineering Design  Tarek Aziz  Civil Engineering

D18  Taylor Brooke Hodgin  Biology  Student Perceptions of the Usefulness of Training Videos for Preparing them to Teach Nutrition Education in the Community  Suzie Goodell  Food, Bioprocessing & Nutrition Sciences

D19  Joshua Michael Souther  Food Bioprocessing and Nutrition; Joshua Sutton  Food Science; Alden Larrabee  Bioprocessing Science; Nicholas Butterbaugh  Bioprocessing Science; Ryan McMurry  Food Science  High Concentration Formulation of a Spray Dried Protein Product  Brian Farkas  Food, Bioprocessing & Nutrition Sciences

D20  Daniel Ellis Carta  Wood and Paper Science  Cell Morphology of Genetically Modified Cottonwood With Reduced Cellulose Content  Ilona Peszlen  Wood And Paper Science
D21  David Settle Reid  Biomedical Engineering & Chemistry  Engineering Zebrafish Novel-Immune Type Receptor 9 Expression to Suppress Cytotoxic Signal Transduction Pathways  Jeffrey Yoder  CVM-Molecular Biomedical Science

D22  Abigail Megan Rife  Animal Science  MHC-I Protein Expression in Bony Fish and its Role in Cell Immunity  Jeffrey Yoder  CVM-Molecular Biomedical Science

D23  Brandon J Eudy  Chemistry  Dendritic Encapsulation of Iron Sulfur Cluster  Christopher Gorman  Chemistry

D24  Justin Ryan Rothrock  Biological and Agr Engineering  Carbon Neutral Weed Suppression System  Matthew Veal  Bio & Agri Engineering
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Cassandra Ferring  
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Taylor Treadway  
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Seb Prohn  
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Jessica Fox  
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M. Cade Thorne  
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Adam Kincaid  
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Ricardo Maggi  
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Lacey White  
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Michelle Borges  
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Brooke Reimer  
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Jason Hescheles  
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Kent Green  
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Robert Baty  
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B22  Rikki Lyn Horne  
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C6  Phillip Nathaniel Pressley  Civil Engineering  Assessing the Environmental Implications of Current Fat, Oil, and Grease Disposal Practices  Tarek Aziz  Civil Engineering

C7  Jordan Leigh Kennedy  Animal Science  Intestinal Villus Structure and Epithelial Cell Morphology in Nursery Pigs Exhibiting Peri-Weaning Failure to Thrive Syndrome (PFTS)  Adam Moeser  CVM-Food Animal Eq

C8  Elizabeth Alaine Moody  Biomedical Engineering  Standardized method for segmenting and registering the human rib cage from CT scans  Lianne Cartee  Bio & Agri Engineering

C9  David Sterling Abuin  Genetics  The Use of Performance Enhancing Drugs  Michael Goshe  Biochemistry

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Abstracts

College of Agriculture and Life Sciences

Session 2, C9
The Use of Performance Enhancing Drugs
David Sterling Abuin Genetics
Soham Savani Microbiology;
Jennifer Keith Biological Sciences;
Nicollete Honeycutt Biological Sciences-Human Biology;
Justyne Hammond Microbiology;
Mohamad Haidar Biochemistry;
Bruce Ballenger Biological Sciences;
Joshua Stanley Biological Sciences-Human Biology;
Elizabeth Green Biochemistry;
Laura Icenhour Biological Sciences-Human Biology;
Alison Mitchell Biological Sciences - Human Biology Concentration;
Jessica Piner Zoology;
Charlotte Rastas Biological Sciences with Human Biology Concentration;
Brandon Carlisle Biological Sciences with Human Biology Concentration;
Ronnie Shammas Jr. Human Biology
Mentors and/or Co-Authors: Michael Goshe Biochemistry

Performance enhancing drugs are used in sports and other recreational and competitive activities, including academics. These substances are used to improve an individual’s overall ability and give them the competitive edge necessary to be the best. Some of the various types used are anabolic steroids, human growth hormone, diuretics, beta-blockers, and amphetamines. The focus of this literary research was anabolic steroids, their detection, positive and negative side effects, government regulation, and the motivation behind their usage. Anabolic steroids have positive effects that include an increase in muscle growth and can be used for other medicinal purposes. Some of the negative side effects of anabolic steroid usage can be life threatening because of the cardiac effects and other non-life threatening effects include stunted growth, decreased natural testosterone secretion, and accelerated hair loss varying in men and women. Current detection methods may include sampling of blood, urine, and hair; however, these methods are continually evolving and improving. The World Anti-Doping Agency and the International Olympic Committee work together to regulate the usage of these drugs in their respective areas. There are numerous ethical implications involved with performance enhancing substances that are based on personal moral values and fairness in competition.

Session 1, D8
BRCA1 and BRCA2 GENE MUTATIONS and INCREASED RISK OF BREAST CANCER
Obed Kwame Agyei Biology
Mentors and/or Co-Authors: Miriam Ferzli Biology

Breast Cancer affects nearly 273,000 people every year in the United States, and women account for almost 95% of the individuals affected. Private companies and the U.S. government spend almost $1 billion on breast cancer research annually to improve its diagnosis and treatment. Breast cancer is a complex, deadly disease highly associated with genetic abnormalities. Since there are numerous types and sub-types of breast cancer, it is very difficult to understand the basic cause of the disease. The objective of this paper is to review how genetic abnormalities correlate with different types of breast cancer. Research in this field has led scientists to determine the main types of breast cancer that manifest in humans and the genetic causes that lead to these manifestations. Much of the research in this field involves experimentation with genes. BRCA1/2 genes were examined among patients with breast cancer and those without the disease. DNA analysis of BRCA1/2 genes was performed. Majority of the patients had mutations on the BRCA1/2 genes while the control group showed no sign of genetic mutations. Mutations of the BRCA1/2 genes are typically hereditary, but other factors such as radiation can trigger mutations. Types of breast cancer are associated with the part of the breast whose cells are being transformed due to mutated genes, either being the ducts, lobules etc. Further elucidation of the affects of mutated BRCA1/2 is essential for understanding human breast cancer manifestations and future treatment of this complex disease.

Session 1, D6
Putative bacterial genes in the genome of mycobacteriophage Mutaforma13 suggests lateral gene transfer and a potentially broad host range
Kimberly Allison Amick Microbiology
Alicia Hilliard Mathematics;
Meredith Wojcik Biological Sciences- Ecology, Evolution, and Conservation Biology;
Christine Zabel Biological Sciences- Ecology, Evolution, and Conservation Biology
Mentors and/or Co-Authors: Susan Carson Plant Biology
Eric Mayer Microbiology;
Eric Miller Microbiology
Lateral gene transfer is a key mechanism for the exchange of genes between organisms. We isolated the mycobacteriophage Mutaforma13 from a soil sample by enrichment on the bacterial host Mycobacterium smegmatis as part of the Phage Hunters First Year Inquiry course BIT/MB 210. We sent the genomic DNA to DHMRI for sequencing and then annotated the genome based on coding potential, BLAST analyses, and protein family function. Many of the genes predicted in Mutaforma13 had sequence similarity to other mycobacteriophages, particularly those in the F1 subcluster. The Mutaforma13 genome also contains a substantial number of genes, which when analyzed by blastp or blastn, had significant sequence similarity with proteins and genes of various bacteria. These bacteria include Mycobacterium avium, M. abscessus, Streptomyces spp., and Arthrobacter spp., microbes that can be found in similar soil environments to M. smegmatis. The presence of several genes with sequence homology to diverse bacteria in the Mutaforma13 genome implies that Mutaforma13 may also infect these other bacterial hosts. Further studies can be done to discern whether Mutaforma13 has a wide host range. This may give insight into the importance of lateral gene transfer in the evolution of bacteria, Mutaforma13 and other bacteriophages.

Session 2, D26
Hofmeister effects on the stability of soluble whey protein isolate aggregates
Aaron Russell Anders Bioprocessing
Mentors and/or Co-Authors: Edward Foegeding Food, Bioprocessing & Nutrition Sciences

Stability of whey proteins in thermally processed beverages near neutral pH is a concern among producers. A technology was recently developed in our laboratory to produce whey protein soluble aggregates with improved heat stability in the presence of salts at neutral pH. The current study was conducted in order determine the effects of salt concentration and type on the stability of whey protein isolate (WPI) soluble aggregates formed under different heating conditions. Turbidity (optical density at 350nm) and absorbance at 280nm were used to measure changes in solubility and denaturation. Soluble aggregates formed using high heating temperature (140°C) for a short amount of time (60-90 s) showed greater salt stability than those formed using lower heating temperature (90°C) for a long period of time (10 min). The effects of sodium citrate and sodium chloride in solution were observed. Sodium chloride required higher concentrations, near 1M, to begin to affect the stability of the WPI soluble aggregates. Sodium citrate caused a salting-in effect at concentrations in the 0.1M range, and salting out at concentrations >0.5M. These results can be explained by the Hofmeister series which predicts that the anion citrate will be more of a salting-out ion than chloride, supporting the results that more sodium chloride is needed to cause destabilization of the whey protein soluble aggregates. When trying to optimize stability in protein beverages, a high heat treatment for a short amount of time should be used, and chloride will result in less destabilization compared to citrate.

Session 1, A23
Identification of Important Human Birth Defects in Pigs
Margaret Elaine Anderson Animal Science
Mentors and/or Co-Authors: Joe Cassidy Animal Science

Structural birth defects can significantly inhibit fetal development and survival. Due to morbidity and mortality in humans suffering from these defects, it is important to develop an appropriate animal model for research. The objective of this project was to establish a swine model to advance research of congenital, structural birth defects in humans. Defects of interest were craniofacial clefting/cleft palate, congenital diaphragmatic hernias, myelomeningocele (spina bifida), heart disease and obstructive uropathy. Working in conjunction with the University of Rochester Medical Center and an industry cooperator a model was developed for identification of rare congenital defects in pigs. The strategy was to dissect only pigs that were stillborn or who died in the first 48 hours. The benefit of this strategy is it minimized the number of dissections while screening a large pig population. Pedigree information is then utilized to identify and purchase animals that produce progeny with an increased incidence of defects, as they would make ideal parents to generate the production of biomedical lines of animals.

Heritabilities of defects were estimated using SOLAR and were found to be significant only in heart defects thus far (h2 = 0.31, P < 0.046). This lack of significance of heritabilities for other defects may be attributed to the relatively low numbers of defects observed at this point. In conclusion, our model allowed us to efficiently screen a large pig population and identify families with higher than expected rates of congenital defects to use for the production of animal models.

Session 2, C12
The Effects of Maternal Obesity on Offspring
Jennifer Brooke Beane Animal Science
Tayla Cunningham Biological Sciences-Human Biology;
Nicola Maher Animal Science, Sci;
Alexis Gomez Animal Science, Sci;
Kaitlin Redmond Biology;
Ashley Kirby Zoology
Mentors and/or Co-Authors: Scott Whisnant Animal Science

Epidemiological studies have shown that in the U.S., 31% of the population is obese. Obesity is a chronic condition that increases the risk of developing disorders such as high blood pressure, diabetes, cardiovascular disease, and cancer. This growing epidemic has caused an increase in the prevalence of cardiovascular diseases and metabolic disorders, such as diabetes. The number of obese women giving birth in the U.S. has grown by 60% from 1990 to 2004. According to the “fetal origins of adult disease hypothesis,” obesity during gestation can alter the healthy organ development of the fetus, which may have postnatal implications. Mothers providing an obeseigenic environment, in utero, predispose their offspring to metabolic conditions programmed into their genome as a result of placental programming. Maternal obesity can hinder the proper development of fetal organs, resulting in postnatal dysfunction of key organs. Obesity in mothers before and during gestation expose the
offspring to increased risk of becoming obese, as well as increased risk of developing metabolic diseases such as type two diabetes and cardiovascular diseases later in life. Through our research, we intended to review negative health effects of maternal obesity on the environment in utero and postnatal consequences.

Session 1, D12
Youth Work and Injury: Can Social Network Videos Illuminate a Public Health Problem?
Jenna M Beck Biological Sciences: Integrated Physiology & Neurobiology
Monica Tadros Biological Sciences;
Lindsey Pandorf Biological Sciences;
Jaies Kunnappillil Biochemistry;
Derick Jones Biological Sciences;
James Hampson Biological Sciences;
Mary Fletcher Biochemistry;
Cody Evans Biological Sciences;
Jarrett Clifton Psychology
Mentors and/or Co-Authors: Michael Schulman Sociology And Anthropology

The majority of teens in the United States work for pay outside the home at some time during their high school careers. Teen workers are clustered in service and retail jobs. During 1998-2007, 5,719 young workers (aged 15-24 years) died from injuries at work. In this exploratory project, we investigate how internet social media are used to communicate health messages about youth work and injury. After reviewing several social media web sites, we selected videos posted on YouTube and other internet video sites. Using Google Video as the search engine, we identified a set of possible relevant videos (72) using “youth job injury”, “working teens”, and “teen workers” as the search terms.

Preliminary screening to remove duplicate and irrelevant videos resulted in a list of 21 videos. Using content analysis methodology, we coded their content. We found that many of the videos were from youth advocacy organizations and contained health promotion messages about being safe at work. Some videos were from individuals and contained personal stories about injury. Others provided information on the benefits of youth employment. It appears that some health and safety organizations are using social network video websites to promulgate public health messages about youth safety at work. However, it is difficult to judge the effectiveness of these videos in terms of health promotion and health communication about workplace safety for working youth.

Session 2, D13
Wastewater Treatment Wetland in Pilot Mountain State Park
Erin M Bennett Biological and Agr Engineering
Mentors and/or Co-Authors: Mike Boyette Biological And Agricultural Engineering

The Pilot Mountain State Park in western North Carolina is open year round to tourists, campers, and hikers. To treat the municipal waste produced, the park has an on-site wastewater treatment plant permitted to treat 10,000 gallons per day. The effluent from the package treatment plant is currently discharged into Grassy Creek, which is classified as a Water Supply IV stream and contains several sensitive species of animals and plants. The pollutant and nutrient levels of the treated waste meet state requirements, but the park would like to reduce them further to set an example and be good stewards to the environment. Of greatest concern are the nitrate levels being released which have been observed to be up to 30 times greater than that of the receiving body of water. The design team was asked to design a tertiary treatment system to further treat the effluent before being introduced to Grassy Creek. To address this issue the team designed a wastewater treatment wetland which utilized the maximum amount of available space and made design decisions to minimize cost. For the design candidate, the average annual projected nitrate reduction from a maximum observed influent concentration of 30.6mg/l is 23.7mg/l, a reduction of 77.5%. Additionally, nitrate reduction is expected to be as high as 99.3% in the warmest month and 48.1% in the coldest month. The annual average nitrate reduction is projected to be 6.9mg/l, a reduction of 76.9%.

Session 1, C11
Training Procedures and Application of Supplemental Information for Teaching Assistants
Kristen Ashley Bogue Biology
Mentors and/or Co-Authors: Sarah Ash Food, Bioprocessing & Nutrition Sciences

An introductory nutrition class requires students to write six thought-provoking response papers on topics related to nutrition. Due to large class size (approximately 400 students) the instructor must use Teaching Assistants to help with the response paper grading. However, because the papers are designed to get students thinking and therefore do not always have right or wrong answers, grading can be challenging. This study will investigate the training methods and supplemental information provided to Teaching Assistants before and during their grading of student response papers. During the first semester, Teaching Assistant training methods and supplemental information were analyzed by each Teaching Assistant and reported on throughout the semester. Teaching Assistants preferred having a “cheat sheet” to follow and a better understanding of the grading rubric. From these results, a new training program was created along with other supplemental materials. During the second semester, the new training program was implemented and Teaching Assistants were once again asked to evaluate its effectiveness. Based on the responses, Teaching Assistants were pleased with the use of “cheat sheets”, accessible supplemental information on Moodle, and a handout that simplified making grade submissions. Some areas of improvement could still be in establishing a time management process for grading, changes in Teaching Assistant submission deadlines, and simplified or more direct response paper questions to allow for better student understanding. The results obtained from this study will be used to create further changes in training for Teaching Assistants.
Session 2, C28
Dietary effects on tissue gene expression of a multi-drug transporter knockout mouse treated with low dose arsenic
Alan Joseph Bohn Genetics
Mentors and/or Co-Authors: David Threadgill Genetics

Little is understood about how the type and amount of dietary polyunsaturated fatty acids alters the toxicity of chemicals, such as arsenic, that are found naturally in food and water sources. Inorganic arsenic is associated with an increased risk for adverse health outcomes including obesity, type II diabetes, and several types of cancer, and is thought to perturb DNA methylation, resulting in changes to basal gene expression. This study examines how dietary fat can affect arsenic toxicity by identifying changes in gene expression in the liver and kidney of exposed mice. Male and female FVB mice were treated with either a low fat or high fat diet containing low dose sodium arsenite for 10 weeks. mRNA was isolated from the kidney and liver for microarray analysis using the Affymetrix Mouse Gene ST 1.0 array. We performed analysis of variance (ANOVA) to identify genes that are significantly differentially expressed by diet and treatment. We found that within groups there was a large degree of variation in response to low dose arsenic, and further that dietary fat content was able to significantly alter gene expression patterns. These data suggest that diet can play an important role in modifying tissue response to arsenic.

Session 1, A24
Laboratory Stress in the Rat
Myrna Janay Braxton Animal Science
Mentors and/or Co-Authors: Tammy Stoker Endocrine Toxicology

Potential stress caused by different animal manipulations was examined by measuring the plasma corticosterone levels in the rat. Corticosterone is a steroid hormone released from the adrenal cortex involved in regulating stress response and is used as a biomarker to evaluate stress in laboratory rats. The relationship between gavaging and/or moving animal cage racks were the examined stressors. When a rat is gavaged a tube is inserted through the esophagus and into the stomach. Female Wistar rats were divided into three test groups (n=7): gavaged, moved, gavaged + moved, and a control group that was neither gavaged nor moved. Controls and gavaged animals were habituated to a holding room 24 hours prior to the experimental start. Animals in the gavaged only group were sham gavaged; moved animals were wheeled down a corridor from the animal room to a holding room; the last group contained animals that were gavaged in the animal room then wheeled to the holding room. Trunk blood was collected from all groups via decapitation 15 minutes after manipulation. Serum corticosterone was measured by radioimmunoassay. Corticosterone levels were significantly higher in the gavaged and gavaged + moved groups (P<.001). No significant difference existed in the comparison between the gavaged and gavaged + moved groups (P>.05). This study demonstrates that gavaging can induce stress in the rat thus raising corticosterone levels and interfering with the physiological endpoint; hence it is an important component to consider when designing a study.

Session 1, C17
Leptin and Leptin Receptor in the Mozambique Tilapia
Emily S Brune Biology
Mentors and/or Co-Authors: Russell Borski Biology

Leptin (Lep) is a small cytokine produced by adipose tissue in mammals. Primarily known for its regulation of appetite and energy status, leptin is considered a pleiotrophic hormone, and thus may have other unknown functions. Additionally, the role of leptin and its putative receptor (LepR) upon energy balance is virtually unknown in non-mammalian systems. This study was conducted to characterize the molecular sequence of Lep and LepR in the teleost fish, Mozambique tilapia, and to determine the expressional profiles of both genes. Using data compiled from RT-PCR amplification, a tissue distribution profile for Lep and LepR was performed. As in mammals, Lep expression was observed in adipose tissue, however in tilapia the predominant site of leptin expression is the liver. LepR expression was detected in all tissues sampled, including the gill, and this may suggest pleiotropic actions for this hormone in teleosts that may include regulation of salt and water balance. Additional analysis, involving Northern Blots of selected tissues are ongoing to determine if multiple transcript variants or gene homologs may exist for both Lep and LepR.

Session 1, B17
Effects of housing on stress levels in boars
Kelly Ann Bryant Animal Science
Mentors and/or Co-Authors: William Flowers Animal Science

Different methods of animal housing and their effects on the stress levels and comfort of the animals have been recently debated between scientists, animal activists, and in various animal industries. Past studies have explored the effects of different housing enclosures for cattle on reproductive performance and various measures of stress including hair growth. Our study focuses on the effect of housing on semen production and quality, libido, and several measures of stress, such as increased hair growth and blood Cortisol levels in swine. A total of fourteen boars were randomly assigned to one of two housing options, pens or crates. Crates were 7 ft. long by 3 ft. wide and are current housing choice for boars in the swine industry. Pens were 8 ft. long by 6 ft. wide. The entire study will take place over 30 weeks. Every ten weeks, the housing environment of the boars will be switched- boars in pens will be moved to crates and vice versa. Libido and semen production are measured.
weekly while blood and hair samples, body weights, and several aspects of social behaviors are evaluated every five weeks. Libido and sperm production data presented in this abstract are from the first ten week period. Boars housed in pens had statistically lower reaction times at 2.1 ± 0.3 seconds compared to 4.4 ± 1.0 seconds for the boars in crates. Boars in pens were also found to have a higher sperm concentration at 316.0 ± 8.2 (sperm x 10^6/mL) while those in crates were only at 290.4 ± 7.5 (sperm x 10^6/mL). Housing boars in pens versus crates appears more advantageous with higher boar libido and sperm concentration, but additional data continues to be collected.

Session 2, D12
Identification of genes encoding light-activated toxins in the banana pathogen Mycosphaerella fijiensis
Shante Sherelle Bryant Biochemistry
Mentors and/or Co-Authors: Margaret Daub Plant Biology
Sonia Herrero Plant Biology

Bananas and plantains are highly valuable commodities and constitute a subsistence crop in developing countries. The causal agent of Black Sigatoka in bananas, Mycosphaerella fijiensis, causes significant yield losses, and is related to pathogens from the genera Cercospora, Cladosporium and Elsinoe known to produce light-activated toxins that play an important role in disease development. Symptom severity of Black Sigatoka increases under light, suggesting the involvement of a light-activated toxin. This research project focused on determining if M. fijiensis produces a toxin similar to the toxin cercosporin produced by Cercospora fungi. Using a bioinformatic approach, we identified gene clusters in the M. fijiensis genome similar to those in the cercosporin biosynthetic pathway in Cercospora nicotianae. These genes are being characterized by functional complementation of strains of C. nicotianae mutant for the CTB (Cercosporin Toxin Biosynthesis) genes by determining if expression of the M. fijiensis genes restores cercosporin production when expressed in these mutant strains. This research focused on two of the CTB genes: one encoding an O-methyltransferase (CTB2) and the other a FAD-oxidoreductase (CTB7). The M. fijiensis genes were cloned into a plasmid and transformed into CTB2 and CTB7 mutants of C. nicotianae. Cercosporin is red, thus complementation can be visually assayed by the presence of a red pigment. Some colonies recovered from transforming the C. nicotianae CTB7 mutant with the M. fijiensis CTB7 gene produced a red pigment. Further analysis is needed to confirm complementation. Mutant strains transformed with the CTB2 gene will also be examined.

Session 1, A1
Effect of exogenous enzyme and DFM supplementation on growth and disease vulnerability in broiler chickens based on ileal IL-10 and INF-gamma mRNA expression patterns
Mary Patricia Bullin Biology
Mentors and/or Co-Authors: Chris Ashwell Poultry Science

Rising feed costs and global demand for poultry products challenge commercial poultry producers to utilize dietary manipulation to decrease illness through exogenous enzyme and direct-fed microbial (DFM) supplementation. Utilizing focused microarray analysis and real-time PCR quantification of interleukin (IL)-10 and interferon-gamma (INF-gamma) mRNA expression patterns in broiler chickens, we compared ileal gene expression in control, exogenous protease, exogenous protease/amylose/xylanase enzymes and/or a DFM treatment in the presence of Clostridium perfringens (CP) disease challenge. Birds receiving the DFM treatment had higher body weights than both the no-enzyme supplemented Control, and treatments supplemented with enzymes alone. Using a mixed-model ANOVA, 8 differentially expressed genes were identified by the microarray approach. MetaCore pathway analysis of these genes identified processes involved in signal transduction, carbohydrate metabolism, and cell death. The expression of INF-gamma and IL-10 was also affected by dietary treatment. Our results suggest enzyme supplementation increases animal performance as well as negative inflammatory and immunological effects, while supplementation with DFM decreases these impacts.

Session 2, B18
Developing a novel method for ameliorating red wine spoilage caused by Brettanomyces bruxellensis
Adam L Bumgarner Food Bioprocessing and Nutrition
Julie Steinberg Food Science;
Kaitlyn Panetta Food Science;
Aaron Massey Food Science
Mentors and/or Co-Authors: Brian Farkas Food, Bioprocessing & Nutrition Sciences
Trevor Phister Food Science

Brettanomyces/Dekkera bruxellensis, a spoilage yeast commonly associated with red wine, metabolizes p-coumaric acid into the spoilage compound, 4-ethylphenol (4-EP). 4-EP contributes potent and undesirable aromas that have been likened to horse sweat, Band Aid, barnyard, and burnt plastic. Several methods of reducing wine spoilage by B. bruxellensis have been tested in the past, however these have been found to be ineffective or unrealistic in industry. The use of inactivated yeasts to adsorb chemical compounds in solution is a novel approach to bind undesirable compounds. The goal of this study was to assess the ability of inactivated B. bruxellensis spp. to sequester the spoilage precursor compound p-coumaric acid and thus reduce red wine spoilage. By binding and removing the precursor p-coumaric acid, the potential for 4-EP spoilage decreases. Effects of inactivation method and yeast strain on binding ability were tested. Yeasts cells were inactivated by the following three methods: Boiling, 70% ethanol, and Zymolase 20T. Two strains, UCD VEN 2077 and UCD VEN 2092, were selected based on their ability to convert p-coumaric to 4-EP. Binding was assessed by suspending inactivated cells in solution with p-coumaric acid and sampled for HPLC-DAD analysis. If successful, this novel method would provide the wine industry with a new tool for controlling spoilage caused by B. bruxellensis.
Multiple-locus variable-number tandem-repeat analysis (MLVA) is a fast, robust, and reliable method for subtyping strains of bacteria. The foodborne pathogen, *Listeria monocytogenes*, remains a leading cause of food-related illness. Symptoms of listeriosis include sepsis, meningitis, and stillbirths. However, *L. monocytogenes* lineages can be difficult to trace, as outbreaks frequently involve a small number of cases over large geographical areas. MLVA has been implemented to identify strains of *L. monocytogenes* and trace the pathogen’s evolution. MLVA analyzes the number of repeats in several genetic locations (loci) which harbor tandem repeats. Earlier MLVA analysis revealed surprising diversity at one locus (LM-23) from a major epidemic clone, epidemic clone II (ECII). To characterize this diversity, LM-23 was amplified by PCR and sequenced from twenty-one strains of *L. monocytogenes*, including nine ECII strains. Sequenced data was aligned and analyzed for the number of times a repeat motif occurred at LM-23. The findings confirmed that ECII strains exhibit several alleles at LM-23, and that nucleotide repeats corresponded to dipeptide repeats (DA) in the coding sequence of a cell-wall-associated protein. In contrast, other clonal groups were highly monomorphic at LM-23, suggesting that the observed diversity among ECII strains may be driven by currently unidentified selective pressures unique to the ecology or reservoir of this epidemic clone. Regardless of the reasons, the observed diversity may be utilized for high-resolution subtyping of strains within this major epidemic-associated clonal group of *L. monocytogenes*.

**Session 2, B23**

**Diversity in a cell wall-associated protein among strains of a major epidemic clone of the foodborne bacterial pathogen, *Listeria monocytogenes***

Nicholas J Butterbaugh  
*Bioprocessing Science*

Mentors and/or Co-Authors: Sophia Kathariou  
*Food, Bioprocessing & Nutrition Sciences*

My research hypothesis is that grooming of *Heliothis virescens*.

For my research I will be performing both behavioral and chemical analyses on *Heliothis virescens*. My research hypothesis is that grooming of the antennae helps to maintain surface chemistry on the antenna. This keeps the antenna clean and prevents a decrease in sensory acuity. The research will be divided into two parts; identification of grooming structures and the study of the amounts and ratios of chemicals when the structures are removed.

Observations indicate that the forelegs are used for grooming the antennae. To test this I will ablate the forelegs as my test group. Additionally I will ablate the midlegs of a separate set of moths to act as a negative control along with moths that have no ablations. The moths will be ablated and then kept for 24 hours. At the end of the 24 hours I will place the moths in an ice bucket for 30 minutes. Then the moths will be placed under a dissecting microscope and the antennae will be removed and placed in a conical glass vial. I will extract the hydrocarbons with hexane, which will then be allowed to evaporate and replaced with octane. The octane solution will be injected into a gas-liquid chromatograph for analysis.

Additionally I will use a microscope to observe the area of the forelegs that is used for grooming. I will then take Scanning Electron and standard optical microscopic pictures to describe any structures that might be related to grooming.
Mycobacteriophage Mutaforma13 contains a conserved beta-lactamase gene

Joshua Russell Chappell Microbiology
Iara Calil Genetics;
Anna Knight Biological Sciences, History;
Hannah Berry Biochemistry
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During the fall 2010 semester, students in the Phage Hunters first year inquiry course isolated a novel bacteriophage, Mutaforma13, and annotated its genome, revealing the presence of a beta-lactamase gene at the gp19 location. Beta-lactamase is produced in some bacteria, providing antibiotic resistance by breaking the beta-lactam ring found in penicillin and other beta-lactam antibiotics. The host bacterium for Mutaforma13, Mycobacterium smegmatis, is naturally resistant to penicillin which presents new questions as to the function of gp19. Phamerator, a genome annotation program, identified a homologous gene in a syntenic location of the genome in related phages of the F1 subcluster. The Mutaforma13 beta-lactamase gene has a high level of sequence similarity with 9 other phages, including several members of the F1 subcluster and one member of the J cluster, suggesting possible evolutionary relationships. New experimental ideas to explore gp19 function include obtaining a mutant strain of M. smegmatis that is sensitive to penicillin. The mutant strain can be used to determine if Mutaforma13 confers resistance to penicillin in M. smegmatis. New insights into emerging antibiotic resistance in related pathogenic bacteria (i.e., M. tuberculosis) may be gained by exploring the phage-mediated transfer of the beta-lactamase gene in M. smegmatis.

Yeast Removal from Spoiled Pickle Brine Solution

Michael Chen Food Bioprocessing and Nutrition Science
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Pichia manshurica and Issatchenkia occidentalis are yeast strains responsible for pickle brine spoilage. In 2010, Mt. Olive lost over $1MM from treating over 400,000 gallons of spoiled brine. Reducing the concentration of yeast cells to below 1,000 CFU/mL in spoiled brine will allow it to be reused in pickle fermentations, thus reducing the environmental impact and profit loss for pickle companies. The effects of HCl and NaOH on the viability of I. occidentalis and P. manshurica in YM Broth as a method to reduce cell concentration below 1,000 CFU/mL were tested. Samples of each strain were adjusted to a pH of 1, 2, 10, and 11 and held at 30 degrees C. Cells were plated at time points of 0, 1, 2, and 3 hours to measure cell viability. Initial concentrations of P. manshurica for pH 1, 2, 10, and 11 were 5.39E+06, 4.03E+06, 8.46E+06, and 1.50E+07 CFU/mL respectively. Final concentrations were 2.96E+06, 6.59E+06, 6.27E+06, and 1.49E+07 CFU/mL for pH 1, 2, 10, and 11 respectively. Initial I. occidentalis concentrations for pH 1, 2, 10, and 11 were 6.33E+06, 1.61E+07, 1.54E+07, and 1.26E+07 CFU/mL. Final concentrations for I. occidentalis were 1.21E+07, 1.10E+07, 1.40E+07, and 1.25E+07 CFU/mL for pH 1, 2, 10, and 11 respectively. HCl and NaOH were found to be ineffective at reducing yeast strain concentration to 1,000 CFU/mL at any level of pH treatment.

Treatment of Alzheimer’s Disease by Gene Therapy and Viral Vector Delivery of Neurotrophic Factors

Andrew Tinlee Chen Biological Sciences
Mentors and/or Co-authors: Patricia Estes Genetics

Alzheimer’s disease is a serious neurodegenerative disorder characterized by dementia, typically beginning with subtle memory loss and gradually becoming increasingly severe; eventually incapacitating. Alzheimer’s cases are divided into two forms, Early onset Alzheimer’s disease (EOAD) which occurs in individuals between the ages of 30 and 60/65, and Late onset Alzheimer’s disease (LOAD) which occurs in individuals ages 60/65 and older. 94 to 99% of all Alzheimer’s cases are classified under LOAD, and according to the Alzheimer’s Association, it is the seventh leading cause of death with mortality rates on the rise. Currently, there is no cure for Alzheimer’s disease, but there is treatment to slow its progression. More recent studies of Alzheimer’s disease are now looking towards the involvement of chromosomal genes in its development. The Amyloid precursor protein, or APP, gene and the MAPT gene, involved with the formation of neurofibrillary tangles, are the two major genes thought to be associated. Another result of Alzheimer’s disease is the shrinking of the cerebral cortex due to massive neural cell loss. Studies are also currently looking to stop neural cell death by the delivery of neurotrophic factors, via viral vectors, which are involved in the maintenance of neuronal growth and development. Although, these areas of study are currently hypothetical and at early stages of clinical trials, a breakthrough has the ability to significantly change the lives of those affected.
The socio-ecological model states that an individual's health behaviors can be affected by the individual himself, as well as the individual's family and roommates, community, and environment. To determine perceived factors that influence NC State students' eating behaviors, we interviewed 17 males and 17 females and analyzed transcripts for recurring themes. Individual factors included television, genetics, knowledge from classes, internal discipline, and self-satisfaction. Family and roommates were both a positive and negative influence. Community influences included going out to eat, classes, cooking, and exercising. Environmental factors included availability of fast food, availability of health food, availability of a gym and the childhood environment. Following up with the subjects in the future could yield more useful results. This research can be used to develop quantitative studies in the future to determine if the factors we found are regional trends and if other universities have similar trends.

Session 1, D14
The Role of ATP in Axon-Glia Intercellular Signaling in Optic Nerve
Kareem Carrington Clark Biochemistry
Mentors and/or Co-Authors: Robert Grossfeld Biology

Glial cells of mammalian central nervous tissue respond to ATP in saline with a relatively large increase in cytoplasmic calcium. ATP is considered to be the probable primary signaling agent between the axons and glia in rodent optic nerve but it is uncertain whether it is the only axon-glia transmitter. The objective of this research has been focused on whether ATP can account for the entire calcium increase under conditions of physiological stimulation of the nerve. Rat optic nerves were incubated with the calcium indicator dye Fluo-4 and then stimulated with above-threshold electrical pulses. Meanwhile, relative levels of calcium in the glial cells were measured by optical imaging of fluorescence emission. Propagated action potentials were recorded during stimulation while light was emitted by nerve fiber tracts. In one experiment, the activation of glial cells appeared to progress in time and direction as would be expected from propagation of the action potentials longitudinally along the nerve. Additional experiments are currently in progress to determine if this response can be replicated. Further experiments will involve stimulation of the nerve with an ATP receptor blocker present to determine the extent to which ATP contributes to physiological activation of the glial cells.

Session 2, A27
Evaluating Sustainable Biofuel Options: Making a Case for Microalgae
Meagan Elizabeth Clark Plant Biology
Mentors and/or Co-Authors: Amy Grunden Microbiology
Marie-Laure Sauer Plant Biology

World energy consumption is expected to increase 44% in the next 20 years. Today, the main sources of energy are oil, natural gas, and coal, all fossil fuels that have limited reserves. These fuels are unsustainable and contribute to pollution. Biofuels are a promising source of sustainable energy. However, current biofuel feedstocks are expensive and compete with food markets. Therefore, there is interest in developing alternative biofuel feedstocks such as algae or non-food crops. In addition to identifying good feedstocks, it is critical to optimize them so that fuels can be made economically and with minimized resource requirements. One approach for ‘improved’ feedstocks is to use Synthetic Biology methods to add genes to feedstock plants to increase fuel yields and/or decrease resource inputs. In this ALS398 seminar, students have researched questions such as what are good potential biofuel feedstocks with regard to inputs/outputs, what genetic improvements to feedstocks could be made, and what are societal implications of using biofuels. Based on our research, we have determined that a sustainable biofuel production system could be developed comprising a co-culture of the microalgae Chlamydomonas and the cyanobacterium Spirulina grown in photobioreactors using recycled water and receiving carbon dioxide and nitrogen inputs from co-located industrial sources. Such a system would be capable of producing lipids which can be converted to drop-in ready transportation fuels. Culturing conditions and synthetic biology approaches were also considered to provide improved biofuel outputs and to mitigate undesirable environmental/societal impacts.

Session 2, A17
Geminivirus involvement in cell cycle control and epigenetics
Rachel Erin Coppersmith Human Biology
Mentors and/or Co-Authors: Jose Ascencio-Ibanez Biochemistry
Geminiviruses are ssDNA plant viruses that devastate crops in tropical and subtropical areas of the world. Geminiviruses subvert the cell cycle machinery of the host to replicate its DNA. We tested the distribution of Beet curly top virus in infected Arabidopsis thaliana using in situ hybridization. The distribution of BCTV in Col-0 (hyper-susceptible ecotype) is not significantly different from Col-0 (control ecotype). Plants over-expressing E2FB (E2FB<sub>OE</sub>, transcription factor involved in DNA replication) showed hyper-susceptibility to BCTV but tolerance to CaLCuV. The first question we addressed is how silencing of Retinoblastoma-related (RBR) protein effects infection of CaLCuV in the E2FB<sub>OE</sub> background. We conducted an experiment with an empty silencing vector (007), a positive silencing vector (Chelatase 008), and an RBR silencing vector. Results showed that silencing RBR arrested plant development more so than the empty silencing vector. We are still investigating whether the progeny of the RBR silenced plants is embryo lethal. Since geminiviruses are not seed-transmitted, this will provide insight on epigenetic roles of RBR. For the second question, we based our experiment in the premise that the C4 protein from BCTV has a direct connection with the brassinosteroid pathway. Previous experiments showed very little symptoms in BCTV C4- as compared to BCTV, therefore, we tested if by spraying brassinosteroids, we could revert to wild type symptoms from the BCTV C4- phenotype. Results show that there is no significant difference between plants sprayed with brassinosteroids and the unsprayed control.

Session 2, D28
Analysis of Student Success in a Plant Biology Course Based on Use of Textbook
Joanna Katherine Davis Biological Sciences
Mentors and/or Co-Authors: James Mickel Plant Biology

There are many different theories on which teaching methods and study tools are best. In general, it is assumed that those who utilize the textbook as a resource earn better grades in their classes. However, depending on how the student learns and the professor teaches, the textbook may not be the best study tool. The objective of this project was to examine the validity of the belief that textbook usage correlates to a higher grade in the class using data collected during NC State’s Spring 2010 semester in Plant Life, an undergraduate introductory plant biology course with approximately 200 students on average. Differences were assessed by looking at final grades and comparing them to the answers students gave on a survey about textbook usage. The results suggest little impact on grades based on textbook use alone. The results of this study can help professors and students better understand how to get the desired results from a course.

Session 2, C27
Role of R97 in Allosteric Modulation of Ras
Kathleen Patricia Davis Biochemistry
Mentors and/or Co-Authors: Carla Mattos Biochemistry

A mechanism of allosteric modulation has been proposed for intrinsic hydrolysis of Ras in the presence of its downstream effector Raf in the Ras/Raf/MEK/ERK pathway. To clarify the role of the key Ras residue R97 in allosteric modulation, the R97L and the R97A mutant forms of the Ras gene were synthesized, in the pET21A(+) vector for protein structure studies and in the pBMN-IRES-Puro vector for cell biology assays. Synthesis was done by site directed mutagenesis technique, which consisted of PCR to generate the mutants, transformation of Top10 strain E. coli cells, and extraction and purification of the vector according to the Qiagen miniprep protocol. For the protein structure studies, the R97A protein product was used to set up screens around the crystallization conditions of wild type Ras, with varying concentrations of Polyethelene glycol and calcium acetate. X-ray diffraction data was collected for two crystals, one grown at 245 mM calcium acetate and the other grown at 365 mM calcium acetate. With the diffraction data for each crystal, the structure of wild type Ras was used for phasing in molecular replacement with Phenix and the electron density was visualized using COOT. The Ras structure at 245 mM calcium acetate in the inactive conformation, as expected, without R97 to interact with the acetate at the allosteric site. Thus, the higher concentration increases the availability of acetate to occupy the allosteric site.

Session 1, A9
Medical Assessment of Neurological Disorders: Parkinson’s Disease, Morgellons Disease, and Factitious Disorder
Taylor Ashley DeMorat Biology
Thomas Jackson Integrative Physiology and Neurobiology;
Taylor Jones Human Biology
Mentors and/or Co-Authors: Miriam Ferzli Biology

Neurological disorders present a wide variety of phenotypes that exhibit an array of definitions, causes, symptoms, and treatments. Many of these disorders require more research so that they can be better defined. The causes, symptoms and treatments can be better described with this added research, as well as create less ambiguity in the criterion by which the disorders are diagnosed and treated. Researchers must empirically define different disorders so all types of physicians are able to accurately assess and treat patients. In order to accomplish this, researchers analyze case studies and examine historical perspectives, attempt to locate specific genetic causes by genotyping, and study the effects of different treatment on patients. Researchers discovered ambiguity in multiple disorders that must be addressed so that physicians are more capable of accurately treating patients. Specifically, this research demonstrates that more data is needed in order to accurately define these disorders. The three disorders discussed are Parkinson’s Disease, Morgellons Disease, and Factitious Disorder. Parkinson’s is a degenerative disorder of the central nervous system that results in movement-related symptoms, behavioral problems, and dementia late into the disorder. Morgellons is an unexplained disorder that results in filaments protruding from skin lesions that may or may not be parasitic. Factitious Disorder is a disorder in which an individual deliberately induces false symptoms in order to assume the role of the sick person. From further research, physicians will hopefully have better assessment techniques, better treatment methods, and a better understanding of their patients.
Session 1, C2

Preschool Education in Agriculture/Nutrition Sciences (PEAS): The Development of Early Childhood Nutrition Intervention Curriculum

Allison Katherine Dipper Biological Sciences - Human Biology, Biological Sciences - Nutrition Sciences
Christopher Dunham Nutrition Sciences;
Sydney Riggbee Nutrition Science applied

Mentors and/or Co-Authors: Suzie Goodell Food, Bioprocessing & Nutrition Sciences

Research shows that early and frequent exposure to healthy foods among young children can result in lower weight status in adulthood. Food preference studies indicate the number of positive exposures to fruits and vegetables is directly related to a child/’s affinity for those foods. The suggested number of exposures for the introduction of a new fruit or vegetable is 10-15 individual instances. This is a difficult task for most parents to achieve at the dinner table; therefore, it is essential for the school environment to take an active part in this process. The purpose of this research project was to begin the development a curricular resource (PEAS: Preschool Education in Agriculture/Nutrition Science’s) that uses inquiry-based, hands-on lessons to teach preschool children about agricultural and nutrition sciences for Head Start classrooms. A team of undergraduate human biology and nutrition science students was formed. Each student was assigned three unit topics to develop, consisting of five hands-on lessons. Lessons were created and pilot tested in local private and Head Start preschool centers. Pilot testing the developed lessons allowed for students to observe how each lesson preformed in the classroom. Each lesson was revised based on student classroom observations, feedback from preschool teachers observing the lessons in action, and input from nutrition science faculty mentors. The final result was 45 lessons, making significant process towards the completion of an inquiry-based, hands-on agriculture and nutrition science preschool curricular resource. These lessons can be implemented across the nation in Head Start preschool classrooms to improve the health of children and their families. Further research will include the continued development of PEAS and the completion of an assessment to determine attitudes, needs, and barriers of administrators and teachers relating to nutrition education and gardening in the preschool environment. Completing the assessment will allow researchers to determine best methods for successfully disseminating the PEAS curriculum for implementation in Head Start preschool classrooms.

Session 2, B28

Endocytosis of Borrelia burgdorferi culture supernatants is required for RAW264.7 Type I Interferon-responsive gene transcription

Zeshma Durrani Biology

Mentors and/or Co-Authors: Jennifer Miller Microbiology

Borrelia burgdorferi is the causative agent of Lyme disease in the United States. Although patients infected with *B. burgdorferi* exhibit a wide variety of clinical manifestations, 60% of untreated patients develop subacute Lyme arthritis. Previous studies have linked innate immune cell Type I IFN production to the development of severe Lyme arthritis within genetically susceptible inbred mice. *B. burgdorferi* utilizes multiple different ligands to stimulate macrophage Type I IFN-responsive gene transcription. *B. burgdorferi* IFN-stimulatory ligands include RNA, lipoproteins, and unknown components contained within *B. burgdorferi* sonicate and culture supernatants. The purpose of this study was to determine whether endocytosis of *B. burgdorferi* sonicate and culture supernatants is required to trigger macrophage Type I interferon-responsive gene transcription. RAW264.7 cells, an immortalized macrophage-like cell line, were left untreated or were pretreated with the dynamin inhibitor Dynasore prior to the addition of various IFN-stimulatory *B. burgdorferi* ligands. Secreted proinflammatory cytokine levels were assayed by ELISA. Cellular Type I IFN inducible gene transcript levels were measured via real-time quantitative RT-PCR. IFN-responsive gene transcript levels were markedly reduced in Dynasore treated RAW cells stimulated with *B. burgdorferi* culture supernatants. In contrast, Dynasore pretreatment did not alter IFN-inducible transcript levels in RAW cells stimulated with *B. burgdorferi* sonicate. Our preliminary data demonstrate that endocytosis of *B. burgdorferi* culture supernatants, but not of sonicate, is required for RAW cell Type I IFN-responsive gene transcription.

Session 2, D19

A Use of Posters in the Genetics Classroom

Ashley Emily Duxbury Biology

Mentors and/or Co-Authors: Betty Gardner Genetics

In Genetics in Human Affairs, GN 301, the honors section participants are predominantly science majors, but some are non science majors that want to learn more about genetics. The project was changed from a PowerPoint presentation and brochure to a poster presentation. The students had between nine and eleven weeks to complete their posters before the symposium where they presented to Dr. Gardner, me and their peers. All of the students that participated in the honors section received honors credit for GN 301. These posters can then be used in the GN 301 classroom as aids during certain lessons such as X-Linked or autosomal recessive disorders.

Session 2, C2

Development of a Marketable Alternative to Energy Beverages

Elina Susan Emerick Food Science - Science
Evan Halladay Food Science - Science;
Megan Gillis Food Science - Science;
Christopher Hang Food Science - Technology;
Amena Kadibhai Food Science - Technology

Mentors and/or Co-Authors: Brian Farkas Food, Bioprocessing & Nutrition Sciences
The marketability and solution stability of a cafffeinated, whey protein based beverage was examined. An internet survey was made available to energy beverage consumers to determine if a cafffeinated, whey protein based beverage could be a marketable alternative to existing energy beverages. Based on the responses from 150 energy beverage consumers, it was determined that the majority of the consumers preferred an energy beverage with whey protein, natural ingredients, and a multiple container delivery system over existing energy beverages. The solution stability of a cafffeinated, whey protein based beverage was examined by centrifuging solutions for 3 minutes at 7155 x g and weighing the precipitate. It was determined that a solution with 7 g whey protein isolate, 85 mL of water, 10 g fructose, 0.75 mg caffeine, and enough citric acid to reach a pH of 3.2 had a barely discernible pellet, averaging 0.07 g in weight, after centrifugation; therefore, these specifications could be suitable for the proposed beverage.

Session 2, B29
Lignocellulosic Biomass to Ethanol Conversion
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Samantha Walker, Biological and Agricultural Engineering
Matthew Teten, Biological and Agricultural Engineering
Thomas Jacobson, Biological and Agricultural Engineering

Mentors and/or Co-Authors: Jay Cheng, Biological And Agricultural Engineering

Biofuel generated from lignocellulosic materials has demonstrated energetic, economic and environmental advantages when compared to bioethanol derived from starch based plants or directly from sugar. However, the structure of these materials creates challenges to efficiently access the glucose necessary to carry out the fermentation process and subsequent ethanol generation. The lignin, which gives plants their structural integrity, is one source of this challenge and mitigating this challenge is one key to the viability of cellulosic materials as a biofuel. Several methods to pretreat the material have been developed to break down the lignin structure. The two feedstocks utilized for this experiment- corn stover and yellow poplar sawdust- were chemically pretreated using dilute sulfuric acid (H2SO4) and lime (Ca(OH)2). Following pretreatment, the material was rinsed with deionized water and filtered. The next challenge is to break down the cellulose made accessible by the pretreatment and convert it to glucose. Enzymes that specifically target the glycosidic bonds of the cellulose chain are used for this purpose. Cellic Ctec2 was chosen and applied to the biomass. The goal was to determine the highest glucose yield at the lowest enzyme concentration. After testing enzyme concentrations at 5, 10, 15, 20, 25, 30, 35 and 40% (g/g) it was found that a 10% g/g enzyme concentration was the optimal concentration for our process, with an average yield of 1.49 (grams glucose/ gram cornstover) and 2.62 (grams glucose/gram poplar).

Session 1, C4
Scrotal Circumference has Slight Correlation Between Weaning and Yearling age in Beef Cattle
Kayla Melissa Fleetwood, Animal Science

Mentors and/or Co-Authors: Joe Cassady, Animal Science

In the beef cattle industry, the carcass merit of a steer is much more valuable than a bull of the same age. If a bull calf is selected to be a future sire, it is imperative that it pass the Breeding Soundness Exam (BSE). If the scrotal circumference is too small, then the bull cannot be used as a sire and must be culled. If producers can determine at weaning if the scrotal circumference is going to be too small to be used as a sire, the producer can castrate the calf and it can be raised as a steer. The objective of this study was to determine the phenotypic correlation between scrotal circumference at weaning and at yearling for beef cattle. Data were collected from 192 bulls at the Butner beef cattle field laboratory over a 3 year period from 2008-2010. Calves were weaned at approximately 177 +/- 1.5 d and with an average weight of 198 +/- 3.0 kg. Scrotal circumference (SC) was measured using a scrotal tape. The average scrotal circumference at weaning was 19.2 +/- 0.97 cm. After 6 months the average scrotal circumference at yearling was 32 +/- 0.97 cm. The phenotypic correlation of SC at weaning and yearling was 0.12 (P=0.09). The limited amount of data present shows a slight correlation. The data collection will be continued in order to have a better estimation of phenotypic correlation.

Session 2, B2
Management of Diabetes in the Clinical Setting Through Early Intervention Education Classes
Alyse Cristen Flick, Biology

Mentors and/or Co-Authors: Anita Flick, Biology

Diabetes Mellitus is a chronic condition in which an individual has high glucose levels as a result of insulin deficiency or insulin resistance. Over time, high glucose levels can cause serious and life-threatening health complications. According to the American Diabetes Association, 8.3% of the 25.8 million children and adults in the United States have Diabetes Mellitus. Of that percentage, 5-10% of those people have Type I Diabetes, which often starts in childhood or young adulthood. The remaining 90% of people have Type II Diabetes, which is most often caused by obesity and a lack of physical activity. A person with diabetes carries the same risk of having a heart attack as an individual who has already suffered from a heart attack. Diabetes care is a complex medical issue that requires ongoing medical care and education to help reduce the risk of long-term complications. The implementation of early diabetic education classes, focused on goal setting, nutrition, exercise and management of the disease for new and chronic diabetes patients in the primary care setting may help to improve acceptance and compliance among patients. Through a classroom-based instructional series, patients have the opportunity to acquire a better understanding of their disease process as well as management of their diabetes through the classes and take-home materials.
Session 2, B12  
Effects of Astrovirus Infection on ERK1/2  
Clayton Joseph Foret Human Biology  
Mentors and/or Co-Author: Matthew Koci Poultry Science

Astrovirus infections are a leading cause of acute diarrhea in infants and the immunocompromised. Previous studies demonstrate that astrovirus infection induces diarrhea with a decrease in sodium (Na+) absorption associated with decreased apical expression of Na+/hydrogen (H+) exchanger 3 (NHE3). This change in NHE3 is presumably the result of changes in the cytoskeleton via its interactions with intracellular proteins such as ezrin, NHE regulatory factors, and the mitogen-activated protein kinase (MAPK) family. Interestingly, in vitro studies have demonstrated that phosphorylation of the MAPK family protein ERK1/2 is required for astrovirus replication. Our focus was to determine if astrovirus infection leads to increased phosphorylation of ERK1/2 using the turkey astrovirus model of infant diarrhea. We aligned cDNA sequences from several species and designed PCR primers used to amplify the putative turkey homologue. These amplicons were then sequenced and the predicted amino acid sequence of turkey ERK1/2 analyzed to find viable commercially available antibodies. These antibodies were used in western blot analysis of protein lysates from astrovirus infected and control turkeys to demonstrate changes in ERK1/2 phosphorylation. These are the first studies to our knowledge to investigate the sequence of turkey ERK1/2, demonstrate cross-reactivity of ERK1/2 antibodies with turkey tissues, and assay for changes in relative amounts and phosphorylation of ERK1/2 in infected and control tissues. Understanding the role ERK1/2 plays in astrovirus replication and the development of clinical disease is expected to lead to new astrovirus specific anti-viral therapies.

Session 2, B25  
Perceptions of Acupuncture within Wake Co, NC  
Eva Marie Frantz Animal Science  
Mentors and/or Co-Author: Kimberly Ange Animal Science

Acupuncture is currently a growing field in veterinary medicine in the United States; however, attitudes on the subject remain oppositional despite increased scientific understanding (Ahn and Kaptchuk). Therefore, a written survey was distributed at four CareFirst Animal Hospital locations in Wake Co, NC to determine if there are differences in the perceptions of acupuncture between companion animal owners with pets not receiving acupuncture versus those with pets receiving acupuncture. The survey questioned whether being aware and knowledgeable of acupuncture impacted how human owners viewed the effectiveness of animal acupuncture and its usefulness to compliment Western medicine. The survey consisted of 10 questions that were on a 1 (lowest) to 5 (highest) scale. Of the 90 surveys that were sent out, 54 were returned, where 26 were from owners of acupuncture animals and 28 from owners of non acupuncture animals. The non acupuncture clients were less informed about acupuncture than those clients with pets receiving acupuncture (P=0.0001). Acupuncture clients also had a greater appreciation of the compatibility between acupuncture and Western medicine (P=0.0001). In general, non acupuncture clients showed a tendency to view acupuncture as a less effective medicine than those who had pets who had undergone treatment (P=0.08). This survey suggested a link between a pet owner’s knowledge of the field of acupuncture and their perceptions of its effectiveness. It is possible that educational programs explaining acupuncture could encourage more people to use this medical practice to alleviate problems in their companions.

Session 1, A21  
Troubleshooting Expression and Purification of Bacillus subtilis Regulatory Protein, YwcC  
Julia Carina Frei Biochemistry  
Mentors and/or Co-Author: John Cavanagh Biochemistry

Biofilms are multicellular communities encased in an extracellular matrix and are the basis of nearly 80% of infections, especially antibiotic resistant infections. Almost all known bacteria species are capable of utilizing biofilms for defense. In particular, the bacterium, Bacillus subtilis, is capable of forming robust biofilms and can be used to study the molecular machinery that regulates biofilm formation. The TetR-like transcriptional regulator, YwcC, has been shown to play a role in biofilm formation through its repression of slrA. SlrA is an antitressor protein for SinR, the master regulator of biofilm formation in Bacillus. When YwcC is active, it binds to the slrA promoter and prevents transcription, which allows SinR to repress biofilm-related genes. However, once YwcC has been inactivated, SlrA is freely expressed and binds to SinR, allowing biofilm formation. This semester I have worked to develop a protocol for YwcC that would express the protein in concentrations high enough for NMR studies and for its purification. Using the original His-tag construct, I was unable to generate a stable sample despite trying various methods, because the protein would either aggregate or precipitate out of solution. Next, I attempted to create an expression system using a vector that would yield a GST-fused form of the protein. This construct was completed successfully, but it did not produce a fused GST-YwcC product. Currently, I am working on a system that will yield the protein without an affinity tag.

Session 1, B9  
Examples of Genetic Research: Impacts and Applications  
Matthew S Geisz Biology  
Mentors and/or Co-Author: Miriam Ferzli Biology

The field of genetics is one that offers a wide range of prospects including genetic analysis and genetic engineering. We investigated various aspects of genetic research dealing with potential treatments for HIV and hemophilia, and genetically modified corn's potential negative effect on the environment and human health. Research findings concluded that vaccine-induced T-cell responses alone can control replication of a
heterologous virus during both the acute and the chronic phases of infection even after a heterologous challenge. HIV-1 has developed a strategy to protect its highly conserved epitopes, including the CD4+ binding site, using “holes” against initial immune responses. Another example of genetic research has shown that prophylaxis is one way to prevent patients from excessive bleeding and alleviating the pain of hemophilia. Although there are many beneficial applications of genetic research, potential risks can be associated with genetic manipulation. An example of a potential risk is the effect of GM corn on the environment and human health. Recent studies indicate that GM corn, especially BT corn has potential environmental effects such as the threat of gene contamination. More research is needed to determine the full effects of GM crops, how to integrate the vaccine design into the general population, and using genetic analysis to determine treatments to alleviate the pain associated with hemophilia.

Session 2, C29
Developing an Approach to Characterize a Denaturation-Resistant Basic Leucine Zipper Domain from Human T-Cell Leukemia Virus
Zachary Nathan Gonzales Biochemistry
Mentors and/or Co-Author: Charles Hardin Biochemistry

Human T-Cell Leukemia Virus Type-I encodes a human basic zipper protein domain (HBZ), part of a virally-expressed protein implicated in cancer development. The HBZ domain binds the CREB-binding protein (CBP) with much higher affinity than human transcription factors such as MLL and c-Jun. We are characterizing the secondary structure of the 77 residue HBZ fragment, which we think forms a helix-turn-helix (H-T-H) motif at sodium dodecyl sulfate (SDS) concentrations that would normally denature most proteins. We are measuring the number of SDS molecules that bind to the wild-type (WT) fragment, and three mutants: (1) L27A/L28A, (2) L47A/L48A and (3) L27A/L28A/L47A, L48A. The fragments are listed in the order in which they (i) electrophoresed more rapidly than the WT sequence, and (ii) become less capable at inhibiting binding of c-Jun or MLL to CBP. Mutations from leucine (L) to alanine (A) disrupt leucine-zipper interactions, which presumably promotes denaturation of the H-T-H domain. Our focus is to determine how much SDS binds per protein molecule. We are using high-pressure liquid size-exclusion chromatography (HPLC-SEC) to measure elution times for the HBZ WT and mutant constructs. A methylene blue assay has been developed to measure the amount of bound SDS. The BCA assay is used to determine the protein content. Together, these data will allow us to assess whether the amount of SDS bound per protein changes with the extent of domain unfolding.

Session 1, D2
alternatives to Embryonic Stem Cells in Regenerative Medicine: Induced and Somatic Pluripotent Stem Cells
Samantha Marie Goodwin Biological Sciences
Mentors and/or Co-Authors: Miriam Ferzli Biology

Ethical issues limit the availability of human embryonic stem cells to be used for regenerative medicine purposes. However, there are many other types of stem cells naturally found in the body and we now have the technology to manufacture pluripotent stem cells from adult somatic cells. Unfortunately, the manufacturing of stem cells is time consuming and produced low cell number and viability. To improve this process, work is being done to determine how best to increase the feasibility of induced pluripotent stem cells. Researchers use plasmid construction, protein analysis, and different growth sera on somatic cells that were grown in culture and then test cell pluripotency, which refers to the ability of the stem cells to differentiate into various tissue types. By altering growth conditions, protein structure, or genetic information, researchers were able to positively affect either the time of production or the amount of viable cells produced. Umbilical cord and umbilical cord blood are a rich source of stem cells which can be easily isolated as opposed to embryonic stem cells. Their differentiation potential has been tested by placing the stem cells in mediums that promote differentiation. Although there has been success in getting these cells to differentiate, they are also limited in what they can differentiate into. All of this work is being done in the hope that one day; non-embryonic stem cells can be efficient enough to be used as a replacement for embryonic stem cells in regenerative medicine.

Session 1, A2
Impact of HLA-B*1502 Testing on Medical Practices
Sarah K Grantham Sociology
Mentors and/or Co-Authors: Sara Katsanis Institute for Genome Sciences and Policy: Genome Ethics, Law, and Policy

This study examines the impact of pharmacogenetic testing for carbamazepine sensitivity on prescription practices in the United States. Carbamazepine, a first-line pharmaceutical treatment for epilepsy and bipolar disorder, can trigger the potentially fatal skin reactions Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis among those who possess the HLA-B*1502 variant, which is ten times more common in individuals of Asian ancestry, particularly the Han Chinese. In December 2007, the Food and Drug Administration directed carbamazepine manufacturers to update the package inserts to recommend pharmacogenetic testing for HLA-B*1502 in patients of Asian ancestry. In this study, eight U.S. laboratories that conduct HLA-B*1502 testing were surveyed to gain information on testing volume and the rationale behind current HLA-B*1502 testing practices. All six responding laboratories reported negligible requests for HLA-B*1502 testing in comparison with total testing volume and total pharmacogenetic testing volume. Five laboratories reported 0-1 requisitions for HLA-B*1502 testing per month and one laboratory reported 3-19 requests per month, yet 200,000 new diagnoses of epilepsy are made per year in the U.S. These findings demonstrate that the requisitions for HLA-B*1502 are significantly less than what would be expected based on the population of individuals of Asian ancestry in the U.S., suggesting that the FDA recommendation for pharmacogenetic testing in Asian patients has been ignored or patients of Asian descent have been prescribed other medications. These findings lend valuable insight into the impact of drug labeling updates of generics with pharmacogenetic recommendations, as well as the impact that FDA recommendations can have on medical practices.
Session 1, B14  
**Effects of Prenatal Alcohol Consumption on Post Natal Health**  
Jennifer Nicole Hamilton  
Animal Science  
Brittany Richardson  
Animal Science;  
Matthew Tucker  
Biochemistry;  
Alliyson Mentock  
Biochemistry;  
Kelly Holding  
Animal Science  
**Mentors and/or Co-Author(s): Scott Whisnant Animal Science**

Alcohol is a potent teratogen (an agent that can cause malformations of an embryo or fetus) that can affect how a child looks, acts, learns and grows. The way in which ethanol damages the developing central nervous system differs with the stage of embryological development. During the first weeks of prenatal development, ethanol can act as a mutagenic or cytotoxic agent, causing cell death or lethal chromosomal aberrations (Agnihotri et al, 2010). During 4-10 weeks of pregnancy, ethanol acts cytotoxically, causing excessive cell death in the central nervous system and abnormalities in nerve cell migration from cell damage. These abnormal migrations can lead to disorganization of tissue structure. Later on in pregnancy, 8-10 weeks onwards, ethanol can again disorganize or delay cell migration and development. For the third trimester, alcohol exposure to the cerebellum, hippocampus, and prefrontal cortex of the brain may cause brain damage (Niccols, 2007). Previous research has shown that alcohol-exposure prenatally can lead to Alcohol-Related Neurodevelopmental Disorders (ARND). In the most severe cases, individuals are diagnosed with Fetal Alcohol Syndrome, more commonly known as FAS. FAS is marked by “physical, behavioral, and cognitive abnormalities” (Jacobs et al. 2002). Individuals afflicted with FAS are known to have many physiological, cognitive, and behavioral abnormalities. In our analysis, we looked at the short-term and long-term effects on mothers’ offspring due to alcohol exposure in utero.

Session 2, A1  
**Molecular Marker Screening of Advanced Generation Wheat Lines**  
Wesley G Hancock  
Plant and Soil Science - Crop Production  
**Mentors and/or Co-Author(s): Joseph Murphy Crop Science**

Marker assisted selection can be used by plant breeders to improve efficiency in the selection process in modern plant breeding programs. Resistance gene(s) of interest can be identified in lines using DNA collection and molecular marker screening. The objective of this study was to complete the DNA marker analysis of entries in the 2011 Wheat Observation Test of the NCSU Wheat Breeding program to determine if the Yr17 gene, which confers resistance to Stripe rust (caused by  
Puccinia striiformis), was present in the entries in the Observation Test. Nineteen lines were evaluated to determine if the marker for the resistance gene Yr17 was present. The lines of interest plus their parents were propagated in plastic trays in a growth chamber. Seedling leaves were harvested and DNA was extracted from them. Molecular marker analyses were performed on the DNA to determine if the molecular markers for the Yr17 gene of interest were present. Twelve lines from the wheat observation test had the marker for the resistance gene Yr17. Eleven of the lines had a common parent, SS8641, which also tested positive for the Yr17 gene. These results are combined with the observed field data to assist in the selection process of lines in the Wheat Observation Test. This information is beneficial for the breeding program to improve the efficiency and accuracy of the selection process.

Session 2, A26  
**Gonadotrope Purification using Immunomagnetic Bead Technology**  
Ethan K Harrelson  
Biology  
**Mentors and/or Co-Author(s): William Miller Biochemistry**

Pituitary gonadotropes produce follicle stimulating hormone (FSH) and luteinizing hormone (LH), both of which control egg development and ovulation in vertebrates. To understand the regulation of these hormones, it is desirable to isolate primary gonadotropes as a pure cell population. One method to isolate gonadotropes from a mixed cell population is to specifically express H2Kk in them. This can be done using an FSH-beta promoter expressing an H2Kk gene (FSHBH2Kk). H2Kk is a cell surface protein used as an antigenic hook for isolating any cell type. The objective is to determine how much H2Kk must be expressed in gonadotropes for their efficient isolation. Transformed gonadotropes will be transiently transfected with the FSHBH2Kk expression plasmid and mRNA for H2Kk will be measured using real-time PCR. Increasing doses of FSHBH2Kk will be used and increasing times of transfection will be tested. The optimal dose and time will be chosen for H2Kk expression and then cells will be fluorescantly stained for cell surface H2Kk and cells will go through the isolation procedure. These experiments will define the optimal conditions for expressing H2Kk in gonadotropes for their purification. They will also indicate how efficiently gonadotropes can be isolated given maximal expression of H2Kk. This project will test the necessary plasmid concentration and time for the protein hook to form and travel to the cell’s membrane.

Session 1, A18  
**Characterization of transgenic tomato plants with reduced inositol trisphosphate signaling**  
Hayley L Hedges  
Microbiology  
**Mentors and/or Co-Author(s): Imara Perera Plant Biology**

The phosphoinositide pathway is a critical signaling pathway in plants and animals that is rapidly activated in response to environmental cues. A deeper understanding of this pathway has the potential to maximize yields of crops by expanding our knowledge of how plants respond to environmental stress. In order to study the role of this pathway in plant stress responses, transgenic tomato plants were generated...
expressing either an active or inactive form of the mammalian type I inositol polyphosphate 5-phosphatase (InsP$_5$-ptase). The InsP$_5$-ptase enzyme hydrolyzes inositol (1,4,5) trisphosphate (InsP$_3$), the second messenger in the phosphoinositide pathway, and terminates the signal. My project entailed generating transgenic lines using Agrobacterium tumefaciens-mediated plant transformation and selecting putative transgenic tomato plants which express either the active or inactive form of the InsP$_5$-ptase enzyme. This involved screening for presence of transgene, testing transgene expression using RNA isolation, monitoring ploidy levels, microscope protein extraction with immunoblotting, and radioimmunoassay of InsP$_3$ levels to test InsP$_5$-ptase enzyme activity. The inactive form is a full-length protein with a point mutation in the catalytic site that eliminates activity of the InsP$_5$-ptase producing an almost identical foreign protein but because the enzyme is inactive, InsP$_3$ levels are comparable to the wild type tomato plants. Plants expressing the inactive form serve as a useful control to confirm that altered InsP$_3$ mediated signaling affects the stress responses of InsP$_5$-ptase transgenic tomato plants.

Session 1, C18
Bioinformatic Analysis of the Membrane Occupation and Recognition Nexus (MORN) Repeats of Plant PIP5K proteins
Jameelah Maralyn Henderson Biochemistry

Bioinformatic Analysis of the Membrane Occupation and Recognition Nexus (MORN) Repeats of Plant PIP5K proteins. Membrane Occupation and Recognition Nexus (MORN) repeats are sequences 23 amino acids in length. A unique MORN domain composed of multiple MORN repeats are found in phosphatidylinositol(4)phosphate 5-kinases (PIPK5) of plants and not found in PIP5Ks in other organism. The MORN domain is involved in lipid binding, membrane targeting and enzymatic regulation. Our research is focused on an extensive bioinformatics analysis of the MORN repeats to identify which amino acids are conserved in plant PIP5K MORN repeats compared with other MORN repeats in plants and other species. The Pfam database is a large collection of protein families, each represented by multiple sequence alignments and hidden Markov models (HMMs). The MORN PFAM dataset revealed multiple protein duplications in the PFAM dataset. To minimize data redundancy and improve sequence reliability an original database of individual MORN repeats from different species was curated by using sequence redundancy tools and regular expressions to retrieve the MORN repeats from a non-redundant protein set from animal, plant and bacteria. Alignments of the MORN repeats from each database were transformed into numerical data using a sequence metric analysis (Atchley et al., PNAS, 102;6395, 2005) and each alignment statistically analyzed for significant amino acids. Literature cited: Atchley WR, Zhao J, Fernandes AD, Druke T (2005) Solving the protein sequence metric problem. Proc Natl Acad Sci U S A 102: 6395-6400

Session 2, C24
Transformation and Imaging of Arabidopsis for Phosphoinositide Research
David M Higgins Plant Biology

The phosphoinositide pathway is involved in sensing changes in gravity and osmotic stress in plants. The nature of the pathway’s regulation is currently not well known, but is hypothesized to involve the binding of proteins to the key enzyme phosphatidylinositol 4-phosphate 5-kinase (PIP5K). To test this hypothesis, I have been attempting to generate whole plants expressing tandem affinity purification (TAP)-tagged forms of Arabidopsis PIP5K1 in order to analyze interacting proteins. Although both positive controls were successfully transformed, screened, and propagated, neither of the two lines containing variants of the TAP-PIP5K fusion protein could be produced and we have concluded that the construct is toxic to plants. To investigate whether the product of the enzyme might also be toxic, we expressed the human form of the PIP5K in plants. The human PIP5K has a lower Km for the substrate phosphatidylinositol 4-phosphate (PIP) and a higher Vmax compared to the plant enzyme. The transgenic plants produced 2-4-fold higher levels of phosphatidylinositol-4,5-bisphosphate (PIP2) and had shorter roots with bulging root hairs. Because increasing PIP2 can affect membrane trafficking, I began a second project to investigate membrane morphology. In order to study the effects of higher levels of PIP2 on trafficking, we crossed our preexisting GFP lines with a tonoplast-targeted YFP line and imaged the resulting plants using confocal microscopy. The images revealed no major defects in tonoplast structure. Future directions will include more imaging with different dyes targeted to membranes.

Session 1, D18
Student Perceptions of the Usefulness of Training Videos for Preparing them to Teach Nutrition Education in the Community
Taylor Brooke Hodgin Biology

Nutrition NUTS volunteers provide nutrition education relevant to parents and children at several Head Start preschools in North Carolina. Student volunteers have diverse backgrounds in nutrition knowledge due to the wide range of majors studied. Training videos are used to teach the lesson facts and sample interactions to the students before entering the community. We investigated student perceptions of the usefulness of training videos in preparing them to teach dental health education in Head Start facilities. To obtain feedback, an anonymous evaluation was e-mailed to all WALNUTS volunteers every week after viewing that week's specific training video. We found that the majority of volunteers agreed that the training videos were very effective in preparing them for their interactions with participants in the community. However, effectiveness of the training videos could be improved by including examples of how to interact with both children and parents, how to engage non-English speaking participants, and how to use the board as a tool within the lesson.

Session 2, A11
Ultrasonication Pretreatment of Lignocellulosic Biomass for Enhanced Sugar Production
Nathaniel Preston Houck Biological and Agri Engineering

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Lignocellulosic biomass like switchgrass is a promising renewable energy source, but the sugars stored within its structure naturally occur as cellulose and hemicellulose. To utilize these sugars for bio-products, it is first necessary to release the sugar polymers from the lignin structure. One pretreatment method with potential to breakdown this structure is ultrasonication, which utilizes high frequency sound waves within a liquid medium to form micro-bubbles that are capable of hitting and breaking the lignocellulosic matrix. This experiment tested the effectiveness of ultrasonication on delignification of biomass, and consequently sugar availability in treated samples. Switchgrass at loadings up to 10% in water or low alkaline solutions (up to 0.5% NaOH) was subjected to ultrasonic waves using a batch system (individual beakers using low volumes) at amplitudes of 50% to 100% from 5 to 10-minutes. The lignin (both acid soluble and insoluble) and reducing sugar contents of each sample were determined using modified Laboratory Analysis Protocols (LAP) from the National Renewable Energy Lab (NREL). Results did not show significant variance between amounts of acid soluble and insoluble lignin of sonicated and untreated biomass, except with the 100% amplitude, 10-minute biomass trials, which showed 20% lignin reduction. Biomass sonicated in NaOH solutions also had similar results with no significant increase in lignin breakdown due to sonication. To continue this investigation a continuous system was developed and is currently being tested to determine if a recycling continuous setup can make this treatment more effective.

Session 1, A4
New Digs for Asheboro’s Ocelots
Elizabeth W Hyde Animal Science
Eva Frantz Animal Science;
Elizabeth Pragar Biological Sciences;
Katie Robertson Zoology;
Kristy Casper Animal Science;
Brittany Price Animal Science;
Barbara Athens Biochemistry;
Katelyn Miller Animal Science
Mentors and/or Co-Authors: Jenny Campbell Biology

Designed in 1987 and built in 1993, North Carolina Zoo’s ocelot (Leopardus pardalis) exhibit is outdated and in need of renovation. The ocelots are currently confined to 43 square yards indoors in the Sonora Desert Dome, which allows only one pair to be exhibited at a time. The existing design has minimal opportunities for visitor education and a lack of opportunity for animal enrichment has created behavior issues for the animals. Keepers have stated the holding area impedes their ability to provide quality care and lacks adequate storage facilities for necessary husbandry items. Based on our observations of the exhibit itself, research on current exhibit and management standards and discussion with zoo staff, we suggest the following design changes: (1) build a standalone outside exhibit that will allow all the ocelots to be on exhibit at one time while increasing square yardage and (2) redesign the holding area to provide maximum storage of items necessary for optimal care and space for food preparation. Our changes will allow us to increase environmental enrichment opportunities in the exhibit. Lastly, we will enhance visitor education through interactive displays that reach a diverse audience. We will present our findings to the North Carolina Zoo to highlight issues with the current exhibit and provide a new design that will give the ocelots an optimal living environment in a new, outdoor location.

Session 2, B6
Microbial Resistance and the Consequences of Pharmaceuticals in Animal Production Agriculture
Jodie Louise Joseph Animal Science
Jennifer Cook Human Biology;
Alicia Braxton Zoology;
Alyssa Worf Nutrition Science;
Danielle Linquist Zoology;
Lacey White biochemistry, human biology;
Michelle Borges Biochemistry, Nutrition Science;
Kira Pruitt Biology and Animal Science;
Sara Reichelt Zoology, Poultry Science;
ShinHae Yoon Biological Sciences (Human Biology Concentration), Nutrition Sciences;
Hernant Desai biochemistry
Mentors and/or Co-Authors: Charles Williams Poultry Science

The use of veterinary pharmaceuticals in food animal production is a controversial and ongoing issue with regard to human and animal health. Antibiotics, also known as antimicrobial drugs, are used in food animal production for disease prevention, therapeutics, overall health, and growth promotion. Bacterial resistance to antimicrobial drugs is an evolutionary mechanism that has been observed prior to the implementation of antimicrobial use in animal agriculture. It has been argued that the use of antibiotics has expedited this innate characteristic. Overuse of antimicrobial drugs in human and animal therapies has been shown to lead to increased resistance and decreased effectiveness. The purpose of this research committee is to consider the perspectives of the livestock industry, public health organizations, veterinarians, and physicians and subsequently recommend actions that should be taken to determine the proper use of veterinary pharmaceuticals in animal production agriculture. After consulting with various experts in these disciplines and reviewing the peer reviewed scientific literature, the committee’s consensus is that the judicious use of antimicrobial drugs in animal agricultural should continue to be regulated, but more extensive research should be conducted and increased surveillance should be implemented before an absolute regulatory policy can be decided.
Bacterial contamination of broiler breeder hatching eggs and chicks stored under various temperatures and handling procedures prior to incubation

Muhammad Samad Khan Microbiology
Mentors and/or Co-Authors: Mike Wineland Poultry Science

The study examined bacterial contamination in relation to the temperature changes during the initial stage storage. Eggs are typically stored on the farm at temperatures ranging from 15.56 - 21.11°C for a couple of days before transportation to the hatchery by trucks, which may not have temperature control system. During transportation condensation can form on the egg surface promoting bacterial growth causing internal contamination. Temperatures chosen for initial egg storage were 13.33°C, 18.33°C, and 23.33°C. Three groups of 75 eggs were used and stored at their respective initial temperature for three days, then all three groups were exposed to temperature 32.22°C for thirty minutes then stored at 18.33°C for two days. Twenty-five eggs from each group were examined for contamination on three levels: eggshell surface, shell/membrane interface, and interior contents. The remaining fifty eggs from each of the three groups were incubated for 21 days at standard poultry incubation temperatures. When the chicks hatched they were euthanized and yolk of the chick was examined for contamination. The result indicates that higher temperature during initial storage decreases contamination on the eggshell surface and shell/membrane interface. However there was no difference in bacterial level of the egg contents. The chicks were further euthanized and the result indicated that 23.33°C storage exhibited a greater incidence of samples with no bacterial growth although they were not significantly different.

Potential Effect of Homing Endonucleases on Genome Heterogeneity in Mycobacteriophage Mutaforma13

William Henry Kohlway IV Microbiology
Morgan Carter Biochemistry;
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Mentors and/or Co-Authors: Eric Miller Microbiology
Morgan Carter Microbiology;
Susan Carson Plant Biology

Mycobacteriophages, viruses that infect Mycobacterium spp., are clustered based on genome synteny. In fall 2010, our class isolated 17 novel mycobacteriophages. One of these bacteriophages, Mutaforma13, was sequenced, and then annotated by the Phage Genomics class. Using genome comparison software, we compared the 57,701 bp Mutaforma13 genome to other F1 subcluster mycobacteriophages. We found a large degree of conservation in the 5’ half of the genome among F1 phages, while the 3’ half displays a high degree of heterogeneity. The sequence variation in the 3’ half of the genome could be caused in part by the activity of homing endonucleases found in this region. There are potentially...
three homing endonuclease genes in the Mutaforma13 genome that are members of the gene family known to cleave and insert genes into DNA. One HNH-type homing endonuclease gene in Mutaforma13 is adjacent to a glycosyltransferase gene that potentially confers resistance to host restriction endonuclease activity. We hypothesize that the HNH homing endonuclease/glycosyltransferase genes are a cassette that can be mobilized between phage genomes by lateral gene transfer.

Session 1, D4
Causes and Risk Factors of Ventricular Septal Defects, Hypertrophic Cardiomyopathy, and Coronary Heart Disease
Amalia Chrysoussa Kondyles _Biophysics_
Michael Wyngarden _Human Biology_
Madison Pace _Human Biology_
_Mentors and/or Co-Authors: Miriam Ferzli _Biology_

Heart disease is one of the most common causes of death in humans. Cardiac diseases such as ventricular septal defects (VSD), hypertrophic cardiomyopathy (HC M), and coronary heart disease (CHD) are caused by multiple factors including birth defects, genetics, and the environment respectively. The goals of these studies were to prevent, detect, and reduce the symptoms associated with these diseases. Risk factors were detected through blood pressure, age, EKG (echocardiogram), BMI (body mass index), and others to determine the heart condition. Methodologies employed to study these effects included surveys and longitudinal studies in participants who aged from infancy for VSD, young adulthood for HCM, and mature adulthood for CHD. In some cases animal models were also used. The different treatment options considered were surgical procedures for VSD, exercise to prevent CHD, and a combination of both for HCM patients. The patients were examined regularly for follow up screenings after treatment to determine the effectiveness of the treatments. These research studies explored the treatment options for each cardiac disease; while some treatments work better than others, there were no singular treatments that were more significant than others. All of these studies contributed to the knowledge about heart disease; however, further research needs to be done in order to discover the best possible solutions to save lives. With a growing understanding of the causes and risks of a variety of heart diseases, it is becoming possible to know how to prevent mortality due to such diseases.

Session 1, B3
Determining how Preschool-age Children Express Meal Termination Cues
Jessica Hansen Kruse _Microbiology_
_Mentors and/or Co-Authors: Suzie Goodell _Food, Bioprocessing & Nutrition Sciences_

Communication between child and parent can often seem confusing and ineffective, particularly at mealtime. For instance, children often change their food preferences which can lead to misinterpretation and misunderstanding between the parent and child. Thus, researchers at NCSU have been working to devise a list of meal termination cues; this is a list of verbal and nonverbal behaviors that children express during a change their food preferences which can lead to misinterpretation and misunderstanding between the parent and child. The frequency of these codes can then reveal the extent to which they express his/her satiety and preferred meal termination cue. This list was then used as a definitive set of meal termination cues that researchers will mark the occurrences of during a coding session. The list was gathered from observing lower-income, African American families during three separate dinners. The list was then used as a definitive set of meal termination cues that researchers will mark the occurrences of during a coding session. The frequency of these codes can then reveal the extent to which they express his/her satiety and preferred meal termination cue. This list can then be utilized as a guide for parents to better understand when their child is expressing their fullness and thus, a desire to stop eating. The implications of this study can reach into childhood obesity as well as childhood malnutrition.

Session 2, A20
Does Green Fluorescent Protein Affect Superoxide Reductase Activity?
Matthew Mcallister Kuchta _Biochemistry_
_Mentors and/or Co-Authors: YangJu Im _Microbiology_
Wendy Boss _Plant Biology_

Reactive oxygen species are present at basal levels in plants but can be raised to toxic levels in response to environmental stresses. Plants reduce the amount of these species through enzymes such superoxide dismutase (SOD) which detoxifies superoxide anion radicals. Our initial hypothesis was that if plants could more effectively and efficiently removed superoxide, they would be more stress tolerant. To test this hypothesis, we expressed the enzyme superoxide reductase (SOR) in Arabidopsis. SOR is an enzyme that reduces superoxide to hydrogen peroxide in a one-electron reduction in an extremely efficient manner which does not produce oxygen as a byproduct. SOR was expressed with a green fluorescent protein(GFP) fused to the N-terminus. Initial results showed increased stress tolerance in Arabidopsis expressing the GFP-SOR; however, further studies indicated that SOR alone was less stable. We hypothesized that GFP was either stabilizing the SOR and/or was aiding SOR activity by donating an electron to SOR and facilitating the reduction of superoxide to water. To determine if this was true, we expressed and purified recombinant SOR and GFP-SOR protein in Escherichia coli and compared the ability of the two proteins to reduce superoxide.

Session 2, A23
The role of the lipid-mediated InsP3 pathway in phosphate sensing
Eric Scott Land _Biology_
_Mentors and/or Co-Authors: Imara Perera _Plant Biology_

The role of the lipid-mediated InsP3 pathway in phosphate sensing
Phosphate is an essential nutrient for plant growth. The major goal of this project is to determine the role of the inositol (1,4,5) trisphosphate (InsP3) signaling pathway in phosphate sensing and uptake. To address this question we utilized wild type and transgenic Arabidopsis plants expressing the mammalian type 1 inositol polyphosphate 5-phosphatase (InsP5-phatase) as well as ipk1 mutant plants and compared their short and long term responses to low phosphate. InsP5-phatase rapidly hydrolyzes the second messenger InsP3. Transgenic InsP5-phatase plants have reduced InsP3 and altered InsP7 signaling. IPK1 is a critical enzyme in the synthesis of inositol hexakisphosphate (InsP7) and ipk1 mutants have reduced InsP7 levels and exhibit phosphate starvation responses even under non-limiting phosphate. Long term responses to low phosphate were studied by growing seedlings on decreasing concentrations of phosphate and monitoring root growth and root morphology. Short term responses were examined by growing plants in liquid culture and transferring them to a media lacking phosphate. Following a period of starvation, phosphate was added back to the media. Samples were analyzed for inorganic phosphate content and expression of phosphate responsive genes. Our results show that the phosphate content of seedlings responded rapidly to changes in external phosphate. Furthermore, we observed differences in the phosphate response of InsP5-phatase and ipk1 seedlings compared to wild type suggesting that the InsP3-mediated pathway is involved in the sensing and/or uptake of phosphate.

Session 1, D16
Development of Recombinant Turkey Astrovirus Expression System
Miranda Croft Lemyre Poultry Science
Mentors and/or Co-Author: Matthew Koe Poultry Science

Astroviruses are a leading cause of acute gastroenteritis in young animals, yet little is known about how they cause disease. Previous studies in our laboratory using the turkey as a model for astrovirus infection suggest diarrhea occurs without a change in morphology of intestinal villi and no evidence of inflammation or cell death. Further analysis demonstrated changes in epithelial cell ultrastructure and actin rearrangement in areas of viral replication. Increased electron density found at the apical region of enterocytes post infection may indicate a change in cell cytoskeleton. Collectively, these studies demonstrated infected tissues have a decreased ability to absorb sodium, as well as changes in subcellular localization of sodium/hydrogen exchanger 3 (NHE3). The current study was designed to develop methods for understanding how astrovirus proteins interact with proteins of the host epithelium, and how these interactions may be involved in the development of disease. To accomplish this, primers were designed for RT-PCR amplification of TastV-2 cDNA. Digestion of PCR product and adenoviral vector system with restriction enzymes was shown successful using gel electrophoresis. These DNAs will then be used to produce a recombinant adenovirus encoding the nonstructural genes from TastV-2. This recombinant adenovirus will be used to induce expression of TastV-2 nonstructural (NS) proteins in polarized Caco-2 cells and assessed for changes in cell physiology. The development of this recombinant expression system will be an invaluable tool, and will greatly increase our understanding how astroviruses interact with their host cells to cause diarrhea.

Session 1, B12
Incorporating a Thermostable Esterase into Microalgae to Enhance Biofuel Production
Sarah Elizabeth Levinson Microbiology
Mentors and/or Co-Author: Amy Grunden Microbiology

A sustainable alternative to fossil fuels is needed to combat problems such as rising levels of greenhouse gases and dependence on foreign countries for oil. Recently, lipid-producing microalgae have emerged as the leading platform for producing high-quality, sustainable biofuels. In order to make the conversion of microalgal lipids into transportation fuels as efficient as possible, lipid production and extraction needs to be maximized. Esterases catalyze the hydrolysis of esters into alcohols and fatty acids and have been shown to minimize sulfur and phosphorous contamination of extracted fatty acid/lipids, which is important since these elements can poison downstream catalysts in the biofuel production process. The primary goal of this study is to genetically enhance a halophilic microalga, Dunaliella salina, by incorporating an esterase from the hyperthermophilic archaeon Sulfolobus solfataricus. The esterase encoded by ORF SSO02521 was previously modified by the addition of a polyhistidine-tag on the C-terminus to allow purification using a nickel column. However, the hist-tag impeded proper folding of the esterase and prevented its soluble expression. To address this problem, a newly modified version of the esterase was engineered with the hist-tag fused to the N-terminus of the enzyme. The esterase gene was then over-expressed in the Escherichia coli strain BL-21(DE3). Recombinant protein production was analyzed using SDS-PAGE. Soluble recombinant esterase will be purified using column chromatography. The purified S. solfataricus esterase will subsequently be biochemically characterized as well as used for production of antibodies to track the expression of recombinant protein in Dunaliella.

Session 1, C8
The role of sexual reproduction in natural populations of Aspergillus flavus
Mary Hunt Lewis Plant Biology
Mentors and/or Co-Author: Ignazio Carbone Plant Pathology

Aspergillus flavus is an ascomycete that produces the mycotoxin called aflatoxin (AF). Currently, two nonaflatoxigenic strains of A. flavus are being used as biocontrols in fields containing crops such as corn and peanuts. These strains are non-aflatoxigenic due to a nonsense mutation within the AF gene cluster or a completely missing AF gene cluster. While A. flavus was thought to only reproduce asexually, more and more evidence is being reported that supports the presence of sexual recombination. The sexual cycle may compromise the role of safe biocontrol because these strains would have the capability of recombining and therefore producing offspring that have a regained toxigenic phenotype. Our goal is to determine the effects of biocontrol usage, specifically of strains AF36 and afla-guard®, on populations of A. flavus and A. parasiticus. We hypothesize that the use of biocontrol agents in a management regime for AF contamination will lead to an increase in genetic variation of both A. flavus and A. parasiticus. This will be examined by genotyping natural strains of these fungi isolated from field plots before and after

20th Annual NC State Undergraduate Research Symposium 2011
Session 1, D3
Hope for Haiti: An Analysis of the Cholera Epidemic, Effective Treatments, and Prevention
Stephanie Michelle Leyrer Biological Sciences

Haiti was affected by an earthquake of magnitude 7.0 on January 12, 2010, which was followed ten months later by a cholera epidemic that spread rapidly due to poor sanitary conditions. Cholera is a pathogenic disease caused by an enterotoxin produced by the bacterium Vibrio cholerae, which causes hyper-secretion of metabolites from the digestive tract of infected individuals. Preventative measures, such as probiotics and vaccinations, have been effective and are in high demand but short supply. Some common treatment methods that have been employed include providing patients with re-hydration therapy, performing proactive assessments of water supply in various areas to educate the communities about unsafe drinking water, and engaging in epidemiological research surveys to better understand the outbreak’s origin and how to avoid further outbreaks. The public health system currently employed in Haiti is not equipped to address the health needs of the entire population. Current research supports that many of Haiti’s principle public health concerns, including the cholera outbreak, stem from political and economic constraints. While probiotics, vaccinations and other treatments are effective short-term solutions, education and infrastructure reform are the most viable long-term investments for eradicating cholera in Haiti.

Session 2, B1
Fighting Fire with Fire
Kelsy L. Lindsay Food Bioprocessing and Nutrition
Jessica Fox Food Science;
M. Cade Thorne Food Science;
Adam Kincaid Food Science

Of approximately seven billion humans on Earth, nearly half use some sort of natural biomass fuel source for cooking. The use of natural biomass has proven to be detrimental not only to the environment, but also has shown to have negative health effects on people living in underdeveloped societies. Women and children who spend the majority of their time in smoke-filled huts are most susceptible to breathing toxic fumes from wood burning cookstoves. Despite the well-documented health and environmental issues associated with indoor biomass fueled cookstoves, very little has been done in the way of solving this pressing concern. The primary motivation of the clean cookstoves project is to study and identify a culturally acceptable wood burning cookstove that decreases deforestation, pollution, and health problems associated with smoke inhalation. Unlike other developing world problems such as HIV/AIDS and malaria which each have single worldwide solutions that may pertain to all cultures and regions affected, there is not one model cookstove to help alleviate the problems of smoke inhalation in developing nations because each nation has its own cultural values; however, a more efficient traditional wood-burning cookstove is more likely to be accepted than a natural gas or electric-powered stove. Enhanced wood cookstoves offer the most practical solution for a developing nation as it allows natives to maintain culturally accepted cooking techniques. The group has identified a particular cookstove model of interest containing a “rocket elbow” that may be widely applied with minimum modifications.

Session 1, C12
Comparison of Gene Regulation in Drosophila CNS and Trachea
Sarah Kaitlyn Long Chemical Engineering

The central nervous system (CNS) midline and the trachea are two tissues found within the Drosophila embryo that are controlled by the related bHLH-PAS transcription factors, Single-minded (Sim) and Trachealceless (Trh), respectively. Sim and Trh share a binding partner—Tango—and DNA binding site—CNS midline enhancer element (CME)—and regulate many of the same genes. However, Sim activates many genes expressed in the midline, but not in the trachea. Likewise, Trh activates several genes expressed in the trachea, but not the midline. To understand how genes are activated in both cell types, we studied the gene Moody, which is expressed in both tissues. First, to identify the cis-regulatory regions that control Moody expression, we examined the Moody genomic region for sequences conserved between Drosophila species. This led to the identification of three conserved regions that were located near two CMEs. We tested two constructs Moody 1.2 and Moody 1.9 by fusing them to GFP, which we then introduced into fly embryos to generate transgenic lines. Moody 1.2 is expressed in the CNS and trachea, while Moody 1.9 is restricted to the CNS, despite having one more CME than Moody 1.2. These results suggest Moody 1.9 contains a binding site for a repressor which inhibits tracheal expression and is absent in Moody 1.2. These studies can now be used to identify binding sites and specific transcription factors that control the development of these two tissues.
Session 2, D2
Restoration of Failed NCSU Stormwater Wetland
Laura Elizabeth Lord Biological and Agr Engineering
Ryan Owings Biological Engineering;
Judah Emory Biological Engineering;
Greg Turner Biological Engineering;
Alysondria Campos Biological Engineering
Mentors and/or Co-Author: William Hunt Biological And Agricultural Engineering
Mike Boyette Biological And Agricultural Engineering;
Kathy DeBusk Bio & Agri Engineering

Stormwater wetlands are a type of Best Management Practice, BMP, designed to store and filter stormwater runoff. North Carolina State University currently has a failed stormwater wetland that is not retaining water. The wetland has multiple issues contributing to its failure including a sink hole, an ineffective outlet structure, and bank erosion from inflow. By conducting a land survey and research in Phase I, the causes of these problems were identified. The sink hole was determined to be a result of an abandoned, broken sewer pipe, which diverted water out of the wetland which allowed the permanent pool depth to drop below an acceptable level and inflow pipes to cause erosion in the banks. The outlet structure is oversized and not functioning properly. Phase II of the project began with the analysis of soil tests and calculations based on survey and research data. The second part of Phase II proposed solutions based on the prior phases to restore the wetland to a function state which includes removing the abandoned pipe, altering existing structure, and creating improved earthwork designs. At the end of Phase II, a final design was chosen by the Facilities Maintenance Division at NCSU. Additionally, in Phase III a vegetation and maintenance plan were devised for the university to use as rules for post-construction maintenance. The overall benefits to this project are that NCSU will have a aesthetically-pleasing, functioning wetland that will act as an educational outreach area and provide good habitat for wildlife.

Session 2, A2
The Effects of Kinase Phosphorylation on Isoforms of the Pregnane X Receptor
Benjamin Jay Lyles Biological Sciences - Human Biology
Mentors and/or Co-Authors: Andrew Wallace Toxicology

The human pregnane X receptor (hPXR) is a nuclear receptor highly expressed in the liver that is responsible for sensing xenobiotic materials in the human body, and subsequently regulating the synthesis of drug metabolizing enzymes such as cytochrome P450s (CYPs), including the main CYP in the liver, CYP3A4. Like other proteins, hPXR can be phosphorylated at its tyrosine, serine, and threonine residues causing conformational changes that impact co-activator and co-repressor interactions and can alter PXR’s function as a transcription factor. Interestingly, truncated hPXR protein isoforms are found in the liver, produced due to the presence of functional translational start sites found in the messenger RNA sequence. The function of these truncated PXR isoforms, lacking potential phosphorylation sites found near the N-terminal AF-1 domain and DNA binding domain, was assessed in promoter activity assays. By transfecting mammalian wild type hPXR (wt-hPXR) or truncated isoform plasmids into HepG2 cells and then treating with hPXR agonist rifampicin (Rif), it was determined that the truncated PXR isoforms did not induce CYP3A4 CYP3A4 promoter activity. Co-transfections of wt-hPXR and truncated PXR isoforms were treated with Rif and protein kinase A (PKA) or protein kinase C activators, and CYP3A4 promoter activity was assessed and analyzed. It was determined from these experiments that PKA activation and p70S6k kinase activity strongly inhibited wt-hPXR activity leading to decreased CYP3A4 promoter activity, PKC activators did not cause significant inhibition. Co-transfections of truncated PXR isoforms did not alter CYP3A4 promoter inhibition. However, it seems that overall hPXR function is dependent on the full size protein and the function of the truncated isoforms remains unexplained. More research is merited to determine the function of the smaller protein isoforms, as this would lead to a better understanding of drug metabolism in the liver.

Session 2, D16
Weight and Factors Influencing Weight Among Individuals With Autism
Micah Logan Mabe Biology
Mentors and/or Co-Author: Lin Sikich Psychiatry

Autism spectrum disorders affect 1 in 110 children within the United States, and those with autism are twice as likely to be obese as people without a disability. Many people with autism (~30%) take antipsychotics, which frequently lead to significant weight gain. This pilot study will obtain information about factors contributing to the high rate of obesity in autism to inform the design of an intervention study for individuals with autism who are overweight and obese. Height, weight, fat mass, medication use, food preferences, sedentary and physical activities and parental BMI will be assessed in roughly 100 individuals with autism (3-60 years). Their % of 50th percentile BMI (%idealBMI) will be compared to that of 200 age-matched, nondisabled controls. This clinical research study is still ongoing at the UNC School of Medicine, and will hopefully be concluded by fall of 2011.

Session 2, B13
Renovating the Asheboro Zoo Otter Exhibit
Christine V Mayer Biology
Meredith Wojcik Biological Sciences- Ecology, Evolution, and Conservation Biology;
Jennifer Wenger Animal Science;
Andrea Massa Animal Science;
**Erin Kamm** Animal Sciences;  
**Rina Jaffe** Animal Science;  
**Meredith Brown** Zoology;  
**Heather Brown** Animal Science  

**Mentors and/or Co-Authors:** Jenny Campbell Biology

The North American River Otter (NARO), a semi-aquatic mammal, is native to Canada and the United States. In recent years, the NARO has been extirpated from large sections of its original range, which has sparked an increase in conservation efforts. At the North Carolina Zoological Park located in Asheboro, the NARO exhibit is outdated and fails to meet key welfare standards of the Association of Zoos and Aquariums (AZA). These inadequacies prevent the captive otters from displaying a more complete repertoire of species specific behaviors and limit opportunities for environmental enrichment. Furthermore, the exhibit poses management challenges for the zookeepers and does not have an effective education message. Our design addresses these deficiencies and modernizes the exhibit through incorporation of current management standards with information on otter ecology. We expanded the overall exhibit size and increased the water-to-land ratio to the 1.4 AZA specifications. We replaced the standing water feature with a flow-through system to provide enrichment and improve water quality. In order to address keeper concerns, we enlarged the holding facility to optimize long-term housing of potentially sick, young, or newly introduced animals. Finally, our new education message engages a broader audience with interactive features designed to stimulate interest in conservation issues associated with the NARO. The overarching goal of the project is to improve the lives of the captive otters while enhancing visitors’ experience.

**Session 2, C19**  
**Lab Scale Evaluation of Australasian Sourced FBS and American Sourced Control Lots on AVONEX Growth**  
**Tyler Robert McCaw** Biochemistry/Chemical Engineering  
**Mentors and/or Co-Authors:** James Knopp Biochemistry

AVONEX cultures grown on USA sourced FBS lots were shown to grow significantly better than lots grown on Australian sourced lots; furthermore, there is less lot to lot variability in the American lots lessening the potential of breaching specified parameters. Subsequent purification of harvest material via three stage column chromatography indicated that the batches grown on USA sourced FBS lots were also better able to produce the target protein as these concentrations are significantly higher than those of batches grown on Australian sourced FBS. Extensive quality analysis of the produced proteins showed that FBS source had negligible impacts on the ability of the cells to correctly carry out post-translational modifications of the proteins; ergo, the decision to switch sources can be made entirely upon the ability of the cells to grow and the highest titers achieved. Following cell culture and purification data analysis, it was determined that FBS source should not be shifted to Australian lots.

**Session 2, C5**  
**THE USE OF AN EDUCATIONAL BLOGGING SYSTEM IN AN INTRODUCTORY BIOLOGY COURSE**  
**Sapna Rushikesh Mehta** Biology  
**Mentors and/or Co-Authors:** Miriam Ferzli Biology

The effects of an educational blogging system were evaluated for an introductory biology course. The effectiveness of the blog was tested with four experiments corresponding with material for each of the four exams in the course. Statistical tests have confirmed that increased student involvement in blogging systems have a positive effect by increasing classroom participation as well as exam grade achievement. The statistical data for this exam was based on student’s four exam grades, where the first exam was the control system (blog was not available to students). For exam two, students were offered the option of using the blog without any reward of extra credit points. Exam three as well as the final exam material involved reward for the students participation, three points for the third exam and five extra credit points were offered for the final exam material. At the end of this study, we were able to perform statistical t-tests (paired) where the p-values from each exam (2, 3 and final) were compared to the control experiment. Our studies concluded that as students being offered more and more rewards for their participation; more students did in fact participate, as well as the fact that the exam grades corresponding to the increased amount of participation showed an increase. From this, one may conclude that an educational blogging system increases student’s ability to actively participate with their classmates, and that increased participation in these blogging systems does in fact increase exam grades.

**Session 1, B4**  
**Campylobacter jejuni motility**  
**Kennedi Nichole Miller** Human Biology  
**Mentors and/or Co-Authors:** Jonathan Olson Microbiology

Campylobacter jejuni is a gram-negative microaerophile that is the primary cause of human gastroenteritis. *C. jejuni* relies on oxidative phosphorylation and the electron transport chain for all of its energy requirements. *C. jejuni* has a highly branched respiratory chain consisting of four metal binding pterin containing enzymes (nitrate reductase, sulphite oxidase, SN oxide oxidase, and formate dehydrogenase). The donor enzyme formate dehydrogenase is of particular interest because one mutation was created in which the resulting strain lacks motility. Motility is of importance in order for *C. jejuni* to elicit pathogenic behaviors. In this study our three genes of interest are *C. jejuni* NCTC 11168, *fdhD*, and *modE*. *C. jejuni* NCTC 11168 is the wild type strain, FdhD:CM has a mutation in *fdhD*, and modE:CM has a mutation in the “downstream” regulatory gene. Previous work has indicated that the FdhD:CM strain is non-motile. This study was intended to determine the cause of the motility defect found in *fdhD*. All three strains where tested for motility, formate dehydrogenase activity, and FlaA expression. FlaA is the major flagellum subunit and is required for motility.

**Mentors and/or Co-Authors:** James Knopp Biochemistry
Session 1, C19
Development of In Vitro Produced Bovine Embryos in a Cross-Species Embryo Transfer Model
Matthew Charles Milloway Animal Science
Mentors and/or Co-Authors: Charlotte Farin Animal Science

Recently it has been shown that in vitro embryo production (IVP) could be responsible for a suite of developmental abnormalities known as Abnormal Offspring Syndrome (AOS). In order to conveniently study the effects of AOS, 2 experiments were developed to explore the use of a cross-species embryo transfer model to study development of IVP bovine embryos. Experiment 1 was designed to identify a sire for production of experimental IVP embryos. Five bulls were tested in an IVP system over a five week period. A greater proportion of blastocyst development was associated with fertilization from Bulls A, D and E. Bull E was selected for use in Experiment 2. Experiment 2 was designed to test the viability of cross-species development of bovine embryos in the uterine environment of recipient does. Blastocysts sired by Bull 5 were produced in vitro. On day seven, two groups of recipient female goats were used, one group receiving 2 blastocysts per uterine horn and the other receiving 5 blastocysts per horn. All embryos were transferred to the recipients via transcervical deep cornual insemination. Tracts were then harvested on day 13, and were transferred to the lab in order to examine percent recovery and developmental status of the embryos. Of 57 blastocysts transferred, 2 blastocysts were recovered from the tracts on day 13. These 2 embryos exhibited severe developmental retardation. In conclusion, use of a caprine-bovine cross-species embryo transfer model does not appear to be a viable option for in vitro development studies.

Session 1, A17
Characterization of a novel ovary lipoprotein receptor that binds vitellogenins in fishes
Katelyn Tracy Molloy Biological Sciences
Mentors and/or Co-Authors: Craig Sullivan Biology

The low-density lipoprotein receptor (LDLR) superfamily is comprised of several different genes encoding various membrane receptors involved in endocytosis of a variety of ligands, notably plasma large lipid transfer protein family members (LLTP). These receptors contain characteristic configurations of structural domains previously described of this superfamily including LDLR, very low-density lipoprotein receptor (VLDLR) and vitellogenin receptors (Vtgrs). These receptors consist of unique configurations of domains, which define their identities, and class A ligand binding repeats (LDLa), which determine their ligand specificities.

Vitellogenins (Vtgs) are a LLTP sub-family of yolk precursors that are secreted by the liver in response to estrogen and taken up specifically by growing oocytes via endocytosis mediated by ovary Vtgrs. Recently, three ovary Vtgr proteins were shown to bind two types of Vtgs (VtgAa and VtgAb) in white perch (Morone americana) and a novel Vtgr cDNA (LRX+1) was discovered in the closely related striped bass (M. saxatilis). Partial cDNAs were amplified by polymerase chain reaction (PCR) from reverse transcribed (RT) ovary mRNA template with degenerate primers designed using cDNA sequence encoding stripped bass LRX+1. Products were cloned and sequenced. The complete perch LRX+1 cDNA (3657bp) was obtained using 3’ and 5’ rapid amplification of cDNA ends (RACE). We discovered a novel class of vertebrate lipoprotein receptors that binds Vtgs in fishes. Understanding how this new receptor interacts with different types of Vtgs will aid in explaining the importance of yolk processing and nutrient provision to fish embryos and larvae.

Session 1, C1
Evaluation of Use and Effectiveness of Online Quizzes as a Study Aid for an Introduction to Animal Science Laboratory Course
Susannah Paige Morehead Animal Science
Mentors and/or Co-Authors: Kara Stewart Animal Science

To allow students to better understand laboratory material presented in an Introduction to Animal Science laboratory course, online study quizzes were created for students to review material prior to a laboratory examination. Quizzes were created for four topics that were covered on two separate examinations during the Spring of 2010. In total, 113 students were asked to participate with over 85% of them taking the quizzes for both examinations. The quizzes provided the student with 15 randomly generated questions from a question bank of over 100 questions. The grade students received on each examination and the numbers of quizzes attempted were recorded. In the present study, 93.8% and 86.7% attempted the online quizzes at least once for the first and second examination, respectively. Results illustrate that taking the quizzes aided the students in improving their course grade on the first (p<0.0001) and second examinations (p<0.0003). Students who did not participate, scored lower than the remainder of the students on the exams. The online quizzes were well received by the students as a useful means to further grasp Animal Science concepts. 95% of students surveyed said they liked the online quizzes as study aids and 89% of students surveyed said they believed their grade in the course was improved by using the online quizzes. The online quizzes appear to be a viable study aid for an animal science laboratory course and will continue to be offered to students in future semesters.

Session 1, B5
The effect of different feeding practices on the plasma protein concentration in horses.
Blair T Morton Animal Science
Mentors and/or Co-Authors: Shannon Pratt-Phillips Animal Science
Nitrogen fixation is a key component of organic agriculture. Farmers use legume cover crops to provide fixed atmospheric nitrogen (N) to their crops through a symbiotic relationship between a host legume and soil-dwelling bacteria called rhizobia. The objective of this study was to determine how hairy vetch (*Vicia villosa*) legume planting history affects quantity of compatible soil rhizobia (*Rhizobium leguminosarum* biovar *viciae*, Rlv). We hypothesized that there is a correlation between Rlv population size and HV planting history. The Most Probable Number (MPN) method was used to estimate rhizobia population density in 6 paired soils, including three with (V+) and three without (V-) hairy vetch planting history. Sterilized HV seeds were germinated in lab; thereafter, 6-day old seedlings planted in sterile translucent growth chambers were inoculated with 1 ml of 5⁻¹ soil dilution series. After 6 weeks, plants were harvested to determine the MPN rhizobia estimation in each soil, and nodule numbers per plant. Across most organic farm soils with and without hairy vetch history, MPN results estimated 5,040 Rlv per g⁻¹ soil, except for one site, Cedar Grove V⁻, where only 3,020 rhizobia Rlv cells were estimated per g⁻¹ soil. Cedar Grove was unique in that rhizobia was added to the V⁻ site as an inoculant at planting, suggesting lower overall rhizobia population size as compared to the other two sites, and increased through inoculation. Nodule counts supported MPN estimates, where the Cedar Grove – V field also had lower nodule numbers.
Session 2, A29
An Analysis of the Effects of Maternal Age on Type I Diabetes in the Offspring
Breanna Lauren Pasko Biology
Matthew Movassaghi Animal Science;
Cassandra Ferring Zoology, Animal Science;
Taylor Treadway Animal Science
Mentors and/or Co-Authors: Scott Whisnant Animal Science

Type I diabetes (diabetes mellitus) is an autoimmune disease that affects insulin production in the body. Insulin is an important hormone for blood-glucose regulation, and it is consequently worth investigating any factors that may inhibit insulin function or production. This project consists of an analysis of research on the effects of maternal age on Type I diabetes in the offspring. Through careful evaluation of current and past research, this project was aimed to determine the relationship between advancing maternal age and the onset of Type I diabetes in the offspring. A positive correlation can be shown between advancing maternal age and increased occurrence of Type I diabetes in the offspring. The primary purpose of this project is to provide an increased understanding of the relationship between maternal age and Type I diabetes in the offspring; however, further research is needed to isolate maternal age as a sole factor.

Session 2, A21
Characterization of cyclin-dependant kinase like proteins that respond to geminivirus infection in arabidopsis.
Rashmi Bharat Patel Biochemistry
Mentors and/or Co-Authors: Jose Ascencio-Ibanez Biochemistry
Linda Hanley-Bowdoin Biochemistry

Geminiviruses are a large, diverse family of plant infecting viruses that cause serious crop losses world-wide (Rojas et al., 2005). They are small, single stranded DNA viruses that use the plant DNA replication machinery to replicate their genomes. In a previous microarray study, two cyclin-dependant like kinase (CKLs) genes from the core cell cycle group of genes were up-regulated during infection with the geminivirus Cabbage leaf curl virus in arabidopsis (Ascencio-Ibanez et al., 2008). Since no information is available for the CKL group of genes, we intend to characterize the two CKLs that were up-regulated. The objective for this project is to generate the tools to understand the function of the CKL genes. We will clone these genes (CKL5 and CKL6) in fusions with GFP to follow their expression during infection. The constructs will then be used to transform arabidopsis. Both series of constructs will be required for understanding when and where the CKLs are expressed in arabidopsis. Another aspect that we want to explore is the silencing of the CKL5 and CKL6 with geminivirus silencing vectors, to test if the kinases are required for the infection. A third aspect will be the expression of the proteins in bacterial systems to generate antibodies. The project is in the early stages and we will present the initial steps of the cloning strategies.

Session 2, C20
Is there a Role for NAAG in Axon-glia Signaling in Rat Optic Nerve?
Hamish Sunil Patel Biochemistry
Mentors and/or Co-Authors: Robert Grossfeld Biology

N-Acetylaspartylglutamate (NAAG) is an abundant neuropeptide that is widely distributed, at high concentrations, in mammalian central nervous system. It has been proposed to be a neurotransmitter or neuromodulatory substance that regulates communication between nerve cells. The enzyme glutamate carboxypeptidase II is similarly distributed in brain, where it hydrolyzes NAAG to form N-acetylaspartate and the neurotransmitter glutamate. Since we previously measured GCPII activity in isolated optic nerves, we tested whether NAAG itself could activate the glial cells as a potential transmitter between nerve cell axons and glial cells. Changes in cytoplasmic calcium in response to addition of NAAG or glutamate to the saline were detected by optical imaging of neonatal rat optic nerves that had been incubated with the calcium-sensitive dye Fluo-3AM. Data were digitized and analyzed by Image Pro Plus and Excel. Samples of commercial NAAG activated an increase in glial cell calcium when administered at relatively high concentration. When the samples were purified by ion exchange chromatography, they lost all or almost all of their bioactivity. These results suggest that the relatively small degree of impurity of glutamate in the commercial samples was sufficient to activate the glial cells, as glutamate is known to do, and that NAAG is unlikely to be an intercellular signaling agent in rat optic nerve by itself but possibly can be as a source of glutamate upon hydrolysis.

Session 2, A12
Behavioral Variation in Wild-Derived Zebrafish: Testing Anxiety Disorders and Uncovering the Neurogenomic Bases of Affective Disorders
Florence Perrin Biological Sciences
Mentors and/or Co-Authors: John Godwin Biology

Behavioral variations in response to stress across individuals often has a genetic basis, which, combined with environmental factors, can contribute to the development of affective disorders. Two compartments are described in the literature as ‘proactive’ and ‘reactive’, and illustrate consistent relationships between behaviors within individuals across environmental conditions. Proactive individuals cope with stressors by displaying active behaviors, while reactive individuals cope passively. Although affective disorders are predominant in reactive individuals, laboratory lines of animals used for testing antidepressants are more likely to be proactive. The Godwin Laboratory at NC State obtained a population of wild zebrafish, and divergently selected two lines displaying reactive or proactive phenotypes, respectively. We
Marine fish are an important dietary component for humans, yet also the main source of mercury exposure. Ingesting high levels of mercury affects the developing nervous system of embryos and children, and is a concern for adults. Little is known about mercury levels in North Carolina’s marine fish. We (1) quantified and compared tissue mercury levels of dolphinfish Coryphaena hippurus, king mackerel Scomberomorus cavalla, and wahoo Acanthocybium solandri caught recreationally and porgy Pagrus pagrus, red grouper Epinephelus morio, and triggerfish Balistes capriscus caught commercially; and (2) compared tissue mercury levels of these species with mercury consumption recommendations established by the Environmental Protection Agency (EPA), and Food and Drug Administration (FDA). We collected tissue samples for three months when each species was in season. There were significant differences in mercury content among targeted species. In particular, dolphinfish (0.07ppm), triggerfish (0.09ppm), and porgy (0.19ppm) had significantly less mercury than other targeted species. Nearly all (96%) individuals of these species were below EPA’s action level (0.3ppm), the most conservative metric that we examined. Conversely, 80% of collected wahoo (0.42ppm) and grouper (0.48ppm) exceeded EPA’s action level. King mackerel had significantly higher mercury concentrations (1.3ppm) than all targeted species, exceeding even FDA’s action level of 0.0ppm. In general, we found a positive relationship between fish length and mercury concentration. Results suggest dolphinfish, triggerfish, and porgy are good choices for NC consumers, grouper and wahoo should be limited and king mackerel avoided.

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Session 1, C5
An assessment of mercury in economically important fishes commonly landed off the coast of North Carolina
Sally Jane Petre Environmental Science: Ecology
Mentors and/or Co-Autors: Derek Aday Biology

Muscular dystrophy refers to a wide range of genetic disorders that result in progressive muscle wasting. Research on Duchenne Muscular Dystrophy identified mutations in the dystrophin gene that caused improper localization of the dystrophin-glycoprotein complex (DGC). While these mutations account for a large percentage of muscular dystrophy cases (Duchenne Muscular Dystrophy), other genes play important roles in muscle function, and when mutated can result in other forms of muscular dystrophy. Sarcoptes, an integral membrane protein, is one component of the DGC thought to play a role in muscle function. While defects in some components of the DGC are known to cause muscular dystrophy in humans, mice homozygous for a null mutation in sacrospan appear to have normal muscle function. The purpose of this project is to determine if sacrospan is required for proper muscle function in a less complex organism, the red flour beetle, Tribolium castaneum. In this project RNA interference (RNAi) was used to knock-out sacrospan function in T. castaneum. To do this, we generated sacrospan-specific dsRNA which, when injected into T. castaneum, triggers RNAi-mediated silencing of sacrospan. To facilitate the detection of muscle phenotypes we used a transgenic T. castaneum strain (Pig-19) that expresses a muscle-specific, enhanced green fluorescent protein (EGFP). Muscle-specific EGFP expression was observed in both injected and control beetles and the differences in their phenotypes recorded. Results from both embryonic and larval RNAi will be presented.
How Behavior, Genetic Diversity, and Habitat Loss Affect Big Cat Populations.
Samantha Marie Rierson Biology
Natalie Nielsen Biological Sciences;
Ashley McGuigan Biological Sciences
Mentors and/or Co-Authors: Miriam Ferzilli Biology

Due to human expansion, loss of habitat, and amplification of disease through lack of genetic diversity, many big cat species are facing extinction. Some of these species include lions, tiger, and cheetahs. Research in this area is vital to protect these endangered species from extinction due to these variables. By understanding the behavior and genetics of the different cat species we can form better conservation plans to help keep surviving populations alive. Researchers in this area employ methods including testing genetic diversity by collecting fecal DNA, taking samples from necropsies, utilizing ultrasound, observing the animals in their natural habitat, and exposing them to different stimuli to gather information about big cat populations. Based on the research the tiger and cheetah species showed a very low genetic diversity which could threaten the health of future generations. Research on the natural habitat of tigers concluded that the biggest factors of tiger health include the availability of resources like prey and water and their solitary preference. Lions, on the other hand, live in prides because it is most beneficial for the whole species because it increased reproductive success. Additionally, captive cheetahs are more prone to disease due to the stress of their alien environment. Our study showed that with urbanization, oak leaf dryness was significantly higher than that found in natural habitats. No other dependent variables varied predictably over the course of this study. The results of this study have important implications for future management and conservation strategies, especially as urban landscapes become more prevalent.

Monitoring the levels of herbivory in urban and natural environments: comparing the rate of herbivory and dryness on two oak species
Patricia S Riad Biology
Mentors and/or Co-Authors: Rob Dunn Biology
Benoit Guenard Biology

Urban landscapes differ from more natural ones in nearly every measurable feature. While conservation and landscape management studies are commonly concerned with the net effect of these across varying gradients of urbanization, we aimed to isolate what factors affect urban plants, using the native Willow oak (Quercus phellos L.), and the introduced Sawtooth oak (Quercus acutissima Carruth.) as focal species. Leaf damage, seedling dryness, leaf number, and root length were all measured and compared as a function of environment (urban/natural) and species origin (native/non-native). Our study showed that with urbanization, oak leaf dryness was significantly higher than that found in natural habitats. No other dependent variables varied predictably over the course of this study. The results of this study have important implications for future management and conservation strategies, especially as urban landscapes become more prevalent.

In the past, the contributions of island biogeography to the fields of ecology and evolution have been substantial. Studies of insect diversity, including those conducted on ants, are largely based on individual collections from different islands. Though this method may reveal ecological relationships within specific ecosystems, inconsistencies in sampling efforts can skew the observed correlations and thus limit the ability of the patterns to systematically represent the true diversities present on islands. In this study I summarize the information known about ants in the Pacific islands and analyze the significance of sampling efforts and island area in predicting known species diversities. A database was created via an extensive search through scientific publications about ants found on Pacific islands, particularly in Melanesia and Polynesia. All islands were considered individually and a species list was created for each of them. The results showed that sampling intensity (based on the number of published studies per island) and island size (km$^2$) were both important in explaining the observed ant diversities, however the relative importance of those two factors varied between Melanesian and Polynesian islands. This indicates that our knowledge of Pacific island ant biodiversity is largely dependent on the sampling effort realized and that many regions could be under sampled. As a result, more systematic surveys should be conducted in order to fully understand patterns of ant diversity.

Carbon Neutral Weed Suppression System
Justin Ryan Rothrock Biological and Agr Engineering
Mentors and/or Co-Authors: Matthew Veal Bio & Agri Engineering

The purpose of this project is to design, build and test an eco-friendly and carbon neutral weed suppression system for agricultural and horticultural crops. Current chemical weed suppression methods have the potential to harm the environment and many have eventually become ineffective. Tillage, another method of weed suppression, has a high energy input and may cause soil erosion. Flame cultivation on the other hand, although developed 80 years ago, has some definite advantages and is the focus of this project. The objective of flame cultivation is to vaporize water cells in weeds by using a concentrated flame thus eliminating the weed. The carbon neutral weed suppression system design incorporates a gasifier which produces the flammable gas used as the fuel in the system from readily available crop waste. All of the
Session 2, D3
The Effect of Pollen Irradiation on Pollen Tube Growth, Seed Set, and Offspring Vigor in Controlled Hybridizations of Buddleja (Butterfly Bush)
Anna Leigh Sauls Horticultural Science
Mentors and/or Co-Authors: Dennis Werner Horticultural Science

A study was conducted to investigate the effect of pollen irradiation on pollen tube growth, seed set, and offspring vigor in controlled hybridizations of Buddleja. This information is vital to developing a pollen mutagenesis technique for development of compact and sterile forms of this excessively vigorous and potentially invasive plant. Pollen of the cultivar 'Miss Molly' was irradiated at 0 (control), 20, 40, 80, 160, and 320 Gy of gamma irradiation derived from Cobalt 60. Treated pollen was then used in controlled hybridizations onto the female parent 'Blue Chip'. Two experiments were conducted. Seed set was not impacted at the 20 and 40 Gy treatments, but was reduced at 80 Gy by 42.07% and 39.95% in experiment 1 and 2, respectively. No seed set was obtained using pollen treated at 160 Gy and 320 Gy. A clear trend was observed that pollen irradiation treatment and seedling vigor in experiment 1, as measured by dry weight after about 40 days growth, except that seedlings derived from the 80 Gy treatment showed a 39.9% decrease in dry weight as compared to the control. In experiment 2, percent dry weight reduction of seedlings in the 20 Gy, 40 Gy, and 80 Gy treatments was 0, 10.1, and 29% compared to the control. Only a slight reduction in pollen tube length was observed in the 160 Gy treatment, No clear trend was observed between pollen irradiation level and in vitro pollen germination for treatments between 0 and 160 Gy.

Session 2, A30
Building Soils, Building Minds: Evaluating Learning Gains Resulting from Community-Engaged Coursework in Soil Science
Maximilian Kolbe Sherard Sociology
Mentors and/or Co-Authors: Julie Grossman Soil Science
Seb Prohn Department of Psychology

Service-learning is a method of teaching, learning and reflecting that combines academic classroom curriculum with meaningful service. Two classes in the Soil Science department were observed at the beginning of the semester and again at the end to determine student-learning outcomes related to service-learning. The first course included a community-integrated learning experience in which students developed and delivered soil science lessons to underserved youth in neighborhoods where community gardens had been established. The second course was a control course with no service-learning component. We hypothesized that the service-learning class would increase learning in five areas: teaching skills, critical thinking skills, comfort with material, ambition to learn more, and comfort with diverse audiences relative to the control. Mean responses for each question category were calculated and t-tests were used to determine statistical significance for each variable. Results did not support the hypothesis, and showed decreases in mean values for all variables within all categories. The only statistically significant result in the service learning group were decreases in “Flexibility in the Classroom,” “Recognizing Sound Arguments,” “Systematic Problem Solving.” Statistically significant results in the non-service group showed decreases in “Flexibility in the Classroom,” “Recognizing Sound Arguments,” and “Systematic Problem Solving.” We conclude that pre-survey results may have reported student overconfidence in measured indicators, suggesting that their post-survey data may have been a more accurate report of their real confidence once exposed to the material.

Session 2, B21
Role of Glutamate in Axon-glia Signaling in Rat Optic Nerve
Hitesh Shivalingappa Biochemistry
Mentors and/or Co-Authors: Robert Grossfeld Biology

Glia cells supply nutrients to neurons and regulate nerve function and development. ATP and glutamic acid are intercellular signaling agents that are believed to mediate communication between neurons and glia. Each of them can increase cytoplasmic Ca2+ levels in the glia. The goal of my studies will be to determine the extent to which glutamate contributes to axon-glia interactions. As a first step, I have examined the response of rat optic nerve glia to ATP, which is generally considered to be the main active agent. Rat optic nerves were treated with collagenase to allow removal of the meninges and expose the glial cells to chemicals added to the saline. The nerve was then incubated with the calcium-sensitive dye Fluo-3 AM, and images of cellular fluorescence emission were digitized and analyzed. Two successful experiments were performed on isolated optic nerves to demonstrate the activation of glia by 100 µM ATP.

Session 2, D27
Affect of Black Pearl Pepper Plant Pollen on Western Flower Thrips Consumption by Orius insidiosus
Ryan Christopher Sides Biology
Mentors and/or Co-Authors: Steven Frank Entomology

Flame cultivation can be successfully used on over 30 common field and fruit crops. Components of the weed suppression system are attached to a tractor toolbar. The system is carbon neutral because residue from the previous year’s cotton crops is the biomass that is used to scorch the weeds in cotton fields. The effect of pollen irradiation on pollen tube growth, seed set, and offspring vigor in controlled hybridizations of Buddleja (Butterfly Bush). Two experiments were conducted. Seed set was not impacted at the 20 and 40 Gy treatments, but was reduced at 80 Gy by 42.07% and 39.95% in experiment 1 and 2, respectively. No seed set was obtained using pollen treated at 160 Gy and 320 Gy. Results did not support the hypothesis, and showed decreases in mean values for all variables within all categories. The only statistically significant result in the non-service group showed decreases in “Flexibility in the Classroom,” “Recognizing Sound Arguments,” and “Systematic Problem Solving.” We conclude that pre-survey results may have reported student overconfidence in measured indicators, suggesting that their post-survey data may have been a more accurate report of their real confidence once exposed to the material.
O. insidiosus is considered to be an effective biological control agent against the WFT, as they are native to North America and feed and reproduce on pollen, while nymphs and adults actively eat thrips. A banker plant is a plant that provides an alternative source of food for natural enemies when pest populations are low. In this case, the Black Pearl Pepper (BPP), an ornamental pepper plant, is used to provide pollen as an alternative food source to O. insidiosus. The advent of banker plants aims to improve the efficacy of biological control; however, one criticism of banker plants is that they give natural enemies alternate food choices, which may cause them to not exhibit the same predation rates on their pest as they would if the banker plant system were not present. We tested this hypothesis by isolating single adult female O. insidiosus in vials in a 2x2 factorial experimental design. The treatments included vials that were with and without BPP flowers, and vials with and without thrips. This study showed no significant difference between the consumption of thrips by O. insidiosus when pollen was available versus when it was not. This is an encouraging result in the argument for using banker plants to improve the efficacy of biological control.

Malnutrition has been a long standing issue affecting the inhabitants of Haiti. The issue not only encompasses a lack of proper nutrients, but also includes agricultural obstacles such as soil fertility and trade. In addition, poor governmental infrastructure serves to exacerbate problems regarding water and sanitation, along with long term and short term relief options from a wide range of organizations. Malnutrition has ravaged the overall health of the Haitian population, from physical manifestations to vitamin deficiencies. These ailments include physical and cognitive developmental delays, weakened immune systems, and Vitamin A, Iron, and protein deficiencies. Collectively, these issues were evident for years prior to the earthquake, which functioned as a catalyst for new found international involvement efforts in Haiti. Organizations are working to supply both nutritional resources and health education.

Malnutrition in Haiti

Kelsey Marie Sikes Microbiology
Sarah Whalley Biological Sciences;
Alexa Martin Human Biology;
Hanah Bussaleh Biochemistry;
Khristyna Stolyarchuk Biochemistry;
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Mentors and/or Co-Authors: Gerry Luginbuhl CALS-Dean's Office and Staff

Analysis of Haitian Clinic Files

Camille Elizabeth Studer Chemistry and Biochemistry
Amanda Saad Biology;
James Arnold Zoology;
Tamara Estes Biology

Mentors and/or Co-Authors: Gerry Luginbuhl CALS-Dean's Office and Staff

The Biolog GEN III MicroPlate™ is a system used to identify a broad range of Gram-negative and Gram-positive bacteria. The system utilizes a microorganism’s biochemical fingerprint to provide an identification marker; it analyzes a microorganism in 94 phenotypic biochemical tests: 71 carbon source utilization assays and 23 chemical sensitivity assays. All of nutrients and biochemicals needed to incubate the bacteria are prefilled and dried into the 96 wells of the MicroPlate™. GEN III MicroPlate™ is the next generation of MicroPlate™ with a more accurate identification and user friendly procedure than GEN II. The purpose of this study is to validate GEN III compared to GEN II, by comparing the accuracy their identifications. 109 clinical samples were used during the process; they were identified first with 16S sequencing, then by both GEN II & III and the results compared. The study revealed a decrease in the number of correctly identified isolates when using GEN III MicroPlate™ protocol. This is thought to be the result of threshold values being too strict.

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Therapeutic proteins are administered through intravenous infusions using large volumes of diluted protein. Switching to a smaller volume, easy use, and rapid injection method is currently a goal for therapeutic protein development. Pharmaceutical companies are interested in the possibility of using spray drying to produce a powdered protein that can be suspended in a non-aqueous vehicle at 200 mg/ml active protein. When concentrating protein to levels of 200 mg/ml in a small injectable volume, viscosity and suspension instability issues arise. The goal of this project is to evaluate the spray drying of various proteins at the pilot plant scale. Whey Protein Concentrate with lactose, pasteurized egg whites with trehalose, and Green Fluorescent Protein with trehalose were used in testing as surrogates for cost prohibitive pharmaceutical proteins. It is hypothesized that it is feasible to spray dry proteins with high protein to excipient ratios with minimal protein denaturation, as well as producing spherical particles with low moisture content and high density. The spray drying process and protein to excipient ratio directly affects the final suspension viscosity and stability, as well as protein denaturation. Maintaining protein activity is a critical factor as therapeutic proteins must be active in order to be effective. Spherical particle shape decreases particle to particle interaction, further reducing the final suspension viscosity and improving suspension stability. Also, low moisture content helps extend powder storage time and prevent particle aggregation during storage. Along with those factors, a high powder density is critical to achieving 200 mg/ml final suspension concentration.

Session 2, B24
Characterization of zinc finger coordination and protein-peptide interaction properties of HIV-1 nucleocapsid protein NCp7
Khrystyna Yuriyivna Stolyarchuk Biochemistry
Mentors and/or Co-Authors: Paul Agris Biological Sciences
William Graham Forest Biomaterials

Nucleocapsid protein 7 (NCp7) is a well characterized multifunctional chaperone protein that is expressed by the viral genome of HIV-1. NCp7 participates in the recruitment of the host cell human tRNA Lysine 3 (htRNALys3) as a primer for viral reverse transcription. In the early stages of viral pathogenesis, NCp7 is cleaved from the viral poly-protein Pr55Gag, and is comprised of 72 amino acid residues. Residues 15-28 and 36-49 are highly conserved regions of NCp7 that require the incorporation of zinc for proper folding and overall protein structure. The literature suggest that these conserved regions, referred to as zinc knuckles, are responsible for the recognition and rearrangement of htRNALys3 by NCp7 into a conformation favorable for reverse transcription. The initial focus of this study examined the significance of the zinc coordination on the structure of NCp7 in relation to binding and recognition of htRNALys3. Zinc coordination was performed using dialysis and binding in relation to structure analyzed by Circular Dichroism (CD). The resulting data illustrated a complete dependence of NCp7 on zinc for proper recognition and binding of target htRNALys3. In addition to the NCp7 structural studies, competition assays were performed to characterize a peptide that may interfere with NCp7’s ability to recognize and bind htRNALys3. Peptide 6 was isolated from a previous study for its ability to bind htRNALys3 with a Kd value comparable to NCp7. Fluorescence quenching assays and CD titration studies revealed that P6 associates with NCp7 with great affinity, effectively inhibiting recognition and binding NCp7 to htRNALys3.

Session 2, A19
The effect of restricted grazing on intake of non-fibrous carbohydrates in horses
Alison Thomas-Hollands Genetics
Mentors and/or Co-Authors: Paul Siciliano Animal Science

Laminitis is a devastating disease affecting horses’ feet. Excessive non-fibrous carbohydrate (NFC) intake increases laminitis risk. Eight mature idle horses were used in a 4x4 Latin square design to determine the effects of restricting pasture access on NFC intake. The horses were randomly assigned to one of four groups, two per group, and groups were randomly assigned to one of four treatments of 3, 6, 9 or 24hr of pasture access for 7d. Three and 6hr groups were fed free-choice hay when not grazing. Each group grazed an 0.5 acre cell. Groups were reassigned to a new treatment every 7d so that each group received all treatments. Intake was calculated using a plate meter to estimate the initial herbage mass of each cell and then subtracting that remaining at the end. Pasture samples were analyzed for NFC by the NC Department of Agriculture Forage Testing Lab. Mean pasture NFC intake was 2.23, 2.74, 1.82, and 2.88±0.2 g NFC/kgBW for 3, 6, 9, and 24hr respectively and was greatest (P<0.05) for 24hr compared to all others. Mean total NFC intake was 2.23, 2.74, 1.82, and 2.88±0.2 g NFC/kgBW for 3, 6, 9, and 24hr respectively, and was lowest (P>0.05) for 9hr compared to all others. Pasture NFC intake was reduced by grazing restriction but adding hay to the 3 and 6hr groups negated this effect.

Session 1, B16
Casein as a Molecular Chaperone: The Ability of Casein to Control Protein Aggregation and Enzyme Activity
Kara Ann Tinker Biochemistry, Microbiology
Mentors and/or Co-Authors: Edward Foegeding Food, Bioprocessing & Nutrition Sciences
Research has shown that caseins exhibit many properties of molecular chaperones. Previous findings were based on individual casein properties, and one goal of this project was to determine if chaperone activity was also observed in a milk protein ingredient, milk protein concentrate (MPC). In order to understand the ability of casein to control protein aggregation, a series of protein solutions composed of whey protein, MPC, and both proteins were created. The turbidity of these solutions were measured in order to understand the effect of casein on the aggregation of a protein solution. It was hypothesized that the presence of casein would lower the turbidity of a protein solution after heating. Chaperone activity, based on turbidity alone, was difficult to establish in MPC due to extensive light scattering by the casein micelles. In order to understand the ability of casein to control enzymatic activity, a series of beta-galactosidase assays were conducted on pure beta-galactosidase and a mixture of beta-casein and beta-galactosidase before and after heating (75°C, 10min). It was hypothesized that the presence of beta-casein would protect the enzyme from denaturation under a heat treatment. The results of this experiment are currently being analyzed, however the tentative conclusion of the experiment is that casein does exhibit molecular chaperoning properties.

Session 2, C1
Phylogenetic analysis of FLOWERING LOCUS T gene and evolutionary phenology divergence in angiosperms
Christopher Michael Trlica Chemistry
Mentors and/or Co-Authors: Qiuyun (Jenny) Xiang Plant Biology

Flowering time is a crucial factor in plant reproductive success, affecting pollination and seed setting. Angiosperms display a wide range of variation in flowering phenology as a result of natural selection and evolutionary adaptation. The FLOWERING LOCUS T gene (FT gene) has been shown to control flowering phenology in Arabidopsis thaliana and some other model species. FT orthologs have been isolated from a diverse array of flowering plants. Analyses of the evolutionary history and molecular evolution of a gene can shed light on the molecular changes and evolutionary mechanisms driving the phenotypic variation controlled by the gene. The objectives of my study are (1) to reconstruct the genealogical history of the FT gene in flowering plant using phylogenetic analysis, (2) to examine the rate of evolutionary change and identify any gene duplications using the software tool BEAST, (3) to determine if there is any correlation between flowering time and molecular changes in the gene using character correlation analysis, and (4) to test if the evolution of the FT gene tracks the phylogeny of angiosperms. A total of 134 FT ortholog sequences were obtained from NCBI GenBank via Blastx using the FT amino acid sequence from Arabidopsis. The sequences were aligned using the software tool MUSCLE and checked by eye. Maximum likelihood, maximum parsimony, and Bayesian inference tests were conducted using the software tools raxml, MrBeyes, and PAUP.<

Session 2, B16
Control of enzymatic oxidation during processing of purple-fleshed sweetpotatoes for anthocyanin-rich extracts and starch recovery
An Nguyen Truong Food Bioprocessing and Nutriti
Mentors and/or Co-Authors: Van-Den Truong Food Science

Purple-fleshed sweetpotatoes (PFSP) are rich in polyphenolics and antioxidant activities. This starchy vegetable can be processed into various products including beverages and natural colorants. For juice extraction, sweetpotatoes are usually subjected to heat treatment for making into purées, which are the intermediate materials for subsequent processing operations. Heating inactivates pigment-degrading enzymes and gelatinizes starch but high viscosity and cooked flavor of purées are undesirable. The study aimed to control polyphenol oxidase (PPO) and peroxidase (PO) activities in raw PFSP for improving polyphenolic extraction and concurrently recovering native starch as co-product. Acidified water was blended with PFSP slices and the slurry was passed through a juicer to obtain the pigmented extracts. Samples were taken for measuring pH, enzyme activities and color values. Total phenolics (TP) and total monomeric anthocyanins (TMA) were analyzed according to Folin-Ciocalteau and pH-differential method, respectively. Water extracts of PFSP had high PPO and PO activities which were 99% and 96% inactivated by citric acid concentration above 0.5% and 4% (w/v), respectively, resulting in significant increases in TP and TMA. The TP content increased from 87.2 to 477.8 mg/100g fw and TMA from 8.56 to 87.21 mg/100g fw when citric acid concentration increased from 0% (pH 6.0) to 3% (pH3.0), and the process resulted in starch recovery of 18% from raw materials. The results demonstrate an efficient process for acidified juice extraction with high TP and TMA, and provide an alternative for the sweetpotato industry in producing natural colorants and functional beverages from PFSP.

Session 1, D9
Globally Engaged Agriculture
Tracy Lynn Turnbull Agricultural Education & International Studies
Mentors and/or Co-Authors: Ron Campbell Agri & Resource Economics

The exportation of agricultural products is one way for our country to become more globally engaged, and reap the economic benefit of international trade. In 2008, North Carolina exported $3.1 billion in agricultural products, up 51% from the previous year. Agriculture commissioner Troxler, stated, “exporting agriculture goods supports over 24,000 North Carolina jobs in the farm, food processing, storage, and transportation industries, and that there is still a huge amount of room for growth in exports.” My research investigates the benefits and challenges of agricultural exports by following the North Carolina sweet potato from the field of the local farmer to its final destination in the foreign food market. Through interviews with local farmers and analysis of export data, I was better able to understand the export system from farmer and government perspectives. I also investigated exports from a consumer point of view by touring the New Spitalfields Wholesale Market in London, England. There I spoke with consumers about trends in sweet potato imports and what other types of products they would like to see. By understanding how producers and consumers are working to increase the agricultural exports of North Carolina I was able to create recommendations for efficiency and growth in the industry. Increasing global exports as a nation in the agriculture sector will create more
American jobs, encourage growth in the farming industry, and ultimately increase demand for agriculturally based products, thus stimulating the national economy through the use of the global market.

Session 1, C23
Adaptations of organisms in extreme ecosystems; Desert, Arctic, and Benthic Biomes
Sarah Rebecca Uzzell Textile and Apparel Management
Mentors and/or Co-Author(s): Miriam Ferzli Biology

The human population is growing and expanding into ecosystems that are exotic and extreme. With environmental obstacles, such as pressure, temperature, absence of sunlight, and hypoxic oxygen levels, how are we to survive in these environments that show such barriers to life? Species within desert, benthic, and arctic biomes have created adaptations to live in these habitats and we can learn from these traits. Through the process of observation and dissection of different species, we have discovered some of the ways that animals and plants alike have learned to survive in extreme environments. Desert animals have found unique ways to obtain water. Some amphibians and reptiles sequester water from their bladder to remain hydrated. The red fox chooses water rich foods to replace energy content when water is low. Lipids under the skin/cuticle are used by birds and scorpions to reduce water loss. Benthic dwelling creatures have acquired mechanisms to survive in the extreme conditions of the subphotic zones of the ocean. Such mechanisms allow them to thrive in hypoxic and high pressure conditions. Similarly arctic plants have evolved to develop mechanisms that prevent death or injury when temperatures get dangerously low. The plants have developed over time, and have gained the ability to know when to stop growth development and prepare for freezing temperatures. This knowledge about plants has also helped scientists develop new anti-freezing methods.

Session 2, D22
Peptide Aptamers That Interfere With Geminivirus Replication
Kimberly A. Wagner Genetics, Biochemistry
Mentors and/or Co-Author(s): Linda Hanley-Bowdoin Biochemistry

Geminiviruses are single-stranded DNA viruses that are responsible for significant crop damage and loss around the world so it is important to find a resistance strategy against this disease. Cabbage leaf curl virus (CaLCuV) and tomato golden mosaic virus (TGMV) are begomoviruses (one of the four genera of geminiviruses) that can infect dicotyledonous plants. The AL1 protein is the only protein essential for geminivirus replication. Since AL1 is essential, interference with its function can reduce viral replication. Peptide aptamers are small artificially generated proteins selected for specific binding to particular proteins. Studies have shown that AL1 binds to several peptide aptamers. Furthermore, this protein-protein interaction decreases viral replication in the plant cell line Nicotiana tabacum. We created vectors that contained the viral genomes of TGMV or CaLCuV independently with a peptide aptamer replacing the viral coat protein. Replacing the coat protein with the peptide aptamer ensures that the aptamer protein will be produced where the virus is found. We are using these vectors to infect Nicotiana benthamiana and determine if the aptamers confer resistance to the plant. Experiments to determine if the peptide aptamers interfere with viral replication by interacting with AL1 are ongoing in Nicotiana benthamiana and in Nicotiana tabacum. Preliminary results show that the aptamers do not confer a significant amount of resistance to plants infected with CaLCuV.

Session 2, A6
Identification of a Novel Dominant-Negative Mouse Pregnane X Receptor Splice Variant
Adam R Ward Environmental Science
Mentors and/or Co-Author(s): Andrew Wallace Toxicology

The pregnane X receptor (PXR) is a ligand-activated transcription factor responsible for the induction of several metabolizing genes, notably CYP3A4, which produce proteins involved in detoxifying and clearing xenobiotic and endobiotic compounds from the body. In mice, we identified a novel form of PXR expressed in the testes, referred to as mPXR3. mPXR3 results from alternative splicing of precursor mRNA, leading to a deletion of exon 6 compared to the reference cDNA of mPXR1, and resulting in a change in the ligand binding domain of the protein. In transfection experiments, mPXR3 alone displays no ligand-activated induction of CYP3A4 promoter activity, compared to the significant ligand-activated induction observed with mPXR1. Dose-response studies with increasing amounts of mPXR3 transfected alone did not significantly increase CYP3A4 promoter activity between transfection groups. Co-expression of mPXR3 and mPXR1 was assessed using co-transfection experiments, with increasing amounts of mPXR3 transfected relative to mPXR1. Higher basal and ligand-activated CYP3A4 promoter activity was observed with increasing amounts mPXR3, indicating an interaction between mPXR3 and mPXR1. However, the ligand-to-control ratio significantly decreased with increasing amounts of mPXR3 to mPXR1, indicating mPXR3 acts to repress mPXR1 function. Additionally, a time course experiment verified by Western blot that mPXR1 and mPXR3 proteins were being expressed at equivalent levels. Our findings suggest that mPXR3 functions in testes to maintain basal CYP3A4 transcription, and to repress the ligand-activated induction of CYP3A4. An endogenous substrate of CYP3A4 enzyme is testosterone, so mPXR3 may be buffering the effects of PXR ligand in testes to prevent testosterone degradation by CYP3A4.

Session 2, C21
Impact of dietary phosphate concentrations on neonatal pigs
Jessica Gabrielle Waters Biology
Mentors and/or Co-Author(s): Chad Stahl Animal Science

The goal of this research was to determine the effects of various dietary phosphate concentrations on neonatal pigs. The study was conducted on weanling pigs and was divided into two phases. In the first phase, pigs were fed diets containing different levels of dietary phosphate. The results showed that the pigs fed the higher dietary phosphate levels had better performance compared to those fed the lower levels. In the second phase, pigs were fed diets containing different levels of dietary phosphate and were also exposed to different levels of environmental stress. The results showed that the pigs fed the higher dietary phosphate levels had better performance under stress conditions compared to those fed the lower levels. Overall, the study showed that dietary phosphate levels can have a significant impact on the performance of neonatal pigs.
Dietary phosphate is required for both bone and soft-tissue growth, and deficiency during the neonatal period has been shown to reduce impact the tissue-specific stem cells responsible for bone and muscle growth (Alexander et al., 2010). In this study, we examined the impact of both dietary phosphate deficiency and excess on neonatal pigs. A total of 75 pigs (1 d of age) were pair-fed a PO4 deficient (PD), PO4 adequate (PA), or PO4 excess (PE) milk-replacer diet over an 18d period. While sera PO4 did not differ between the PA and PE fed groups, sera PO4 was lower (P < 0.05) in PD fed animals by d 6 and remained so until trial completion. Sera calcium (Ca) concentrations were higher (P < 0.05) in PD fed animals at all time points when compared to their PE fed counterparts, while PA fed animals did not differ from either group. Pigs fed the PE diet had greater (P < 0.05) sera PTH than either the PA or the PD fed pigs throughout the study. As is typical in P deficiency, PD fed animals had lower ADG (P < 0.05) and were less efficient at feed conversion (P < 0.05) than PA and PE fed animals. Satellite cells and MSC isolated from 21 of the pigs after 12d, had reduced (P < 0.05) proliferation in PD fed pigs. MSC from PE fed pigs had higher proliferation when compared to PA fed pigs. Additional research is needed to further clarify how PO4 status affects stem cell activity and the subsequent changes in growth.

Session 2, B19

Variation in induced defense against caterpillars among ancestral and derived Zea plants

Sarah Elizabeth Widney Biology

Mentors and/or Co-Authors: Micky Eubanks Entomology

Herbivores are persistent and destructive pests in commercial agriculture. Some plants, notably the more wild phenotypes, have natural defenses against herbivores and diseases. Species in the genus Zea range from primitive weeds with very small seeds to the high yielding Zea mays ssp. mays used in agriculture. We compared the induced defenses to caterpillars of four different species/lines of Zea: Z. diploperennis, Z. mays ssp. parviglumis from two different locations, and Z. mays ssp. mays. We infested the different species/varieties of Zea with fall armyworms (Spodoptera frugiperda) and measured the growth of the armyworms after one week. Fall armyworms fed Z. diploperennis and Z. mays parviglumis from Talpita were smaller and grew slower than the caterpillars feeding on Z. mays parviglumis from San Lorenzo and the Z. mays mays landrace. To measure plant response, we used qPCR to quantify expression levels of three genes associated with induced defense against insects in corn and other plants (wip1, lag, and pr1) at 2, 24, and 36 hours after exposure to fall armyworm herbivory. Higher levels of defense gene expression were found in the ancestral Zea (Z. diploperennis and Z. mays ssp. parviglumis) than in the more derived Zea plants. Our results suggest that if resistance genes such as wip1 could be re-incorporated into the genome of modern corn, we could substantially increase the resistance of these plants.

Session 2, D25

Extra Credit in Undergraduate Level Courses

Jamie L Winslow Biological Sciences

Mentors and/or Co-Authors: Sarah Ash, Food, Bioprocessing & Nutrition Sciences

Extra credit is offered at the discretion of faculty in undergraduate level courses. Because of this fact it varies in popularity among professors, disciplines, and in the manner that it is offered. This study was designed to compare faculty and student views on extra credit opportunities. It also seeks to examine whether or not extra credit has an influence on a student’s final grade. A survey of 297 NC State students found that while 46% were offered extra credit in some of their classes, only 47% took advantage of it most of the time. Social science professors were the most likely to offer extra credit (69%), while math and science courses along with humanities courses followed closely behind, at 59% and 51% respectively. Most extra credit was offered in the form of extra assignments, roughly 85%, while extra points on tests and attendance bonuses were also common. While 51% of students found extra credit to be a necessary part of a course grade, only 14% recognized a change in their overall grade when they took advantage of an extra credit opportunity. These results will be compared to data analyzed from a faculty survey.

Session 1, B6

Inorganic and Organic Compounds Affect the Body in Dynamic Ways

Garrett Richard Wydysh Biology

Mentors and/or Co-Authors: Miriam Fezzi Biology

Nearly half of all Americans are estimated to use prescription drugs. Little is known about what physiological effects these drugs have as well as their effectiveness in treating the condition for which it is prescribed. Prescription drugs are specifically prescribed for conditions such as anaphylaxis, and narcolepsy. Research was done to determine how drugs such as epinephrine, naturally occurring in the body as adrenaline, and modafinil, an inorganic prescription, affect the body on a micro and macro level. These experiments evaluated the effectiveness of the drugs through in-lab sleep studies, clinical trials, and animal studies. Sleep studies included MRI, cognitive tests, and sleep monitoring. The clinical trials observed the effectiveness of epinephrine on different cases of patients with allergic symptoms, such as generalized urticaria, hypotension, gastrointestinal problems, and bronchoconstriction; as it relates to their recovery/mortality rate. Conversely, tests were performed on dogs intramuscularly and sought to detect the blood-cell response to epinephrine. Epinephrine was found to be effective in that there was approximately a 30 percent lower hospitalization rate of those given epinephrine. The animal tests noticed upon injection of epinephrine that there was an increase in leukocytic and erythrocytic cells. Modafinil had positive effects of reversing performance impairments associated with sleep deprivation. Vigilance, alertness, and reaction times were improved. These drugs, both organic and inorganic, had positive effects on patients that led to a better quality of life.
Session 1, B20
The effect of leptin on voluntary feed intake and preference in weanling pigs
Ginny C Zimmerman Biology
Mentors and/or Co-Author: Gerald Huntington Animal Science

The objective was to determine the changes of blood plasma leptin concentrations in 25 sows and their piglets that in response to prenatal and postnatal preference tests using flavored feeds. Sows from North Carolina State University swine unit were assigned to gestation diets containing: control, sweet, sucrose, umami, or monosodium glutamate (MSG). After parturition, the piglets were randomly fostered to a sow that received a different flavor than the piglets’ mother. On day 8 after weaning, blood samples were collected before preference testing with the piglets. After the first week of preference testing, leptin (2.5 μg/kg bw) and saline as injection control was administered before the final two days of preference testing. Leptin concentrations were determined by radioimmunoassay (RIA). The results showed preference for lactaram over umami for both the leptin injected (P< 0.09) and control tests (P< 0.01). Difference between MSG and sucrose flavors intake was not significant with the most preference apparent in saline (P< .13). The most intake per piglet was saline for umami vs lactaram and MSG vs. sucrose, then leptin and control varied (1.13/0.96, 1.05/ 0.86, 0.78/0.92 pds respectively). Piglets whose mother sow was given sucrose diets had higher concentrations of leptin (P< .10). The piglets whose mother received umami had greater serum leptin concentrations than those with control or MSG diets (P< 0.06). Through the flavor tests, we will be able to better formulate swine diets for pregnant sows and their piglets improving health and increasing feed intake during weaning.

College of Design

Session 1, D11
Human-Centric Design: Observations Within Community
Matthew Riley Huston Graphic Design
Mentors and/or Co-Authors: Denise Crisp Graphic Design

Designed systems are more relevant and effective when grounded in accurate observation. This study will ultimately inform a system that allows pre-independent teenagers to evaluate community needs and propose solutions. With affordable video recording technologies, those who are participating in the design system can have greater influence in shaping it. This study investigates human-centric design processes using ethnographic research methods (interview and observation). I provided young students (ages six to thirteen) with Flip video cameras to record participation in school activities and their after-school experiences at home. The cameras became a tool for expressing their own experiences and interests. In social situations, one student tended to hold the camera for recording while the others observed the visuals on the screen. Younger students tended to investigate the immediate visual feedback on the screen, taking on the role of recorder, rather than recorded performer. The older students tended to narrate their recordings by talking about the person, object, or place and its relationship to themselves. These findings will inform future instruction of students to document and evaluate their own community’s needs.

College of Education

Session 2, A22
DREAMing to Succeed: Undocumented Latino Student Access to Higher Education
Vanessa Theresa Greene Psychology
Mentors and/or Co-Authors: Tuere Bowles Education

Undocumented student access to higher education has been a lasting, controversial, and significant topic in the United States. The topic is particularly relevant considering the great number of migrant workers in North Carolina. Currently, most states make it extremely difficult for undocumented students to access higher education because these students are required to pay out of state tuition without assistance from federal/state funds. The Latino/a community makes up the majority of undocumented students, as they are the largest minority group in the United States. This research seeks to contribute to the ongoing dialogue, with a specific focus on how denying undocumented Latino students’ access to post-secondary education creates problems for the United States and ultimately threatens societal sustainability. The goal is to promote awareness about the issue. A literature review will address relevant information on the barriers Latino undocumented students face in pursuing higher education. The review will also include articles that address the long term societal and economical affects of denying the largest minority group access to higher education. In addition to the literature review, informal interviews were conducted with current NCSU students to access their diverse views and experiences pertaining to the topic. Content of the interviews will anchor an extension and engagement digital story project and showing used to convene a forum to foster public deliberation and awareness raising.
Mapping Change: Shifts in Food Production Systems in NC
Nikhil Shah Architecture
Mentors and/or Co-Authors: Tuere Bowles Education

A series of information graphics documenting how the agricultural industry in North Carolina has changed over the past thirty years through measure of revenue, demographic shifts, and how they relate to our everyday lives. Specific focus will be given how agricultural production has developed in regards to the globalization of food sheds, and also to the globalization of labor - seasonal and migrant farmworker populations.

An Environmental Justice Case Study of the New Hill Wastewater Treatment Plant
Shana T. Wilson Biology
Mentors and/or Co-Authors: Tuere Bowles Education

Historically, throughout the United States, landfills, hazardous waste sites, and other environmental threats have been sited near low income or minority communities. The case of a wastewater treatment plant (WWTP) being built in New Hill, North Carolina is no different. The residents of New Hill are greatly opposed to the idea of a WWTP in their historic town. The New Hill residents believe they were targeted as a site for the WWTP because they are a minority community. Along with the WWTP, New Hill would face the added stresses of possible water contamination, changes in water quality, odors resulting from the plant, exposure to toxic substances, exposure to disease-producing microorganisms, and oxygen deficient air. This research study details the stakeholders involved, the community impact, and a host of related planning issues.

College of Engineering

A Visualization Interface Design for Wide-area Monitoring of Electric Power Systems
Joel E Anderson Computer Science
Mentors and/or Co-Authors: Aranya Chakrabortty Elec & Comp Engineering

In this project we are developing a Graphic User Interface (GUI) for data analysis of large electric power systems using Synchrophasors. Our objective is to use phasor data and create visually meaningful information that can help us in understanding how catastrophic disturbances such as blackouts and voltage collapse spread from one region to another in power grids, and how the stability margins of the system are adversely affected by such propagation. We use statistical regression methods as well as different fundamental ideas of filtering, system identification and modal decomposition such as the Eigenvalue Realization Algorithm (ERA) as the primary analytical tools for this development. A Python based software application, referred to as Watchdog, which allows us to generate real-time spatio-temporal plots of disturbance events spreading across geographical contour-maps of power networks with scrolling waveforms, is used for visualization of the disturbance events. We demonstrate the software through in-depth analysis of several recent events in the US west coast power system with further goals of extending these methods to more complex events from the Eastern Interconnection.

Multiscale interactions of Mechanics, Microstructures, and Composition of Heart Valve Tissues
Brittany N Ballhouse Biomedical Engineering
Mentors and/or Co-Authors: Hsiao-Ying Shadow Huang Mechanical & Aerospace Engr
Lianne Cartee Bio & Agri Engineering

The function of heart valves is to allow blood to flow through the heart smoothly and prevent retrograde flow of blood. Previous studies showed that the mechanical property of heart valve tissues, microstructures of extracellular matrix, and collagen concentrations are keys to the healthy heart valves. Therefore, this study investigated the relationship between these three factors in native porcine aortic and pulmonary valves and provided insights to the healthy heart valves. Heart valve leaflets were prepared for biaxial loading to obtain mechanical properties. The histology of collagen fibers network was prepared and sections were stained with Masson's Trichrome stain. The photomicrographs of collagen fiber microstructures were obtained via an optical microscope. The collagen concentrations of heart valve leaflets were determined via an assay kit. The results indicated that aortic valves are stiffer than pulmonary valves macroscopically. Microscopically, it is due to collagen fibers in aortic valves are more in alignment than ones in pulmonary valves. It is observed that distilled water has substantial effects on collagen assay results. Moreover, higher collagen concentrations were observed on the edge regions than that of the belly regions of the pulmonary valve leaflets. However, aortic valve leaflets provide inconsistent location-dependent collagen concentration results, suggesting that collagen extraction time might play a significant role. This work provides quantified mechanical and chemical data within heart valve tissues and helps further studies on how to treat heart valve disease.
Fat, Oil, and Grease (FOG) Abatement from Food Service Establishment Wastewater: Comparing Current Practices with Engineering Design
Ryan John Blair Civil Engineering
Mentors and/or Co-Authors: Tarek Aziz Civil Engineering

Fat, Oil, and Grease (FOG) accumulation in the sewer collection system ultimately leads to sanitary sewer overflows (SSOs). A 2004 EPA report to congress estimates that roughly 3 – 10 billion gallons of raw sewage are discharged into the environment via SSOs in the US each year. The EPA report cites FOG accumulation as the single leading blockage-based cause for these overflows. Food service establishments are required, by law, to remove FOG from their kitchen wastewater prior to its release into the collection system. This removal is typically accomplished through the use of grease abatement devices. Despite their prevalence, a universal ordinance has not been set and limited research has been conducted on current grease abatement practices. In this study a survey has been developed for dissemination to municipalities throughout the country to establish a better understanding of current grease abatement management strategies. After analysis of the survey results, information regarding common GAD design will be used to develop computational fluid dynamics models of GADs. These models will provide preliminary insight into effective GAD configurations. These results will also be compared with CFD simulations of GADs constructed using sedimentation design principles.

Designing a Safer Automotive Lifting Solution
Kevin Brandon Bradley Chemical Engineering
John Moreci Mechanical Engineering;
William Chang Mechanical Engineering;
Aaron Bailey Chemical Engineering
Mentors and/or Co-Authors: Seth Hollar Elec & Comp Engineering
Elaine Rideout Entrepreneurship Program

In order for home automotive mechanics to work underneath their vehicles safely, they need to lift them with a jack and then transfer them to a rigid jack stand in case of jack failure. A jack is a dynamic lifting device while a jack stand is a static structure that is designed to hold the weight of an automobile indefinitely. Jacks and jack stands must be placed on a vehicle’s jacking points. A jacking point is a place on the bottom of a vehicle that is designed to support its weight. Switching from a jack to a jack stand is made difficult because these jacking points are too small to hold a jack and a jack stand at the same time. As a result, many home mechanics choose to compromise their safety by forgoing jack stands and working underneath the vehicle while it is only being supported by a jack. This practice has resulted in many undue injuries among home mechanics. In fact, the Consumer Products Safety Commission found that over 15% of all Americans were injured using hoists, lifts and jacks in 2009. These statistics were confirmed during the market research conducted to confirm the viability of the concept of The Awesome Jack System. The current relationship between jacks, jack stands and jacking points produces a safety problem for the home mechanic that The Awesome Jack System will solve.

(Electro)Mechanical Deformation of Diblock/Triblock Copolymer Systems
Sarah Marie Breland Chemical Engineering
Mentors and/or Co-Authors: Richard Spontak Chemical and Biomolecular Engineering

Polymeric actuators, characterized as electroactive polymers (EAPs), are capable of mechanical deformation under an applied electric field and have shown tremendous promise in technologies ranging from micro air vehicles and flat panel speakers to disk drives and responsive prosthetics. Of particular importance are dielectric elastomers (DEAPs) that actuate on the basis of a Maxwell compressive stress that develops upon application of an electric field. Factors such as the cross-link density and chain length dictate their electromechanical properties. Tuning these properties by simply varying the crosslink density and chain length is highly desirable, though not yet achieved. A promising solution to this shortcoming is to use physically cross-linked block copolymer solutions in which elastomeric materials with a high initial modulus can undergo strain softening and reach high strains before failing. A triblock copolymer system composed of a poly[styrene-b-(ethylene-co-propylene)-b-styrene] (SEPS) copolymer with the midblock selectively solvated with an aliphatic oil. The microphase-separated and self-assembled system forms a three-dimensional network due to formation of bridges of EP block between the glassy S micelles. The modulus of these materials is tuned by varying the population of bridges that connect the micelles by systematically blending a diblock copolymer, while the total polymer concentration remains constant. Doing so provided material of high modulus at zero strain and promoted a reduction in modulus at an applied strain. These trends are clearly seen in the stress-strain curves and are reflected in the actuation behavior.
Indium based solders InAu and InSn offer a significant advantage over standard AuSn solder in microelectromechanical systems due to their low bonding temperatures of approximately 180 °C. Two materials systems utilizing low temperature bonding (100-180 °C, 10 kPa) and annealing (0-250 °C) were analyzed for the formation of ductile intermetallic compounds (IMC) with high melting temperatures in the solder. The microstructure and phase composition of IMCs were characterized with scanning electron microscopy, focused ion beam analysis, and energy dispersive xray spectroscopy. The mechanical properties of IMCs were investigated with shear and remelt tests. Results show that a materials system was obtained with a remelt temperature greater than 460 °C and with shear test results comparable to the AuSn standard.

Session 2, B3
Sub-wavelength patterns in silicon give rise to form-birefringence for MIR light
Jillian Marie Clements Electrical & Computer Engr
Mentors and/or Co-Authors: Michael Escuti Elec & Comp Engineering

The need for improved polarization sensitive elements at mid-infrared wavelengths (2-40µm) is becoming increasingly prevalent, especially for use in astronomical polarimetry. Current optical devices used to observe MIR light are physically large, allow for too much absorption, and contain very low levels of birefringence. As an alternative, utilizing polarization gratings in these elements can offer lower absorption rates, higher levels of birefringence, and are relatively inexpensive to create. Polarization gratings are already being used for optical and near-infrared wavelengths (1-5µm) and are commonly found in applications such as liquid crystal displays, non-mechanical optical beam-steering, and telecommunication devices. Previous research has shown that the use of liquid crystal polymers for the grating’s features will result in high absorptions rates for wavelengths less than 25µm. To counter this absorption in MIR light, we have formed a grating whose structure is comprised of splayed sub-wavelength patterns onto a silicon substrate. By fabricating our polarization grating onto an un-doped silicon substrate, we can ensure low absorption rates throughout MIR (~0%). However, silicon is an isotropic material; meaning it contains no inherent birefringent properties. The substrate will use sub-wavelength form-birefringence to create an inhomogeneous anisotropic layer with an isotropic material (i.e. silicon).

Session 2, B5
Reconfigurable Computing Telepresence Robot
Taylor Michael Courier Electrical & Computer Engr
Mentors and/or Co-Authors: Chris Brown Tech Transfer Office

The purpose of this project was to create a high performance sensor platform for NASA with hardware-level data processing capabilities by replacing the proprietary electronics and control system of a military IED examination robot, the MARCbot, with a Xilinx Virtex-6 FPGA controller. The primary task of the MARCbot Sensor Platform (MSP) is to process tele-operation commands from a remote computer and return a live video feed from an onboard camera. A JAVA program on the host computer uses a UDP protocol to transmit drive commands to the onboard controller, a Xilinx Virtex-6. This Field Programmable Gate Array (FPGA) based controller implements a MicroBlaze soft processor, which runs Petalinux, a board specific Linux distribution. A program, written in C, running on this system interprets the UDP packets and sends drive commands to the Parallax servo controller over a serial protocol. An onboard camera transmits live video to the JAVA program over an 802.11 standard wireless network so the robot can be operated out of line of sight. The UDP packet structure is designed to be extensible, so that it could easily incorporate data from additional sensors. The hardware and software modifications that have been implemented enable a user to drive the MARCbot and view the video feed in a standalone program from the remote computer. Although the current platform does not incorporate hardware level processing, work is being done to utilize the partial reconfiguration capabilities of the Virtex-6 to optimize multi-sensor processing.

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Session 1, B15
Effectiveness of superfine powdered activated carbon for the removal of sulfamethoxazole
Evan Charles Ged Environmental Engineering
Mentors and/or Co-Authors: Detlef Knappe Civil, Construction and Environmental Engineering

Powdered activated carbon (PAC) is an important drinking water treatment additive for the removal of trace organic contaminants. The research hypothesizes superfine PACs (S-PACs) remove trace contaminants more effectively than traditional PACs, primarily because adsorption kinetics are enhanced. The hypothesis was tested with the antibiotic sulfamethoxazole (SMX), a suitable candidate considering its prevalence in surface waters and its relatively poor adsorbability (effective SMX removal means many other pharmaceuticals would be removed to a greater degree). The objectives of the research were to assess SMX removal as a function of PAC base material and particle size. Five commercial PACs made from bituminous coal, lignite, coconut shells, and wood (both thermally and chemically activated) were investigated. S-PACs were wet milled derivatives of the as-received carbons. Batch kinetic tests were conducted with (S-)PAC doses of 15 mg/L to assess the effectiveness of each carbon to adsorb SMX. Experiments have been completed with water from utilities in North Carolina, Colorado and Florida. There is sufficient evidence favoring the performance of S-PACs over that of as-received PACs. After a contact time of 30 minutes, SMX removals for as-received PACs ranged from 17-48% while those of S-PACs ranged from 33-99%. The most suitable S-PACs for SMX removal were superfine PACs ranging from 17-48% while those of S-PACs ranged from 33-99%. The most suitable S-PACs for SMX removal were superfine PACs ranging from 17-48% while those of S-PACs ranged from 33-99%. The most suitable S-PACs for SMX removal were superfine PACs ranging from 17-48% while those of S-PACs ranged from 33-99%. The most suitable S-PACs for SMX removal were superfine PACs ranging from 17-48% while those of S-PACs ranged from 33-99%. The most suitable S-PACs for SMX removal were superfine PACs ranging from 17-48% while those of S-PACs ranged from 33-99%. The most suitable S-PACs for SMX removal were superfine PACs ranging from 17-48% while those of S-PACs ranged from 33-99%.
11C has many advantages and potential applications over other radiotracers commonly used pre-clinically. 11C decays 100% by positron emission to 11B with a half-life of 20.38 minutes, resulting in limited commercial viability compared to other radio-tracers such as 18F. The ease with which 11C is assimilated into a glucose structure during synthesis, however, makes it favorable to 18F. 11C is typically produced via the 14N(p,α)11C reaction with 10MeV proton cyclotrons. Such cyclotrons are often associated with large initial and operational costs, which lead to 11C as a less economic choice for radio-tracer production. Consequently, there are many preclinical applications that could benefit from a lower-cost source of 11C. With the advent of smaller, lower energy cyclotrons, it now is possible to utilize the 11B(p,α)11C reaction, which has a suitable cross-section for energies in the range of 7MeV. This project involves the design and optimization of a solid boron-trioxide target in order to provide an economic alternative for 11C production. Considerations for the design of a solid target involve maximizing the anticipated yield as a function of incident beam-current and the associated thermodynamic considerations for the target. Transport calculations were confirmed using MCNPX and reaction cross-section data from the EXFOR/CSISRS database. This, in turn, guided the thermodynamic design simulations carried out and optimized in ANSYS CFX, in order to provide a proof of concept target ideally suited for 11C production in a 7MeV cyclotron.

Session 2, B10
Template Polymerizations on a Surface
Christopher Allen Kilgore Chemical Engineering

Nuclear Engineering

Mentors and/or Co-Author: Jan Genzer Chemical and Biomolecular Engineering

One of the biggest limitations in the field of synthetic polymers is the inability to control precisely the length and sequence of copolymers. Nature is not limited by these issues as seen in the template (polymerization) replication of DNA. Therefore, it is of great interest to investigate the use of template polymerizations to see if it can offer better control over polymerizations. Templates can even be anchored on a surface to provide better control since this eliminates the bulk interaction of the templates. Our research has been started at the elementary level with the deposition of synthesized thiol monomers on a gold-coated silicon wafer. These monomers were deposited onto the gold surface and analyzed through the use of attenuated total reflectance (ATR), water contact angle, with infrared variable-angle spectroscopic ellipsometer (IR-VASE) and X-ray photoelectron spectroscopy (XPS) being performed in the near future. Polymerizations were then performed by adding a radical initiator and analyzed through the same means. Investigations into using different length spacers to distance the monomers from the surface have also been done and are currently being analyzed. Our findings will lay a foundation for looking into how to lay a monolayer on a surface that is capable of selectively non-covalently binding monomers. These monomers would then be polymerized and the resulting polymer would be removed and analyzed. In order to more closely resemble nature, the use of nucleosides as templates on a surface is being investigated.

Session 2, A15
Effect of High Pressure on the Gravimetric Sorption of Ethoxylated Biopolymer Blends
Siddhartha Kollipara Chemical Engineering

Mentors and/or Co-Author: Richard Spontak Chemical and Biomolecular Engineering

Molecular separation research is beneficial for applications requiring ever-increasing purity at an affordable cost. Strategies capable of achieving high gas separation efficiencies based on absorption and mesoporous adsorption involve energy drawbacks, complicated installation, and high maintenance. Gas separation properties are generally compared using permeability coefficients of materials at varying operating conditions. With the use of a gravimetric sorption balance, separation properties can be better understood since they allow for the determination of solubility and diffusion coefficients individually. Polyethylene glycol (PEGda) is an example of a dense polymer that is a low cost reliable alternative to molecular separation due to its high CO2 selectivity and mechanical integrity. Many natural biopolymers, such as silk and gelatin, are known for their excellent mechanical properties. By utilizing these polymers in a non-crystalline state, they could enhance not only the mechanical properties but also the gas separation properties of PEGda systems. The goal of this research is to fully study the effects of carbon dioxide (CO2) and oxygen (O2) at low (2bar) and high (7bar) pressures on ethoxylated biopolymer blends. Both solubility and diffusion coefficients will be obtained at various polymer blend ratios to determine optimal conditions. Polyethylene glycol (PEGda), chitosan (CH), and gelatin (G) polymers were used to prepare ethoxylated biopolymer blend films. Blend films consisting of PEGda and a second biopolymer were prepared in increments of 20 wt%. Solubility curves generally exhibit Fickian diffusivity when the gas was introduced to the blend films at both low and high pressures.
The project centers around the fabrication of free-standing liquid phase structures with microscale precision using eutectic indium gallium alloy (EGaIn 75% Ga 25% In by weight, M.P. ~15.5 °C). These structures are of interest because they are not susceptible to surface tension related instabilities despite being composed of a high surface energy liquid. This stabilization is caused by a thin (nm scale) oxide passivation layer that forms readily in ambient air. Structures can be fabricated using either droplet placement or extrusion techniques. One of the suggested uses for these structures is the fabrication of durable elastic wire bonds for use in flexible electronics.

Session 2, B27

Nanofibers of Water-Soluble Polymers via Foam Electrospinning
Alexandra Marcela Landry Chemical Engineering
Mentors and/or Co-Authors: Saad Khan Chemical and Biomolecular Engineering

We characterize a novel needle-less, high-throughput electrospinning process capable of producing multiple nanofibers, simultaneously. The characteristically large surface area to volume ratio have made nanofibers desirable for a wide range of applications such as energy storage, tissue scaffolding, and many others. Traditional syringe electrospinning apparatuses are limited by low-throughput technologies and potential needle clogging. This proposed process is designed to circumvent these limitations. Utilizing bubbled foams, produced by sparging polymer-solvent solutions, Taylor cone-like perturbations form on the surface of each foam bubble once an electric field is applied, producing nanofibers via electrospinning methodologies. We identify key electrospinning and solution parameters for producing a web with uniform fiber morphology, and demonstrate the process versatility with poly-vinyl alcohol (PVA) and poly-ethylene oxide (PEO). Similar trends are found for this technique as those seen in needle-plate electrospinning, in that a critical applied voltage is necessary for the production of uniform fibers with 7 wt. % PVA. Uniform fibers with average diameters around 300 nanometers can be electrospun using this process. We found electrospinning 7 wt. % PVA produced uniform fiber mats with an average diameter of 300 ± 89 nm. When increasing the polymer concentration, the average fiber diameter increased and self-bonding was observed in the nonwoven mats. Foam electrospinning was also seen to produce fibers of a finite length when using PEO, since the bubbles eventually break in the electric field, possibly electrospinning the resulting droplets further.

Session 1, B18

Optimizing the Neutronic Design of BWR Fuel Assemblies with No Part-Length Rods
Matthew Leonard Nuclear Engineering
Luther Hardee Nuclear Engineering;
Josh Berting Nuclear Engineering;
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Daniel Peeler Nuclear Engineering;
Brett Dougherty Nuclear Engineering;
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Current Boiling Water Reactor fuel assembly designs include the use of a number of part-length rods that pose a significant modeling problem when utilizing current modeling techniques. A separate study determined that the heat flux gradients and cross flow turbulence induced by proximity to a part-length rod can cause the liquid film on adjacent full-length rods to rupture and form localized hot spots leading to possible fuel failure. This phenomenon cannot be accurately predicted by current subchannel analysis methods and thus margin is increased to offset this uncertainty. This project seeks to add a carbon rod extension to the top of each part-length rod to eliminate these thermal hydraulic instabilities and restore lost margin. The effect on the neutronic design of the assembly as well as the full core will be analyzed, with necessary changes to fuel enrichment, coolant flow rate, and other parameters, using the SCALE 6.0 and FORMOSA-B codes. A successful design will have core neutronics behavior, in terms of discharge burnup, reactivity coefficients, cycle length, and thermal margins that matches or outperforms the current design with part-length rods.

Session 1, D7

Deciphering Contradictory Approaches for Calculating Skin Friction
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Current hypersonic aero/thermodynamic publications present contrasting information in regard to the proper method for determining the skin friction across the transition of a laminar to a turbulent boundary layer. The value of skin friction is particularly important because it can be used in combination with the Reynolds's Analogy to calculate the heat transfer rate, and thus prescribe the necessary thermal protection system to the space vehicle. The first method ever proposed is Prandtl's approach, which assumes that the virtual origin of the turbulent boundary layer is located at the leading edge. This conclusion, while very important to the initial foundation of thermal protection system, produces fundamentally inaccurate results and is therefore not the method of choice. The two methods that are under consideration differ in the variable that they equate throughout the transition point of the boundary layer. One method equates the boundary layer thickness across transition, whereas the other method equates the momentum thickness. Several prominent sources contradict each other in the method they suggest for determining skin friction. It is important for engineers to understand that equating momentum thickness across transition is the correct approach because it is the only method that can be mathematically proven. This method also aligns with experimental data when the transition point is located at the end of the transition region.
Session 2, D23
Rapid Detection of Food-Borne Pathogens Using Nanostructured Membranes
Brinda Monian Chemical Engineering
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As evidenced by massive food recalls of recent years, the food industry is in critical need of a solution to the problem of dangerous bacteria and viruses present in food, such as salmonella. The Centers for Disease Control and Prevention estimates that in the U.S. alone, 76 million illnesses occur annually from food-borne pathogens. In addressing this problem, the food industry would highly benefit from a more convenient way to proactively detect pathogens. Food samples could be routinely and rapidly tested during production and processing, before any infected products are sent to stores, become available to the public, and then require recalling. We are investigating a novel method to quickly (in a few hours) and sensitively detect pathogens in food samples. We believe that nanofibrous membranes hold great promise as a material on which to trap pathogens for detection, because of their high surface area and loading capacity. In our envisioned method, antibodies that recognize specific pathogens are immobilized on the nanofibers. The membrane is then exposed to a liquid food sample. Any pathogen, if present, becomes bound to its corresponding antibodies on the membrane. Next, the membrane is soaked in a solution of enzyme-tagged antibodies. If these antibodies also latch onto pathogen on the membrane, the enzyme will catalyze a rapid color-change reaction. The color change indicates the presence and amount of harmful bacteria or viruses in the food sample.

Session 2, C8
Standardized method for segmenting and registering the human rib cage from CT scans
Elizabeth Alaine Moody Biomedical Engineering
Mentors and/or Co-Authors: Lianne Cartee Bio & Agri Engineering

As the age of an occupant involved in a motor vehicle crash increases, the likelihood of the occupant obtaining a thoracic injury also increases. This research is part of a larger five-year study that hopes to quantify the age and gender variations of the thoracic skeleton to explain this pattern in injuries. In order to create a quantifiable model, it is required that around 320 thoracic computed tomography (CT) scans be segmented and registered to a standard model. To ensure consistency and accuracy of these segmentations, a standardized method for segmenting the scans was created with the hopes that the process could be automated. The medical image computing software, Slicer 3D, was used and parameters were researched for needed functions to ensure accuracy for each step of the segmentation process. A systematic protocol was written and implemented for the segmentation of scans in the 0-20 year age range, around 160 scans. The protocol included cropping the volume to a workable size, thresholding with appropriate Hounsfield values, a “hole-filling” operation, labeling the map appropriately, creating a 3D representation, and some steps for registration of the ribs. The segmentation protocol continues to be altered to best fit the needs of segmenting the scans in varying age ranges. This protocol will be used as part of the development of a broader protocol, which will prepare the data for deformable shape based registrations. The idea of an automated musculoskeletal segmentation process will be researched further in the future.

Session 1, C21
Measurement of Fat, Oil, and Grease (FOG) in Wastewater
Marc Richard Mueller Environmental Engineering
Mentors and/or Co-Authors: Tarek Aziz Civil Engineering

Fat, oil, and grease accumulation in sanitary sewer lines is the single largest blockage-based cause for sanitary sewer overflows. According to a 2004 EPA report to congress, 3-10 billion gallons of raw sewage overflow into the environment each year. Current methods used to measure the FOG concentration in wastewater are unable to sufficiently provide reproducible or accurate results. It is necessary to know the amount of FOG in wastewater to advance the science and development of effective policy regarding the discharge and abatement of FOG. The present research uses EPA Method 1664, a gravimetric n-hexane separation procedure for the isolation of FOG material from wastewater. This presentation aims to provide a brief summary of the history of n-hexane extraction of FOG in wastewater and presents preliminary results from controlled experiments to identify potential sources of error with Method 1664.

Session 2, C6
Assessing the Environmental Implications of Current Fat, Oil, and Grease Disposal Practices
Phillip Nathaniel Pressley Civil Engineering
Mentors and/or Co-Authors: Tarek Aziz Civil Engineering

In North Carolina, fat, oil, and grease (FOG) waste generated by the food service industry is primarily disposed of by direct land application and composting, though there are waste-to-energy alternatives. Currently, there is no tool that directly compares the environmental impacts of current practices and waste-to-energy alternatives. Our preliminary investigation assesses several environmental emissions from the direct-to-land application of FOG waste. The biosolids emissions assessment model (BEAM) is a tool that estimates carbon dioxide equivalent emissions from portions of the FOG disposal process. However, there is not a model that compares the environmental effects of the entire process. The ultimate goal of this project is to create a decision support tool for municipalities to more accurately compare disposal methods. To more closely model the actual environmental impacts of different processes within each disposal method, a life cycle analysis (LCA) uses the “cradle to
grave” approach. The current model uses published data to represent typical compost and land application processes. It uses the National Renewable Energy Laboratory (NREL) database to account for the emissions created by the components used in the process, like the manufacture of diesel. By accounting for these intermediate emissions, the model allows for better comparison between two methods with different inputs and thus different intermediate emissions.

Session 2, B8
High Temperature Irradiation Capsule for Materials Testing in the PULSTAR Reactor
John William Robbins Nuclear Engineering
Mark Meneses NE;
Jason Hescheles NE;
Kent Green NE;
Spencer Feuerstein NE;
Koki Faasii NE;
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Mohamed Bourham Nuclear Engineering

The core outlet temperature for high temperature reactors (ex. VHTR/NGNP – a helium cooled, graphite moderated reactor) is expected to be between 750°C and 850°C. The fuel, clad and structural materials of these reactor systems will be subjected to temperatures that exceed those encountered in current LWRs; however, there currently exists limited data to describe materials behavior at such extreme temperatures. In order to characterize and observe the irradiation behavior of materials under such demanding operating conditions, a similar environment must be attained for materials testing. This project aims to design an irradiation capsule that will allow for high temperature testing of structural materials through gamma heating in the PULSTAR reactor at North Carolina State University. The design entails careful selection of materials that allows minimal activation, and a complex inert gas cooling system for temperature control. The irradiation capsule is a right circular cylinder with an approximate two-inch radius and a two-foot height. Our analyses, based on gamma/neutron flux and thermal experiments, Monte Carlo (MCNP) simulations, and computational heat transfer and fluid flow, show that gamma attenuation of a tungsten inner core can generate high temperatures that are encountered in next generation reactors. Our analyses show that forced convection cooling by helium along with an appropriate nitrogen blanket around the samples is sufficient to ensure capsule (outside) wall temperatures to remain less than 70°C (to prevent moderator boiling in the PULSTAR reactor).

Session 1, D10
Cell Culture Techniques
Thea Esme Roper Chemical Engineering
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Stephanie Teeter Biomedical Engineering

My primary research aim was to comprehend various aspects of the cell growth cycle and obtain a proficiency in the techniques needed to perform cell culture. In order to do this, I worked with a rat liver cancer (JM1) and a human breast cancer (MCF7-0) cell line. Within a laminar flow hood, I used aseptic techniques to passage the cells. This sterile environment prevented microorganisms from getting in the flasks. I maintained a supply of viable cells by feeding and sub-culturing flasks. Then, I used a hemacytometer to determine the number of cells inside of the flasks. Finally, I used a microscope to analyze and photograph the cell density of the cells during their growth phases.

Session 2, A25
ACETABULAR MORPHOLOGY IN FEMORALCETABULAR IMPINGEMENT
Laura Christine Rucker Biomedical Engineering
Mentors and/or Co-Authors: Lianne Cartee Bio & Agri Engineering

Femoralacetabularr impingements (FAI) are variations in normal hip morphology that cause friction between the acetabulum and femur. The normal motion of the hip is often disturbed by the damage resulting from the FAI, which has been identified as a cause for osteoarthritis. The focus of this study is to quantify the morphology of the acetabulum and femur. Specifically, the volume of the acetabulum that is occupied by the femoral head will be measured, as well as the overlapping surface area between the acetabulum and femur. A set of 48 CT scans of patients with FAI’s will be used for the study. The scans are imported into Mimics, an image segmentation program that imports 2D scans and can create 3D models from the data. Normal and hips containing impingements are modeled to compare within patient. The study is currently ongoing, but the surface area data will be compared with the acetabulum volume to determine the correlation. The FAI hip data will then be compared with normal hip data to determine if there is any difference in the morphology. This study could help explain the correlation between FAI’s and osteoarthritis, as well as provide a program that can increase early detection.
Session 2, A5
Quantification of gene expression during different stages of differentiation in human embryonic stem cells
Teal Russell Biochemistry
Mentors and/or Co-Authors: Balaji Rao Chemical & Biomolecular Eng

Human embryonic stem cells are able to differentiate to embryonic and extra-embryonic lineages in vitro, such as the inner cell mass and trophectoderm. This project aims to quantify the level of expression of various genes at different stages of differentiation. Specifically, we want to study the changes in gene expression levels to determine if a certain gene is only expressed at a particular stage of differentiation, and if it is expressed at a specific level. Therefore, we will be able to determine the function of certain genes in the development of embryonic and extra-embryonic lineages based on their expression level. We also want to determine if the genes are involved in the development of certain embryonic tissues.

Session 2, C25
Purification of RCNMV binding protein
Megan Elizabeth Smithmyer Chemical Engineering
Mentors and/or Co-Authors: Balaji Rao Chemical & Biomolecular Eng

This project involves a mechanism for cell targeting through use of engineered protein binders. A protein-based adaptor molecule was designed to bind a virus which has been altered to contain a drug and the target cell. This will allow the virus to specifically attack cancer cells and hopefully minimize the effect of cancer therapy on healthy cells. In this project, this protein was purified and its affinity for RCNMV encapsulating chemotherapy reagents tested. These tests proved that the variant dubbed RBP (RCNMV Binding Protein) was able to bind RCNMV with a high affinity.

Session 2, C11
Prediction of the Three Dimensional Structure of Cellulose Synthase
Andres David Vargas Materials Engineering
Mentors and/or Co-Authors: Yaroslava Yingling Material Science Engineering

Cellulose synthases (CesAs) are the proteins responsible for the polymerization of cellulose from glucose. These proteins exist in all plants and form similar protein families within many different clades. Due to the recent decoding of various plant genomes, there has been an explosion of DNA sequences coding for CesAs. In order to determine which portions of the CesAs have specific functionalities, I have compared the genes from poplar, arabidopsis, and cotton lineages. Portions of genes which display high conservation in distant orthologous and paralogous gene pairs can be expected to provide important functionality to the protein that precludes the erosion of these portions by mutation and genetic drift and reinforces their preservation by natural selection. These portions consist of cysteine and serine rich regions and one highly specific DCD (aspartic acid–cysteine–aspartic acid) string. The DXD string is known to play a part in many glycosyltransferase proteins in ligand binding. Therefore, computer model of CesA created by our group was used to model the binding of UDP-glucose to CesA. I found that the UDP-glucose ligand fit well into the space predicted by the DxD region which sheds light on the complexity of the catalytic process of cellulose.

Session 1, C14
Characterization and Emulation of the Memristor
Heather Christine Vaughn Electrical & Computer Engr
Mentors and/or Co-Authors: Subhashish Bhattacharya Elec & Comp Engineering

Most everyone who has taken physics will remember that there are traditionally three basic passive circuit elements used today: the resistor, the capacitor, and the inductor. Until recently however, few people knew of the fourth basic passive element, the memristor. Short for memory resistor, the memristor has recently become a major player in the Electrical Engineering field. The resistance of a memristor at any point in time is based on the effect of the current flow and flux through the memristor for the entire lifetime of the device, giving the memristor a “memory”. This “memory” leads to the only non-linear relationship between time and the resistance for any basic passive element. While this relationship could have many interesting effects on electrical circuits, production of the memristor is still in its infant stages, which prohibits the ability to test the effects of a memristor on electrical circuits. This project developed a device which would emulate the major characteristics of the memristor and allow these characteristics to be tested in conjunction with several different electrical circuits. To create this device, the major characteristics of the memristor were first identified. A mathematical model of these characteristics was then developed. The mathematical model was then implemented in a combination of a microcontroller and digital potentiometer, creating a device that emulates the characteristics of the memristor. This device can now be used to test the effects of the memristor in electrical circuits.

Session 2, D5
Simulation and Evaluation of the BoxBot automated package transport system
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Mentors and/or Co-Authors: Michael Kay Fitts Dept of Industrial and Systems Engineering
The purpose of this design study/simulation is to evaluate the potential of small autonomous robots to deliver packages in office and residential settings. Such a system should allow quick access (<5 min) anywhere in the system to a variety of goods and services such as cooked meals, library books, office supplies and personal parcels. To this end, the author has designed several concepts and evaluated their potential utility via simulation, mathematic and economic analysis. The author has examined two scenarios in detail. The first involves movement of one robot delivering packages in a 60 meter by 60 meter nine story office building with one dumbwaiter available to transport the robot between floors. Deterministic modeling results in an average parcel delivery time from a random starting point in the building to a random end point to be under 3 minutes. The second scenario involved an autonomous rail system coordinating with an autonomous fork lift system to deliver goods in a 1 km by 1 km area. This scenario was studied via discrete simulation. With a rail station spacing of 20 m, one rail robot/fork life robot pair, and a sub-critical demand, the system achieved an average parcel delivery time of 2.26 minutes. The amount of demand handled before average delivery time exceeded 5 minutes scaled approximately linearly with the number of robot pairs, with the scale factor being adjusted by the distance between rail stations.

Session 2, D24
Validation of OpenFOAM, an Open Source Computational Fluid Dynamics (CFD) software package
Jonathan William Witt Civil Engineering
Mentors and/or Co-Authors: Tarek Aziz Civil Engineering

Computational Fluid Dynamics (CFD) software packages can be expensive, with costs ranging in the tens of thousands of dollars, and are often inhibitive with regards to the ability to “open the hood” and modify the code. Openness is particularly important for research applications which may require modifications or additions to existing models. OpenFOAM is a free, open source CFD software package that provides many of the features common to commercial CFD packages. There has been little validation of OpenFOAM however, and it lacks the user-friendliness of commercial codes. The objective of this research is to perform a validation of OpenFOAM for the well-established physics of turbulent plane jets. This validation will include comparison with experimental expressions for jet behavior such as centerline velocity decay, jet expansion, and the non-dimensionality that should be observed at varying jet cross-sections. Results will compare OpenFOAM with a commercially available software package, PHOENICS. Discussion will be given as to the obstacles in using OpenFOAM more widely for the complex geometries and grid configurations commonly explored with CFD.

Session 1, C9
RF Atmospheric Plasma Based Air Filtration Using Porous Metals
Daniel David Wooten Nuclear Engineering
Mentors and/or Co-Authors: Steven Shannon Nuclear Engineering

RF Atmospheric Plasma Based Air Filtration Using Porous Metals
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Atmospheric plasmas, specifically RF atmospheric plasmas, provide efficient means for sterilization and biological remediation. Several groups have shown that under ideal conditions total elimination of bacteriological agents, such as E. Coli, is possible. The goal of this project is to design and optimize a flowing air sterilization system based around porous metals and atmospheric RF plasmas, which is compatible with current air handling infrastructure. This system is designed to eliminate organic contaminants down to the viral level with minimal impedance to airflow. Optimization of this system will focus on decontamination efficiencies, minimization of power consumption, and ease of incorporation into existing airflow systems. Unique challenges to this project include: geometries dictated by existing air flow systems, minimizing pressure drops through the system, power consumption, the necessity of a very stable glow discharge, and the interaction of the unique electrical properties of porous metal structures with RF driven plasmas. System design, characterization of the plasma region, and preliminary tests as an inline air treatment system are presented.

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College of Humanities and Social Sciences

Session 2, C17
Islamophobia in America
Jeanelle Sierra Katherine Alexander History
Mentors and/or Co-Authors: Steven Greene Public & International Affairs
The debate surrounding the “9/11 Mosque” has intensified the anti-Islamic sentiment present in America and initiated a recent wave of anti-Islamic attacks on Muslim communities across America. This intensified Islamophobia spreading throughout the nation raises several questions deserving scholarly attention. What are the personal characteristics that seem to correlate with Islamophobia? Is the anti-Islamic sentiment more significant than any other negative associations with non-Christian religions? These questions will be addressed in my research by the administration of an experimental survey. My hypothesis is that if an individual is associated with Islam than he or she will be more likely to be negatively perceived by Americans. The experimental survey explores whether a Muslim student group or a Muslim Candidate is more negatively perceived than a student group or candidate associated with Christianity, Judaism, or is Non-Religious. The analysis of my survey results revealed that support for a Muslim student group was significantly less than support for a Christian student group. Furthermore, the demographics that were significantly Islamophobic were males and those who had no or few classes with Muslims. The experimental Muslim candidate variable rendered no significant results. I conclude by discussing the implications of these results regarding the role of Muslims in America.

Session 2, A7
Children’s willingness to share feelings may be influenced by mother’s beliefs about emotions
Jarrett Jemale Clifton Political Science
Mentors and/or Co-Authors: Amy Halberstadt Psychology

Open communication between parents and children is thought to be a protective factor as children move through elementary school and on into adolescence. Parents’ beliefs about children’s emotions may have a significant impact on how much children want to share with their parents. Parents value emotions differently; they think about emotions, both positive and negative, as being good and, thus, they may try to “work things out” with their children, or they think about emotions as problematic and, thus, teach their children to “get over it” (Wong, McElwain, & Halberstadt, 2009). As a result, parents may react to their children’s emotions in different ways, and this may affect children’s behaviors in response to their parents’ reactions. In this study, mothers report their beliefs about children’s emotions using the Parents’ Beliefs about Children’s Emotions Questionnaire (Halberstadt et al., 2008). Their third-grade children report their willingness to share their emotions with their mothers, using the Affective Sharing Questionnaire (Gentzler et al., 2005). Mothers and children complete these questionnaires while participating in the CUED IN study (Halberstadt, Garrett-Peters, et al). Families are African American or European American represent all levels of socioeconomic status. I predict that parents who value emotions will foster a more comfortable environment regarding emotions than parents who view emotions in a negative way. Therefore, children of these parents will be more likely to share their feelings with their mothers.

Session 2, B10
Legalizing Sexual Exploitation: Prostitution Law in the Netherlands
Eleanor Lynn Hawthorne Political Science
Mentors and/or Co-Authors: D. Murray Chass-Dean's Office

Prostitution, what some call the world’s oldest profession, is a massive global industry. From pornography to human trafficking, there is a lot of money to be made by capitalizing on sex. Yet, many of the areas where profit can be gained regarding sex are illegal or seen as morally repugnant in many industrialized nations. Socially, this tends to lead towards problems such as the exploitation of women and children, human trafficking and organized crime. In 2001, the Dutch government legalized prostitution within its borders. Legalization is when a government’s policies treat prostitution as a legitimate source of income or job aside from moral opinion. Legalization is rare and not a course of action that most governments choose or see as a feasible option. The Netherlands was able to enact this type of policy approach because of a unique set of historical and cultural factors: tolerance, pragmatism, and a lack of moral pushback. The primary motivators for the move towards legalization were the well-being of sex workers and migrants, societal discontent with the sex industry, organized crime associated with the industry, and human trafficking issues serving the demand for sex workers. I will provide insight into the methods the Dutch government has taken to address these issues, whether or not these measures have been successful, and what additional approaches are necessary to quell the problems with this industry on an international scale.

Session 2, C15
Truth and Reconciliation Commission of Sierra Leone: Effectiveness, Similarity to South African Model and Universal Application
Casey Natasha Huntington Political Science
Mentors and/or Co-Authors: Robert Moog Public & International Affairs

Similar to many countries within Africa, Sierra Leone has suffered through colonialism and war, which has resulted in many deaths and long-term problems that has forced its more modern government to confront those issues in hopes of transitioning towards a better future. One of the more complex issues of all that the Sierra Leonean government has had to deal with is the Sierra Leonean Civil War. By way of the Lome Peace Accord Agreement, a Truth and Reconciliation Commission (TRC) was created to investigate the crimes committed from the start of the war up until the signing of the agreement, to grant amnesty to those perpetrators who confess to their crimes, to hear both the victims and perpetrators accounts of what happened, and send a final report to the president once all hearings were conducted. With the release of the Commission’s final report in 2004, many questions began to surface concerning the success of the commission, whether it was modeled from the South African TRC, and whether there is potential for universal application of the South African model? Based on research the jury is still out? on whether the TRC of Sierra Leone was successful, with success being defined as whether the victims of the crimes committed and the citizens of Sierra Leone view the commission as being effective and fair or not. And while the Sierra Leonean TRC is a version of the South African TRC, there is no potential for universal application of the South African model.
Session 1, D5
Communication Affects HIV/AIDS Prevention
LaTonya Jones Communication
Mentors and/or Co-Authors: James Kiwanuka-Tondo Communication

According to a July 2010 report, The Center for Disease Control reports that there are over one million people living with Human Immunodeficiency Virus (HIV), in the United States. Of those people, 20 percent (1:5) are unaware that they have the infection. Regionally, young African-American males (age 13-24), living in the southeast account for the most AIDS cases (75:100,000). In 2008, North Carolina was named as the tenth highest state with the most newly reported AIDS diagnoses (1,157). An astounding 18,000 people die annually from AIDS (Acquired Immune Deficiency). Men who have sex with men (MSM) are more susceptible to contract the infection—specifically males ages 13-24. African-Americans represent 46 percent of HIV cases in the United States. Although it is not one of the top ten causes for the United States population as a whole, AIDS is the fourth leading cause of death for African-American men, ages 25-44. New cases of HIV infection continue to increase yearly and homosexual African-American males are affected at disproportionate rates. Currently, there is a lack of research publication pertaining to analyzing effective communication messages that promote HIV prevention campaigns, specifically addressing African-Americans. In order to see a decline in the number of yearly HIV cases, careful construction and promotion of HIV prevention campaigns are critical to address the issue. Thus, this research analyzes how effectively ten HIV prevention campaigns are constructed and promoted to the African-American audience.

Session 2, B9
Social Networks and Violence in Rio de Janeiro
Mitiele Leandra Konrath International Studies, Anthropology
Mentors and/or Co-Authors: D. Murray Chass-Dean’s Office

Many scholars have attributed the current high levels of crime in Rio de Janeiro, Brazil, to the failure of government operated institutions. This study argues that the consistent levels of violence in Rio’s favelas result not from the failure of government but, rather, from the relationships linking civilians, drug traffickers, and civic leaders/police officials, supported by economic constraints and stigmas marginalizing the urban poor, and enforced through the implementation of fear and violence. I find that in order to effectively engage in decreasing violence, it is important to view the delinquent behavior with a broader, more holistic lens in order to investigate all the endogenous and exogenous forces that encourage the routine occurrence of violence. In this report, I propose to support my claim by using case study examples to discuss the connections that link the different groups that compose Rio’s society. In supporting my claim, I also propose to explain how and why it is that these social dynamics exist and influence Rio’s inhabitants by engaging in discourse regarding the utilization and shifting of fear and violence throughout the system, establishing each actor’s status within the culture.

Session 2, B17
India, Beauty Pageants and Globalization
Karen Deanne Lundin Interdisciplinary Studies
Mentors and/or Co-Authors: D. Murray Chass-Dean’s Office

Within the past two decades, India has made its mark on the global stage by its domination of international beauty pageants, such as Miss Universe and Miss World. However, the victories earned in these pageants by beautiful Indian women have come at the price of forgoing traditional cultural ideals of beauty to embrace the mold of the Western beauty queen. From the examples set by Sushmita Sen and Aishwarya Rai, Indian women change their physical appearances through strict dieting, cosmetic talent, and rigorous exercise rituals for the small chance of changing their life. The beauty pageant is more than a parade of beautiful women competing for a tiara and world-renowned title; it is one more strategy of globalization through entertainment and popular culture. Beauty pageants serve as a gateway for Indian women to raise social status, find comfortable senses of self as women, and enhance career options, mostly in the media or entertainment industries. The spread of pageantry in India has had a hand in the spread of Indian nationalism through physical and imagined communities, which is nationalism within the communities in India and nationalism amongst Indians of the Indian Diaspora. This poster demonstrates how beauty pageants in India catalyze the debate of beauty pageants as a tactic for empowerment of Indian women or as a sign of the superficial and physical cultural expectations of the West.

Session 2, C22
A New Synergy in Development: Microfinance and Fair Trade
Alexander Joshua Martin Interdisciplinary Studies
Mentors and/or Co-Authors: Nora Haenn Interdisciplinary Studies

In the world of international development, new methods have been used to bring people out of poverty. Microfinance has worked to bring capital to those who never had the opportunity to enter a bank. Fair trade has assisted small producers in earning a higher profit on their products, allowing them to break free of a cycle of produce-sell-subsist. Fair trade and microfinance share some commonalities that make them prime candidates for a blended system. However, there is wide debate on the economic feasibility of both systems. Drawing on recent research field and the author’s personal experience, this poster will propose how a blended system might address the economic drawbacks of each
separate approach and ultimately be more effective than the implementation of one system alone. To illustrate the potential in a blended micro-
credit/fair trade scheme, the poster uses the lives of two women, both working in handicrafts. These illustrations will reveal how each woman
has benefited from a single system but could benefit further from the blended scheme. Finally the poster suggests a three-part impact analysis
methodology, which will evaluate the effectiveness of the proposed system.

Session 1, B25
Emily Dickinson’s Quest for Identity as Emerson’s Great American Poet
Margaux E Novak English Literature & International Studies
Mentors and/or Co-Authors: Thomas Lisk English

In “The Poet” Ralph Waldo Emerson says, “I look in vain for the poet whom I describe... We have yet had no genius in America.”
When Emerson wrote this he was sending out a plea to writers across the United States for someone to take up the noble challenge of beginning
an original literary tradition—a way of recording values, tradition, and life in America instead of borrowing form and subject matter from the
European Romantics. My thesis is that Emily Dickinson read “The Poet” and was so persuaded with Emerson’s call for an American Poet that
she undertook this endeavor. My research this past semester has shown an inner conflict Dickinson faced that prevented her from realizing her
success during her lifetime as opposed to Whitman. Dickinson grew up with a father who disapproved of openly educating his daughters. The
knowledge that Dickinson’s father disapproved of her writing poetry only added another hindrance. Dickinson was also painfully shy and unsure
about the quality of her poetry. Because she was a woman, and because she did not have anyone in her family or town who she could show her
verse to and be reaffirmed, she held back on earnestly searching for a publisher. Dickinson did answer Emerson’s call for an American Poet—
although the poignant fact is that she never realized it in her own lifetime.

Session 2, A14
LGBT Students’ Experiences in and Perceptions of College Communication Courses
Stephanie Nicole Raney Public and Interpersonal Communication
Mentors and/or Co-Authors: Kama Kosenko Communication

In order to further the growing body of communication research surrounding the lesbian, gay, bisexual, and transgender community, this project
was undertaken to determine the role of LGBT-inclusive pedagogy in college communication courses and its effects on LGBT students’
experiences and perceptions in these courses. The purpose of this project is was to explore LGBT college students’ experiences in
communication courses to determine what kinds of LGBT-inclusive teaching methods and materials produce the best effects for this
marginalized community. By method of constant comparative analysis, qualitative interview data from participants, adults who had taken at
least one communication course in their college tenure, will be analyzed. Implications for the communication discipline will be discussed.

Session 1, B13
Working class African American women and heart disease: How communication and community impact knowledge and prevention behaviors
Ranata Lyn Reeder Communication
Mentors and/or Co-Authors: Kama Kosenko Communication

Heart disease is the number one killer of women in America. Obesity, diabetes, high cholesterol, and high blood pressure are all contributing, or
resulting, illnesses of heart disease. African American women are disproportionately affected by heart disease and its accompanying illnesses,
and this is especially the case for African American women in the southern states. This study evaluates the impact that communication and
community have on heart disease prevention, knowledge, and awareness among working class African American women in North Carolina.
Through interview and survey data, the author analyzes how economic and regional factors contribute to the prevention of heart disease among
African American women.

Session 2, D7
Analysis of the Global Sex Trade: United States Policy and the Prostitution Debate
Katie Irene Starr Foreign Languages & Literature
Mentors and/or Co-Authors: D. Murray Chass-Dean's Office

Many cases of human sex trafficking go undocumented due both to a general lack of knowledge about its existence and to a lack of political will
by governments to effectively address the issue. Although human trafficking is a $32 billion/year industry worldwide, many countries do not
have legislation to prosecute trafficking offenders, or to identify trafficked humans as victims. Demand for commercial sex in the United States
is very high, making the U.S one of the largest destination countries for sex trafficking in the world. This has prompted the U.S. government to
establish the Trafficking Victims Protection Act of 2000. Each year, this Act generates a report ranking sex trafficking policies in other
countries according to their effectiveness. Major contributions to the dialogue surrounding sex trafficking policy come from nongovernmental
organizations, and one of the major debates about sex trafficking policy deals with commercial sex and prostitution laws. While many NGOs
advocate for the abolition of prostitution as a means of eradicating sex trafficking, other organizations and governments advocate legalizing
prostitution. The United States adheres to the abolitionist argument, requiring that other countries follow their abolitionist model, and
withholding humanitarian aid from countries where prostitution is legal or regulated. My research compares the role of the U.S. government in the global sex trade with the role of nongovernmental organizations. I argue that while both governmental and nongovernmental organization influence U.S. legislation, their collaboration is key in creating an effective and comprehensive sex trafficking policy.

Session 1, C10
Converging Diets: The Influence of Globalization on Human Nutrition
Caitlin Chandler Vincent Interdisciplinary Studies
Mentors and/or Co-Authors: Nora Haenn Interdisciplinary Studies

This poster examines the science behind obesity and its emergence as a global health problem. Today, societies in both high and low-income countries are converging toward a similar diet. These changes in diet and nutrition ultimately affect the health of the world’s population, and a particular concern is the growing prevalence of obesity. Obesity rates are increasing around the world independent of changes in income. No longer is obesity a condition of affluence. Biologically, obesity is not contagious. However, this poster argues that food environments have become more “infectious” as a result of processes of globalization. These processes include economic integration, rapid urbanization, the spread of ideas and advanced technologies, and expansive advertising exerted by the food industry. Collectively, they have contributed to a diet high in fat and added sugars, which have increased health burdens in low- to middle-income countries where malnutrition is already a public health concern. As a result, the World Health Organization is likely to call for more regulation of the food industry.

Session 2, A24
A History of the Veil in Modern Egyptian Society and its Symbolism Across Cultures
Suzanne Marie Webb International Studies
Mentors and/or Co-Authors: Nora Haenn Interdisciplinary Studies

This research uses Egypt’s feminist history as a case study to explore the multifaceted meaning of “the veil” within Middle Eastern society, focusing on the development of colonial feminism under British rule, the “unveiling” in the post-colonial era and the reveiling of Egyptian women beginning in the 1970’s. Each period represents a distinct change in the function and meaning of the veil to Egyptian women, but also shows women’s agency within many of those changes, an idea in opposition with common Western stereotypes of Middle Eastern women. This is because while the symbolism of the “veil” within the Middle East has changed over the last century, the Western perspective of the veil has not; instead it has retained the Orientalist view that veiling is a monolithic, oppressive practice. The purpose of this study is not to evaluate the validity or legitimacy of veiling but instead to dismantle the preconceived framework from which most Westerners approach the subject, and to provide a nuanced, factually based perspective from which to more accurately analyze veiling and its relation to women’s rights. This perspective demonstrates the utility of the veil within women’s movements in Egyptian society and how it has become an adaptation to modernization over the past century.

College of Natural Resources
Session 1, D20
Cell Morphology of Genetically Modified Cottonwood With Reduced Cellulose Content
Daniel Ellis Carta Wood and Paper Science
Mentors and/or Co-Authors: Ilona Peszlen Wood And Paper Science
Perry Peralta Wood And Paper Science

To enhance the utilization potential of the forest biomaterial, wood quality traits of genetically engineered wood for specific applications including solid wood, fiber, composites, and energy needs to be investigated. The primary objective of this research is to investigate cell morphology of wild type and transgenic cottonwood (Populus trichocarpa) with reduced cellulose content in order to understand how cell wall formation is affected by this genetic modification. This research is a unique opportunity because the wood samples to be studied are the first genetically engineered trees produced with lower cellulose content to provide information and improve our understanding on the role cellulose has in wood formation. Five xylem-specific cellulose synthase genes were knocked down in three ways. A total of 34 transgenic trees, two to six plants per line, and three wild type trees were grown in the greenhouse of the Forest Biotechnology Group at North Carolina State University and harvested at eight months. Vessel diameter, vessel area percentage, vessel number per square millimeter, fiber diameter, fiber wall area percentage, and cell wall thickness of fibers were measured on cross sections using an image analyzer system and statistical analyses were conducted on the data. The results of this investigation will be discussed in this presentation.

Session 1, A19
In response to the rapidly increasing oil prices, it is of extreme urgency to investigate alternative forms of energy. The utilization of waste cellulosics, such as waste paper and sludge from pulp and paper plants, has received widespread attention. According to the Environmental Protection Agency, the United States generates over 68 million tons of paper and paperboard waste each year. Waste paper is a plentiful and low cost feedstock alternative for making bioethanol, and cellulose, the major component of wastepaper, can be converted into fermentable sugars by enzymatic hydrolysis. This project identified the sugar conversion potential of six common sources of waste paper: white copy paper, newsprint, magazine, cardstock, soda carton, and corrugated board. It was discovered that white copy paper had the highest sugar recovery of 60.93% at an enzyme dosage of 16 FPU. Additionally, it was found that ash and lignin content have a large effect on enzymatic hydrolysis. Previous research has indicated that pretreatment is an essential step to increasing the enzymatic digestibility of waste paper that is decreased by the presence of ash and lignin. This work provides valuable data on the sugar conversion of different waste lignocellulosic biomass that others can base their research upon when studying the further pretreatment of these waste paper sources.

Session 2, A15
NOx Emissions Uncertainty: Investigating Irregular Plants and the Corresponding Source Classification Codes
Colin Edward Geisenhoffer Environmental Technology
Mentors and/or Co-Authors: Terrie Litzenberger Forestry&Environmental Resource

In the previous school year, I have been involved in research regarding Emissions Uncertainty focusing on NOx emissions from combustion sources. In my research my group members and I made some rather interesting findings. One of these findings was rather interesting data quality problems. I theorized that due to our data quality criteria certain plants were being removed from multiple Source Classification Codes (SCCs) effecting the overall distribution of our findings. To investigate this problem I decided expand on this research and created my own research project. My study focuses on determining which plants are being removed from the database multiple times. This information was then used to compare the removed plants to one another in form of their NOx emissions distribution. This information was then used to determine if certain power companies were repeat offenders. Lastly, I also investigated spatial relationships of the plants to each other to determine if there are trends involving geographic location for example; a state by state trend.

Session 1, B7
Health and Well-Being of Southeastern Conference Football Fans
Ryan Andrew Jones Sport Management
Mentors and/or Co-Authors: Michelle Harrolle Parks,Recreation & Tourism Mgt

Fans who are highly attached to their favorite teams may experience physical and emotional stress when watching their favorite team win or lose (Wann, 2006). The purpose of my study was to measure health-related quality of life and well-being of collegiate fans after their favorite Southeastern Conference (SEC) football team plays to determine any beneficial or detrimental effects. The participants (N = 29) were SEC football fans who watched their favorite team play during the 2010-2011 season. The survey was distributed a day before their team played and a follow-up was conducted after the team played. The final sample consisted of 72% males (n = 21) and 28% females (n = 9). Game outcomes included 20 wins and nine losses. A repeated-measure ANOVA within subjects showed no significant differences before or after the football game on the eight health variables within the RAND-36 Health Inventory \[F(1,28) = .17, p = .68\]. A MANOVA showed significant differences between fans that watched winning teams versus losing teams for all of the health variables \[F(8,20) = 3.024, p = .02\]. Participants who watched games in which their favorite team won had significantly higher post health scores. This small pilot study has shown that for our participants watching winning teams may have a positive effect on their health and well-being. As many sport fans watch and attend numerous hours of sporting events, future research should examine the health benefits and detriments of fans and overall effect on public health.

Session 2, D11
Habitat selection by herpetofauna in relation to slope aspect at Hill Demonstration Forest, near Durham, NC
Byron Mikel Levan Fisheries, Wildlife, and Conservation Biology
Mentors and/or Co-Authors: Chris DePerno Forestry&Environmental Resource

Slope aspect is important in shaping plant communities and may be responsible for shaping habitat use of herpetofauna species. North facing slopes hold moisture longer and increase the availability of water to organisms. Reptiles and amphibians may select north slope aspects to minimize water loss, increase water absorption, and manage body temperatures. Therefore, the objective of this research is to determine the relationship between herpetofauna habitat use and slope aspect. We conducted the research at Hill Demonstration Forest near Durham, North Carolina. We used \(\frac{1}{4}''\) plywood coverboards (4’X4’) to sample herpetofauna species across the landscape. Further, we summarized 5 years of data that were collected by Fisheries, Wildlife, and Conservation Biology Summer Camp students. Preliminary data indicate that herpetofauna species richness was similar regardless of slope aspect. Our study provides a baseline for future studies evaluating the role of slope aspect on herpetofauna habitat use.
Session 1, C16
Toxicity of Weathered Fuel Product to Hydroponic Trees
Andrew David McEachran Environmental Technology
Mentors and/or Co-Authors: Elizabeth Nichols Environmental Technology

Phytoremediation uses plants to break down, extract, and immobilize contaminants in the soil and groundwater. A phytoremediation demonstration site in Elizabeth City, NC has removed 80% of fuel contaminants after 3 years, but critical "hotspots" of fuel remain. These hotspots are areas of the site where tree mortality has been historically high due to high amounts of fuel in the soil and groundwater. In order for the site to effectively eliminate the remaining 30% of fuel contaminants, tree survival in the areas with high amounts of fuel must be determined. This study will determine if willow trees (Salix spp.) can survive direct contact with free product fuel, which was collected from the top of the groundwater from select monitoring wells on site. I will determine tree health and survival by monitoring differences in normalized relative transpiration (NRT), water use efficiency production (WUEP), and mortality over 5 different concentrations. Willow trees will be grown hydroponically and dosed in hydroponic solutions. After dosing, I will determine NRT and mortality daily, and WUEP at the conclusion of the experiment. I will estimate an EC50 or LC50 of free product fuel to willow trees.

Session 2, C18
Connecting Tourists and Local Communities through Cellphones: START-Net
Asia Jacqueline Murphy Wildlife Sciences
Mentors and/or Co-Authors: Duarte Morais Parks, Recreation & Tourism Mgt

Vulnerable communities in poor regions are able to produce tourism services and products because these activities are an extension of their traditional practices (e.g., tracking wildlife, making crafts, engaging in cultural performances); however, lack of understanding of market preferences and inability to reach markets often prevent them from fully benefiting from tourism opportunities. Conversely, independent tourists and tour operators struggle to find authentic providers of community-based services and products, demonstrating a market demand for the products/experiences that these rural communities can sell. We hypothesized that connecting entrepreneurially minded rural communities to tourists by the creation of a cell phone network would allow rural communities to alleviate poverty through their own actions. This winter, we conducted interviews in multiple rural communities around the city of Pretoria, South Africa. In addition to these interviews, we met with key South African stakeholders to discuss potential roadblocks to the Sustainability and Technology for the Advancement of Rural Tourism Network (START-Net). In this presentation we will share findings from content analysis of field data and impressions from our field journals -- and we will discuss the implications of these findings for community-based tourism projects as well as to our personal growth as engaged global citizens.

Session 1, A16
Creation of a Plastic-like Material from Tobacco Stalks
Kimberly Anne Phillips Chemical Engineering, Paper Science Engineering
Mentors and/or Co-Authors: Med Byrd Forest Biomaterials

The tobacco waste produced from cigarette manufacturing is largely unused; however, by treating the material with chlorine dioxide it is possible to create a plastic-like material from this bio-resource. The two types of materials used include a pretreated, reconstituted tobacco product, and air-dried tobacco biomass. A few treatments have been analyzed to understand why this transformation occurs including a bleaching sequence and an acid chlorite treatment, both using chlorine dioxide. The use of peracetic acid instead of the chlorine dioxide in the acid treatment was also analyzed in order to understand the role of chlorine dioxide in the reaction. It was found that the bleaching sequence was the best form of treatment for both of the materials tested and formed a strong, durable material very similar to a plastic-type product. The results of the acid chlorite experiment were less successful, resulting in a weak fibrous mass. Using peracetic acid in the acid chlorite treatment proved to be unsuccessful, concluding that the chlorine dioxide must play a role in the transformation of the raw material to the plastic-like mass.

College of Physical and Mathematical Sciences

Session 1, D1
Quantification of Fenton Chemistry
Oindree Banerjee Physics
Mentors and/or Co-Authors: Leslie Sombers Chemistry

Hydrogen peroxide is an endogenous molecule in the brain that plays an important neuromodulatory role and is also essential for normal cell function. It is also a reactive oxygen species that has been implicated in oxidative stress, especially in the brain. There is ample scope for Fenton
dye-sensitized solar cells, which utilize a photoactive dye attached to a semiconductor (TiO₂) to create a cheap, efficient solar cell. We used density functional theory (DFT) to study the surface of two different polymorphs of TiO₂: rutile and anatase. The calculations were performed with the PBE functional and projector augmented wave basis set, using periodic boundary conditions to mimic an infinite solid lattice. First, the bulk forms of rutile and anatase were optimized. The optimized solids were then cut along Miller planes (110 for rutile and 101 for anatase) to form a slab several layers thick (4 layers and 15 Å deep for rutile; 5 layers and 18 Å deep for anatase) with a 10 Å vacuum slab. The slab was then optimized with constraints: the bottom layers (3 for rutile, 4 for anatase) were fixed at bulk geometry, while the surface layer was allowed to move into its relaxed configuration. The results of these test show that the nonlinear thin shell instability does play a critical role in the evolution of the blastwave. From this, we quantify the geometric parameters introduced by Chugai et al. in their analysis. In particular, factors critical to creating a matching optical spectral profile from the simulation include measuring the volume filling fraction of the dense fragments, surface area ratio of those fragments versus that of a smooth shell, and the relative velocities of the dense packets of matter.

Session 2, A8
Failed Gamma Ray Bursts: Choked Relativistic Jets inside a Massive Progenitor
Christopher Hiers Blackwell Physics
Mentors and/or Co-Authors: Davide Lazzati Physics

Recent advances in satellite technology and response times have fueled speculation that there is in fact a link between gamma ray bursts (GRB) and supernova (SNe). There have been several pairs of GRB-SNe that are spectroscopically confirmed to be connected, fueling the desire to find a theoretical link between these two great cosmological phenomena. In this project the student has worked to analyze simulations of relativistic jets, characteristic of gamma ray bursts. In this situation the jets stall inside the stellar radius of massive stars, dissipate their energy, and instead produce a “radio bright” explosion similar to a core-collapse SNe. Through further analysis we hope to identify other properties characteristic of these explosions in order to aid in identifying them throughout the cosmos.

Session 2, D20
Immobilization of H₂O₂-Producing Oxidase Enzymes Within a Biopolymer Membrane for Real-time Voltammetric Measurements of Non-electroactive Molecules
Amanda Kathleen Corder Chemistry
Mentors and/or Co-Authors: Leslie Sombers Chemistry

Fe²⁺ + H₂O₂ → Fe³⁺ + OH⁻ + OH

Solar energy is plentiful, renewable, and environmentally friendly. One method of converting solar energy to electricity is through the use of dye-sensitized solar cells, which utilize a photoactive dye attached to a semiconductor (TiO₂) to create a cheap, efficient solar cell. We used density functional theory (DFT) to study the surface of two different polymorphs of TiO₂: rutile and anatase. The calculations were performed with the PBE functional and projector augmented wave basis set, using periodic boundary conditions to mimic an infinite solid lattice. First, the bulk forms of rutile and anatase were optimized. The optimized solids were then cut along Miller planes (110 for rutile and 101 for anatase) to form a slab several layers thick (4 layers and 15 Å deep for rutile; 5 layers and 18 Å deep for anatase) with a 10 Å vacuum slab. The slab was then optimized with constraints: the bottom layers (3 for rutile, 4 for anatase) were fixed at bulk geometry, while the surface layer was allowed to move into its relaxed configuration. Future work will include attaching carboxylic acid to these optimized surfaces for use as a linker to a dye molecule, as well as including defects in the unit cell. Our overall goal is to study the linking mechanisms and the roles they play in the functionality of dye-sensitized solar cells.
Measuring rapid chemical fluctuations in the brain is crucial to the field of neuroscience, particularly to the study of addiction and how it affects behavior. While electroactive chemicals are easily observed and studied using fast scan cyclic voltammetry (FSCV), non-electroactive chemicals are more difficult to measure. In order to quantify them using electrochemical techniques, an enzymatic reaction is used to generate a secondary product which is electroactive and serves as the reporter molecule. Electrodeposition is a method used to immobilize an enzyme, such as glucose oxidase, at the surface of a single carbon fiber microelectrode that reacts with its specific substrate, glucose, to generate an electroactive product molecule, hydrogen peroxide, that can be measured using FSCV. Hydrogen peroxide can then be oxidized at the microelectrode surface and the current measured can be correlated with the amount of substrate consumed by the enzyme. Using this innovative technique, glucose oxidase was encapsulated at the carbon fiber electrode by creating an insoluble chitosan hydrogel, which is a biopolymer extracted from crustacean shells. The enzyme-modified carbon fiber microelectrodes were characterized in vivo to determine their electrochemical properties. Their performance to detect rapid fluctuations of glucose was verified in vivo. The enzyme electrodes successfully measured changes in concentration of non-electroactive glucose in real-time. This novel voltammetric biosensor technology can be implemented for the development of other enzyme-modified microelectrodes capable of detecting rapid fluctuations of non-electroactive neurotransmitters, such as acetylcholine, in real time.

Session 1, D13

Kinetic Activity and Stability of Dehaloperoxidase Mutant, F21Q

Donna Kimberly Dang Biochemistry

Mentors and/or Co-Authors: Stefan Franzen Chemistry

Dehaloperoxidase (DHP) in the annelid Amphitrite ornata produces the enzyme of interest which functions dually as a hemoglobin and as a peroxidase. DHP is the first of its kind to coordinate the reversible binding of oxygen as a globin and it also activates hydrogen peroxide (H₂O₂) as a peroxidase. DHP oxidizes the substrate, trihalophenol (TXP), in the presence of hydrogen peroxide to dihaloquinone, whereas halophenols interact with DHP as an inhibitor. The inhibition site for DHP is located internally within the enzyme at the distal pocket, whereas the substrate binds externally. Thus, DHP is a prime example of the two-site competitive inhibition model. Histidine 55, or the distal histidine (H55), acts as the acid-base catalyst and is the key residue that participates in the charge relay with the iron where it alternates between the ferrous (Fe²⁺) and the ferric (Fe³⁺) iron oxidation states. The objective is to observe the overall stability of the mutant F21Q when the hydrophobic nature of the binding pocket is affected upon the mutation of a hydrophobic residue, F21 (phenylalanine), to a hydrophilic residue, Q21 (glutamine). The relative space that glutamine occupies is compared to that of phenylalanine, which also has some effect on the nature of the binding pocket. Dihedral angles of H55 and the bond lengths between atoms of interest and the heme iron are compared with the wild-type DHP A data for analysis. The stability was observed by utilizing kinetic assays, Visual Molecular Dynamics (VMD) and NAMD Scalable Molecular Dynamics (NAMD).

Session 1, D23

Dendritic Encapsulation of Iron Sulfur Cluster

Brandon J Eudy Chemistry

Mentors and/or Co-Authors: Christopher Gorman Chemistry

Iron Sulfur clusters are among the most ancient biological molecules found on our planet. They are important structures in our biochemistry due to their vital roles in areas such as DNA repair and enzyme activity. The properties of these clusters may be modified by encapsulation. It is thought that with encapsulation, the redox properties of these clusters will change. They may also be tested in environments where they would normally be unstable. Encapsulation is achieved by using dendrimers, which are synthetic branched polymers that bond to the cluster in multiple locations. These dendrimers are amphiphilic and are soluble in both water and oils to allow for protection of the cluster by the lipid branch and solubility in water by the hydrophilic branch. Dendrimer creation is a multistep process with a final step of coupling the dendrimer to the cluster as a ligand. Our study is on how dendrimers can affect the electronic properties of the Iron Sulfur Cluster. Different dendrimer architectures are being explored for experimental purposes. We are comparing dendrimers of different levels of hyper branching and determining how this attribute affects redox potential.

Session 2, B11

Mutation Effects of Dehaloperoxidase

Mitchell Bradner Filip Chemistry

Mentors and/or Co-Authors: Stefan Franzen Chemistry

Dehaloperoxidase (DHP), found in the annelid Amphitrite Ornata, is a unique hemoglobin-peroxidase that dehalogenates trihalophenols into dihaloquinones. The binding site is located in the distal pocket of the heme group. The rate at which the oxidation of phenols occurs can be altered by mutating DHP. The mutant R33A was analyzed in a UV-VIS spectrometer to investigate its ability to oxidize 2,4,6-trichlorophenol in the presence of H₂O₂ at different concentrations. A simulation of R33A in Visual Molecular Dynamics (VMD) was created in order to study the internal effects the mutant had on the movement of the distal histidine. Mutant R33A’s kinetics and histidine activity is very different from the wild type. The significance of this mutant may be important but more research must be conducted to understand how DHP and its mutants work.
Session 2, A9
Changes in the Mechanical Properties of Electrospun Polymer Mats due to Annealing
Kristen Elizabeth Hale Business Management
Mentors and/or Co-Authors: Laura Clarke Physics

Electrospun polymeric materials consist of nanofibers randomly arranged into a mat-like structure. The electrospun polymer mat’s fiber size and porosity are similar to the human body’s extracellular matrix, the basic supportive structure for the body, and thus these materials are highly useful for medical purposes, such as functional tissue engineering, wound healing, and drug delivery. However, electrospun materials have poor mechanical properties and require enhancement. The purpose of this study is to obtain quantitative results to determine how selective heating of electrospun polymer mats can be used to strengthen the mechanical properties of the mat while maintaining the mat’s desirable high porosity. Electrospinning a solution of polymethyl methacrylate (PMMA) in chloroform and dimethylformamide (DMF) (50:50) results in a nanofiber mat. Samples were obtained from the various mats and mechanical strength and modulus were determined using a tensile tester (Instron). Further research will involve heating the PMMA mats in a conventional manner (in an oven) or alternatively, embedding metal nanoparticles into the PMMA fibers and heating the electrospun web via the photothermal effect of the nanoparticles when irradiated with visible light. Mechanical strength enhancement resulting from each type of heating will be compared to determine the most advantageous mechanical strength (or modulus) enhancement method for polymeric material mats.

Session 2, C14
Dehaloperoxidase Mutagenesis: Molecular Dynamics and Kinetics for K36A
Kathleen Marie Hall Chemistry
Mentors and/or Co-Authors: Stefan Franzen Chemistry

*Amphitrite ornata* is a terebellid polychaete that inhabits marine environments, which are contaminated with toxic brominated phenols that are secreted by other organisms. To detoxify the brominated phenols, *A. ornata* produces dehaloperoxidase (DHP I). DHP I has two genes, DHP A and DHP B, and A is the main focus of the work to be presented. DHP A is a dual function protein, meaning that it functions as both a hemoglobin and a peroxidase. The rate of peroxidase enzyme kinetics of the K36A mutant of DHP A was measured. A fit of the experimental kinetics to the Michaelis-Menten equation showed differences in $V_{\text{max}}$ and $K_m$ when compared to the wild type DHP A. The $K_m$ value for the wild type is smaller compared to the mutant K36A, while the $V_{\text{max}}$ value for the wild type is bigger compared to the mutant K36A. The $K_m$ value for the wild type is smaller compared to the mutant K36A, while the $V_{\text{max}}$ value for the wild type is bigger compared to the mutant K36A. This suggests that the on rate, $k$, is getting smaller, so the binding is not as good as the wild type. Along with kinetics, molecular dynamics were run on both wild type DHP A and K36A were obtained. Plots for the dihedral angle of the distal histidine, and the bond length for the mutant K36A, that the on rate, $k$, is getting smaller, so the binding is not as good as the wild type. Along with kinetics, molecular dynamics were run on both wild type DHP A and K36A were obtained. Plots for the dihedral angle of the distal histidine, and the bond length between the heme iron and ne2 and nd1 atoms of the distal histidine are different for the mutant and the wild type. The wild type compared to K36A had different qualities which through kinetics, it is shown that binding is not as good compared to wild type.

Session 2, A3
Examining pH Trends in North Carolina Streams and Rivers
Kristopher Michael Hoover Statistics
Kristen Gulledge Statistics and Economics;
Paul Godfrey Statistics and Economics
Mentors and/or Co-Authors: Bill Hunt Statistics

Recent analysis of the pH levels in NC rivers and streams have shown decreases in pH level. This is disturbing considering the efforts that have been made in the past to reduce the severity of acid rain (Clean Air Act with Title IV). A decrease in the amount of acid rain should lead to higher pH levels. This does not appear to be the case. Our study will investigate the downward trend in pH in NC rivers and streams.

Our study detected strong patterns of seasonality in pH in the Blue Ridge region and found a seasonal pattern in the amount of NOx and SOx in the rain. We determined that there has been a statistically significant decrease in the pH of rivers in the Blue Ridge and a slightly significant decrease in the rivers of the piedmont from 2000-2009. After analyzing the wet deposition data, we determined that there has been a significant increase in the rain's pH and a significant decrease in SOX and NOX gasses in the rain. SOX and NOX gasses in the rain both have a strong positive correlation with the pH of the waterways in NC. We expected pH and the amount of SOX and NOX in the rain to be inversely related, since both gasses cause acid rain. This likely means that Title IV has been successful in achieving its goals of reducing acid rain and there is another reason for the decrease in pH in the Blue Ridge.

Session 2, B22
The Synthesis of Azide Unnatural Amino Acid and Dehaloperoxidase B Mutagenesis for Protein-Bioconjugation Reactions and Photodynamic Therapy
Rikki Lyn Horne Zoology
Mentors and/or Co-Authors: Alexander Deiters Chemistry

In order to improve the effectiveness of photodynamic therapy (PDT) and expand its utility to a wide range of cancers, research is being focused on the development of novel photosensitizers which are capable of specifically targeting cancer cells and/or bacteria over host mammalian...
tissue. We envision that such targeting and discrimination may be achieved via porphyrin-antibody conjugates, themselves synthesized from modified recombinant antibodies containing unnatural amino acids for their bioconjugation with porphyrin-based photosensitizers, developing fundamentally new PDT agents. In order to generate porphyrin-antibody conjugates, a suitable unnatural amino acid, (S)-2-amino-6-2-azidoethoxy carbonyl amino hexanoic acid, was first synthesized in gram quantity. The synthesized unnatural amino acid contains an azido group, which provides a bio-orthogonal chemical handle for use in protein labeling. This functional group has a chemical reactivity that is fully orthogonal to the chemistry of the common 20 amino acids and will be reacted via [3 + 2] cycloaddition (Click chemistry) with porphyrin-based photosensitizers to generate porphyrin-antibody conjugates. Dehaloperoxidase B (DHPB) is the model protein which has been selected first for the site-specific incorporation of the unnatural amino acid. Site-specific incorporation is needed to prevent mis-folding and loss of protein function upon conjugation with the porphyrin-based photosensitizer. Mutagenesis of an undesired stop codon and introduction of the amber codon for incorporation of the unnatural amino acid into DHPB have been accomplished. Recombinant protein expression is currently underway, followed by investigation of the bioconjugation step.

Session 2, B26
Comparison of Anthropogenic Effects on Bedload Particle Sizes Transported By Piedmont Streams of Central North Carolina
Julie Anna Johnston Marine Earth & Atmospheric Sci
Mentors and/or Co-Authors: Karl Wegmann Marine,Earth & Atmospheric Sci

Billions of dollars have been spent on the physical restoration of Atlantic-margin waterways in an effort to minimize water pollution and restore biological integrity; however, little research exists on the physical conditions of stream channels prior to Euro-American settlement of the Carolina Piedmont. The intent of this research project is to investigate if the maximum size of bedload being transported by Piedmont streams of central North Carolina, and has the size increased significantly following post-European American landscape modification. Waterways located within the boundaries of Umstead State Park, Wake County, North Carolina are the focus of this study. Field procedures consisted of 1) detailed geomorphic assessment, 2) sediment sampling and characterization of the size of the current bedload, channel bars, and stream banks, (3) sediment sampling and characterization of pre-European bedload and channel bar deposits preserved beneath millpond legacy sediments. Results have shown that the bedload particle size of pre-European channels preserved beneath millpond legacy sediments is significantly smaller than the bedload being transported by the streams today. Stream channel instability caused by excess deposition of sediment can severely impact aquatic life including the food chain, spawning and rearing habitat, and other functional components. Suspended solids and sediment in natural quantities also replenish sediment bedloads and create valuable micro-habitats, such as pools and sand bars. Therefore, a basic premise for managing bedload sediments in water bodies to protect aquatic life is needed to maintain natural levels of suspended and bedload sediments in water bodies.

Session 2, C23
Determining the Substrate Binding Site of Dehaloperoxidase(DHP) by Surface Mutation of K58A
Za Mawi Khamh Chemistry
Mentors and/or Co-Authors: Stefan Franzen Chemistry

Dehaloperoxidase (DHP), isolated from the coelom of the terebellid polychaete Amphitrite ornata, is a heme enzyme with globin structure and has peroxidase activity. Although it is now known that the internal binding site is an inhibition site and the substrate-binding site is located on the surface, it is still not known where exactly the substrate binds to the enzyme. In this research, the DNA of dehaloperoxidase was expressed in E.coli and the surface amino acid residue 58, lysine (K), was mutated to alanine (A), which decreased the overall charge of the enzyme. The molecular dynamics simulations were run for the mutant and the distance between heme iron and the histidine 55 nitrogens for the mutant K58A in the initial 5ns was also measured. The kinetics of the mutant was measured and compared to the wild type’s kinetics. The kinetics of K58A showed that the specificity constant, kcat/Km, value is lower than the wild type, which suggests that the substrate-binding rate of the mutant is slower than the wild type. Mutating the lysine at residue 58 has an effect on the substrate binding rate but the fact that the overall charged was reduced might have been the reason of the result. Therefore, double mutants were made to keep the charge the same as wild type and the kinetics were measured.

Session 2, A10
Effects of the K99A Mutant on the Enzymatic Activity of Dehaloperoxidase
Christian Blake Lawrence Biochemistry
Mentors and/or Co-Authors: Stefan Franzen Chemistry

The focus of this project is to examine the effects of site-directed mutagenesis on the enzymatic activity of the Dehaloperoxidase- Hemoglobin from Amphitrite ornata. The first phase of this project involved the use of molecular dynamics simulations to examine the enzymatic activity of DHP A. VMD was used to mutate residue K99 into residue A99 on DHP A. A 5 ns simulation of the mutant was conducted using NAMD. The next phase of the project involved measuring the enzymatic activity of DHP A by measuring the kinetics of the mutated enzyme. It was determined that the K99A mutation reduced the amount of protein expressed and the overall stability of the protein, which could mean that this area is a site of protein folding.
Session 2, C3
How Can Air Quality Trend Lines Be Preserved?
Rachel Elizabeth Marceau Statistics
Kristen Immen Statistics;
Alissa Anderson Environmental Science- Statistics
Mentors and/or Co-Authors: Bill Hunt Statistics

For the past 40 years, the United States Environmental Protection Agency (EPA) has monitored criteria pollutants to see whether air pollution is improving. Trend lines provide an excellent means to determining whether pollution reduction programs are working. Currently, the EPA calculates trends using a strict average of all monitoring sites, even though monitors are not spaced equally with respect to geography or population. This traditional approach may not capture all pertinent information. Therefore, the project considered population and area weighting approaches to calculating trend lines. The project looked at county-level weighting schemes for six criteria pollutants: carbon monoxide, nitrogen dioxide, ozone, particulate matter (both PM fine and PM10), lead, and sulfur dioxide from 2000 to 2008. The counties causing deviations in population and area weighted trends are discussed, as well as how the trends improve upon their removal. In addition to weighting air quality trends, the project looked at potential network thinning. With the spread of national budget cuts, a thinning of the monitoring network seems inevitable. The current layout of the EPA monitoring network is presented as well as the results of different simulated network thinning techniques, such as taking out sites that are below a percentage of the standard and looking at the correlation between monitoring sites.

Session 1, A14
The Effect of Finite Source Size on Supernova Neutrino Flavor Twinkling
Alexander William Mauney Physics
Mentors and/or Co-Authors: Jim Kneller Physics

Simulations of multidimensional core-collapse supernova exhibit turbulent behavior. Previous investigations have shown that this turbulence can affect the neutrinos that propagate through it, leading to a twinkling behavior between the different flavors. To fully simulate the signal of a neutrino burst we must first consider three different effects: the finite size of the neutrino source, the energy resolution of the detector and the time and energy variance of the signal. In this paper we consider the first of these effects and examine how the finite size of the neutrino source modifies the signal by calculating the final state correlation function for two neutrinos emitted along parallel paths through a turbulent three dimensional supernova density profile.

Session 1, C6
What Drives the SASI in Core-Collapse Supernova?
Cody Allen Melton Physics
Mentors and/or Co-Authors: John Blondin Physics

Supernovae are the extremely energetic deaths of stars. These stellar explosions spread heavy elements throughout the universe, which ultimately allows for solar systems, planets, and life. A critical component behind a supernova explosion is the spherical accretion shock instability, or SASI. Two theories describing this mechanism exist. An advective-acoustic mechanism says that entropy perturbations generated at the shock travel inward with the accretion flow with a free-fall velocity, which couple to an acoustic wave. If these perturbations amplify, the advective and acoustic waves lead to an instability. The acoustic theory states that the SASI is purely an acoustic phenomenon in which a sound wave travels around the circumference of the shock. This project attempts to resolve the debate between the two theories by observing the SASI in a regime where the timescales become disparate. Because the sound speed behind the shock is determined by the gravitational potential and the post shock flow speed is a strong function of the ratio of specific heats, gamma, the advective-acoustic mechanism has a much longer timescale for small values of gamma. We find that the timescales become highly disparate when gamma equals 1.2 and use two-dimensional simulations when gamma is 1.2 to quantify the growth rate of the instability. This will allow us to determine whether the SASI operates as an advective-acoustic or purely acoustic phenomenon.

Session 1, C13
Geophysical Analysis & Hazard Assessment of the Hunga Volcanic Province, Tonga
Miranda Lynn Mikesh Geology
Mentors and/or Co-Authors: DelWayne Bohnenstiehl Marine,Earth & Atmospheric Sci

The islands of Hunga Tonga-Hunga Ha'apai are the subaerial western and northern caldera rim remnants of the submerged Hunga volcano, centrally located 55km N-NE from the Kingdom of Tonga in the South Pacific. Over the past 100 years, the Hunga volcano has had numerous eruptive episodes, the most recent of which was an explosive eruption in 2009 from March 17-21st. The event was characterized by earthquakes, eruptive columns of ash and steam plumes, pyroclastic surges and explosive ballistic ejecta. Given the violent eruptive volcanism and active seismicity of the Hunga volcanic province, our study sought to constrain the temporal and spatial variations of seismic activity occurring in the region with the use of autonomous hydrophone technology. Research took place during January 2009-April 2010 and encompassed a two-stage deployment of 11 seismic stations and 16 hydrophones. Our hydrophone analysis revealed eruptive activity characterized by short duration, high frequency “pops”, related to distinct explosive events. Three active vents and Surtseyan type eruptions (i.e. violent eruptions involving short duration explosions coupled with base surges, ballistic ejecta and vast steam/ash plumes) were also observed. Due to the eruptive nature of the Hunga volcano and its close proximity to Tongatapau, a notable tourist region, it is important for regular monitoring...
volcanic monitoring to take place. Currently, no such volcano-seismic monitoring program is established within the Tonga region, thus our study and future studies are imperative for the safety of the island inhabitants.

Session 2, C26
Synthesis 2-Aminoimidazole Containing Imides
Trey Carlton Mullikin Biochemistry
Stewart Harsant Spanish Language And Literature
Cristina Aclaraz Chemistry
Mentors and/or Co-Authors: Christian Melander Chemistry

Bacterial biofilms are considered a defense mechanism, through which planktonic bacteria cells aggregate and become enclosed by an extracellular matrix. It has been previously shown that 2-aminoimidazoles (2AI) are able to inhibit as well as disperse bacterial biofilms across bacterial order, class, and phylum. Utilizing the 2AI scaffold as an inspiration, a library of 2AI imides was synthesized. This new library will allow the effects of bridged cyclic rings on the inhibition and dispersion of medically relevant bacterial biofilms such as MRSA and MDRAB.

Session 1, A3
Effects of pH on the Cp*Ir(NHC)(H2O)2 Catalyzed Aerobic Oxidation of Cyclopentanol
Amanda L Patrick Chemistry
Mentors and/or Co-Authors: Elon Ison Chemistry

Most oxidation reactions of primary and secondary alcohols require organic solvents and basic conditions and few are performed aerobically. A water soluble catalyst Cp*Ir(NHC)(H2O)2 has been developed to eliminate the need for environmentally harmful organic solvents in an aerobic oxidation reaction. Our goal was to investigate the pH dependence of the reactivity of this catalyst by varying the pH of the aqueous buffer solution used as the solvent in the aerobic oxidation of cyclopentanol. Somewhat surprisingly, it was found that the turnover rates varied very little with pH for this reaction.

Session 1, C15
‘Tidal’ hypothesis and Superhump Phenomenon
Phillip Harvey Phipps Physics
Mentors and/or Co-Authors: John Blondin Physics

My research is on white dwarf star systems where the white dwarf has a companion star that is putting matter onto the white dwarf in a disk, called an accretion disk. These systems are called Cataclysmic variables and are subdivided into classical novae and dwarf novae. Classical novae are caused by sudden nuclear fusion near the white dwarf while dwarf novae are outbursts caused by a sudden increase in the accretion onto the white dwarf. SU Ursae Majoris stars are a subclass of dwarf novae and are characterized by outbursts that are much brighter than the average outburst. These large outbursts are more frequent than the normal outbursts and have high variations in light output known as the Superhump phenomenon which I am researching. It has been hypothesized that these effects are caused by ‘tidally’ driven instability in the accretion disk. The tides have a resonance of about a 3:1 radius in the outer reaches of the accretion disk and the gravitational pull of the companion star excites strong ‘tidal’ waves within the disk. The research is using numerical simulations of gas flow to study the tidal effects in the accretion disk. Previous research has shown that as tidal waves move through the disk they seem to rebound off the inner edge. Changing the gravity inside the disk to resemble that of a black hole changes the tidal effects in the disk to erase the reflections off the inner edge.

Session 1, C3
Liquid-Liquid Phase Transitions: Hydrates of Copper(II) Chloride
Eric Scott Rountree Chemistry
Mentors and/or Co-Authors: James Martin Chemistry

Color changes seen in high concentrations of copper(II) chloride in water with changes in temperature suggest that the ligand exchange around the Cu²⁺ ion (between H₂O to Cl⁻) is most likely causing a shift from an ionic liquid to a neutral solution as the temperature is decreased. We are currently examining this phenomenon and the crystallization that occurs at lower temperatures through DSC analysis, UV-Vis spectroscopy, and hopefully in the near future, X-ray Crystallography, in order to construct a concentration versus temperature phase diagram that will illustrate the effect of the structure within the liquid on crystallization as well as show the transition that is occurring in the liquid state.

Session 2, A28
Site-Directed Mutagenesis and Protein Expression of Dehaloperoxidase
Jennifer Maria Rowe Chemistry
Mentors and/or Co-Authors: Stefan Franzen Chemistry
Dehaloperoxidase (DHP), an enzyme found in the marine worm Amphitrite ornata, is of interest because of its dual functionality as both hemoglobin and peroxidase. In this study, DHP was used to examine how structure and function interact in a dual function heme protein. Point mutations were implemented on the DHP protein to examine the difference in kinetics and activity between mutant and wild type at the binding site. DHP was cloned and expressed in Escherichia coli and purified. A kinetic assay tested for the rate of oxidation of the substrate 2,4,6-trichlorophenol (TCP) in the presence of H2O2. Absorbance change was measured against time. Comparing mutant with wild type revealed that the kinetics differ significantly. Decrease in the rate of reaction between the wild type and R33Q indicates a decrease in the catalyst reaction rate, possibly due to a change in the surface charge of the protein, as well as conformational changes of the distal histidine. The change in Km may also be related to surface charge.

Session 2, D9
Lissajous Figures as a model for Two Flavor State Neutrino Oscillations
James Rudolph Rowland Physics

Mentors and/or Co-Authors: Chueng Ji Physics

The phenomena of neutrino oscillations have been studied extensively since Bruno Pontecorvo proposed it in 1957 and remain a serious issue when one considers that the Standard Model neither accounts for the mass of neutrinos nor includes the oscillation between neutrino flavor states. We have studied this phenomena in hopes of developing a simple two dimensional model which is analogous to the phenomena of two flavor state neutrino oscillations. We began by studying the coupled-pendulum system which serves as an analogue for neutrino oscillations. We solved the equations of motion of the system by changing variables to obtain an uncoupled system of differential equations. The resulting equations of motion are sinusoidal and resemble the parametric equations describing a Lissajous figure. The model we have developed makes use of these Lissajous figures to describe the phenomena of neutrino oscillations. The case for pendula with equal masses studied thus far provided a sound groundwork and motivation to develop a model taking into account pendula of different masses and eventually develop a model describing three flavor state neutrino oscillations.

Session 1, B21
Blood Pressure Modeling
Brittany Kaye Smith Mathematics

Mentors and/or Co-Authors: Mette Olufsen Mathematics

The impact of gravity during head-up tilt, a test often used in the clinic to diagnose patients, who suffer from dizziness, is not well described. In my research, I use mathematical modeling to analyze experimental blood pressure (BP) data measured at the level of the aorta and the carotid artery (in the neck) in a number of healthy volunteers. Traditionally, BP is measured at the level of the heart, though sensors detecting changes in BP are located in the neck. In response to the drop in BP (sensed in the neck) heart rate, peripheral resistance, and cardiac contractility is increased. During HUT the neck is lifted above the heart, thus gravitational pooling lead to a drop in BP at the level of the neck, while BP at the heart either is constant or increases. During HUT the body is supposed to respond by increasing HR, but pressures measured at the level of the heart do not reflect BP felt by the sensors in the neck. Related to this dilemma, I developed a model predicting BP at the level of the neck given aortic blood pressure and compared predicted values with data obtained at both locations. Furthermore, I will show using a differential equations model predicting BP using heart rate as an input that it is possible to predict BP measured in the neck, but not those measured in the aorta.

Session 1, A8
The Effects of Pharmacological Manipulation in the Ventral Terminal Area on Dopamine Transients in the Nucleus Accumbens as Measured by Fast Scan Cyclic Voltammetry
Deanna Marie Tesch Chemistry

Mentors and/or Co-Authors: Leslie Sombers Chemistry

The mesolimbic dopamine pathway, that projects from the ventral terminal area (VTA) to the nucleus accumbens (NAc), is associated with addiction related behaviors such as reward and reinforcement. Using fast-scan cyclic voltammetry (FSCV), real-time measurements of dopamine (DA) transients in the NAc have previously been measured. These transient dopamine events in the NAc are linked to drugs of abuse and are related to cues predicting reward. The presence of these transients in the NAc can be pharmacologically manipulated by exogenous chemicals. Previous studies have found that glutamatergic activation of the VTA using NMDA caused fluctuations in DA transients in the NAc (Sombers et. al. 2009). Glutamatergic activation of the VTA is gated by cholinergic innervations from the laterodorsal tegmental nucleus on the VTA. We are directly investigating the effect of acetylcholine neurotransmission on dopamine transients using FSCV in the NAc on freely-moving Sprague-Dawley rats. Intra-VTA micro-infusions of carbachol, an acetylcholine receptor agonist, were used to modulate DA transients in the NAc. When carbachol was infused into the VTA, both the frequency and amplitude of DA transients in the NAc were increased. Injections of AP-5/Carbachol into the VTA attenuated the effects of carbachol, decreasing DA transients in the NAc. ACh and glutamate neurotransmission in the VTA work synergistically to modulate DA transients in the NAc. Further characterization of these molecules is needed to understand the extent of their roles in modulation of DA transients in the NAc, and time-lock these events with behaviors related to addiction.
Polycarbodiimides are formed through polymerization of carbodiimide monomers using transition metal catalysts, such as titanium (IV), copper, or nickel. Polycarbodiimides are helical polymers and each repeat unit contains two tunable pendant groups. Because of the sensitivity of the catalyst, there is a limit to the size and type of pendant groups on each monomer during polymerization. Post-polymerization modification of the polymer is how we get around this limit. Copper catalyzed azide-alkyne cycloaddition (click chemistry) is the reaction that combines an azide functional group with an alkyne functional group. By forming polycarbodiimides that have alkyne pendant groups, we can “click” on additional functionalities using a wide variety of azide functional groups, resulting in polymers with potential biomedical properties.

This research is part of a larger project examining benthic ecological and biogeochemical processes during summer and winter regimes along the Antarctic Peninsula from Smith Island (63°S) to Marguerite Bay (68°S). The Antarctic Peninsula area currently shows one of the largest warming trends in the world. Satellite images were used to assess the impact of warming on sea-ice formation and retreat for the years 1991-2000. Sea ice is forming later in the year. In 1991 ice started forming between May and June and reach its peak concentration in August. However, later in the decade, ice started forming between July and August, and sea ice concentrations did not reach their peak until September. The southernmost station had the longest average duration of sea ice, and also had the highest concentration levels of ice overall. There was significant year-to-year variation in ice concentration and duration in the northern part of the study area with three years being ice-free. If these trends continue there could be significant impact on the biological community.

N-Acyl-2,3-dihydro-4-pyridones have been identified as an extremely versatile synthetic intermediate with many applications to natural product synthesis. One of the key features of these molecules is the chiral branch attached to the pyridone ring. Synthesizing these molecules through reduction of N-acylpyridinium salts has previously required the presence of a bulky triisopropylsilyl (TIPS) branch which restricts nucleophilic addition nearly exclusively to one diastereomer. However, addition and removal of this bulky branch requires extra steps in chemical synthesis that can result in significant loss of final product in a complicated natural product synthesis scheme. This study analyzes the synthesis stable stereoisomers of N-acyl-2,3-dihydro-4-pyridones without the presence of this large side chain. Several example molecules have been formed through reactions with grignard reagents and resulting structures have been analyzed using qualitatively using NMR. Current results have indicated a slight favor for one diastereomer, but not to the degree desired for practical synthesis.

Discrete energy states are well-known phenomena in quantum mechanics. However, the coherent states in quantum mechanics reveal much more complicated nontrivial phenomena. In order to investigate these nontrivial phenomena, we analyze the particles placed in a quadratic potential well which can be displaced by a certain distance to generate a new equilibrium state. The new equilibrium state corresponds to a coherence state oscillating like a classical mass on a spring, with an expected position and momentum that oscillates. The generated coherent state is a summation of many different energy states and have some distribution that can be found. The coherent state can be produced from any single energy state and will have different motions and uncertainties for depending on which state was used. Once the properties of this motion are fully known, it can be applied to two or more particles whose oscillations are coupled. These coupled systems can be modeled by a similar transformation used for the coherent state. It is important to understand the coupled coherent state as it will be able to describe currently unknown aspects of nature. Neutrino particles which have three different flavor states, for instance, are thought to undergo flavor changes. For this mixing to be possible, their three flavor states must have some coupling that can be modeled with the coupled coherent state. If this model is accurate, it will allow the determination of these flavor states' masses.
**College of Textiles**

Session 1, B23

**Computational Simulations of the Effect of Compatibilizers on the Interface in Bicomponent Fibers Comprised of Polyethylene and Nylon 6**

Jacob M Majikes  
Materials Engineering

Mentors and/or Co-Authors: Melissa Pasquinelli Textiles

The interface in materials comprised of more than one polymer type can impact the mechanical properties of that material. For example, interfacial adhesion is weak in bicomponent fibers that are comprised of polyethylene (PE) and nylon-6 (N6), and thus splitting is observed during fiber production. To improve the adhesion between incompatible polymers like PE and N6, compatibilizers are often added during fiber processing. Block copolymers are particularly well suited as compatibilizers; they can be designed so that one block favors PE and the other block favors N6, thus effectively 'stitching' the interfacial boundary between PE and N6. We performed computational simulations with dissipative particle dynamics to predict the interfacial interactions and to tune the effectiveness of the compatibilizer as a function of the block copolymer composition and block size. These predictions agree with experimental measurements obtained by our collaborators on a series of PE/N6 bicomponent fibers in the side-by-side cross-sectional geometry that were compatibilized with variations of a styrene-ethylene/butylene-styrene (SEBS) block copolymer.

Session 1, A12

**Biodegradation of PLA-based Films Under Composting Environments**

Celina Valletti  
Polymer and Color Chemistry

Mentors and/or Co-Authors: Richard Kotek Textile Engineering Chemistry and Science

In response to an increasing shortage of landfill space, there is an extreme urgency to produce plastic packaging (bags, bottles etc.) which readily degrades upon disposal. Presently, plastic packaging is derived from petroleum based polymers which degrades after 100 years. Previous research has indicated polyactic acid (PLA) is completely biodegradable under industrial composting conditions. Hence, PLA is a sustainable alternative to petrochemical-derived products, since the lactides from which it is ultimately produced can be derived from the fermentation of agricultural by-products such as corn starch. Thus, the aim of our research was to evaluate the compostability of commercial grade PLA derived polymer in the form of films on a laboratory scale. The pellets (2 grams) were melted into films at 200° C on a Carver heat press. To study the biodegradation, the films were composted on a laboratory scale for approximately 8 days. Films were removed from the composter after 1, 2, 4, and 8 days. Chemical, morphological, thermal, and mechanical properties of the films were evaluated before and after composting studies. A 100% PLA film was also composted and subjected to similar characterization as the commercial grade PLA derived films. We expect to observe full decomposition of the 100% PLA and commercial grade PLA derived films after 8 days under composting environments.

**College of Veterinary Medicine**

Session 1, A22

**Mouse IgG2b monoclonal antibody in prevention of IgE binding to canine mast cells**

Alyssa Ann Abramsky  
Biochemistry

Mentors and/or Co-Authors: Bruce Hammerberg Department of Population Health and Pathobiology

Hypersensitivity allergic reactions in canines are often mediated by the immunoglobulin, IgE. IgE binds to Fc receptors on mast cells with a high affinity, inducing inflammatory reactions of mast cells after cross-linking of IgE molecules. Anti-IgE monoclonal antibodies are useful in immunotherapy for humans that suffer allergies due to IgE reactions by reducing the amount of free IgE. Mouse IgG2b monoclonal antibody (mAb 5.91) has been produced that blocks canine IgE binding at the receptor site of mast cells. The purpose of this project is to test whether mAb 5.91 will specifically bind the epitope on the free IgE that would normally bind the Fc receptors, thus preventing free IgE from binding the receptors that are present on canine mast cells. The Fab2 fragments separated from the Fc fragments of mAb 5.91 are particularly useful in this test due to a reduction of non-specific binding. mAb 5.91 was purified from exhausted culture media supernatants by affinity chromatography and quantified by ELISA performed on the flow through. The antibody was digested with pepsin in order to cleave Fc fragments from Fab2 fragments, and the resulting Fab2 fragments were purified by passage through two affinity chromatography columns. Based on previous results of flow cytometry, mAb 5.91 has been found to bind free IgE but is not known to bind IgE that has already bound to receptors, thus making it safe for therapy for IgE-dependent hypersensitivity in dogs.

Session 2, C16

**Construction of a Chimeric Protein in Listeria monocytogenes**

Lauren Nicole Canada-Smith  
Zoology

Mentors and/or Co-Authors: Paul Orndorff Department of Population Health and Pathobiology
**Session 2, A4**

**Regulation of Intestinal Stem Cell Proliferation and Differentiation by Transcription Factor Sp2**

Candis Marie Cook Genetics

Proteins that associate with DNA and determine whether genes are "on" or "off" are termed transcription factors. A subset of such factors, termed sequence-specific DNA-binding proteins, physically interacts with specialized DNA sequences that are distributed non-randomly in the genome. Serious consequences, such as developmental defects can occur in instances where particular sequence-specific DNA-binding proteins are not expressed appropriately. The first mammalian sequence-specific DNA-binding protein to be analyzed in detail is termed Sp1. Animals that have been engineered to lack any given member of the Sp family exhibit catastrophic developmental defects involving a subset of tissues. These results imply that each member of the Sp family is an essential gene. Sp2 is a novel member of the Sp family that has received little experimental attention. Although expressed in many types of cells, little Sp2 DNA-binding and transcription activity can be detected and its target genes have not been defined. Sp2, however, is critical for animal development, as studies in the Horowitz laboratory have shown that its absence results in the cessation of growth at an early embryonic stage. Given the requirement for Sp2 at the earliest developmental stages, the Horowitz lab postulated that Sp2 might be an important regulator of stem cells. To determine if Sp2 regulates stem cells, the Horowitz lab created a conditional "knock-out" mouse line in which Sp2 expression is eliminated in stem cells that maintain the small intestine.

**Session 2, D6**

**Dynamics of cell properties drive gut development**

Brooke C Griff Zoology

Abnormalities in gut tube formation may lead to life-threatening birth defects known as intestinal malrotation that occur as often as 1 in every 500 live births. Understanding the causes of abnormal gut development is essential in recognizing prevention and treatment options. The objective of this project is to evaluate how the gut tube and its cells change during transformation at different stages. We hypothesize that an increase in the number of cells, decrease in cell size, change cell shape to taller cells, and left-right asymmetry occurs during gut formation. Immunohistochemistry and image analysis software have been used to perform morphometric measurements of changes in cross sectional area, cell shape, cell proliferation, and cell number within the gut tube of different stages of *Xenopus laevis* embryos. The results show that cross sectional area decreases 400%, the length: width ratio of individual cells increases 200%, and overall cell number decreases 200%. Surprisingly, cell proliferation does not significantly increase until after the gut has elongated, showing that proliferation does not drive gut tube lengthening, and that changes in cell shape and rearrangement may be more important for generating length. Distinct left-right asymmetries were calculated for cell area and cell angle and are likely to be involved in generating the differences in the elongation of the left and right sides of the gut required for proper looping and rotation. Abnormalities in these processes of gut formation may underlie intestinal malrotation.

**Session 1, B19**

**MARCKS Protein Detection in Equine Neutrophils**

Ethan M Hefner Animal Science

Mentors and/or Co-Authors: Sam Jones Department of Clinical Sciences

Myristilated Alanine Rich C-Kinase Substrate (MARCKS) is a protein involved in cellular migration and adhesion. Neutrophils are the body's first line of defense against infection and are recruited to migrate and combat infection. Although some neutrophil migration is vital for host immune response, excess neutrophil migration and subsequent activation can be harmful. MARCKS involvement in neutrophil migration has been of particular interest in proposing biomedical applications to address influx neutrophil migration. MARCKS involvement in cellular motility is facilitated by the Protein Kinase C (PKC) pathway; PKC phosphorylates MARCKS, translocating it from the plasma membrane to the cytosol of the cell. The proteins presence in the membrane is necessary for cell movement. Based on the highly motile nature of equine neutrophils, it was hypothesized that MARCKS plays a role in the migratory function of these cells. To examine if MARCKS is present within, and a potential mode of migration in equine neutrophils, blood was collected and cell lysates were prepared. Proteins were isolated from the cells and used in SDS-PAGE. Western Blot (using primary human MARCKS antibody) was employed to identify the presence of MARCKS protein and detect phosphorylation status of the protein upon stimulation with leukocyte chemotaxis inducers. The experiments allowed conclusion that MARCKS is expressed in equine neutrophils. Phosphorylation was maximal at 30 seconds stimulation and decreased as time
Session 2, C7
Intestinal Villus Structure and Epithelial Cell Morphology in Nursery Pigs Exhibiting Peri-Weaning Failure to Thrive Syndrome (PFTS)
Jordan Leigh Kennedy Animal Science
Mentors and/or Co-Authors: Adam Moeser CVM-Food Animal Eq

Peri-weaning failure to thrive syndrome (PFTS) is a poorly understood disease syndrome in nursery pigs resulting in significant economic losses to the U.S. swine industry. Nursery piglets afflicted by PFTS exhibit little to no feed intake post-weaning and eventually “waste away” until many are euthanized for humane reasons (Moeser, 2010). The pathogenesis of PFTS is poorly understood; therefore investigations into PFTS pathophysiology are needed. The objective of this experiment is to uncover the underlying pathophysiologic mechanisms of PFTS through microscopic analysis of intestinal villi enterocytes of nursery piglets exhibiting PFTS as well as healthy, thriving nursery pigs and fasted controls. Distal small intestine (ileum) from control and PFTS pigs was harvested at day 4 and 11 post-weaning, fixed in formalin, and processed for H&E staining. Villus height and crypt depth were measured in the tissue sections. In addition, the height and width of enterocytes at the tip of randomly-selected villi from each pig within each treatment were also measured. Villus height was reduced (p<0.05) and crypt depth was increased (p<0.05) in PFTS ileum compared with control and fasted pigs. Enterocytes from PFTS ileum were immature in appearance as indicated by their cuboidal shape and irregular alignment compared with columnar-shaped enterocytes in control and fasted pigs. Overall, this research revealed unique intestinal epithelial morphology associated with PFTS that is independent of feed intake. It remains unclear at this point whether PFTS lesions are due to defects in intestinal epithelial maturation or due to infectious disease processes yet to be determined.

Session 2, C10
Immunoglobulin-Complement Complexes in Equine Chronic Idiopathic Urticaria
Emma Jane Poole Animal Science
Mentors and/or Co-Authors: Bruce Hammerberg Department of Population Health and Pathobiology

Equine chronic idiopathic urticaria (ECIU) is an immunological response to an unidentified exogenous cause that affects horses of all ages and breeds. Due to the fact that ECIU is poorly responsive to treatment with glucocorticoids and antihistamines, it can potentially cause discomfort to the degree that the animal cannot perform to its full capabilities. As of yet the pathogenesis of ECIU is poorly understood. The hypothesis of this research is that the immunoglobulins IgG and IgE form a complex with complement proteins in elevated levels in the serum of affected horses. Serum samples from two horses with symptoms of ECIU were passed through a Sephacryl 300 molecular sizing column and an affinity column of monoclonal antibody specific for IgE attached to sepharose beads. ELISAs were performed using the flow through samples collected from the columns. The levels of IgG, IgE, and each of the aforementioned immunoglobulins in complex with the complement protein C3 were measured for both horses. While both subjects had high levels of IgG in complex with C3, only one horse had high levels of total IgG - this horse also had elevated levels of an IgE-C3 complex as well as total IgE. This research provides evidence that IgG, IgE, and C3 exist in complex in some cases of ECIU. Further research with more affected subjects should be performed to further test this hypothesis.

Session 2, B4
Borrelia Present in Ixodes affinis and Ixodes scapularis ticks collected from North Carolina’s Coastal Plains
Sara Elizabeth Reichelt Zoology, Poultry Science
Mentors and/or Co-Authors: Ricardo Maggi CVM-Comp Animal

The tick species Ixodes affinis and Ixodes scapularis are enzootic vectors for spirochetal bacteria of Borrelia burgdorferi s.s., the pathogen that causes Lyme disease in the USA. I. affinis and I. scapularis are very common in North Carolina’s coastal plains, where specimens were acquired. PCR, targeting two regions of the 16s-23s intergenic spacer, was used to test for the presence of Borrelia DNA in I. affinis and I. scapularis. In I. affinis, Borrelia DNA was discovered in 63.2% or 155 individual ticks. B. burgdorferi s.s. and B. bissetti were identified by DNA sequencing in 33.5% and 27.9% I. affinis respectively. There were statistical differences of Borrelia prevalence found between sexes of the ticks with I. affinis females at 76.8% and I. affinis males at 55.6%. B. burgdorferi s.s. also had a difference between males and females with females at 44.6% and males at 27.3%. 298 individually tested I. scapularis/ticks were found to be negative for Borrelia. In comparison to previous studies done in the Southern states this study found a higher incidence of Borrelia spp. in I. scapularis tick collected from the coastal North Carolina, exposing the possible importance of I. affinis in the cycle of B. burgdorferi s.l. in North Carolina. The lack of Borrelia DNA in I. scapularis shows the need for more studies to define the cycle of B. burgdorferi s.s. in the southeastern states of the USA.
target them for destruction. Zebrafish (*Danio rerio*), which has emerged as a model organism for infection and immunity, possess cytotoxic cells that are predicted to function like mammalian NK cells. The zebrafish genome has been sequenced and the family of novel immune-type receptors (NITRs) has been predicted to function as NKRs. In this gene family, Nitr9 is predicted to be the lone activating NKR and previous studies have shown that Nitr9 partners with and signals through the adaptor protein DAP12 to initiate target cell destruction. We hypothesize that mutating Nitr9 so it can no longer partner with DAP12 will result in a “dominant negative” form of the Nitr9 receptor (dnNitr9) that is competent to bind its ligand but unable to initiate the cytoplasmic signal transduction cascade required for activating the NK cell. We further hypothesize that zebrafish expressing dnNitr9 will be immune compromised. The aim of this project is to design and engineer a transgenic line of zebrafish expressing dnNitr9 in cytotoxic cells in immune system tissue. The long term goal of this study is to determine if zebrafish expressing dnNitr9 are more susceptible to infection and/or tumor formation. These studies will provide insight into the functional role of NITRs, the immune system of bony fish and provide a system for functional comparison of mammalian and zebrafish cytotoxic cells and tissues.

Session 1, D22

**MHC-I Protein Expression in Bony Fish and its Role in Cell Immunity**

Abigail Megan Rife  
*Animal Science*

**Mentors and/or Co-Authors:** Jeffrey Yoder  
*CVM-Molecular Biomedical Science*

The expression of major histocompatibility complex class I (MHC-I) proteins on the cell surface of vertebrate animals serves as a marker of “self” for their immune system via receptors that bind MHC-I and can differentiate between “self” and “non-self”. Loss or changes in MHC-I expression on the cell surface, such as during infection or transformation, can lead to a cell being identified as “non-self” by the immune system and targeted for destruction. Zebrafish encode variable MHC-I proteins and possess cytotoxic cells that recognize and kill zebrafish tumor cells. We are interested in determining if the presence of matched MHC-I proteins on the surface of tumor cells is sufficient to down regulate their killing by zebrafish cytotoxic cells. Since zebrafish are not in-bred, MHC-I varies between individual fish. The purpose of this project is to develop two MHC-I matched lines of zebrafish. A genotyping strategy was recently published describing a method for identifying specific MHC-I alleles in individual zebrafish. We employed this approach to genotype multiple zebrafish in our facility and selectively bred individual fish to generate families of MHC-I matched zebrafish. These families can then be used to evaluate the role of MHC-I in regulating the function of zebrafish cytotoxic cells.

Session 2, D10

**Effect of Verapamil on the Absorption of Topically Applied Avermectin**

Sarah Nicola Shishakly  
*Biology*

**Mentors and/or Co-Authors:** Ronald Baynes  
*Department of Population Health and Pathobiology*

Avermectin is a macrocyclic lactone which is poorly absorbed across the skin and is a good substrate for P-glycoprotein (P-gp). P-gp is an efflux pump within the cell and can efflux avermectin out of the bloodstream and into the intestines. Verapamil is another substrate for P-gp and studies have demonstrated that verapamil increases oral bioavailability of avermectin by competitively inhibiting avermectin efflux by P-gp in the intestines. However, no study has specifically looked at verapamil’s effect on the absorption of avermectin through the skin. The purpose of this study was to prove that verapamil does not increase avermectin’s absorption across the skin when it is topically applied. In this study, the first method was a Bronouh flow through diffusion cell system. Rat skin was used in the cells and there were six treatment groups: avermectin, avermectin + verapamil, avermectin + itraconazole, avermectin + cyclosporine, avermectin + dexamethasone, and avermectin + vinblastine each dosed at 150 µg/cm². The second part of the study was an isolated perfused porcine skin flap (IPPSF). There were two treatments groups: avermectin alone and avermectin + verapamil. The dose was 150 µg/cm² and there were three replicates for each treatment group. For both experimental systems there was no statistical difference in the absorption of avermectin by itself and the absorption of avermectin when mixed with any other drug. This indicates that P-gp may not have an active role in avermectin’s absorption in the skin.
## Index of Student Presentations Listed by Lead Author

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Ronnie Shammas Jr.  
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| Session 2, C17 | Jeanelle Sierra Katherine Alexander  
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| Session 1, D6 | Kimberly Allison Amick  
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Biological Sciences-Ecology, Evolution, and Conservation Biology | Putative bacterial genes in the genome of mycobacteriophage Mutaforma13 suggests lateral gene transfer and a potentially broad host range | Agriculture and Life Sciences / Microbiology |
| Session 2, D26 | Aaron Russell Anders  
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| Session 1, A13 | Joel E Anderson  
Computer Science | A Visualization Interface Design for Wide-area Monitoring of Electric Power Systems | Engineering / Electrical & Computer Engineering |
| Session 1, A23 | Margaret Elaine Anderson  
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Session 1, C17  Emily S Brune  Biology  Leptin and Leptin Receptor in the Mozambique Tilapia  Agriculture and Life Sciences / Biological Sciences

Session 1, B17  Kelly Ann Bryant  Animal Science  Effects of housing on stress levels in boars  Agriculture and Life Sciences / Animal Science

Session 2, D12  Shante Sherelle Bryant  Biochemistry  Identification of genes encoding light-activated toxins in the banana pathogen Mycosphaerella fijiensis  Agriculture and Life Sciences / Plant Biology

Session 1, A1  Mary Patricia Bulfin  Biology  Effect of exogenous enzyme and DFM supplementation on growth and disease vulnerability in broiler chickens based on ideal IL-10 and INF-gamma mRNA expression patterns  Agriculture and Life Sciences / Poultry Science

Session 2, B18  Adam L Bumgarner  Food Bioprocessing and Nutriti Julie Steinberg  Food Science; Kaitlyn Panetta  Food Science; Aaron Massey  Food Science  Developing a novel method for ameliorating red wine spoilage caused by Brettanomyces bruxellensis  Agriculture and Life Sciences / Food, Bioprocessing, and Nutrition Sciences

Session 2, B23  Nicholas J Butterbaugh  Bioprocessing Science  Diversity in a cell wall-associated protein among strains of a major epidemic clone of the foodborne bacterial pathogen, Listeria monocytogenes.  Agriculture and Life Sciences / Food, Bioprocessing, and Nutrition Sciences

Session 2, C13  John Avery Campbell  Biochemistry  Development of 3' Aptamer-tagged Viral RNA Templates for Selection of Replicase/RNA Complexes in Potato Virus X  Agriculture and Life Sciences / Molecular & Structural Biochemistry

Session 2, C16  Lauren Nicole Canada-Smith  Zoology  Construction of a Chimeric Protein in Listeria monocytogenes  Veterinary Medicine / Population Health & Pathobiology

Session 1, D20  Daniel Ellis Carta  Wood and Paper Science  Cell Morphology of Genetically Modified Cottonwood With Reduced Cellulose Content  Natural Resources / Wood & Paper Science

Session 2, B15  Grayson Leonard Cave  Biochemistry  Foreleg Grooming Structures and Cuticular Hydrocarbon Ratios of Heliothis virescens  Agriculture and Life Sciences / Entomology

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Sealing MEMS: Solders Beyond Gold

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Evaluating Sustainable Biofuel Options: Making a Case for Microalgae

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Sub-wavelength patterns in silicon give rise to form-birefringence for MIR light

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Children’s willingness to share feelings may be influenced by mother’s beliefs about emotions

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Veterinary Medicine / Biomedical Engineering

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Session 2, B11  Mitchell Bradner Filip  
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| Session 1, B15 | Evan Charles Ged | Environmental Engineering | Effectiveness of superfine powdered activated carbon for the removal of sulfamethoxazole | Engineering / Civil, Construction & Environmental Engineering |
| Session 2, A15 | Colin Edward Geisenhoffer | Environmental Technology | NOx Emissions Uncertainty: Investigating Irregular Plants and their Corresponding Source Classification Codes | Natural Resources / Forestry & Environmental Resources |
| Session 1, B9 | Matthew S Geisz | Biology | Examples of Genetic Research: Impacts and Applications | Agriculture and Life Sciences / Biological Sciences |
| Session 2, D14 | Gregory Ian Gibson | Nuclear Engineering | Design and Optimization of a Solid Boron Trioxide Target for Producing Carbon-11 via 11B (p, n) 11C | Agriculture and Life Sciences / Nuclear Engineering |
| Session 2, C29 | Zachary Nathan Gonzales | Biochemistry | Developing an Approach to Characterize a Denaturation-Resistant Basic Leucine Zipper Domain from Human T-Cell Leukemia Virus | Agriculture and Life Sciences / Molecular & Structural Biochemistry |
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| Session 2, C14 | Kathleen Marie Hall | Chemistry | Dehaloperoxidase Mutagenesis: Molecular Dynamics and Kinetics for K36A | Physical and Mathematical Sciences / Chemistry |
| Session 1, B14 | Jennifer Nicole Hamilton | Animal Science | Effects of Prenatal Alcohol Consumption on Post Natal Health | Agriculture and Life Sciences / Animal Science |
| Session 2, A1 | Wesley G Hancock | Plant and Soil Science - Crop Production | Molecular Marker Screening of Advanced Generation Wheat Lines | Agriculture and Life Sciences / Crop Science |
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| Session, A18| Hayley L Hedges  
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| Session, B19| Ethan H Mefner  
Animal Science | MARCKS Protein Detection in Equine Neutrophils | Veterinary Medicine / Animal Science |
| Session, C18| Jameelah Maralyn Henderson  
Biochemistry | Bioinformatic Analysis of the Membrane Occupation and Recognition Nexus (MORN) Repeats of Plant PIP5K proteins | Agriculture and Life Sciences / Plant Biology |
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Plant Biology | Transformation and Imaging of Arabidopsis for Phosphoinositide Research | Agriculture and Life Sciences / Plant Biology |
| Session, D18| Taylor Brooke Hodgin  
Biology | Student Perceptions of the Usefulness of Training Videos for Preparing them to Teach Nutrition Education in the Community | Agriculture and Life Sciences / Food, Bioprocessing, and Nutrition Sciences |
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| Session, A11| Nathaniel Preston Houck  
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| Session, C15| Casey Natasha Huntington  
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Elizabeth Pragar Biological Sciences;  
Katie Robertson Zoology;  
Kristy Casper Animal Science;  
Brittany Price Animal Science;  
Barbara Athens Biochemistry;  
Katelyn Miller Animal Science | New Digs for Asheboro's Ocelots | Agriculture and Life Sciences / Biological Sciences |
| Session, B26| Julie Anna Johnston  
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Natural Resources / Parks, Recreation & Tourism Management

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Session 1, B10  Christopher Allen Kilgore  
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Session 1, A20  Heidi Elizabeth Klumpe  
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Session 1, B8  William Henry Kohlway IV  
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Engineering / Chemical & Biomolecular Engineering
Session 1, D4  Amalia Chryssoula Kondyles  Biology  Michael Wyngarden  Human Biology; Madison Pace  Human Biology  Causes and Risk Factors of Ventricular Septal Defects, Hypertrophic Cardiomyopathy, and Coronary Heart Disease  Agriculture and Life Sciences / Biological Sciences

Session 2, B9  Mitiele Leandra Konrath  International Studies, Anthropology  Social Networks and Violence in Río de Janeiro  Humanities and Social Sciences / Sociology & Anthropology

Session 1, B3  Jessica Hansen Kruse  Microbiology  Determining how Preschool-age Children Express Meal Termination Cues  Agriculture and Life Sciences / Food, Bioprocessing, and Nutrition Sciences

Session 2, A20  Matthew McAllister Kuchta  Biochemistry  Does Green Fluorescent Protein Affect Superoxide Reductase Activity?  Agriculture and Life Sciences / Plant Biology

Session 2, A16  Collin Alexander Ladd  Chemical Engineering  Three Dimensional Printing of Oxide Stabilized Liquid Metal  Engineering / Chemical & Biomolecular Engineering

Session 2, A23  Eric Scott Land  Biology  The role of the lipid-mediated InsP3 pathway in phosphate sensing  Agriculture and Life Sciences / Plant Biology

Session 2, B27  Alexandra Marcela Landry  Chemical Engineering  Nanofibers of Water-Soluble Polymers via Foam Electrospinning  Engineering / Chemical & Biomolecular Engineering

Session 2, A10  Christian Blake Lawrence  Biochemistry  Effects of the K99A Mutant on the Enzymatic Activity of Dehaloperoxidase  Physical and Mathematical Sciences / Chemistry

Session 1, D16  Miranda Croft Lemyre  Poultry Science  Development of Recombinant Turkey Astrovirus Expression System  Agriculture and Life Sciences / Poultry Science

Session 1, B18  Matthew Leonard  Nuclear Engineering  Optimizing the Neutronic Design of BWR Fuel Assemblies with No Part-Length Rods  Agriculture and Life Sciences / Nuclear Engineering

Session 1, B12  Sarah Elizabeth Levinson  Microbiology  Incorporating a Thermostable Esterase into Microalgae to Enhance Biofuel Production  Agriculture and Life Sciences / Microbiology

Session 1, C8  Mary Hunt Lewis  Plant Biology  The role of sexual reproduction in natural populations of Aspergillus flavus  Agriculture and Life Sciences / Plant Pathology

Session 1, D3  Stephanie Michelle Leyrer  Biological Sciences  Hope for Haiti: An Analysis of the Cholera Epidemic, Effective Treatments, and Prevention  Agriculture and Life Sciences / Biological Sciences

Session 2, B1  Kelsey L Lindsay  Food Bioprocessing and Nutrition  Jessica Fox  Food Science; M. Cade Thorne  Food Science; Adam Kincaid  Food Science  Fighting Fire with Fire  Agriculture and Life Sciences / Food, Bioprocessing, and Nutrition Sciences
Session 1, D7  Whitney Q Lohmeyer  Mechanical & Aerospace Engr  Deciphering Contradictory Approaches for Calculating Skin Friction  Engineering / Mechanical & Aerospace Engineering

Session 1, C12  Sarah Kaielyn Long  Chemical Engineering  Comparison of Gene Regulation in Drosophila CNS and Trachea  Agriculture and Life Sciences / Genetics

Session 2, D2  Laura Elizabeth Lord  Biological and Agr Engineering  Ryan Owings  Biological Engineering; Judah Emory  Biological Engineering; Greg Turner  Biological Engineering; Alysondria Campos  Biological Engineering  Restoration of Failed NCSU Stormwater Wetland  Agriculture and Life Sciences / Biological & Agricultural Engineering

Session 2, B17  Karen Deanne Lundin  Interdisciplinary Studies  India, Beauty Pageants and Globalization  Humanities and Social Sciences / Sociology & Anthropology

Session 2, A2  Benjamin Jay Lyles  Biological Sciences - Human Biology  The Effects of Kinase Phosphorylation on Isoforms of the Pregnane X Receptor  Agriculture and Life Sciences / Biological Sciences

Session 2, D16  Micah Logan Mabe  Biology  Weight and Factors Influencing Weight Among Individuals With Autism  Agriculture and Life Sciences / Psychology

Session 2, B23  Jacob M Majikes  Materials Engineering  Computational Simulations of the Effect of Compatibilizers on the Interface in Bicomponent Fibers Comprised of Polyethylene and Nylon 6  Textiles / Textile Engineering, Chemistry & Science


Session 2, C22  Alexander Joshua Martin  Interdisciplinary Studies  A New Synergy in Development: Microfinance and Fair Trade  Humanities and Social Sciences / Sociology & Anthropology

Session 1, A14  Alexander William Mauney  Physics  The Effect of Finite Source Size on Supernova Neutrino Flavor Twinking  Physical and Mathematical Sciences / Physics

Session 2, B13  Christine V Mayer  Biology  Meredith Wojcik  Biological Sciences-Ecology, Evolution, and Conservation Biology; Jennifer Wenger  Animal Science; Andrea Massa  Animal Science; Erin Kamm  Animal Sciences; Rina Jaffe  Animal Science; Meredith Brown  Zoology; Heather Brown  Animal Science  Renovating the Asheboro Zoo Otter Exhibit  Agriculture and Life Sciences / Biological Sciences

Session 2, C19  Tyler Robert McCaw  Biochemistry/Chemical Engineering  Lab Scale Evaluation of Australasian Sourced FBS and American Sourced Control Lots on AVONEX Growth  Agriculture and Life Sciences / Molecular & Structural Biochemistry

Session 1, C16  Andrew David McEachran  Environmental Technology  Toxicity of Weathered Fuel Product to Hydroponic Trees  Natural Resources / Forestry & Environmental Resources

Session 2, C5  Sapna Rushikesh Mehta  Biology  THE USE OF AN EDUCATIONAL BLOGGING SYSTEM IN AN INTRODUCTORY BIOLOGY COURSE  Agriculture and Life Sciences / Biological Sciences
Session 1, C6  Cody Allen Melton  
Physics  
What Drives the SASI in Core-Collapse Supernova?

Session 1, C13  Miranda Lynn Mikesh  
Geology  
Geophysical Analysis & Hazard Assessment of the Hunga Volcanic Province, Tonga

Session 1, B4  Kennedi Nichole Miller  
Human Biology  
Campylobacter jejuni motility

Session 1, C19  Matthew Charles Milloway  
Animal Science  
Development of In Vitro Produced Bovine Embryos in a Cross-Species Embryo Transfer Model

Session 1, A17  Katelyn Tracy Molloy  
Biological Sciences  
Characterization of a novel ovary lipoprotein receptor that binds vitellogenins in fishes

Session 2, D23  Brinda Monian  
Chemical Engineering  
Rapid Detection of Food-Borne Pathogens Using Nanostructured Membranes

Session 2, C8  Elizabeth Alaine Moody  
Biomedical Engineering  
Standardized method for segmenting and registering the human rib cage from CT scans

Session 1, C1  Susannah Paige Morehead  
Animal Science  
Evaluation of Use and Effectiveness of Online Quizzes as a Study Aid for an Introduction to Animal Science Laboratory Course

Session 1, B5  Blair T Morton  
Animal Science  
The effect of different feeding practices on the plasma protein concentration in horses.

Session 1, C21  Marc Richard Mueller  
Environmental Engineering  
Measurement of Fat, Oil, and Grease (FOG) in Wastewater

Session 2, C26  Trey Carlton Mullikin  
Biochemistry  
Synthesis 2-Aminoimidazole Containing Imides

Session 1, B11  Asia Jacqueline Murphy  
Wildlife Sciences  
Small Mammal Community Response to Climate Change

Session 2, C18  Asia Jacqueline Murphy  
Wildlife Sciences  
Connecting Tourists and Local Communities through Cellphones: START-Net

Session 1, B25  Margaux E Novak  
English Literature & International Studies  
Emily Dickinson’s Quest for Identity as Emerson’s Great American Poet

Session 1, A6  1  
Improving organic agriculture by quantifying legume cover crop rhizobia soil populations

Physical and Mathematical Sciences / Physics
Physical and Mathematical Sciences / Marine Earth and Atmospheric Sciences
Agriculture and Life Sciences / Microbiology
Agriculture and Life Sciences / Animal Science
Agriculture and Life Sciences / Zoology
Engineering / Chemical & Biomolecular Engineering
Engineering / Biomedical Engineering
Agriculture and Life Sciences / Animal Science
Agriculture and Life Sciences / Biological Sciences
Engineering / Civil, Construction & Environmental Engineering
Physical and Mathematical Sciences / Chemistry
Natural Resources / Parks, Recreation & Tourism Management
Humanities and Social Sciences / English
Agriculture and Life Sciences / Soil Science
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<th>Name</th>
<th>Major</th>
<th>Title</th>
<th>College</th>
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<tr>
<td>Session 2, D17</td>
<td>David W Overman</td>
<td>Human Biology</td>
<td>The Effect of Group-Work on Developing Interpersonal Engagement in ALS 103</td>
<td>Agriculture and Life Sciences / Honors Teaching Students</td>
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<td>Session 2, A29</td>
<td>Breanna Lauren Pasko</td>
<td>Biology</td>
<td>An Analysis of the Effects of Maternal Age on Type I Diabetes in the Offspring</td>
<td>Agriculture and Life Sciences / Animal Science</td>
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<td>Matthews Movassaghi</td>
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<td>Cassandra Ferring</td>
<td>Zoology, Animal Science</td>
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<td>Taylor Treadway</td>
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<td>Session 2, A21</td>
<td>Rashmi Bharat Patel</td>
<td>Biochemistry</td>
<td>Characterization of cyclin-dependant kinase like proteins that respond to geminivirus infection in arabidopsis.</td>
<td>Agriculture and Life Sciences / Molecular &amp; Structural Biochemistry</td>
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<td>Session 2, C20</td>
<td>Hamish Sunil Patel</td>
<td>Biochemistry</td>
<td>Is there a Role for NAAG in Axon-glia Signaling in Rat Optic Nerve?</td>
<td>Agriculture and Life Sciences / Biological Sciences</td>
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<td>Session 1, A3</td>
<td>Amanda L. Patrick</td>
<td>Chemistry</td>
<td>Effects of pH on the Cp*Ir(NHC)(H2O)2 Catalyzed Aerobic Oxidation of Cyclopentanol</td>
<td>Physical and Mathematical Sciences / Chemistry</td>
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<td>Session 2, A12</td>
<td>Florence Perrin</td>
<td>Biological Sciences</td>
<td>Behavioral Variation in Wild-Derived Zebrafish: Testing Anxiety Disorders and Uncovering the Neurogenomic Bases of Affective Disorders</td>
<td>Agriculture and Life Sciences / Biological Sciences</td>
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<td>Session 1, C5</td>
<td>Sally Jane Petre</td>
<td>Environmental Science: Ecology</td>
<td>An assessment of mercury in economically important fishes commonly landed off the coast of North Carolina</td>
<td>Agriculture and Life Sciences / Biological Sciences</td>
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<td>Session 1, A16</td>
<td>Kimberly Anne Phillips</td>
<td>Chemical Engineering, Paper Science Engineering</td>
<td>Creation of a Plastic-like Material from Tobacco Stalks</td>
<td>Natural Resources / Forest Biomaterials, Wood &amp; Paper Science</td>
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<td>Session 1, C15</td>
<td>Phillip Harvey Phipps</td>
<td>Physics</td>
<td>'Tidal' hypothesis and Superhump Phenomenon</td>
<td>Physical and Mathematical Sciences / Physics</td>
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<td>Emma Jane Poole</td>
<td>Animal Science</td>
<td>Immunoglobulin-Complement Complexes in Equine Chronic Idiopathic Urticaria</td>
<td>Veterinary Medicine / Population Health &amp; Pathobiology</td>
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<td>Phillip Nathaniel Pressley</td>
<td>Civil Engineering</td>
<td>Assessing the Environmental Implications of Current Fat, Oil, and Grease Disposal Practices</td>
<td>Engineering / Civil, Construction &amp; Environmental Engineering</td>
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<td>Session 2, D4</td>
<td>Veronica Buenconsejo Pura</td>
<td>Biochemistry</td>
<td>Investigating the effect of temperature on growth of Ralstonia solanacearum strains collected from tobacco and tomato crops</td>
<td>Agriculture and Life Sciences / Plant Pathology</td>
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<td>Benjamin Ross Quigley</td>
<td>Biology</td>
<td>Functional Characterization of the Tribolium castaneum Sarcospan Homolog</td>
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<td>Stephanie Nicole Raney</td>
<td>Public and Interpersonal Communication</td>
<td>LGBT Students' Experiences in and Perceptions of College Communication Courses</td>
<td>Humanities and Social Sciences / Communication</td>
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<td>Ranata Lyn Reeder</td>
<td>Communication</td>
<td>Working class African American women and heart disease: How communication and community impact knowledge and prevention behaviors</td>
<td>Humanities and Social Sciences / Communication</td>
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<td>Session 2, B4</td>
<td>Sara Elizabeth Reichelt</td>
<td>Zoology, Poultry Science</td>
<td>Borrelia Present in Ixodes affinis and Ixodes scapularis ticks collected from North Carolina's Coastal Plains</td>
<td>Veterinary Medicine Veterinary Medicine / Clinical Sciences</td>
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<td>1, D21</td>
<td>David Settle Reid</td>
<td>Biomedical Engineering &amp; Chemistry</td>
<td>Engineering Zebrafish Novel-Immune Type Receptor 9 Expression to Suppress Cytotoxic Signal Transduction Pathways</td>
<td>Veterinary Medicine / Molecular Biomedical Sciences</td>
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<td>1, B22</td>
<td>Patricia S Riad</td>
<td>Biology</td>
<td>Monitoring the levels of herbivory in urban and natural environments: comparing the rate of herbivory and dryness on two oak species</td>
<td>Agriculture and Life Sciences / Biological Sciences</td>
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<td>1, A5</td>
<td>Samantha Marie Rierson</td>
<td>Biology</td>
<td>How Behavior, Genetic Diversity, and Habitat Loss Affect Big Cat Populations.</td>
<td>Agriculture and Life Sciences / Biological Sciences</td>
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<td>Natalie Nielsen</td>
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<td>Ashley McGuigan</td>
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<td>1, D22</td>
<td>Abigail Megan Rife</td>
<td>Animal Science</td>
<td>MHC-I Protein Expression in Bony Fish and its Role in Cell Immunity</td>
<td>Veterinary Medicine / Genetics</td>
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<td>John William Robbins</td>
<td>Nuclear Engineering</td>
<td>High Temperature Irradiation Capsule for Materials Testing in the PULSTAR Reactor</td>
<td>Engineering / Nuclear Engineering</td>
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<td>Zachary Bailey NE</td>
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<td>2, C4</td>
<td>Katie Elaine Robertson</td>
<td>Zoology</td>
<td>Summarizing Pacific Ant Biodiversity through Island Biogeography Analysis</td>
<td>Agriculture and Life Sciences / Biological Sciences</td>
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<td>1, D10</td>
<td>Thea Esme Roper</td>
<td>Chemical Engineering</td>
<td>Cell Culture Techniques</td>
<td>Engineering / Biomedical Engineering</td>
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<td>1, D24</td>
<td>Justin Ryan Rothrock</td>
<td>Biological and Agr Engineering</td>
<td>Carbon Neutral Weed Suppression System</td>
<td>Agriculture and Life Sciences / Biological &amp; Agricultural Engineering</td>
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<td>1, C3</td>
<td>Eric Scott Rountree</td>
<td>Chemistry</td>
<td>Liquid-Liquid Phase Transitions: Hydrates of Copper(II) Chloride</td>
<td>Physical and Mathematical Sciences / Chemistry</td>
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<td>2, A28</td>
<td>Jennifer Maria Rowe</td>
<td>Chemistry</td>
<td>Site-Directed Mutagenesis and Protein Expression of Dehaloperoxidase</td>
<td>Physical and Mathematical Sciences / Chemistry</td>
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<td>2, D9</td>
<td>James Rudolph Rowland</td>
<td>Physics</td>
<td>Lissajous Figures as a model for Two Flavor State Neutrino Oscillations</td>
<td>Physical and Mathematical Sciences / Physics</td>
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<td>2, A25</td>
<td>Laura Christine Rucker</td>
<td>Biomedical Engineering</td>
<td>ACETABULAR MORPHOLOGY IN FEMORALCETABULAR IMPINGEMENT</td>
<td>Engineering / Biomedical Engineering</td>
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<td>2, A5</td>
<td>Teal Russell</td>
<td>Biochemistry</td>
<td>Quantification of gene expression during different stages of differentiation in human embryonic stem cells</td>
<td>Engineering / Chemical &amp; Biomolecular Engineering</td>
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<td>2, D3</td>
<td>Anna Leigh Sauls</td>
<td>Horticultural Science</td>
<td>The Effect of Pollen Irradiation on Pollen Tube Growth, Seed Set, and Offspring Vigor in Controlled Hybridizations of Buddleja (Butterfly Bush)</td>
<td>Agriculture and Life Sciences / Horticultural Science</td>
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<td>1, B24</td>
<td>Nikhil Shah</td>
<td>Architecture</td>
<td>Mapping Change: Shifts in Food Production Systems in NC</td>
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<td>Session 2, A30</td>
<td>Building Soils, Building Minds: Evaluating Learning Gains Resulting from Community-Engaged Coursework in Soil Science</td>
<td>Maximilian Kolbe Sherard (Sociology)</td>
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<td>Effect of Verapamil on the Absorption of Topically Applied Avermectin</td>
<td>Sarah Nicola Shishakly (Biology)</td>
<td>Veterinary Medicine / Population Health &amp; Pathobiology</td>
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<td>Session 2, B21</td>
<td>Role of Glutamate in Axon-glia Signaling in Rat Optic Nerve</td>
<td>Hitesh Shivalingappa (Biochemistry)</td>
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<td>Session 2, D27</td>
<td>Affect of Black Pearl Pepper Plant Pollen on Western Flower Thrips Consumption by Orius insidiosus</td>
<td>Ryan Christopher Sides (Biology)</td>
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<td>Session 1, B1</td>
<td>Malnutrition in Haiti</td>
<td>Kelsey Marie Sikes (Microbiology)</td>
<td>Agriculture and Life Sciences / Food, Bioprocessing, and Nutrition Sciences</td>
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<td>Session 1, A10</td>
<td>Analysis of Haitian Clinic Files</td>
<td>Camille Elizabeth Studer (Chemistry and Biochemistry)</td>
<td>Agriculture and Life Sciences / Honors Teaching Students</td>
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<td>Session 1, A11</td>
<td>Biolog GENIII Study</td>
<td>Janet Rebecca Smith (Microbiology)</td>
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<td>Session 1, B21</td>
<td>Blood Pressure Modeling</td>
<td>Brittany Kaye Smith (Mathematics)</td>
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<td>Session 2, C25</td>
<td>Purification of RCNMV binding protein</td>
<td>Megan Elizabeth Smithmyer (Chemical Engineering)</td>
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<td>High Concentration Formulation of a Spray Dried Protein Product</td>
<td>Joshua Michael Souther (Food Bioprocessing and Nutritional Science)</td>
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<td>Analysis of the Global Sex Trade: United States Policy and the Prostitution Debate</td>
<td>Katie Irene Starr (Foreign Languages &amp; Literature)</td>
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<td>Session 2, B24</td>
<td>Characterization of zinc finger coordination and protein-peptide interaction properties of HIV-1 nucleocapsid protein NCp7</td>
<td>Krystyna Yuriyivna Stolyarchuk (Biochemistry)</td>
<td>Agriculture and Life Sciences / Molecular &amp; Structural Biochemistry</td>
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<td>The Effects of Pharmacological Manipulation in the Ventral Tegmental Area on Dopamine Transients in the Nucleus Accumbens as Measured by Fast Scan Cyclic Voltammetry</td>
<td>Deanna Marie Tesch (Chemistry)</td>
<td>Physical and Mathematical Sciences / Chemistry</td>
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<td>The effect of restricted grazing on intake</td>
<td>Alison Thomas-Hollands (Agriculture and Life Sciences)</td>
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| Session 1, B16 | **Kara Ann Tinker**  
*Biochemistry, Microbiology* | Genetics of non-fibrous carbohydrates in horses | Animal Science |
| Session 2, C1 | **Christopher Michael Trlica**  
*Chemistry* | Phylogenetic analysis of FLOWERING LOCUS T gene and evolutionary phenology divergence in angiosperms | Agriculture and Life Sciences / Plant Biology |
| Session 2, B16 | **An Nguyen Truong**  
*Food Bioprocessing and Nutrition* | Control of enzymatic oxidation during processing of purple-fleshed sweetpotatoes for anthocyanin-rich extracts and starch recovery | Agriculture and Life Sciences / Food, Bioprocessing, and Nutrition Sciences |
| Session 1, A25 | **Matthew Kyle Tucker**  
*Human Biology* | Synthesis of Alkyne Functionalized Polycarbodiimides to Incorporate Bioactive Molecules by Click Chemistry | Physical and Mathematical Sciences / Chemistry |
| Session 2, A18 | **Kaitlin Tucker**  
*Geology and Marine Science* | Sea Ice Timing and Duration Along the Antarctic Peninsula | Physical and Mathematical Sciences / Marine Earth and Atmospheric Sciences |
| Session 1, D9 | **Tracy Lynn Turnbull**  
*Agricultural Education & International Studies* | Globally Engaged Agriculture | Agriculture and Life Sciences / Agricultural & Resource Economics |
| Session 1, C23 | **Sarah Rebecca Uzzell**  
*Textile and Apparel Management* | Adaptations of organisms in extreme ecosystems; Desert, Arctic, and Benthic Biomes | Agriculture and Life Sciences / Biological Sciences |
| Session 1, A12 | **Celina Valletti**  
*Polymer and Color Chemistry* | Biodegradation of PLA-based Films Under Composting Environments | Textiles / Textile Engineering, Chemistry & Science |
| Session 2, C11 | **Andres David Vargas**  
*Materials Engineering* | Prediction of the Three Dimensional Structure of Cellulose Synthase | Engineering / Materials Science & Engineering |
| Session 1, C14 | **Heather Christine Vaughn**  
*Electrical & Computer Engr* | Characterization and Emulation of the Memristor | Engineering / Electrical & Computer Engineering |
| Session 1, C10 | **Caitlin Chandler Vincent**  
*Interdisciplinary Studies* | Converging Diets: The Influence of Globalization on Human Nutrition | Humanities and Social Sciences / Sociology & Anthropology |
| Session 2, D22 | **Kimberly A. Wagner**  
*Genetics, Biochemistry* | Peptide Aptamers That Interfere With Geminivirus Replication | Agriculture and Life Sciences / Molecular & Structural Biochemistry |
| Session 2, A6 | **Adam R Ward**  
*Environmental Science* | Identification of a Novel Dominant-Negative Mouse Pregnane X Receptor Splice Variant | Agriculture and Life Sciences / Environmental & Molecular Toxicology |
| Session 2, C21 | **Jessica Gabrielle Waters**  
*Biology* | Impact of dietary phosphate concentrations on neonatal pigs | Agriculture and Life Sciences / Animal Science |
| Session 2, A24 | **Suzanne Marie Webb**  
*International Studies* | A History of the Veil in Modern Egyptian Society and its Symbolism Across Cultures | Humanities and Social Sciences / Sociology & Anthropology |
| Session 2, D5 | **Charles Ryan West**  
*Fitts Dept Indus & Syst Engr* | Simulation and Evaluation of the BoxBot automated package transport system | Engineering / Industrial & Systems Engineering |
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<td>2, D15</td>
<td>Patrick R White</td>
<td>Mathematics</td>
<td>Stereoselective synthesis of N-acyl-2,3-dihydro-4-pyridones using organometallic reagents</td>
<td>Physical and Mathematical Sciences / Chemistry</td>
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<td>Howard Hamilton Whittle</td>
<td>Physics</td>
<td>Coherent State Oscillations of Single and Coupled Particles</td>
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<td>Sarah Elizabeth Widney</td>
<td>Biology</td>
<td>Variation in induced defense against caterpillars among ancestral and derived Zea plants</td>
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<td>1, D15</td>
<td>Shana T. Wilson</td>
<td>Biology</td>
<td>An Environmental Justice Case Study of the New Hill Wastewater Treatment Plant</td>
<td>Education / Adult &amp; Higher Education</td>
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<td>Jamie L. Winslow</td>
<td>Biological Sciences</td>
<td>Extra Credit in Undergraduate Level Courses</td>
<td>Agriculture and Life Sciences / Food, Bioprocessing, and Nutrition Sciences</td>
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<td>Jonathan William Witt</td>
<td>Civil Engineering</td>
<td>Validation of OpenFOAM, an Open Source Computational Fluid Dynamics (CFD) software package</td>
<td>Engineering / Civil, Construction &amp; Environmental Engineering</td>
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<td>1, C9</td>
<td>Daniel David Wooten</td>
<td>Nuclear Engineering</td>
<td>RF Atmospheric Plasma Based Air Filtration Using Porous Metals</td>
<td>Engineering / Nuclear Engineering</td>
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<td>1, B6</td>
<td>Garrett Richard Wydysh</td>
<td>Biology</td>
<td>Inorganic and Organic Compounds Affect the Body in Dynamic Ways</td>
<td>Agriculture and Life Sciences / Biological Sciences</td>
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<td>Ginny C Zimmerman</td>
<td>Biology</td>
<td>The effect of leptin on voluntary feed intake and preference in weanling pigs</td>
<td>Agriculture and Life Sciences / Animal Science</td>
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The annual Undergraduate Research Symposium continues to highlight presentations on some of the finest work and thinking at NC State University. The objectives of the Symposium are to demonstrate the importance of research in the undergraduate experience, to recognize the contributions made by our undergraduates to research, and to stimulate research involvement by young people. The Symposium has been endorsed by the Chancellor, the Faculty Senate, and the Council of Academic Deans. Undergraduate students engaged in scholarly research with faculty in all disciplines have been invited to participate.

Students present their contributions in poster formats during one of two sessions. Each presentation is placed under one of the colleges listed below. Teams of judges in each category select outstanding contributions for special recognition. The students making these outstanding contributions to research are further honored at the annual Sigma Xi Awards banquet on Tuesday, April 26, 2011 at 5:00 p.m. and the Honors Baccalaureate. Details about the symposium can be found at http://www.ncsu.edu/ugrs/.

**Categories**

- Agriculture and Life Sciences/Vet Med
- Design
- Education
- Engineering
- Humanities and Social Sciences
- Poole Management
- Natural Resources
- Physical and Mathematical Sciences
- Textiles

Financial support for this year’s symposium has been provided by

- Division of Undergraduate Academic Programs
- Materials Research Society NCSU Student Chapter
- NC State University Provost's Office
- NC State University Vice Chancellor for Research and Graduate Studies
- Office of Undergraduate Research
- Sigma Xi: The Scientific Research Society
- North Carolina Biotechnology Center’s Event Sponsorship Grant to George Barthalmus
- College of Agriculture and Life Sciences

Special thanks to Anthony Tran, a graduate of the College of Design, for the abstract booklet cover design, and Kim Cox and Katie Lynch for serving as the Web Masters for the creation and layout of the symposium.

The Undergraduate Research (UR) Committee Chair, Gerry Luginbuhl, along with George Barthalmus, Director of UR, and Judy Day, Assistant Director of UR appreciate the efforts of the committee members and especially the time and expertise of the symposium judges.
# The 20th Annual NC State University Undergraduate Research Symposium

## Judges

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## The 20th Annual
**NC State University**
**Undergraduate Research Symposium**
**Organizing Committee, 2010-2011**

Gerry Luginbuhl, Chair

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