April 14, 2015

Dear Undergraduate Researchers, Mentors, University Community and Guests:

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 10:00 a.m. to 2:00 p.m., on Tuesday, April 14, 2014 at the Talley Student 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 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,

Dr. Mike Mullen
Vice Chancellor and Dean
Division of Academic and Student Affairs
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### Session 1

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A22 Robert William Raidt Food Science-BS  Effects of Gamma Irradiation on Chocolate Dairy Powder used for Chocolate Milk  Gary Cartwright Food Science
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A24 Andrew Stephen Drake Chemical Engineering-BS  Incorporation of High-Aspect-Ratio Cd-Se Nanorods into Hyperelastic Thermoplastic Elastomer Gels  Richard Spontak Chemical & Biomolecular Engr

A25 Austin Collin Flick Biological Sciences-BS  An Outside Analysis of the Patient Surveying Process of Raleigh Orthopedic Clinic  Anita Pardue University Career Center

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Biological Engineering  
Michele Proctor  
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Vassili Kouprianov  
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Joseph Cansler  
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**Katelyn Thomas**  
Agricultural Business Management;  
**Vasiliki Lambropoulos**  
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**Nicole Freitas**  
Animal Science;  
**Martha Calvert**  
Nutrition Science;  
**Mattie Thompson**  
Animal Science;  
**Colin Woolard**  
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**Amber Stark**  
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**Veronica Emmerich**  
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**Tyler Church**  
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**Breanne Burgess**  
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**Breanne Burgess**  
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**Alli Nickell**  
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**Victoria Lane**  
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Kyvaugn Ferguson;  
Suman Dev Nuclear Engineering;  
Stephen Trippe Nuclear Engineering;  
Philip Kilgore Nuclear Engineering;  
Mohamed Albinali Nuclear Engineering;  
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Daniel Armstrong Chemical Engineering  
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Dept-Population,Health,Pathobi;

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Seth Hollar  
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Omar Yaqoub Y.A.Y.  
Al Ahmadi  
Nuclear Engineering;  
Daniel Mikkelson  
Nuclear Engineering;  
Kelsey Kelly  
Nuclear Engineering  

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Dmitriy Anistratov  Nuclear Engineering

C29  Dylan Scott Hoagland  
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Jacqueline Austell  
Nuclear Engineering;  
Luke Obenauf  
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Kevin Boyle;  
Megan Smith  
Nuclear Engineering  

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Matthew Stokely  Nuclear Engineering
Joseph Doster  Nuclear Engineering

C30  Sana Talat Qureshi  
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Chad Stahl  Animal Science

D1  Adam C Rushing  
Biological Engineering-BS

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Mike Boyette  Biological And Agricultural Engineering

D2  Erin Allyson Beasley  
Animal Science-BS

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Ronald Baynes  Department of Population Health and Pathobiology
Sharon Mason  CVM-Food Animal Eq;
Kevin Anderson  CVM-Food Animal Eq;
Steven Washburn  Animal Science;
Keena Mullen  Animal Science
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Biological Engineering  
Irrigation and Drainage System Utilizing Sustainable Agricultural Retention Pond  
Mohamed Youssef  
Biological And Agricultural En

D9  Joshua Victor Chen  
Nuclear Engineering-BS  
Anant Singhal  
Nuclear Engineering;  
Jarvis Scott  
Nuclear Engineering;  
Thomas Gomez  
Nuclear Engineering;  
Zachery Mayfield  
Nuclear Engineering;  
Michael Vickery  
Nuclear Engineering  
Production of Technetium-99m via Optimized Cyclotron Targetry  
Matthew Stokely  
Nuclear Engineering  
Joseph Doster  
Nuclear Engineering;  
Matthew Stokely  
Nuclear Engineering
<table>
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<tr>
<th>Number</th>
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<tr>
<td>D10</td>
<td>Elizabeth Ann Harris</td>
<td>Animal Science-BS</td>
<td>Influence of TGF-beta 2 on MHC class I and II expression on equine bone marrow-derived mesenchymal stem cells</td>
<td>Lauren Schnabel Dept of Clinical Sciences&lt;br&gt;Julie Long Dept of Clinical Sciences</td>
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<td>Alix Berglund</td>
<td>Comparative Biomedical Sciences</td>
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<td>D11</td>
<td>Lucas Bruce Dillard</td>
<td>Biochemistry-BS</td>
<td>A Review on Ethics and Regulation of Preimplantation Genetic Diagnosis</td>
<td>Hsiao-Ching Liu Animal Science&lt;br&gt;Hsiao-Ching Liu Animal Science</td>
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<td>Meghan Watson</td>
<td>Animal Science</td>
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<td>Jasmine Smith</td>
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<td>Dylan Deprospero</td>
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<td>Wade Thomas</td>
<td>Anthropology-BA</td>
<td>Carbon and Oxygen Isotopes Investigate Dietary Trends Among Pre- Agriculturalists and Early Agriculturalists from Michoacán Mexico</td>
<td>Chelsey Juarez Sociology and Anthropology</td>
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<td>D13</td>
<td>Nikki McArthur</td>
<td>First Year College</td>
<td>An Uncommon -2 Programmed Translational Frameshift in a Bacteriophage Tripp Transposase Gene</td>
<td>Adam Groth Plant &amp; Microbial Biology&lt;br&gt;Eric Miller Plant and Microbial Biology</td>
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<td>Adam Connell</td>
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<td>Zachary Davis</td>
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<td>Connor McKenney</td>
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<td>D14</td>
<td>Jacob R Deal</td>
<td>Physics-BS</td>
<td>The Design of a Pressure Gauge for Cryogenic Applications</td>
<td>David Haase Physics</td>
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<td>D15</td>
<td>James M Schaefer</td>
<td>Textile Engineering-BS</td>
<td>Analysis of Wi-Fi Location Services Through Network Number and Type</td>
<td>Warren Jasper Textile Engineering Chemistry and Science</td>
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<td>D16</td>
<td>Vishwas N Rao</td>
<td>Chemistry-BS</td>
<td>Engineering the substrate specificity of enzymes involved in secondary metabolite biosynthesis: a route to new small molecule therapeutics</td>
<td>Gavin Williams Chemistry&lt;br&gt;Christopher Ladner Chemistry Grads &amp; Temps</td>
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<td>D17</td>
<td>Abigail Lynn Beitel</td>
<td>Biological Sciences-BS</td>
<td>Dissemination patterns, antimicrobial resistance profiles, and genotypic characterization of Salmonella isolates in North Carolina and Iowa swine farms following land application of manure</td>
<td>Siddhartha Thakur CVM-Food Animal Eq</td>
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D18  **William Bert Garrison**  
*Chemical Engineering*  
Simultaneous detection of real-time brain glucose and dopamine fluctuations using glucose oxidase-modified carbon-fiber microelectrodes coupled with background-subtracted fast-scan cyclic voltammetry in live animals  
**Leslie Sombers**  
*Chemistry*

D19  **Matthew S Hursey**  
*Chemistry-BS*  
**Ian Sullivan**  
*Chemistry; Jonathan Boltersdorf*  
*Chemistry*  
Synthesis and Photocatalytic Investigations of n-type SnNb2O6  
**Paul Maggard**  
*Chemistry*

D20  **Indya Jade Thompson**  
*Environmental Sciences-BS*  
**Kristen Wade ; Carole Roman**  
Responses to Environmental Stimuli: Companion Animals, Invertebrate Sensory Responses, and Non-Human Primate Behaviors  
**Miriam Ferzli**  
*Biological Sciences*  
**Lisa Paciulli**  
*Biological Sciences*

D21  **John R Ritter**  
*Chemical Engineering-BS*  
Process intensification of CO consumption by C. ljunghahlii in a low power input biocomposite gas absorber  
**Michael Flickinger**  
*Biomanufacturing Training and*

D22  **Alexis Dupont**  
*Zoology-BS*  
**Reshma Patel**  
*Zoology; Tia Simon**  
*Biological Sciences; Marissa Rosen*  
*Zoology*  
Conservation Psychology: Determining potential motivating factors behind pro conservation behaviors.  
**Jennifer Campbell**  
*Biological Sciences*

D23  **James Daniel Chapa**  
*Food Science-BS*  
**Gloria Lai**  
*Food Science; Christina Sipes**  
*Food Science; Emily Snedeker**  
*Food Science*  
Quality Optimization of Muscadine Puree for Jam Production  
**Tyre Lanier**  
*Food, Bioprocessing & Nutrition Sciences*  
**Gabriel Harris**  
*Food, Bioprocess & Nutrition Sc*

D24  **Meaghan B Gandolph**  
*International Studies-BA*  
Vietnamese Mail Order Brides in Taiwan  
**Carol Ann Lewald**  
*International Studies*

D25  **Joshua D Dickerson**  
*Materials Science and Engr-BS*  
Nano/Macroscopic Swelling of Block Ionomers Prepared from Solvents Differing in Polarity  
**Richard Spontak**  
*Chemical & Biomolecular Engr 
Kenny Mineart**  
*Chemical & Biomolecular*
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<tr>
<th>No.</th>
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<tr>
<td>D26</td>
<td>Caitlyn Michelle Joyner</td>
<td>Chemical Engineering-BS</td>
<td>Soft Composites Derived from Hydrogels and an Electroactive Polymer</td>
<td>Richard Spontak Chemical &amp; Biomolecular Engr</td>
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<td>Rachel Aquino Banawa</td>
<td>Psychology-BA</td>
<td>Digital Games and Older Adults: an Exploration of Gender Differences in Emotion</td>
<td>Jason Allaire Psychology</td>
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<td>Deneisha Poe</td>
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<td>William Grenhart Psychology</td>
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<td>Keiko Gomez-Gurley Psychology</td>
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<td>D28</td>
<td>April Dawn Boggs</td>
<td>Fisheries, Wildlife, Cons-BS</td>
<td>Fascioloides magna and larval tapeworm infections in white-tailed deer</td>
<td>Christopher DePerno Forestry&amp;Environmental Resources</td>
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<td>James Flowers Population, Health, Pathobiology</td>
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<td>Malinda Burke</td>
<td>International Studies-BA</td>
<td>Red on the Sun: How Rwanda's Gacaca Courts Divide through Collective Identity Assignments</td>
<td>Carol Ann Lewald International Studies</td>
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<td>D30</td>
<td>Ashley Martin</td>
<td>Animal Science-BS</td>
<td>Beef-based Fast-food Items as a Means to ‘Extend’ Commercial Dry Dog Food for Low-Income Households</td>
<td>Korinn Saker CVM-Molecular Biomedical Scien</td>
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### Session 2
1:00 PM - 2:30 PM

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<thead>
<tr>
<th>Poster #</th>
<th>Student Presenters</th>
<th>Project Title</th>
<th>Mentors and/or Co-Authors</th>
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<tbody>
<tr>
<td>A1</td>
<td>Nour Abdelhakeem Saleh</td>
<td>Expression and Purification of ERECTA Receptor Kinase</td>
<td>Guozhou Xu, Biochemistry</td>
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<td>A2</td>
<td>Gabriela M Quinlan</td>
<td>Pathogen Prevalence in Native Bee Assemblages of Raleigh, North Carolina</td>
<td>David Tarpy, Entomology, Margarita Lopez-Uribe</td>
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<td>A3</td>
<td>Mary Jean Osborn</td>
<td>Changes in Understanding of Mutation, Camouflage and Natural Selection with Participation in Game Activity</td>
<td>Jennifer Landin, Biological Sciences</td>
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<td>A4</td>
<td>Alexander Nash Titleist Johnson</td>
<td>Slippery When Wet: Liquid Metal Interfaces</td>
<td>Michael Dickey, Chemical Engineering</td>
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<td>A5</td>
<td>Shannon Patricia Conroy</td>
<td>Identifying Regulators of Time of Day Variations in Stress Responses</td>
<td>Colleen Doherty, Biochemistry</td>
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<td>A6</td>
<td>Natalie Chilton Andrews</td>
<td>Analysis of 5-enolpyruvylshikimate-3-phosphate synthase and its relation to Glyphosate (Roundup®) resistance in Amaranthus palmeri</td>
<td>Michael Goshe, Molecular and Structural Biochemistry, James Burton, Horticultural Science</td>
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<td>A7</td>
<td>Meredyth Diana Monroe Daniel</td>
<td>Measuring the Quality Assurance of Knee Surgery by Examining Patient Outcomes</td>
<td>Huong Nguyen, Administration</td>
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<tr>
<td>A8</td>
<td>Justin Garrett Cody</td>
<td>Design of a High Efficiency Single Volume Neutron Scatter Camera (SVNSC)</td>
<td>John Mattingly, Nuclear Engineering; Mohamed Bourham, Nuclear Engineering;</td>
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<td>Kyle Weinfurther</td>
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<td>Nuclear Engineering; Jessica Williams</td>
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<td>Nuclear Engineering; Alaimoana Vaivelata; Equasha Kenner; Richard Frazier; Stephen Fawcett</td>
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</table>
Asish Andhavarapu  
Nuclear Engineering;  
Saeed Alrayssi Nuclear Engineering;  
Sulaiman Aldhuhoori Nuclear Engineering;  
Alex Somers Nuclear Engineering;  
Alma Angelica Lambert Nuclear Engineering;  
Molly Glass Nuclear Engineering;  
Bradli Crump Nuclear Engineering;  
Justin Cody Nuclear Engineering

A9  Lazar Dale Panich  
Mechanical Engineering-BS  
Exploration of 3D Printing of Liquid Metals Near Room Temperature  
Michael Dickey  
Chemical Engineering

A10  Michael C Rosenberg  
Mechanical Engineering-BS  
Finite Element Analysis of Composite Materials for Wind Turbine Blades  
Mohammed Zikry  
Mechanical and Aerospace Engineering

A11  Anne S Link  
Animal Science-BS  
The Impact of Gender on the Human-Animal Relationship  
Jennifer Campbell  
Biological Sciences

A12  Rebekah Faith Lee  
Physics-BS  
Vibrational Properties of Granular Packings  
Karen Daniels  
Physics;  
Theodore Brzinski  
Physics;  
Karen Daniels  
Physics;

A13  Rebecca Suzanne Sears  
Fisheries, Wildlife, Cons - BS  
Ashley Le ;  
Alexandra Davis  
Effective Strategies for Mammalian Conservation in Africa, Asia, and Europe  
Miriam Ferzli  
Biological Sciences;  
Lisa Paciulli  
Biological Sciences

A14  McKendry B Fleming  
Food Science-BS  
Kelcey Carver Food Science;  
Christopher Biamonte  
Food Science  
Humectant Effects on Moisture Migration in Intermediate Moisture Foods  
Tyre Lanier  
Food, Bioprocessing & Nutrition Sciences;  
Richard Theuer  
Food, Bioprocessing and Nutrition Sciences

A15  John Horton Wright  
Chemical Engineering-BS  
Implementation of a High Temperature Antibiotic Resistance Selectable Marker in the  
Robert Kelly  
Chemical & Biomolecular
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<tr>
<td>A16</td>
<td>Thomas Craig Chappelow</td>
<td>Hyperthermophilic Biomass Degrading Bacterium</td>
<td>Engr</td>
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<td>A17</td>
<td>Nyd Sertsuvalkul</td>
<td>Characterization of the role of the E3 ligase, BRUTUS, in Embryonic Iron Homeostasis in Arabidopsis thaliana</td>
<td>Terri Long, Plant and Microbial Biology</td>
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<td>A18</td>
<td>Alexandra Rose Carlson</td>
<td>Development of a method to detect hoof acceleration profiles in all four hooves simultaneously.</td>
<td>Paul Siciliano, Animal Science</td>
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<td>A19</td>
<td>Annapurna Hanumanthu</td>
<td>Mutation of a single ligand binding domain amino acid of the teleost estrogen receptor beta-a increases its binding affinity to diethylstilbestrol</td>
<td>Mary Beth Hawkins, Department of Biological Sciences</td>
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<td>A20</td>
<td>Sze Ting Hung Larissa Jones Danny Ibrahim</td>
<td>Identifying Geminivirus Resistance Gene in Arabidopsis</td>
<td>Jose Ascencio-Ibanez, Maria Reyes, Dominique Robertson, Plant Biology;</td>
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<td>A21</td>
<td>Mychal Dennis Jones Emily Robinson Rebecca May Joseph Lawdanski</td>
<td>Autonomous Reel Mower</td>
<td>Gary Roberson, Biological And Agricultural Engineering</td>
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<td>A22</td>
<td>Benjamin Hobson Joshua Rudd</td>
<td>Quarter Scale Tractor Modifications</td>
<td>Grant Ellington, Biological And Agricultural Engineering; Edward Godfrey, III, Biological And Agricultural Engineering</td>
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<td>Amie Nguyen</td>
<td>Biological Sciences-BS</td>
<td>Mapping the substrate cleavage site for a clotting factor (Factor VII)</td>
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<td>Ashle Mills Page</td>
<td>Polymer and Color Chemistry-BS</td>
<td>Impact of Asymmetric Deformation on Recrystallization in Spin-Formed Aerospace Structures</td>
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<td>Kevin Chang</td>
<td>Zoology-BS</td>
<td>How does popular media's portrayal of animals affect viewer perceptions?</td>
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<td>Jordan E Wong</td>
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<td>Measurements of rat caudate-putamen, nucleus accumbens core, and nucleus accumbens shell volumes reveal region-specific lateralization but not sex differences</td>
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<td>Ashley Verney</td>
<td>Harrison-Jackson</td>
<td>Breed and gender differences of liver gene expression in swine drug metabolism</td>
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<td>Jeffrey Michael Niski</td>
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<td>Quantifying the activity of Dehaloperoxidase B using a colorimetric assay</td>
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<td>B7</td>
<td>Kalysha E Clark</td>
<td>Zoology-BS</td>
<td>Perceptual Range of a Fossorial Rodent (Tamius dorsalis) in Fragmented Forests</td>
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<td>Erik Kristopher Vosburgh</td>
<td>Environmental Engineering-BS</td>
<td>Manipulating the flow of EGaIn, via the addition of an oxide layer.</td>
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<td>Morgan Mccafferty</td>
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<td>Comparison of Two Sampling Techniques to Assess Antimicrobial Concentrations in the Airways of Steers</td>
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<td>Shayna Diamond Swick</td>
<td>Biological Sciences-BS</td>
<td>Development of a Validated Survey for Head Start Outdoor Learning Center Assessment</td>
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<tr>
<td></td>
<td>Renae Luu</td>
<td>Biological Engineering</td>
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<td>Steve Hall</td>
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B11 Jean-Luc Thomas Banks  
*Microbiology-BS*

The Development and Assessment of a Problem-Based Learning Case Study On Student Performance in General Microbiology

Alice Lee  
*Biological Sciences*

B12 Brittany Lee Bradish  
*Animal Science-BS*

Patrick Piatak  
*Biochemistry;*

Delaney Hay  
*Animal Science;*

Abigail Lane  
*Animal Science;*

Gabrielle Robbins  
*Animal Science;*

Gregory Sheets  
*Agricultural and Environmental Technology;*

Hannah Jenkins  
*Biochemistry;*

Grace Stevens  
*Animal Science;*

Katie Johnson  
*Animal Science*

An integrated algae production platform to feed and fuel our communities

Amy Grunden  
*Plant and Microbial Biology*

B13 Megan E Martin  
*Biological Sciences-BS*

Serene Ahmad  
*Biochemistry*

Ali Arafat  
*Biochemistry*

Environmental Influences on Chronic Respiratory Diseases

Miriam Ferzli  
*Biological Sciences*

Lisa Paciulli  
*Biological Sciences*

B14 Lauren Danielle Maynard  
*Fisheries, Wildlife, Cons - BS*

Downed wood in the neighborhood: availability of woody debris in an urban-exurban matrix

Christopher Moorman  
*Forestry and Environmental Resources*

George Hess  
*Forestry and Environmental Resources*

B15 Reagan Robert Dewayne Weeks  
*Physics-BS*

Index of Refraction Measurements of Aerosol Materials

Hans Hallen  
*Physics*

B16 Jessica Margaret Buddenbaum  
*Biological Sciences-BS*

Peyton Brown  
*Biological Sciences*

Active Teaching Styles Positively Impact Student Learning Gains

Miriam Ferzli  
*Biological Sciences*

B17 Haley N Vartanian  
*International Studies-BA*

A Spoonful of Cooperation Helps the Medicine Go Down: Integrating

Shea McManus  
*Sociology & Anthropology*
traditional and western medicine for Southeast Asian refugee welfare

B18  **Steven M Plante**  
*Chemical Engineering-BS*

**Incorporation of an Ionic Liquid into a Sulfonated Block Copolymer**

**Richard Spontak**  
*Chemical & Biomolecular Engr*

B19  **Lynde Joy Ring**  
*Food Science*

**Characterization of Campylobacter in Turkey Flocks Raised in Different Environments**

**Sophia Kathariou**  
*Food, Bioprocess & Nutrition Sc*

**Michael Martin**  
*Dept - Population, Health, Pathobi;*

**Jeffrey Niedermeyer**  
*Food, Bioprocess & Nutrition Sc; Seiche Genger*

**Christina Lindsey**  
*Dept - Population, Health, Pathobi;*

B20  **Katherine Carlette Speight**  
*Food Science-BS*

**Rachel Stowe**  
*Food Science; Elliott McDowell*  
*Food Science; Jennifer Lee*  
*Food Science*

**Reduction of Water Activity in Restructured Beef Jerky with Humectants**

**Tyre Lanier**  
*Food, Bioprocessing & Nutrition Sciences*

B21  **Alexandra Kaye Fraik**  
*Zoology-BS*

**The Impacts of Inbreeding on the Fitness of *Culex pipiens form molestus***

**Fred Gould**  
*Entomology*

B22  **John Taylor**  
*Biological Engineering*

**Jordan Matthews**  
*Biological Engineering; Alex Cao*  
*Biological Engineering; Aaron Freeman*  
*Biological Eng.*

**Design and Construction of a Continuous Centrifuge**

**Ratna Sharma-Shivappa**  
*Biological And Agricultural Engineering*

**Mike D. Boyette**  
*Biological And Agricultural Engineering*

C1  **Robert Lampe**  
*Biological Sciences-BS*

**Domoic Acid Production throughout *Pseudo-nitzschia australis* Growth Phases**

**Astrid Schnetzer**  
*Marine Earth And Atmospheric Sciences*
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<th>C2</th>
<th>Julie Allison Sikes</th>
<th>Environmental Tech &amp; Mgmt-BS</th>
<th>A study of Richland Creek: How legacy sediments impact the Neuse River.</th>
<th>Karl Wegmann</th>
<th>Marine Earth And Atmospheric Sciences</th>
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<td>Adam Lee Geology</td>
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<td>C3</td>
<td>Rebecca Anne Stubbs</td>
<td>Biological Engineering-BS</td>
<td>Design and Construction of a 3D Watershed Hydrologic Simulator</td>
<td>Francois Birgand</td>
<td>Biological And Agricultural Engineering</td>
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<td>Tyler Overby</td>
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<td>Nicole Mathis</td>
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<td>Michael Hatcher</td>
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<td>C4</td>
<td>Qiannan Huang</td>
<td>Biochemistry-BS</td>
<td>The pH Dependence of Dehaloperoxidase Enzyme Using Michaelis-Menten Kinetics</td>
<td>Stefan Franzen</td>
<td>Chemistry</td>
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<td>Jing Zhao</td>
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<td>Melodi T Charles</td>
<td>Biological Sciences-BS</td>
<td>Seeing Stress: Visual adaptation of zebrafish (Danio rerio) ASC in response to external stressors</td>
<td>Antonio Planchart</td>
<td>Biological Sciences</td>
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<td>Huiqi Lin</td>
<td>Biochemistry-BS</td>
<td>NO and Nitrite with Dehaloperoxidase-Hemoglobin A from Amphitrite ornata: Binding or Reaction?</td>
<td>Stefan Franzen</td>
<td>Chemistry</td>
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<td>Brittney V Adams</td>
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<td>Optical Properties of Greenland’s Glacial Lakes</td>
<td>Chris Osburn</td>
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Alper Bozkurt  
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D2  Ian T Stancil  
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Teratogenicity of Zinc dimethylthiocarbamate on Japanese medaka skeletal development

Seth Kullman  
Biological Sciences

D3  Alexis Rose Elia  
Bioprocessing Science-BS

Justin Perry  
Bioprocessing Science, Currey Nobles Food Science

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Fletcher Arritt  
Food, Bioprocess & Nutrition Sc

D4  Megan Taylor Fruchte  
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Mary Curtis  Biological Engineering; Cyrus Belenky  Biological Engineering; Chelsea Durant  Biological Engineering

Floating Wetland Trash Barrier

Michael Burchell  
Biological And Agricultural Engineering

D5  Jordan Kathleen Smith  
Biological Sciences-BS

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Lee-Ann Jaykus  
Food, Bioprocess & Nutrition Sc

Jennifer Shields  
Food, Bioprocessing, and Nutrition Science

D6  Mackenzie Wrightsel Blum  
Biological Engineering-BS

Megan Colonel  Biological Engineering; Bradley Hunter  Biological Engineering; Jacqueline Ammons  Biological Engineering

Urban Stormwater Phytoremediation Using Silva Cell Bioretention Structure

William Hunt  
Biological And Agricultural Engineering

Jonathan Page  
Biological And Agricultural Engineering
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Biological Sciences

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Biological Sciences Grads and Temps

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Sanjay Shah  
Biological And Agricultural Engineering  
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D15  **Lakshmi Hasitha Chennu**  
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      **Jacob Drums**  
      **Mark Townley**  
      **Plant and Microbial Biology** |
Session 2 - A6
Analysis of 5-enolpyruvylshikimate-3-phosphate synthase and its relation to Glyphosate (Roundup™) resistance in A. palmeri
Natalie Chilton Andrews Animal Science-BS, NC State University

Mentors and/or Co-Authors:
Michael Goshe Molecular and Structural Biochemistry, NC State University
James Burton Horticultural Science

Glyphosate resistance in weed species has become a growing concern in the agricultural community over the past few years. Glyphosate, or Roundup™ (Monsanto Technology LLC) is non-selective and can be used with glyphosate resistant, transgenic crops. It is believed that glyphosate resistance occurs in A. palmeri as a result of an increase in the copy number of a gene responsible for the production of 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS). Roundup’s mechanism of action blocks the activity of EPSPS through competitive inhibition. Based on genetic analysis, the increase in gene copy number correlates with Roundup resistance, but little is known regarding the protein abundance of EPSPS with resistant A. palmeri strains. In order to investigate this, protein extraction and immunoblot analyses were conducted with about 30 A. palmeri biotypes obtained from various locations across North Carolina. Strains exhibiting differential levels of protein expression were identified and are currently being subjected to SDS-PAGE in-gel digestion using trypsin with the extracted peptides analyzed by liquid chromatography-tandem mass spectrometry (LC/MS/MS). Once compiled, these results will be used to design future quantitative LC/MS/MS experiments as well as to probe potential post-translational modifications in order to elucidate the EPSPS differences between resistant A. palmeri strains.

Session 1 - A12
Preimplantation Genetic Diagnosis
Tanya N Ansari Bioprocessing Science-BS, NC State University
Sidney Reinertsen Animal Science, NC State University;
Ingrid Chen Biochemistry, NC State University;
Zoe Caira Animal Science, NC State University

Preimplantation genetic diagnosis (PGD) is a method of embryo profiling. It is used to detect chromosomal disorders in embryos in vitro. The preferred biopsy used is the trophectoderm biopsy, which is the least invasive. The most widely used technology to screen the embryo is fluorescent in situ hybridization (FISH). These methods are used by couples who want to view their child’s genetic material before conception.

Session 1 - B15
Comparing species, presenting injury, and length of treatment of Turtle Rescue Team patients and its implications on North Carolina Wildlife
Catherine Mary Bartholf Animal Science-BS, NC State University

Mentors and/or Co-Authors:
Shweta Trivedi Animal Science, NC State University
Turtle Rescue Team (TRT) is a student-run, faculty supervised organization at the North Carolina State University College of Veterinary Medicine (NCSU-CVM) that treats native, sick and injured, wild chelonians (Lewbart, 2005). TRT is important to the education of the veterinary students at the NCSU-CVM interested in wildlife medicine, because it provides them with the opportunity to practice working with and managing clinical wild-turtle cases, “provide competent and state-of-the-science veterinary care to sick and injured wild turtles, and provide clinical case material for the generation of new knowledge in the form of case reports and hypothesis-driven, peer reviewed publications” (Lewbart, 2005). The goal of this study was to create a database for TRT and provide statistical analysis of past patients to assist in the managing of its current and future patients. The statistical data will also provide more information to TRT to utilize when educating the public about our impact on wildlife population. The database was created from the patient case files for the years of 2011, 2012, and 2013 for a total of 914 patients. The results from the database include a species breakdown for each year, trends in presenting injury and fatality, length of time in treatment/rehab, and overall release rates of patients.

Session 2 - D6
Urban Stormwater Phytoremediation Using Silva Cell Bioretention Structure
Mackenzie Wrightsel Blum Biological Engineering-BS, NC State University
Megan Colonel Biological Engineering, NC State University;
Bradley Hunter Biological Engineering, NC State University;
Jacqueline Ammons Biological Engineering, NC State University

Mentors and/or Co-Authors:
William Hunt Biological And Agricultural Engineering, NC State University
Jonathan Page Biological And Agricultural Engineering, NC State University

Urban stormwater runoff has been a problem in many cities, because the runoff often carries nitrogen and phosphorus based pollutants to downstream aquatic ecosystems. Additionally, urban tree growth often suffers from high soil compaction and low water infiltration. Through this study, the research team intends to resolve both of these problems with the design and implementation of a silva cell bioretention system. The silva cell should serve as protection from soil compaction, and the bioretention media is designed to remove pollution from stormwater before it enters the environment.

Session 1 - C13
The Phage Hunters SAGA: A Student-based Approach to Genome Annotation
Anna-Claire Virginia Bousquet Life Sciences First Year, NC State University
Trisha Slehria Psychology, NC State University;
Nicholas Carson Biological Sciences, NC State University;
Anderson Clark Chemistry, North Carolina State University

Mentors and/or Co-Authors:
Eric Miller Plant and Microbial Biology, NC State University
Adam Groth Plant and Microbial Biology, NC State University;

Bacteriophage Tripp was isolated during the NCSU Phage Hunters course as a plaque-forming phage on the bacterium Paenibacillus larvae that causes American Foulbrood Disease in honeybees. By using various bioinformatics tools, students were able to take a recently sequenced genome and analyze it as a class. This group approach allowed us to gain an understanding of both bacteriophage biology and the use of annotation programs such as Geneious, GeneMark, DNA Master, BLAST, and Phamerator. Overall genome annotation was done using DNA Master. Specifically, GeneMark and Glimmer were Hidden Markov Model programs used to identify regions of coding potential, followed by ribosome binding site analysis. By working with these tools, we were able to produce a final annotated file for submission to GenBank. The annotated Tripp genome has 54,439 base pairs, a 378 base pair terminal repeat, and 92
Session 2 - B12
An integrated algae production platform to feed and fuel our communities
Brittany Lee Bradish Animal Science-BS, NC State University
Patrick Piatak Biochemistry, NC State University;
Delaney Hay Animal Science, NC State University;
Abigail Lane Animal Science, NC State University;
Gabrielle Robbins Animal Science, NC State University;
Gregory Sheets Agricultural and Environmental Technology, NC State University;
Hannah Jenkins Biochemistry, NC State University;
Grace Stevens Animal Science, NC State University;
Katie Johnson Animal Science, NC State University
Mentors and/or Co-Authors:
Amy Grunden Plant and Microbial Biology, NC State University

As the demand for renewable sources of transportation fuel and food increases, interest in using algae for the production of biofuels and co-products continues to grow. Algae are photosynthetic, single-cell organisms, which produce numerous valuable compounds through specific metabolic pathways. Unlike other biofuel feedstocks, algae do not require arable land or freshwater that may compete with food crops. While algae are extremely valuable in their capacity to produce industrially-relevant materials, several important challenges to their commercial-scale production exist. The primary purpose of this investigation was to outline an ideal platform capable of sustainable production of biofuels and co-products that overcome these limitations to feed and fuel future communities. The advantageous characteristics of algae genera \textit{Dunaliella} and \textit{Chlorella} are metabolic production potential, halo-tolerance, and cell physiology, making them ideal candidates for a sustainable production platform. Algae, naturally or through controlled genetic modification, produce lipids for fuels as well as a range of compounds for a variety of applications such as pharmaceuticals, cosmetics, and livestock husbandry. Research suggests that the preferred methodology for growth is a combination of open pond and photobioreactor systems, depending on the co-product. The preferred method for extraction of products includes ultrafiltration and hydrothermal extraction. Co-localization of algae with existing CO$_2$-producing industries would result in increased fuel production, limiting environmental effect, and decreasing cost. Our research suggests that developing an integrated algal cultivation and production platform featuring \textit{Dunaliella} and/or \textit{Chlorella} would result in the economical and environmentally sustainable production of biofuel and co-products.

Session 2 - C8
Elucidation of ERL-1, a ligand binding receptor essential for development in Arabidopsis thaliana
Elizabeth Alexandria Brown Biochemistry-BS, NC State University
Nour Saleh Biological Sciences, NC State University
Mentors and/or Co-Authors:
Guozhou Xu Biochemistry, NC State University

ERL1 is a member of the ERECTA family (ERFs) of protein receptors. ERL1 protein is a ligand binding receptor known as LRR-RLK type found in \textit{Arabidopsis thaliana}. It has an extracellular domain (ECD) rich in repeated Leucine residues, one membrane domain and a kinase domain. As a receptor kinase, ERL1
works along with other two receptors ERECTA and ERL2. It can form homo or heterodimers with the ERECTA family of receptor kinases upon activated by its ligands. ERECTA, ERL1 and ERL2 play pleiotropic role in plant development, stomata formation. Stomatal lineage specific factors EPF1 and EPF2 control the activation of the ERL1 that regulates the stomatal development. The main objective of this research is to unravel the molecular mechanism of differential binding and activation of ERL1 by EPF/EPFL ligand through structural and in vivo studies. The ECD of the ERL1 was expressed in baculovirus-insect system and have been purified by nickel-affinity chromatography, and size exclusion chromatography in sufficient quantity for biochemical, biophysical, and crystallographic studies. Structural elucidation of the ERL1 receptor can provide insight into ligand-induced receptor activation and its role in regulation of stomatal development.

Session 1 - B23  
Stabilizing an Acidified Chunky Tomato Cheese Dip with Emulsifying Agents in a Hot Fill and Hold Thermal Process  
Joseph Lee Cansler Food Science-BS, NC State University  
Mentors and/or Co-Authors:  
Tyre Lanier Food, Bioprocessing, and Nutrition Science, NC State University  
Abstract A leading manufacturer of ready-to-eat cheese dips noted that consumers have preference for a home prepared dip consisting of melted processed cheese plus canned tomato pieces. The challenge was given to develop a shelf stable, ready-to-eat dip that would be similar in taste and texture, when consumed at room temperature, as this home prepared dip eaten immediately after heating. Shelf stability of the oil in water emulsion must also be assured to permit long shelf life of sealed jars at room temperature. An acidified hot fill and hold thermal process was trialed to create a shelf stable form of this cheese dip with diced tomatoes. Disodium phosphate and lecithin were added at varying levels to enhance emulsion stability. These also affected pH, which could aid in creating a similar flavor profile and viscosity at room temperature as that of the heated, home prepared cheese/tomato dip. Viscosity and yield stress of dips were measured by rotational viscometry. Emulsion stability was investigated by temperature abuse testing to effect phase separation. Key Words: Cheese dip, viscosity, emulsifier, pH, rheometer, colorimeter, calipers, lecithin, disodium phosphate

Session 2 - A18  
Development of a method to detect hoof acceleration profiles in all four hooves simultaneously.  
Alexandra Rose Carlson Animal Science-BS, NC State University  
Mentors and/or Co-Authors:  
Paul Siciliano Animal Science, NC State University  
The present research looks at the use of accelerometers placed on hooves to establish normal variation within horses (comparing left and right for both front and hind hooves) with the assumption that irregular values could indicate subtle lameness undetected by observation alone. Stage 1 (of research) involved designing custom made 1 in² devices incorporated with an accelerometer to be placed on the dorsal aspect of the hoof wall. Preliminary testing of prototypes revealed failings with devices requiring modification to system and design. Stage 2 involved utilizing modified devices on hooves of horses to analyze acceleration measurements of each hoof. One device was placed on each hoof for each horse to collect data. Hoof acceleration measured from seven horses (one voided due to device malfunction). Each data collection involved 6 repeated measurements trotting horses on flat concrete (~40 ft at NCSU research barn, ~60 ft at NCSU vet school). Analysis of front hooves’ from 3 horses and hind hooves’ from 5 horses. 50 lines of continuous movement analyzed from each measurement. The repeatability coefficient (RC) for the differences between the front hooves’ acceleration was 0.041122 g-force (g) with a within-horse standard deviation (S_w) of 0.014846 g and a mean within-horse coefficient of variation (CV) of 53.42% ± 27.17%.
The RC for the differences between hind hooves' acceleration was 0.042767 g with a within-horse $S_x$ of 0.015439 g and a mean within-horse CV of 78.72% ± 18.08%. Further testing is required to verify the significance in relation to lameness detection.

**Session 1 - B2**  
Optimization of alcohol by volume by modifying sugar and temperature conditions during beer fermentation using a wild yeast  
Morgan Frances Caudill *Bioprocessing Science-BS*, NC State University  
Nicholas Scarff *Bioprocessing Science*, NC State University;  
Emily Forrest *Food Science*, NC State University;  
Shelby Bernal *Bioprocessing Science*, NC State University  
*Mentors and/or Co-Authors:*  
Tyre Lanier *Food, Bioprocessing, and Nutrition Science*, NC State University

Sour beers are often more expensive and more difficult to produce than many other styles of beer because of the substantial amount of time needed for fermentation due to the involvement of lactic acid bacteria. With further experimentation, there is hope to produce and optimize a comparably faster fermentation process in order to produce sour beer using a wild yeast isolated from bees. The overall goals of this project was to, 1) determine the optimal brewing conditions for the wild yeast and, 2) define an equation for determining alcohol by volume (ABV) of beer made with the wild yeast using specific gravity values obtained during research. This yeast is likely a top fermenting strain which means that it ferments at a comparable temperature range as *S. cerevisiae*. Optimal brewing temperature is one of the critical variables that was tested. The optimal sugar concentration for yeast growth was also analyzed. The project incorporated analyses of dependent variables such as ABV, total organic acids, and specific gravity (density). As temperature and sugar content change, the fermentation rate and total alcohol production will change, respectively.

**Session 1 - D23**  
Quality Optimization of Muscadine Puree for Jam Production  
James Daniel Chapa *Food Science-BS*, NC State University  
Gloria Lai *Food Science*, NC State University;  
Christina Sipes *Food Science*, NC State University;  
Emily Snedeker *Food Science*, NC State University  
*Mentors and/or Co-Authors:*  
Tyre Lanier *Food, Bioprocessing, and Nutrition Science*, NC State University  
Gabriel Harris *Food, Bioprocessing, and Nutrition Science*, NC State University

Developing jam from pureed whole-fruit Muscadine grapes containing seeds, skin, and pulp could better utilize excess grapes, reduce waste, and increase nutritional value. Concord jams were chosen as a model due to their widespread consumer acceptance. The quality impacting factors of pH, sugar content, water activity, and yield stress were selected for comparison with jams prepared from Muscadine purees. Spreadability was selected as the crucial quality parameter, quantified as inversely proportional to yield stress of refrigerated jam (4°C), and measured via vane rheometry. Pectin gelation of Muscadine jam was modified with the goal of achieving target spreadability by varying sugar concentrations and heat treatments. Muscadine purees at 60°, 65°, and 75° Brix with unadjusted pH (pH = 3.08 +/- 0.01) were prepared by the addition of sucrose to the puree mixtures, which were then brought to and held at either 62°C for 2 minutes, 82.2°C for 1.5 minutes, or 92°C for 1 minute, after which they were rapidly chilled, refrigerated, and allowed to gel at least 24 hours prior to yield stress measurement. The range of heat treatments was selected in an attempt to selectively solubilize the natural Muscadine pectin, as it was hypothesized that the gel would be too strong if all the pectin was solubilized.
Where would we be without agriculture? Naked, hungry and homeless. These are the most important and vital resources of life. Without agriculture, none of these would be attainable. Farmers are always striving to produce crops to support the population which is growing exponentially. Farmers work hard physically each and every day; however, farmers with disabilities continuously work to be as effective as those who aren’t disabled. Just because a farmer has a disability does not mean he/she cannot be effective in the field of agriculture. To help with farmers with disabilities, all-terrain wheelchairs are being implemented across the country. These wheelchairs allow farmers to maneuver around farms to check their crops and make sure their land is still profitable and functional. All-terrain wheelchairs have increased over the past few years due to improvements in technology and instrumentation.. In working with farmers, we also get a behind the scenes look at the amount of manual labor that must be done on a daily basis. These wheelchairs are somewhat of a saving grace to farmers with disabilities.

Session 1 - C21
Development of a Feeder Cell Line to Efficiently Grow and Maintain Porcine Gonocytes and Spermatogonial Stem Cells in Vitro Using Glial Derived Neurotropic Factor
Dallas Mackenzie Clontz Animal Science-BS, NC State University
Mentors and/or Co-Authors:
Robert Petters Animal Science, NC State University

The objective of this experiment was to design a line of feeder cells that will allow for the efficient proliferation and maintenance of porcine gonocytes and spermatogonial stem cells (SSCs) in vitro for extended periods of time. GDNF is a protein that has been experimentally shown to maintain proliferation and self-renewal of SSCs for years in vitro (Sariola & Immonen, 2008). Two immortal lines of cells were used: STO and CHO cells. STO cells are mouse embryonic fibroblast cells and have been experimentally proven to provide a conditioned medium that promoted the growth and health of embryonic stem cells (Amano, Furuno & Nakanishi, 2006). CHO cells are Chinese Hamster Ovary cells and will be used as a control for the STO cells. The gene encoding for the production of the GDNF protein was amplified from porcine testicular derived cDNA using gene specific primers using reverse transcription PCR. The GDNF gene was then cloned into a mammalian expression vector, which we called pEF GDNF. The GDNF expression vector was used to transfect both STO and CHO cells. Presence of the GDNF protein was confirmed using immunocytochemistry and epifluorescence microscopy. Seminiferous tubules (containing early stage germ cells) from one-week old piglets will be harvested, purified and plated down on six well plates. Wells will either be treated with conditioned media containing GDNF produced from either STO or Cho cells or with media harvested from cells that were not transfected.

Session 2 – D21
Amino Acids: An Alternative Nitrogen Source for Biofuel Production from Algae
Nadia Cohen, Plant & Microbial Biology
Traditional inorganic nitrogen fertilizers are both energy intensive and expensive to produce. Their use in algae biofuels production greatly increases production costs and also competes with agriculture for limited nitrogen resources. A possible alternative to traditional nitrogen sources are amino acids harvested from the waste of algal oil extraction. Dunaliella viridis, a marine green microalgal, has been shown to utilize 4 amino acids when supplied at a concentration of 5mM as a nitrogen source. However, it is not known whether the other 16 amino acids could be utilized if provided at different concentrations. D. viridis was first grown on a mixture of all the unutilized amino acids at different concentrations to determine whether there was any concentration that showed growth. Once growth was established at both 10 and 20 mM concentrations, D. viridis cells were grown on individual amino acids to determine which specific amino acids led to growth. We determined that at the higher concentrations of 20 and 50 mM, 6 more amino acids could be utilized for cell growth: methionine, threonine, glutamic acid, phenylalanine, serine, and asparagine. Optimal molarities at which D. viridis will flourish on the 6 amino acids have yet to be determined. In the future, utilization of the 10 unutilized amino acids could be attained by further modification of the growth conditions or genetic engineering. The utilization of 10 amino acids makes amino acids a compelling option as a nitrogen source for Dunaliella viridis biofuel production.

Session 1 - B1
Using artificial micro RNA to determine protein function during SAM transition
Bryson Keith Deanhardt Genetics-BS, NC State University
Mentors and/or Co-Authors:
Robert Franks Plant and Microbial Biology, NC State University

Arabidopsis thaliana can be used to understand the functional pathways of proteins that regulate gene expression in the developing stem (shoot apical meristem) and flowers (carpel margin meristem). Previously presented work using mutational methods have shown the potential for novel protein interactions. Two genes, PENNYWISE (BLH8) and POUNDFOOLISH (BLH9), encode transcription regulating proteins. These two proteins are functionally interchangeable in a heterodimeric complex with KNOX proteins. In addition, SEUSS and SEUSS-LIKE2 proteins may act as binding proteins to allow for transport of this transcription complex across the nuclear membrane. When PENNYWISE and POUNDFOOLISH are both knocked out you acquire a severe phenotype where the Shoot Apical Meristem as well as secondary meristems do not develop and thus the plants are infertile. However, a specific mutation of SEUSS-LIKE2 in the 5th exon appears to rescue this severe phenotype to near wildtype levels. No current mutation of SEUSS and no other alleles of SEUSS-LIKE2 display this rescue. The discovery of this gain-of-function allele has lead to the formulation and execution of an experiment using artificial micro RNA (amiRNA). The focus of this poster will be to explain how to go about creating an amiRNA knockdown in our mutants of interest. The secondary focus will be to explain the potential outcomes and what each of these outcomes may mean in our pathways design.

Session 1 - D11
A Review on Ethics and Regulation of Preimplantation Genetic Diagnosis
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Meghan Watson Animal Science, NC State University;
Jasmine Smith Animal Science, NC State University;
Dylan Deprospero Animal Science, NC State University
Mentors and/or Co-Authors:
**Hsiao-Ching Liu** *Animal Science*, NC State University

Preimplantation Genetic Diagnosis (PGD) has the potential to remove genetic diseases such as Huntington’s, certain cancers, and Tay-Sachs through genetic screening. The process involves examining the genomes of gametes for genetic defects and selecting optimal cells for implantation through In vitro fertilization (IVF). While no genetic editing occurs, the practice has generated its share of controversy, with some labeling PGD children “designer babies.” Despite this, PGD is gaining ground. There are many companies and health insurance providers that offer PGD in medically necessary cases yet still there is very little regulation or discussion about the topic. Being an up and coming technology with the potential for large impacts on the public and private sector, PGD use and regulation is a necessary discussion. This presentation is designed to examine the ethics of PGD from the perspective of doctors, religions, parents, and members of a gene pool, as well as propose regulation on the provision of PGD.

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**Session 2 - D3**

**Application of Acidic Electrolyzed Water to Increase the Shelf Life of Channel Catfish (Ictalurus punctatus) Fillets**

**Alexis Rose Elia** *Bioprocessing Science-BS*, NC State University  
**Justin Perry** *Bioprocessing Science*, NC State University;  
**Currey Nobles** *Food Science*, NC State University  
**Mentors and/or Co-Authors:**  
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The acidic portion of electrolyzed water is a wide spectrum, environmentally safe antimicrobial with numerous applications in the food industry. This study used acidic electrolyzed water as a sanitizing rinse for fresh catfish fillets to potentially increase their subsequent refrigerated, packaged shelf life. Catfish fillets were tray packed and held at 3°C over the course of the study. The efficacy of acidic electrolyzed water was compared to ozonated water via microbial, chemical, and sensory (odor) testing of the packaged fillets during refrigerated storage. Aerobic plate counts were performed to monitor microbial progression while a total volatile base nitrogen assay was used to evaluate the development of spoilage-related compounds. A sniff test by an untrained panel was employed to determine sensorial acceptability of the fillets. Refrigerated shelf life was considered over when the microbial population exceeded 10^7 CFU/g, the TVB-N value exceeded 30 mg NH\textsubscript{3}/100g fish, or the sensory scores indicated the fish were unacceptable, whichever occurred first. If these results of acidic electrolyzed water are confirmed to be comparable or better than existing use of sanitizing ozonated water, the catfish processing industry may choose to adopt electrolyzed water for commercial use.

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**Session 2 - A14**

**Humectant Effects on Moisture Migration in Intermediate Moisture Foods**

**McKendry B Fleming** *Food Science-BS*, NC State University  
**Kelcey Carver** *Food Science*, NC State University;  
**Christopher Biamonte** *Food Science*, NC State University  
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**Richard Theuer** *Food, Bioprocessing and Nutrition Sciences*, NC State University

Moisture migration is a major problem in packaged foods composed of multiple constituents which initially vary in water activity. Such moisture migration between a soft cookie and a water based icing layer was hypothesized as the cause for observed softening of the icing and subsequent spoilage during packaged storage. To solve the problem, various humectants plasticizers (glycerol, glucose syrup and 55% high fructose corn syrup) were added to the cookie formulation to reduce its water activity while maintaining the
desired soft texture, based on Ross, Norrish and Salwin equation calculations for predicted water activity of the finished cookie. Texture of finished cookies was measured by rheological testing in an Instron machine. The goal was to create the cookie as an intermediate moisture food which can be shelf stable due to its low water activity yet soft because water content, the main plasticizer in the product, can remain relatively high due to the depressing effect of added humectants on water activity.

Session 2 - B21
The Impacts of Inbreeding on the Fitness of Culex pipiens form molestus
Alexandra Kaye Fraik Zoology-BS, NC State University
Mentors and/or Co-Authors:
Fred Gould Entomology, NC State University

Culex pipiens form molestus is a vector for West Nile Virus in both Europe and North America. This biological form of Culex pipiens lives underground with restricted access to mates, making wild populations prone to inbreeding. In this study, I examined the impact of inbreeding on different life history traits. I conducted full sibling mating for 5 generations using a lab-reared population originating from a subterranean population in metropolitan Chicago. Across generations egg raft frequency, egg-to-adult survival and oviposition time were used to quantify the effects of inbreeding. Within three generations we saw massive mortality such that only 2 of the 39 original lineages survived. Following this, there was recovery of fitness in 1 of the lineages suggesting that deleterious alleles had been purged. Across all lineages pre-embryonic mortality was more common then post-embryonic mortality. Furthermore, oviposition time was negatively correlated with egg raft size, potentially serving as an important tool in predicting family fitness.

Session 2 - D4
Floating Wetland Trash Barrier
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Cyrus Belenky Biological Engineering, NC State University;
Chelsea Durant Biological Engineering, NC State University
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Local golf course MacGregor Downs Country Club is spending valuable time and labor cleaning up trash from an urban stream. The trash floats from Swift Creek into the lake located at the center of the course. The trash is unsightly and detracts from the aesthetics of the course. Approximately 23 cubic meters of man-made trash floats into the lake every year, and the maintenance crew spends 20 man-hours a week collecting the trash. The goal of this senior design project is to design, test, and implement a device that will make collecting the trash more efficient, while enhancing the appearance of the course. The flexibility of a trash boom is combined with the natural beauty of floating wetlands to create a floating wetland trash barrier. The barrier intercepts trash before it reaches the lake, directing it into a holding area along the bank of the creek and reducing cleaning time significantly. The wetlands are an attractive and environmentally-friendly addition to the course.

Session 1 - B7
Regulators of the iron deficiency response in Arabidopsis thaliana
Megan Elizabeth Guadagnino Plant Biology-BS, NC State University
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Iron uptake is essential for plants, humans, and animals. Plants require a specific concentration of iron for optimal growth. Even though iron is an abundant element in the Earth’s crust, it is not readily available in a form plants can use. Iron deficiency in crop plants is an agricultural issue, because plants do not grow as well when they are iron deficient, leading to reduction in crop. We are interested in studying how plants respond to low iron conditions by modulating regulatory mechanisms used to control iron mobilization and uptake. Our lab currently studies a protein named BRUTUS (BTS) in Arabidopsis thaliana. BTS has been shown to play a role in root growth, rhizosphere acidification, and iron reductase activity in response to iron deprivation. Yeast two-hybrid (Y2H) analysis identified an interaction between BTS and VASCULAR PLANT ONE-ZINC FINGER2 (VOZ2) protein. Previous research has shown that VOZ1 and VOZ2 regulate both abiotic and biotic stress pathways. Since BTS and VOZ2 interact and are both involved in stress regulation, we are interested in the connection between BTS and VOZ2 regulation. To investigate this, we created a bts-1/voz2-2 double mutant and subjected these plants to iron deprivation. Preliminary data show that the double mutant has a significantly longer root length under iron deficiency compared to bts-1 and wild-type. By studying additional typical bts-1 and voz2-2 mutant phenotypes in this double mutant, we anticipate a better understanding of a potential new iron deficiency regulator and/or a connection between iron deficiency and other stress responses.

Session 2 - C10
The Effect of Tall Fescue Sward Height on Blood Glucose and Insulin Response in Grazing Horses
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Endocrinopathic laminitis is a painful condition affecting horses caused by a failure of the laminar attachment to the distal phalanx. In some instances, this can cause the distal phalanx to rotate through the sole of the hoof capsule, and result in mortality. Previous studies have shown that continually elevated serum insulin concentrations associated with increased non-structural carbohydrate (NSC) intake contribute to insulin resistance, and increased risk of laminitis. High concentrations of NSC, in cool-season pasture grass, occur in spring and fall when NSC metabolism lags behind NSC production due to warm sunny days that contribute to increased photosynthesis and cool nights that retard plant growth. The objective of this study was to determine the effect of tall fescue sward height on a grazing horse’s blood glucose and insulin concentration. Six stock-type gelding horses were used in a crossover design with either high (30-40cm) or low (15 cm) sward heights. The horses remained in their height group for 10 hr a d, for 7 d, with jugular venous blood collections at 0, 2, 4, 6, and 8 h on the final day. Insulin area under the curve was greater (P= 0.02) in horses grazing on taller sward height compared to those grazing on shorter sward height. Glucose area under the curve was not significantly different (P= 0.57) between sward heights. In conclusion, managing pasture to maintain relatively short sward heights could be a strategy to prevent elevated blood insulin concentrations in grazing horses.

Session 2 - B5
Breed and gender differences of liver gene expression in swine drug metabolism
Ashley Verney Harrison-Jackson Animal Science-BS, NC State University
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Melissa Merrill Animal Science, NC State University

Current FDA standards for drug withdrawal times in swine are not breed or gender specific. The goal of this study was to investigate changes in liver gene expression in males and females of four different pig breeds after administering the drugs Fenbendazole (anti-parasitic) and Flunixin (anti-inflammatory). The
drug metabolism pathway genes targeted were: *abcb1, cyp1a2, cyp2e1, phenol sulfotransferase, cyp3a22,* and *cyp3a29*. Relative Quantitative Real-Time PCR was used to measure gene expression of the drug metabolism pathway target genes against four house-keeping genes: *tbp, actb, hprt* and *rpl4*. Livers were harvested one hour after the respective drug was administered and preserved in RNA Later solution. RNA was extracted from liver and reverse transcribed to cDNA for use in Real-Time PCR. The cycle threshold values (Ct) were used in statistical analysis to determine if there was a breed and/or sex difference for each drug tested. For Flunixin, there was a significant difference in *cyp3a29* gene expression, revealing higher expression in males than females (P-value < 0.007). In the pigs given Flunixin, Yorkshire pigs had lower expression of *abcb1* than all other breeds. In the pigs given Fenbendazole, Duroc pigs had significantly lower levels of *cyp3a22* than the three other breeds. The results of this study will be useful in assisting with the management and welfare of swine in the food animal industry, as well as, food quality, security, and production profitability. This study may, one day, allow breeders to select for pigs with favorable rates of drug metabolism.

**Session 1 - B19**  
**Classification of Southern Appalachian Pine-Dominated Forests**  
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*Mentors and/or Co-Authors:*  
*Thomas Wentworth*  
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Classification of natural vegetation is necessary in order for conservationists to determine what natural communities and areas of land need to be protected. Existing vegetation classifications have been largely based on expert professional opinion, but these classifications may now be refined using field-collected vegetation data from permanent plots. Recent declines in the area of pine-dominated forests in the southern Appalachian Mountains makes improved classification of these forests a high priority. We selected vegetation data from 342 montane pine-dominated plots in the Carolina Vegetation Survey (CVS) Database for quantitative evaluation of existing classifications, as established by the National Vegetation Classification and the North Carolina Natural Heritage Program. We used the multivariate statistical techniques of cluster analysis and ordination to develop objective plot classifications, comparing our results to those in the existing classification systems. We found that plot assignments in the existing systems did not match well with those based on quantitative analysis of the CVS data and a decrease from 22 to 6 assignment groups may be more accurate. We concluded that the current classifications need to be revised and that additional field sampling must be focused on underrepresented pine-dominated natural communities. We propose future directions for refinement of vegetation classification for this important natural system.

**Session 1 - C11**  
**Preimplantation Genetic Practices: Past and Future**  
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*Animal Science-BS, NC State University*  
*Aishwarya Sriraman*  
*Biochemistry, NC State University*;  
*Drew Fleming*  
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*Hsiao-Ching Liu*  
*Animal Science, NC State University*

Preimplantation genetic practices (PGPs) include diagnosis of the genetic composition of an embryo, as well as any genetic modification applied on an embryo before implantation. In this presentation, we will be reviewing possible future effects of the use of preimplantation genetic practices, as well as comparing PGPs to similar procedures that have been controversial in the past. Preimplantation genetic practices are a newfound medical discovery, and if history is any indicator, then they, like so many other medical discoveries, will become a huge part of daily life. PGPs allow the eventual control of events occurring
inside the womb. Such events include both the phenotypic and the genotypic development of the offspring. As PGPs become more prominent, there will likely first be controversy and then eventual acceptance by the general public. With this acceptance, the number of people and companies dedicated to preimplantation genetic testing, diagnosis, and manipulation will increase as well. This will cause in a change in health insurance coverage, changing a fundamental aspect of the healthcare industry. Preimplantation genetic practices can be used in the agricultural industry as well. In the past, people have not always reacted positively to genetic modification of organisms; therefore, it is uncertain whether PGPs will be accepted or denounced by the public. However, their use in the agricultural industry could lead away from basic artificial selection to a more accurate, scientifically driven approach that could further lead to better productivity.

Session 1 - A6
Effect of pure culture fermentation of cucumber juice by Lactobacillus plantarum on buffer capacity
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After outbreaks of Escherichia coli in 1996 and Salmonella in 1999 from acidic foods, the potential for pathogen growth in fermented vegetable products has been of interest. Previous studies have determined the 5-log reduction time of E. coli in pH 3.3 pickle brines with acetic acid at different storage temperatures. It has been shown that E. coli can survive in acidified products significantly longer than other vegetable pathogens, such as Listeria and Salmonella. Due to the notable acid resistance of E. coli, it is important to understand how E. coli growth and death is affected during fermentation. We want to be able to model how pH changes during fermentation so that we can predict the pH at any time, and thus we are interested in how fermentation affects buffer capacity. In order to determine buffer capacity, we developed a titration method using an automated titrator that would give us a titration curve. Taking the derivative of the curve gives us buffer capacity. This information could prove useful in developing regulatory standards for the fermented vegetables industry. Lactobacillus plantarum is one of the primary species of lactic acid bacteria involved in cucumber fermentation. We performed preliminary experiments to determine the growth curve of L. plantarum in cucumber juice in order to establish the time necessary for fermentation to go to completion. Using a pure culture of L. plantarum, future work will be to determine how fermentation affects acid concentrations, pH, and buffering in cucumber brine.

Session 2 - A20
Identifying Geminivirus Resistance Gene in Arabidopsis
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Danny Ibrahim Biochemistry-BS, NC State University
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Maria Reyes Plant and Microbial Biology, NC State University;
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Geminiviruses are ssDNA viruses that infect many crops in tropical and subtropical areas of the world. These viruses are transmitted by insects, contained one or two genomes, and are replicated in the nuclei of infected cells by the host’s DNA replication machinery. Cabbage leaf curl virus (CaLCuV) is a begomovirus that infects Arabidopsis thaliana (Col-0 ecotype), a model plant, which its whole genome has been sequenced. In a survey, we found that only one of many ecotypes tested shows resistant to CaLCuV infection. Previous studies suggested that the resistance is recessive; therefore, the absence of the protein should produce a resistant phenotype in Col-0. We used F2 progeny from Col-0 and the resistant ecotype to
map the resistance gene to a 200-megabase area in chromosome 1. By using T-DNA knockout mutants, we can attempt to identify the resistance gene.

Session 1 - B21
Tomato Golden Mosaic Virus REn Protein Purification For Structural Studies
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Jonathan Milward Biochemistry, NC State University

Geminiviruses are a type of plant virus which have single stranded circular DNA genomes encoding many unique proteins. Geminiviruses are often found in disease complexes that are highly adaptive to their environments and therefore difficult to prevent from causing disease in crops. Geminiviruses are insect transmitted. Since geminiviruses account for a large amount of loss in crop yield all over the world, a prevention method could help to save crops from insects and the viruses that they transmit. Geminiviruses encode only two proteins directly involved with viral replication, Rep and REn. Rep is a multifunctional protein that cleaves, ligates and initiates replication of the virus, but Rep is not a polymerase. REn increases the replication of DNA during geminivirus infection. Geminiviruses replicate in the nuclei of an infected plant cell by sequestering the DNA replication machinery. The structure of Rep has been determined, however, the structure of REn is still unknown. In order to accomplish this goal, the DNA sequence for REn from Tomato Golden Mosaic Virus (TGMV) was cloned into a plasmid pNSB195, which is an expression vector based on pET16b, which contains a histidine tag (His6x). We transformed pNSB195 onto the E. coli strain BL21. We set up an IPTG induction test to verify the presence of REn. A PAGE gel showed the presence of what appears to be a band of the expected molecular weight 15.6 KDa. Scaled up samples were lysed and put through a His-tag column chromatography with nickel-sepharose resin and eluted with imidazole into a fraction collector and analyzed via acrylamide gel electrophoresis. A clear band of the expected size was observed in fraction number 42. A western blot was conducted to determine if the protein that was previously detected was REn. Once pure protein is retrieved, the use of Nuclear Magnetic Resonance will be performed to map the structure of REn.

Session 1 - B16
Culturing methods for the selection of transgenic Dunaliella viridis
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Kamy Singer Plant and Microbial Biology, NC State University;

Dunaliella viridis is a unicellular green algae found in salt lakes. This algae can produce large quantities of oil and is therefore a great feedstock for biofuel production. To better understand its molecular mechanism of growth and oil production, we are working to establish a transformation method to enable biotechnological use of this algae. One of the first steps in establishing a transformation protocol is the need to identify and select transgenic cells. This can be achieved by using selection markers that allow the transgenic cells to survive while the non-transgenic cells die. Transformation of algae cells with the bleomycin-resistance gene (ble) makes cells resistant to the antibiotic zeocin. Previous work using zeocin showed inconsistent results. We hypothesized that reducing the salt concentration in the selection media coupled with addition of glycerol will improve the effectiveness of zeocin selection. Here, we show that as little as 50 µg/µl of zeocin kills D. viridis cells in reduced salt concentration. Moreover, addition of 7% Glycerol to the low salt media prevented osmotic shock to algae transferred from a high to low salt concentration. Hygromycin and the
herbicide Basta (DL-phosphinothricin) did not show improvement under similar conditions. Selected cells need to form colonies on solid media for propagation. We show here that cell viability and colony formation can be increased by embedding the cells or covering with a second layer of media. Under such conditions, cell viability increased, but colony size decreased.

Session 1 - B10
Effects of Keeping a Food Diary on Eating Behavior in College Students Specifically Relative to Fruit and Vegetable Consumption
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Mentors and/or Co-Authors:
Sarah Ash Food, Bioprocessing, and Nutrition Science, NC State University

The objective of this project is to study the effects of keeping a food diary on eating behavior in college students specifically relative to fruit and vegetable consumption. 460 surveys were administered to North Carolina State University students enrolled in an introductory nutrition class. The questions pertained to difficulty in keeping a food diary, difficulty using the computer entry program, whether the project changed their diets, and in what areas their diets altered. The students found that keeping a food diary was significantly easier than they had expected. They also found the computer program easy to use. Before completing the project, 45% of the students believed it would alter their diet. Following the project 71% actually did alter their diet. 46% of the students increased their consumption of fruits and 45% increased their consumption of vegetables. The study found that keeping a food diary can alter the eating habits of college students. The level of difficulty was low and the results were significant, especially relative to increased fruit and vegetable consumption. The results indicate that keeping a food diary is a relatively easy way to effect dietary behavior change among college students.

Session 2 - A21
Autonomous Reel Mower
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Precision systems began in agriculture allowing for the sustenance of our ever-growing world. Technologies such as autonomous control have enabled crop land to decrease in size while demand continues to grow. Turf cultural systems can benefit immensely from the implementation of precision systems within mowing equipment. A John Deere stand-behind zero-turn rotary mower has been converted to a reel mowing system and is to be equipped with GNSS technology, such that mowing patterns may be input, thus eliminating the need for an operator for routine operation. GNSS data will be transmitted to individual circuit boards, controlling linear actuators at their respective steering levers. An Arduino Mega 2560 is the “brain” of the mower. Using C++, the circuit board is encoded to receive serial data from the GNSS unit. The Arduino and wired H-bridges power the steering actuators. An Adafruit compass determines bearing direction by providing an angle and direction between the current data point and the next data point provided by the GPS unit. Extensive calibration will occur as well as final testing at Weaver Labs.

Session 2 - C16
Non-Enzymatic Browning in Sweetpotato Chips as Affected by Total Free Amino Groups and Frying
Time
Nam Linh Khau, Biochemistry-BS, NC State University
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Consumer interests in fried products from carotene-rich sweetpotato (SP) have increased in the past few years. However, browning and acrylamide formation are among the major undesirable effects of Maillard reaction during frying. This study aimed to evaluate the influence of total free amino group (FAG) levels and frying time in the browning of SP chips. Sweetpotato varieties (n = 163) were stored at 13°C and 85% relative humidity. Freeze-dried samples were extracted with water and analyzed for FAG concentrations using the o-Phthalaldehyde (OPA) method. Peeled roots were cut into 1.5mm slices and fried at 157°C in canola oil for 2.5-3.5 min. Color values (L*a*b*) of fried chips were obtained using Hunter colorimeter and browning index was determined by obtaining the absorbance of the chip extracts at 420nm. There was a positive correlation between the FAG and asparagine levels in the raw samples that were previously analyzed by HPLC method ($r^2 = 0.725$). However, there was no correlation between the L*a*b* color values in the chips and FAG concentrations. In a separate experiment, Covington cultivar was used to test the effect of frying time on SP chip browning. Samples were fried for 3, 6, 9, 12, and 15 minutes at 157°C. There was a strong, positive correlation ($r^2 = 0.922$) between frying time and browning index at 420nm for Covington SP chips. This suggests that frying time may have more profound effect to the browning of the fried SP chips than the concentrations of the analyzed substrates.

Session 1 - C19
Designing Small Aptamers to Impair Rep Activity in the Cabbage Leaf Curl Virus
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Geminiviruses are a large, diverse family of DNA plant viruses containing seven genera, including the Begomovirus genus that contains a mono- or bipartite genome, when bipartite, they contain two genomic circles named DNA-A and DNA-B. DNA-A encodes the proteins required for replication, transactivation, gene expression, and the coat protein. The Cabbage leaf curl virus (CaLCuV) is a Begomovirus that typically inflicts disease on cabbage and collard greens. The overall goal of this project was to determine how effectively new and modified peptide aptamers can repress the replication mechanisms of the Rep protein in the Cabbage leaf curl virus infection in Arabidopsis. To achieve this goal, we first designed primers with the targeted peptide sequences, then amplified them and cloned them on a geminivirus vector. Future goals for this project include using a low-pressure gene gun to inoculate the vector containing the peptide aptamers into a plant host. We will then analyze the effect of the presence of peptide aptamers in the development of the geminivirus infection. The potential impact of synthetic peptide aptamers may provide a model of a more sustainable type of crop protection that increases crop yields and reduces the strain placed on the environment by mitigation of chemical use on soils.

Session 1 - A28
All-Terrain Wheelchair Transporter
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The intent of this project was to research and fabricate a design for an "All-Terrain Wheelchair Transporter" to provide farmers and other agricultural workers who have experienced paraplegic-type injuries with an outdoor mobility solution that eliminates the need to transfer from one chair to another yet meets the needs of all-terrain type settings. By researching design elements of other all-terrain mobility devices, the research team synthesized those elements in a product that maximizes accessibility and mobility while maintaining awareness of user safety.

Session 2 - C9
Semi-Autonomous Device for Improved Animal Welfare
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Current shade devices for cattle share a problem: they are stationary or must be moved by the rancher. Stationary devices concentrate waste and reduce the pasture available for grazing. If a movable device is used the rancher must use their resources to relocate the device to mitigate damages. The need for a mobile device to relieve heat stress of holstein cattle was presented by NC State Dairy Enterprise System. With this information the goal of the project is to produce a semi-autonomous mobile device to provide shade for dairy cattle. The design provides around 400 sq.ft. of coverage that can support a herd of 13 - 20 dairy cattle. This is mounted to a low-speed vehicle modified for rugged terrain conditions. The rancher can collapse the shade and drive it where they please. The design also incorporates semi-autonomous operation for the rancher. Utilizing a microprocessor with GPS and motor control allows the vehicle to navigate pre-planned routes. The rancher will upload latitudinal and longitudinal points that the vehicle will locate to on a programmed time schedule. Two solar panels charge the battery pack needed for the vehicle. These batteries power the electrical components of the project and prevent the necessity of returning to a base station to charge. The design can be broken down for transportation in 3 modular sections; the solar panel assembly, the shade and mast, and the vehicle base.

The project represents a base level prototype for an improvement in the cultivation of livestock.

Session 1 - D13
An Uncommon -2 Programmed Translational Frameshift in a Bacteriophage Tripp Transposase Gene
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Zachary Davis Biomedical Engineering, NC State University;
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Bacteriophage Tripp is a siphoviridae phage that infects Paenibacillus larvae, the bacterium responsible for American Foulbrood disease in honeybee larvae. While analyzing Tripp’s genome using DNA annotation software, we found two consecutive genes that were called to encode partial transposases. If the two genes were joined, they would encode a more typical full-length transposase. We have found evidence to suggest
there is an uncommon -2 programmed translational frameshift joining these protein products. A programmed translational frameshift is an infrequent event that occurs when the ribosome stalls during translation, causing a shift along the RNA and a change in reading frames. A -2 frameshift is considered uncommon because in other transposases only -1 or +1 frameshifts have been observed. Features of a frameshift often include a slippery sequence and a downstream RNA pseudoknot, which is a complex RNA structure. We identified a possible pseudoknot and a slippery sequence in the Tripp genome where the translating ribosome complex would stall and slip back 2 nucleotides allowing the frameshift to occur. Given that transposases facilitate movement of genes within and across genomes, the infrequent frameshift would allow for low level transposase expression and some genetic variation without greatly altering the genome. In the future, we hope to confirm the presence of the RNA pseudoknot and identify the product of the frameshift. This analysis will reinforce our discovery of an uncommon -2 programmed translational frameshift in bacteriophage Tripp.

Session 1 - A16
Bafilomycin A1 Resistance Effects on Sindbis Virus
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The Sindbis virus is an Alphavirus which is transferred from an insect vector to a mammalian host in nature. During the transmission of the Sindbis virus the process of entry of the virus into the host cell is still unknown due in part to the complex transmission cycle of going from the insect vector to a mammalian host and back to the insect vector. The specific Sindbis virus used in our study is named SVHR which is a heat resistance strain. It has been suggested previously that the virus gain entry into the cell by a process of endocytosis followed by a low pH membrane fusion event. Bafilomycin A1 is a specific inhibitor of vacuolar-type H+-ATPase which is most commonly used as a tool to control the acidification of endosomes and as a pH balancer. When Bafilomycin is added to cells prior to infection it prevents the virus RNA synthesis. This has been interpreted as showing a need for endosome acidification for entry. We have previously shown that Bafilomycin does not block virus RNA entry which raises the question how is the Bafilomycin preventing RNA synthesis. Through multiple passages of the virus in BHK cells in the presence of Bafilomycin production of virus can be restored to near normal levels. These results suggest that there is a mutation in the Sindbis virus which makes its replication insensitive to Bafilomycin. We will sequence the drug resistant virus RNAs to determine in which virus gene the mutation is located. Thus acidification is required for RNA synthesis in wild type virus and is not required for entry.

Session 1 - A23
Expression of SPIRAL1-like 5, a potential controller of cell shape, in the fibers of Gossypium hirsutum & Gossypium barbadense
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Cotton is the United States’s number one value-crop, bringing in $120 billion in revenue last year. Cotton fiber is a single cell extension of the seed that is useful in the textile industry because of its length, small diameter, and secondary wall synthesis. Gossypium hirsutum (Gh) is the most widely grown cotton worldwide, yet G. barbadense (Gb) produces a higher quality fiber but cannot be grown as widely. Comparisons of Gh and Gb fiber biology could lead to strategies for improved fiber quality in Gh. SPIRAL1-like 5 (SPI1L5) is a member of a family of microtubule associated proteins that influences cell shape in Arabidopsis thaliana and is associated with the onset of secondary wall synthesis in Gh fiber. SPI1L5 expression and contribution to fiber development in Gb is unknown. In this work, SPI1L5 was cloned from Gb fiber by RACE PCR as were an alternative allele to SPI1L5 and homolog (SPI1L5b) in Gh
Session 1 - C12
Dengue Virus: Wild-type DV-2 Versus Mutant GVII
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Dengue Virus (DV) is an arthropod vectored virus, transmitted to humans via mosquito vectors and commonly found in tropical and sub-tropical environments. There are four serotypes of dengue, DV 1-4, all of which can cause Dengue fever. More severe forms of the disease are dengue hemorrhagic fever and dengue shock syndrome. There are currently no vaccines for Dengue Virus to prevent the contraction of it. Experiments have shown that Dengue Virus affects mammalian cells differently than insect cells due to their difference in composition and thickness of the transmembrane domains. This has allowed the production of mutations of dengue virus as a result of deletions in membrane spanning domain of the virus envelope protein. One of these mutants is GVII, which has less infectivity in mammalian cells than in insect cells. The mutant GVII and the wild-type DV-2 were grown and studied in both mammalian cells (Vero) and insect cells (C636) to observe the level of infectivity of each cell. After harvesting the virus from the cells and purifying the proteins, a trypsin digest was done on both a reducing and non-reducing gel. The location of the bands with respect to the protein marker showed the molecular weight of the proteins in GVII and DV-2. After repeating this process three times, the final reducing gel indicated that the dengue virus samples were contaminated with Espirito Santo virus (ESV). ESV belongs to the birnavirus family, which can infect insects.

Session 2 - B1
Mapping the substrate cleavage site for a clotting factor (Factor VII)
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Factor VII (FVII) is a vitamin K-dependent serine protease, which initiates the blood coagulation pathway with its cofactor tissue factor (TF) upon vascular injury by activating Factor X. Hemophilia is a genetic disorder where there are insufficient blood-clotting proteins (e.g., FVII), causing abnormal clotting. Affected individuals inherit the autosomal recessive deficiency in the plasma glycoprotein and appear phenotypically heterogeneous. The focus is to examine the substrate specificity of FVII using phage display technology. The technique involves using the bacteriophage M13 with a modified phage-coat protein, pIII. The pIII sequence is modified to contain a hexa-histidine region and a randomized 7 amino acid protease-cleavage-region fused to the pIII. The modified M13 phage bind to a Ni-NTA resin through the hexa-His tag and phage that contain a sequence that is cleaved by FVII are released when treated with FVII. Using this technique, 26 unique peptide sequences have been isolated and are cleaved by FVII. Aligning the 26 sequences yielded a consensus sequence of SLTRALDV. The most frequently isolated sequence GLTRALDV was isolated 5 times in the selection process. None of the 26 sequences were identical to the native cleavage sequence NLTRIVGG found in Factor X but many showed similarities. Phages containing various peptide sequences were exposed to FVII for specific time increments and under various conditions as an indicator of cleavage rate and specificity for each sequence. An effective method has been developed to identify and characterize sequences cleaved by FVII. Future plans include the characterization of the substrate specificity of mutant forms of FVII.
Session 2 - C11
Exploring Issues and Making Recommendations Regarding the Subtherapeutic Use of Antibiotics in Animal Production Agriculture
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The basis of this research was to explore risks and benefits related to the subtherapeutic use of antibiotics in animal production agriculture and subsequently make policy recommendations on their use. Their recent correlation to antimicrobial resistance and human health has caused many to suggest banning the use of antibiotics in animal production altogether. We served as an appointed scientific advisory board and received input from several stakeholders with differing viewpoints related to antimicrobial resistance in the animal production industry. Following deliberations, the majority of our panel concluded that the benefits of such use of sub-therapeutic pharmaceuticals exceed the risk and should continue to be made available, within certain limitations. The limitations include using the minimum effective dosage and requiring that farms maintain a documented relationship with a veterinarian to provide prescriptions on an individual farm basis. Our recommendations also include increasing funding for researching alternatives. The minority report from our panel recommended the complete elimination of subtherapeutic antibiotic use in animal production agriculture until there is a more comprehensive understanding of antibiotic resistance and its impact on human health.

Session 2 - C14
The effect of thermophilic anaerobic digestion co-substrate ratio on biogas yield for bioregenerative life support
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Anaerobic digestion is a resource recovery technology that can reduce launch costs and increase the duration of a deep space mission. As part of a bioregenerative life support system, an anaerobic digester could produce biogas and fertilizer by processing organic matter, primarily comprised of human metabolic byproducts and inedible plant biomass. Production rates of these organic materials are known for both female and male astronauts. To determine the optimal digester volume and potential biogas yield for a crew of six (three males and three females), batch experiments were conducted at bench scale. Due to physiological similarities in digestive tracts of humans and swine, swine feces (SF) were used as a simulant of human feces. Wheat straw (WS), a common component of human diet, was used to represent inedible
plant biomass. Three treatment groups comprised co-substrate ratios of SF:WS (1:3, 1:1, and 3:1) based on chemical oxygen demand (COD) were compared with control group containing SF only. Each digester contained an equal mass of SF and a proportional mass of WS. A volume of thermophilic inoculum equal to the total co-substrate volume was added, and each mixture was diluted with diH2O to achieve 3% total solids. Digesters were maintained at 50°C since operation in the thermophilic range decreases digester size, further inactivates human pathogens, and improves biogas yield. Biogas was characterized via gas chromatography. COD destruction and biogas production kinetic data will be used to determine the hydraulic retention time and design volume for a full-scale digester.

Session 1 - B13
A Phage Encoded Toxin-Antitoxin System: hicAB in the Genome of Bacteriophage Tripp
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The honeybee disease American Foulbrood (AFB) is caused by the bacterium *Paenibacillus larvae* and is extremely detrimental to hives. Some bacteriophages, such as Tripp, infect and lyse *P. larvae* as a host. Using DNA Master and other annotation software. We noted a possible pair of adjacent genes tentatively identified as hicA and hicB. The HicAB cassette is a toxin-antitoxin system (TAS) occurring in many bacteria. Typically, HicA is the toxin and HicB is the antitoxin. HicA toxin causes mRNA degradation, inhibiting translation and cell growth, whereas HicB antitoxin neutralizes HicA but the mechanism is not well studied. Prior research shows the *hicA* gene usually precedes *hicB* in the TAS cassette. In bacteriophage Tripp, the HicA-like toxin shows very little similarity to bacterial HicA proteins, while the HicB antitoxin protein shows high similarity (low Blast e-value) to several bacterial proteins. We present an overview of this TAS system and hypothesize on the role of a possible HicAB TAS encoded by phage Tripp.

Session 2 - A2
Pathogen Prevalence in Native Bee Assemblages of Raleigh, North Carolina
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Bees provide the valuable ecosystem service of pollination, which maintains ecological and economic stability. Even though agricultural systems heavily rely on the managed honey bee for crop production, native unmanaged bees play a key role for crop and native plant pollination. The last several decades have seen an overall global decline in pollinator populations including both native and managed bees. Several factors have been proposed for the recent decline, including pathogens. However, little is known about the parasites and pathogens affecting native bees. In an attempt to better understand the pathogens that affect native bees, I quantified pathogen prevalence in honey bees and the most common native bee species of Raleigh, NC. I screened for three known bee pathogens, *Nosema, Ascosphaera* and *Crithidia* using PCR for pathogen detection and DNA sequencing to identify the specific pathogen lineage. I conducted bee surveys at the JC Raulston Arboretum in Raleigh, North Carolina, a semi-urban area, which hosts a high abundance and diversity of native bees. To compare the mean pathogen presence among species, within each disease, I
used mean pathogen prevalence among collected individuals followed by separate one-way ANOVAs. I detected *Nosema* and *Ascosphera* in *Apis mellifera*, and *Crithidia* in *Bombus*, a finding consistent with my expectations. Understanding the patterns in the local disease ecology of bees can help make inferences about the health of the pollinator community in North Carolina.

**Session 1 - C30**  
**Impact of excess dietary energy on the differentiation potential of mesenchymal stem cells.**  
*Sana Talat Qureshi* *Biochemistry-BS, NC State University*  
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Mesenchymal stem cells (MSC) provide the lifetime supply of bone forming cells, but also differentiate into fat cells. Excess energy intake in both young pigs and humans increases both the number of adipocytes and the size of adipocytes. In this project, we hoped to determine the impact of excess energy intake in the ability of MSC to adopt osteoblastic and adipocytic lineages. The neonatal Ossabaw pig was used as our model and MSC were isolated from these animals after 5 months of receiving either a control diet (met all nutrient requirements) or an obesogenic diet (isonitrogenous but with 3x greater calories). The MSC were cultures at an initial plating density of 5,000 cells/cm² in basal growth media (BM, DMEM +10% FBS +antibiotics with complete media changes every 3d until they reached confluence. At confluence, cells then received either osteogenic media (BM + 1mg/ml dexamethasone + 100mg/ml beta-glycerol phosphate + 10mg/ml ascorbic acid ) or adipogenic media (BM + 1mg/ml dexamethason + 10mg/ml insulin +10 mg/ml indomethacin for 12d with complete media changes every 3d. We had planned to examine the gene expression of markers of osteogenic and adipogenic differentiation (RUN X2, OC, LPL, PPARG, and AP2), but these experiments were unsuccessful due to pipetting error.

**Session 1 – A22**  
**Effects of Gamma Irradiation on Chocolate Dairy Powder used for Chocolate Milk**  
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*Mannmeet Cheema* *Bioprocessing Science, NC State University*;  
*Sunni Queipo* *Food Science, NC State University*;  
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It is well recognized in the dairy industry that refrigerated chocolate milk has a shorter shelf-life compared to unflavored milk. One hypothesized cause is that the chocolate dairy powder (CDP), added to white milk to make the finished chocolate milk, introduces a higher microbial load which in turn increases the spoilage rate. Gamma irradiation has been proven to decrease bacterial levels of dry powders, mainly spices and herbs. CDPs obtained from the NCSU dairy plant were microbiologically evaluated for three weeks using Standard Plate Count Petrifilm after receiving either 0 (control), 4 or 15 kilograys (kGy) of gamma irradiation. Changes in color, total phenolics and viscosity were evaluated by a Minolta Colorimeter, the Folin-Ciocalteu method, and a Haake viscometer, respectively. The irradiated CDP with the smallest microbial load and/or least physical/chemical changes was then used to make a production run of skim chocolate milk using HTST continuous pasteurization at 172-175 degrees C for 25-28 seconds. The data provided will give the industry insight into the source of the reduced keeping quality of chocolate milk.

**Session 1 - C5**  
**An Overview of Bacillus anthracis and its Potential Risks to North Carolina State University**  
*Brinkley Hamilton Raynor* *Animal Science-BS, NC State University*
*Bacillus anthracis* (anthrax), a gram-positive bacteria, causes acute infection in animals and humans. Anthrax is a zoonotic disease transmitted interchangeably between animals and humans in its spore form. It is highly infectious and detrimental to human health earning it a Class A (top-priority) classification by the United States CDC. Anthrax has three forms: cutaneous, gastrointestinal and inhalational. The active bacteria produce toxins that cause symptoms ranging from minor skin lesions to rapid death. Although anthrax has a significant presence in history with evidence dating back to the biblical plagues, it has only recently gained infamy as a bioterrorist weapon. We investigated the hypothesis that North Carolina State University (NCSU) is vulnerable to an anthrax outbreak. NCSU seems to be a prime environment for anthrax infection because of its high density population and livestock units. We conclude that a natural outbreak of anthrax is extremely unlikely and that NCSU has enacted precautionary procedures to avert a bioterrorist attack. This conclusion is based on the low incidence of the disease in first-world countries, NCSU biosecurity protocols, and the relative difficulty of obtaining and growing the spores effectively. Additionally, anthrax is treated with common antibiotics and vaccines are available to be deployed in the event of an outbreak. The NCSU community should not fear an anthrax outbreak.

**Session 2 - B19**

**Characterization of Campylobacter in Turkey Flocks Raised in Different Environments**

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There has been a growing concern with how food animals are raised and how it affects the quality and safety of livestock meat and products. *Campylobacter* is a common food borne pathogen that is of high interest in the poultry industry because of its asymptomatic effect in birds, but symptomatic effect in humans. In this study, ceca samples of two different breeds of turkeys from an educational and commercial farm were investigated over a period of nine weeks to determine if there were any differences in the prevalence of *Campylobacter*, its susceptibility to antibiotics, and the strain type as the flocks aged in their different environments. The flocks originally came from the same breeder and were randomly assigned to each farm at the same time. Both flocks were also given the same feed. Colonies obtained from samples grown on *Campylobacter* selective media were purified on nutrient-enriched agar to obtain material to be suspended and plated on seven different antibiotic-treated plates. Samples were then characterized by PCR.
and electrophoresis to determine strain type. At the conclusion of the study, it was found that the *Campylobacter* from the ceca samples collected from the educational farm were consistently susceptible to six of the seven antibiotics used in the study whereas the commercial ceca samples had more variation in antibiotic susceptibility throughout the experiment. Higher strain diversity was observed in the commercial farm—a multi-drug resistant strain in earlier weeks was displaced by a less drug resistant strain as the commercial flocks aged.

**Session 2 - C12**

**What To Eat: How Popular Diets Stack Up Against the US Dietary Guidelines & Current Research**

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Melissa Reel *Animal Science*, NC State University;  
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Examination of recent obesity trends in the United States has shown the importance of a proper diet in living a healthy lifestyle, as 2 in 3 Americans are considered to be obese or overweight. Today there are many differing “expert” opinions on optimal diet, which may be confusing to the consumer who is interested in developing healthy eating habits. There is no consensus on which diets and are most beneficial and closely follow the recommended dietary guidelines. The objective of this project was to examine 5 diets: Atkins, Mediterranean, South Beach, Paleo, and Vegan; to determine which diet would be most beneficial in improving the health (weight loss, health risk factors, etc.) of an individual. The methods utilized in this study included a literature review, a 3-day menu analysis compared to the USDA Recommended Dietary Intakes, and a user acceptability survey completed by university students (N=10). We found that the Mediterranean diet had many improved health outcomes (weight loss, lowered risk factors for cardiovascular disease and diabetes), no nutrient deficiencies when compared to the recommended dietary guidelines during the 3-day analysis, and the highest acceptance ratings within our survey population.

**Session 1 - D1**

**Completion of Syngas fueled Internal Combustion Engine**

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The purpose of this project was to refurbish a single piston four stroke engine designed and built in 1997 to working condition and updated safety features. The project began using an engine originally designed for running on “wood gas” which had been stored in poor conditions. The engine was disassembled, cleaned, honed, painted, and reassembled. The electrical components were rewired and an emergency disconnect was added to the battery. Finally a cage was built so that all the moving parts were covered to prevent injury. It is expected that in the coming weeks that test will be performed so that the engine will be running at peak efficiency, producing the rated 18 HP. This concept to be used in power plants to convert agricultural waste into useable fuel and also activated carbon.
Session 1 - B17
The role of geminivirus infection in the control of auxin response factors controlled by mir-160 and mir-167 microRNAs in Arabidopsis thaliana.
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Geminiviruses are a plant virus family characterized by a single-stranded DNA genome. These viruses are transmitted by insects and are replicated in the nuclei of infected cells. Geminiviruses are becoming a global epidemic affecting many crops in tropical and subtropical areas of the world. Arabidopsis thaliana is readily infected by the Cabbage leaf curl virus (CaLCuV). This virus induces many changes in the transcriptome of the plant affecting pathogen response, cell cycle, senescence and hormone control. Auxin Response Factors (ARF’s) are transcription factors that are affected by the CaLCuV infection. Their expression either goes up (ARF-17 and ARF-10), down (ARF-6 and ARF-8), or is unchanged (ARF-16) during infection with CaLCuV. ARF’s are regulated via silencing through microRNAs (miRNAs). We are interested in understanding and determining if the geminiviruses directly affect the expression of mir-160 and mir-167, which are responsible for the control of the ARF.

Session 2 - A1
Expression and Purification of ERECTA Receptor Kinase
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ERECTA (ERfs) is a family of receptor kinases classified under leucine-rich repeat Receptor-like kinases (LRR-RLKs) consisting of 3 genes, ERECTA, ERL1, and ERL2. ERfs are composed of leucine rich repeats extracellular domain, a transmembrane domain and an intracellular kinase domain. ERfs are vital in stomata development and regulation of longitudinal growth in Arabidopsis. ERF receptors contribute to asymmetric cell divisions and negatively regulate cell fate transitions in stomata development. ERF receptor activity is regulated by EPF/EPFL family of cysteine-rich peptides which can be agonists or antagonists. Six of the eleven genes in the EPF/EPFL family are directly related to ERF signaling pathways. The main objective of this research is to unravel the structure of ERECTA receptor kinase and thereby determining the molecular mechanism of differential binding and activation of ERECTA by EPF/EPFL. With the use of baculovirus mediated insect cells we aim to produce protein, purify it using nickel-affinity chromatography, and size exclusion chromatography to ultimately determine the crystal structure of the protein by X-Ray crystallography. This structural elucidation of the ERECTA receptor kinase will provide insight into ligand-induced receptor activation and its role in regulation of stomatal development.

Session 1 - C10
Tetraselmis chuii, A microalgae with Putative Biofuel Potential
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The use of high-throughput sequencing technologies has radically accelerated the field of bioinformatics studies. An endeavor that once took years, whole genome sequencing is now a matter that can be handled
within a matter of days. The organism *Tetraselmis chuii* is a robust microalgae capable of withstanding a range of salinity conditions that allow easy cultivation; coupled with a high lipid yield, this organism is ideal for the use in lipid-based biofuel energy production systems. In this project, the total DNA as well as the RNA of this organism is isolated and purified using standard methods. The DNA is prepared for the sequencing using magnetic bead cloning technology. Similarly, the RNA content has the mRNA fraction isolated and prepared for sequencing. Using the Illumina sequencing system, total genome sequence and total transcribed genes are identified, and reporting of these sequence can give insight into the lipid metabolism of the algae, and can elucidate targets for recombinant DNA technology.

Session 1 - C16
Analyzing the Effect of Different Applications of the Social Cognitive Career Theory on Recruitment to Food Safety Careers and Education.
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Recently, a general shortage of food safety professionals has been observed despite the food industry rapidly expanding. Food Safety professionals attest that training alone is not sufficient to be fully competent and that a formal education is also crucial. The objective of this research is to work towards finding the most effective method to recruit the next generation of food safety professionals and encouraging them to pursue an education in food safety. Using the Social Cognitive Career Theory, we constructed a recruitment website, PowerPoint presentation, mobile app, and a series of videos. Using a 5-point Likert scale and referencing the STEM Semantics Survey, surveys were constructed and administered to participants before and after viewing the recruitment presentation to measure any changes in their views towards food safety.

Session 1 - D8
Irrigation and Drainage System Utilizing Sustainable Agricultural Retention Pond
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Farmers in Eastern North Carolina face highly variable weather conditions during the growing season and often experience severely dry periods. To help mitigate the effects of water stresses on crop yields, this project aims to design an integrated subsurface drainage and irrigation system for a 48 acre portion of the client’s farm which is on a corn, wheat, and soybean rotation. The current system has drainage ditches at a 244 ft. spacing, and the crops rely on rainfall as the irrigation source. The new system is designed to utilize an on-site pond for storage that will be redesigned to be filled by a drainage canal that collects storm runoff from the contributing watershed and effluent from the subsurface drainage system. This stored water will then be reused as a source for the irrigation system. Sustainability was the key factor in the design of this project, where irrigation requirements are met without the need of a well and the subsurface irrigation system removes the need for a fossil fuel powered pump. With data collection through survey of the research site, soil profile analysis, storm frequency determination, and hydrology measurements, DRAINMOD and AutoCAD programs were utilized to determine the most feasible design. A cost-benefit analysis must be performed to compare the increase in crop yield from various designs to the overall cost of the system. The yield increase from adding laterals and increasing the pond volume will be compared to the increase in initial and maintenance costs of the system.
**Session 2 - A17**  
**Characterization of the role of the E3 ligase, BRUTUS, in Embryonic Iron Homeostasis in Arabidopsis thaliana**  
**Nyd Sertsuvalkul** *Plant Biology-BS, NC State University*  
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Iron (Fe) is a micronutrient indispensable for growth and development of all organisms. In Arabidopsis, BRUTUS (BTS) is an iron binding E3 ubiquitin ligase that negatively regulates the expression of Fe deficiency genes. Low Fe conditions transcriptionally induce and stabilize BTS, which allow it to modulate the levels of the iron homeostasis transcription factors, POPEYE-like (PYEL) proteins, via E3 ligase activity. In vitro analysis revealed that binding of Fe to hemerythrin domains of BTS causes structural instability and degradation. Ultimately, the Fe response capacity of plant cells decreases. Besides its role in Fe deficiency, BTS is expressed in developing embryos and reproductive organs, and the knockout mutant is embryo lethal. However, the relationship between Fe content and embryonic lethality is not well characterized. In our study, we observed the effect of varying Fe concentrations on embryo development. The preliminary data suggests that with low Fe treatments, the emb2454-2 heterozygous mutant exhibits decreased embryo lethality, while the mutant grown under excess Fe conditions has an increase in embryo lethality compared to wild type plants. We also visualized the Fe content of seeds grown in normal, alkaline, and excess Fe soils by Perls’ staining. We are currently growing the mutant in hydroponic solution to corroborate our findings. This study reveals a connection between the Fe deficiency response and embryogenesis systems, which may lead to further elucidation of BTS characteristics and its role in Fe homeostasis.

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**Session 2 - D5**  
**Characterization of Bacterial Contamination in Soaps Collected from Commercial Soap Dispensers**  
**Jordan Kathleen Smith** *Biological Sciences-BS, NC State University*  
**Mentors and/or Co-Authors:**  
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Hand washing with soap is typically used to prevent the spread of enteric disease. However, recent studies have found that soap dispensers themselves may become contaminated with bacteria. The goal of this study was to examine the types and levels of bacteria present in 100 commercial soaps dispensed in containers. 100 soap samples were collected from public restrooms around North Carolina. Data was collected on the type of soap, dispenser, and sampling location. Samples were plated for enumeration on Reasoner’s 2A and Brain Heart Infusion agars, and 72 colonies that showed different physical characteristics were then isolated for later sequencing. Bacterial contamination was observed in 28% of the soap samples when plated on BHI agar, and 19% on R2A. Based on container, 47% of the soap solutions obtained from refillable soap containers showed bacterial growth, compared to 39% of the soaps obtained from disposable containers. Bacterial counts ranged from 4 CFU/ml to >1200 CFU/ml, with the majority of samples having very low numbers of bacterial colonies, and only ~2% having high numbers. Commonly detected bacteria included *Staphylococcus* sp., *Bacillus* sp., *Pseudomonas* sp., and *Micrococcus* sp. Results suggest that there is a low level of bacterial contamination in public soap dispensers in North Carolina and that the dispenser type makes little difference. This contamination may be related to a failure to properly clean the dispenser, and/or associated bacterial growth, although studies are merited to better understand the sources and significance of bacterial contamination in commercially dispensed soaps in public restrooms.
Session 1 - A8
Effects of Geminivirus Infection on ARR Gene Regulation in Arabidopsis

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Geminiviruses are plant viruses that have circular, single stranded DNA. Previous studies involving arabidopsis plants have shown that the arabidopsis response regulator 7 (ARR7) gene become down regulated when the plant is infected with Cabbage leaf curl virus (CaLCuV), as opposite to 5 different RNA viruses. This is important because ARR genes are negative regulators for cytokinin signaling. Cytokinins are involved in several physiological processes such as promoting cell division, chloroplast maturation, regulating cell growth, differentiation, and monitoring nutrient uptake and senescence. It is also interesting that ARR7 is involved in promoting meristem function. Further research on the role of geminivirus infection on ARR regulation in arabidopsis was conducted using CaLCuV and another geminivirus called Beet curly top virus (BCTV). ARR7::GFP, CYCB1;1::GFP and 35S::GFP transgenic lines were used in three experimental groups with the following treatments: mock, CaLCuV infected, and BCTV infected. After the viruses had spread throughout the plants, the meristem of the plant was extracted and sectioned in order to view the effect the infection had on the ARR7 expression in the meristematic area. Some sections were run through immunochemistry using an antibody that detects a CaLCuV protein. Subsequent examination of mounted meristems confirmed successful viral inoculation. Samples were also run through quantitative real-time polymerase chain reaction (qRT-PCR) to amplify several ARR gene products and then the delta-delta ct method was conducted to examine if the ARR genes were up or down regulated during infection.

Session 2 - B20
Reduction of Water Activity in Restructured Beef Jerky with Humectants

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Beef jerky has been proposed as a tasty addition to a fruit and nut trail mix. However, due to the higher water activity (Aw) of jerky as compared to these other ingredients, once sealed together in a package the moisture migrates from the jerky to the other ingredients. Within a short time of storage this causes unacceptably hard jerky and softer nuts and fruits. The goal of this experiment was to lower the Aw of the jerky to a value near the Aw of the other ingredients, while keeping an acceptably soft texture in the jerky. The approach used was the addition of humectants to create an intermediate moisture food. The six humectant treatments were: glycerol (4.5%), sucrose (7%), glycerol (3.5%) + propylene glycol (1%), glycerol (2.25%) + sucrose (2.25%), sucrose (3.25%) + mannitol (3.25%), and propylene glycol (1%) + glycerol (2.25%) + sucrose (2.25%). Using the Ross and Norrish equations, each was calculated to target a final Aw of 0.5, reduced from the typical Aw of jerky (0.75). Jerky texture was measured as Warner-Bratzler shear force using an Instron 5565 Universal Testing Machine and Aw was measured using an Aqualab PRE Water Activity Meter.

Session 2 - C20
Mighty-MIx: A Buggy Bites Solution

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The biggest problem that people in food deprived areas experience is lack of protein. Food aid programs distribute high protein products products rich in macro- and micronutrients. Insects are an emerging protein alternative to traditional animal sources. Mighty-Mix is a nutrient dense, high calorie, high protein, trail-mix product that includes insects to create a shelf-stable meal-relief product. Mighty-Mix includes: an extruded snack derived from the mixture of sweet potato and mealworm flours; dry roasted peanuts; and dehydrated banana chips dusted with mealworm powder. The extruded snack is a noodle shaped product made from fortified sweetpotato flour (SPFF) that provides 100% of the DV for vitamins B1, B2, folic acid and iron, in combination with mealworm flour (MWF), xanthan gum, vegetable shortening and water. Sweetpotatoes are grown worldwide, even in regions of low soil fertility. SPFF is a nutrient-rich, shelf-stable product made with simple processing methods. Mealworm flour (MWF) is derived from Tenebrio molitor Linnaeus 1758 which were dried at 350°F for 5 min. Peanuts were included to increase density and caloric content. Bananas and peanuts are major crops in the tropics and subtropics. The cost of 1 serving of Mighty-Mix was $0.56 when worms were bred on-site. Mighty-Mix satisfies the guidelines according to Food & Agriculture Organization (FAO), for products to target the Prevention of Moderate Acute Malnutrition (MAM); furthermore, spices can be modified to account for cultural preferences. The goal of this project is to have Mighty-Mix dispersed by meal-relief agencies to help feed and nourish communities.

Session 2 - C3
Design and Construction of a 3D Watershed Hydrologic Simulator
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Watersheds are geographically diverse and complex systems generating various hydrologic responses to geographical and climatic drivers. Observations of streams, groundwater flows, and the effect of precipitation are feasible at the watershed scale; however, manipulating those factors and recognizing their independent impacts is near impossible in the field. In order to see and better understand the impact of varying rainfall amount and intensity, topography, and groundwater on hydrology, a small physical model can be a very powerful tool. The intention of this project is to develop a working, 3-dimensional model of a watershed with the capability to simulate a range of storm events, manipulate topography, observe and measure the resulting effect on the outflow of a stable stream, and create a physical representation of the outflow in hydrograph form. The model has been designed with the intention to be used as a teaching tool for university faculty as a physical and practical application of hydrologic principles. The components included in the model and their corresponding responsibilities are: a topographic model to serve as the watershed basin, a naturally flowing stream as the drainage point for the watershed, a rainfall simulator to demonstrate the effects of storm events, a weir box and a physical hydrograph to measure outflow response over time. Each of the components has been scaled to simulate realistic values for a 26.6 hectare watershed in a 1.5 x 0.5 meter system and a reasonable storm event. During a storm simulation water outflow pours into a transparent box divided into sections, each representing a time interval of the event. Each compartment will collect and display the total outflow for its particular time interval, as water will only flow into one section of the box at a time. This physical representation of a hydrograph chart will allow students to better understand effects of precipitation on watersheds.
Session 2 - B10
Development of a Validated Survey for Head Start Outdoor Learning Center Assessment

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Within the United States, roughly 17% of youth and 35% of adults are obese, with low-income, African American and Hispanic children being particularly vulnerable. Head Start preschools have significant Hispanic and African American populations, therefore making it an ideal place for effecting these vulnerable populations. Previously conducted studies have shown that consuming low energy dense foods, such as fruits and vegetables, are ideal for obesity prevention and treatment, however children exhibit greater preference for high energy dense foods. One possible way to increase fruit and vegetable consumption in children is through the implementation and use of outdoor learning centers (OLC) because children are exposed to new foods while in a hands-on play setting. The success of an OLC, however, is dependent on the ability of preschool teachers to use an OLC and their self-efficacy. Due to the limited published data on OLC use in the preschool setting, the research team investigated teacher knowledge, abilities and beliefs of using an OLC in the preschool setting to assess teacher’s self-efficacy. The research team designed a four-step survey validation process and completed the first step: content validation using a 5-point Likert scale. Continuation of this project will lead to a validated survey that will assess Head Start teacher OLC use. The resulting validated survey will be used to provide recommendations for in-service training needs to implement or enhance existing OLCs. Ultimately, sustainable OLC use has the potential to impact childhood obesity.

Session 1 - C1
Nutritional Study of Conjugated Linoleic Acids: A Potential Breakthrough in Human Health
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This research project is an examination of conjugated linoleic acids (CLA’s) and their potential health benefits to humans. Obesity is an increasing challenge globally and in recent years, it has been referred to as a disease in the United States. Microbial biohydrogenation in the gut of ruminants results in intermediary compounds known as CLA. *Trans*-10*, cis*-12, a specific CLA has been shown to have a potent anti-obesity property. In general, CLA also has a critical function in cellular digestion, signal communication, and inflammation. There is extensive information on the structure and composition of CLA’s and their production in the gut of ruminants. Studies measuring CLA have reported variable concentrations of these fatty acids in milk and other food sources. Intake of CLA has shown to alter metabolic activities and lower fat deposition. The effect of CLA supplementation is determined by monitoring fatty acid composition in serum and thrombocyte platelets as well as on other human metabolic activities. Another specific CLA isomer, *cis* -9, *trans*-11, has been shown to have potent anti-carcinogenic activity. Collectively, CLA are strong anti-inflammatory agents. Today, synthetic forms of CLA are available in GNC stores. Dietary consumption of CLA can play a significant role in reducing the occurrence of human obesity.

Session 2 - D9
Second Generation Sidewall Inlet for Poultry and Swine
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Julia Burroughs, Biological Engineering, NC State University;
Ziyu Yin, Biological Engineering, NC State University;
The objective was to design a second generation sidewall inlet for poultry and swine houses for cold-weather applications that would be more cost-effective than currently-available inlets. The sponsor, Hog Slat, provided two popular inlets, a curved and straight door. These two inlets were modeled in Creo Parametric, a 3D modeling software. We also designed a hybrid inlet by combining the positive attributes of the two inlets. The hybrid inlet has a straight door with the frame from the curved door inlet. All three inlets were subjected to air flow simulations using FloEFD software to determine volumetric flow rate, floor temperature distribution, the distance air attached to the ceiling before it dropped, and air seepage. The preliminary results showed that the theoretical inlet was the most effective. Its most impressive feature was its ability to throw fresh air much farther into the barn than the other inlets and promote more effective mixing under minimum ventilation conditions. Therefore, for minimum ventilation applications, the hybrid inlet will be less expensive and will perform better at mixing air in the barn than the other inlets. Additional wind tunnel and field work is ongoing to validate the modeling results.

Session 1 - A10
Potential of Camelina sativa as an Oil-seed Feedstock for Bio-based products
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Camelina sativa, CS, is a cruciferous oil-seed crop belonging to the Brassicaceae family. Common names include false flax, and gold of pleasure. The seeds of Camelina sativa contain 30-40% oil of total dry weight compared to soybeans that contain between 15-20% oil by dry weight. Camelina sativa also has unique properties such as a short growing season (120 days) that make it intriguing for use in cropping systems, it is resistant towards drought, and it is resistant towards pests. These qualities make CS an increasingly favorable oilseed crop for use as a feedstock for biofuels and bioproducts, especially for use as jet fuel due to the high amounts of isoparaffin, a branched chain hydrocarbon with high octane ratings. Aside from bio-based products Camelina oils may also be used as food-grade oils to support a growing food industry. Camelina meal can have significant economical uses as well, particularly as an animal feed. To date a suitable compilation of the literature on Camelina sativa as an industrial oil-seed crop is not available, therefore the objectives of this research effort were to produce a literature review that describes the chemical composition, agronomic process, uses, and industrial significance of the Camelina sativa plant. This literature review, as a presentation of the current state of related research, will be an invaluable tool for groups wishing to begin research on the crop or the crop products.

Session 1 - C2
Impact of Concussions on Athletes
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Alyssa Elliott Psychology, NC State University;
Katelyn Thomas Agricultural Business Management, NC State University;
Vasiliki Lambropoulos Biochemistry, NC State University;
Nicole Freitas Animal Science, NC State University;
Martha Calvert Nutrition Science, NC State University;
Mattie Thompson Animal Science, NC State University;
Colin Woolard Biochemistry, NC State University;
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Veronica Emmerich  *Biochemistry*, NC State University;  
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Concussions have become a major public health concern that affect millions of individuals annually. A concussion is defined as a complex pathophysiological process due to traumatic brain injury that has negative effects on brain function. Based on the findings of many research studies, our group has discovered that recent changes in concussion management and policies, nutritional factors, gender and age differences all impact individual concussion outcomes and length of recovery. In addition, we have found that current research has been directed towards the biochemical understanding of concussions and how the neurological and metabolic pathways of the brain are impacted at the cellular level. Overall, our group has concluded that an increase in concussion awareness has motivated new research in diagnosis, prevention, treatment and management of concussions, particularly in regard to contact sports.

ADDITIONAL ABSTRACTS:

**Session 2 – A22**  
Quarter Scale Tractor Modifications  
**Benjamin Hobson Biological Engineering-BS**  
**Joshua Rudd Biological Engineering;**  
**Renae Luu Biological Engineering;**  
**Steve Hall Biological Engineering**  
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**Grant Ellington Biological And Agricultural Engineering**  
**Edward Godfrey, III Biological And Agricultural Engineering**

Pack Pullers has a rich history competing in the ASABE International Quarter Scale Tractor design competition. This competition provides students with an opportunity to apply engineering fundamentals learned in the classroom, as well as gain practical hands-on design and manufacturing experience. The tractor design is judged on pulling performance, manufacturability, serviceability, maneuverability, durability, safety, sound, ergonomics, and innovation. Teams are also required to submit a written report detailing the design prior to the competition and give a formal presentation to industry experts as if to sell the design during the competition. Through research and development the team has modified last year’s tractor design to improve static weight distribution, traction, drawbar performance, and ergonomics. The 2015 tractor is nearly completed and ready for on track testing. The senior design team has redesigned several major components that have already been fabricated by the BAE Research Shop. The Pack Pullers team will continue to make the final modifications to the 2015 vehicle. The team plans to leave for the competition located in Peoria, Illinois on May 27th to have adequate time for final touched before the competition begins. NC State should be well represented at the international competition by the 2015 Pack Pullers team and tractor.

**Session 2 – B22**  
Design and Construction of a Continuous Centrifuge  
**John Taylor Biological Engineering**  
**Jordan Matthews, Biological Engineering;**  
**Alex Cao Biological Engineering;**

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To create bioethanol from lignocellulosic biomass, the plant cell walls must be broken down to separate the carbohydrates (cellulose and hemicellulose) from lignin via a pretreatment step. This step requires the use of chemicals like an alkaline solution to degrade the biomass. Following this step, the biomass must be removed from the pretreatment aqueous solution for subsequent enzymatic hydrolysis for production of fermentable sugars. The purpose of this project was to design and manufacture a bench-scale continuous centrifuge. Current lab scale separation systems are limited in the volume they can process and operate in batch mode. The device being fabricated will improve efficiency of the process by decreasing down time for cleaning while improving solid recovery. The device will continually separate biomass, chopped switchgrass, from an aqueous solution by revolving the slurry at high speeds.
College of Engineering

Session 1 - C28
MOX Annular Fuel Pellet Design
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Niravkumar Patel, NC State University;
Omar Yaqoub Y.A.Y. Al Ahmadi Nuclear Engineering, NC State University;
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More economically viable nuclear options need to be explored due to the decreasing costs of competing energy sources such as natural gas. A proposed solution is to increase the power production in existing power plants without significant alterations to plant design by using an annular, ring shaped fuel pellet. The fuel would be doubly cooled on both an inside and an outside fuel cladding: thus it could shed more primary and decay heat and operate at lower fuel temperatures. Research previously conducted at Massachusetts Institute of Technology suggested that a uranium fuelled Light Water Reactor could be uprated by as much as 50% using an annular fuel pellet. The project goal was to design a full mixed-oxide (MOX) uranium-plutonium core with annular fuel for a pressurized light water nuclear reactor operating with an 18-month fuel cycle at 4486MWth. This results in a 30% increase in power from the 3451MWth producing AP-1000, increasing revenue by over $230,000,000 per year according to current market prices. Additionally, due to plutonium content, MOX fuel would aid nuclear nonproliferation efforts as the fuel is made from stockpile weapons grade plutonium. It has been found that MOX annular fuel improves the viability of nuclear power, offers the capability of reducing the risk of fuel damage, and helps reduce US plutonium stockpiles.

Session 2 - D1
Miniaturizing plethysmography for use in a multifunctional health monitoring device
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Current treatment plans for chronic respiratory diseases are limited to single point measurements, obtained in the regulated environment of a clinic. The development of a continual health and environmental monitoring system will allow for a better understanding of how external factors are affecting the patient’s respiratory condition and can shift healthcare into a preventative system rather than treating the symptoms. In addition to the integrated electrocardiogram (ECG), ozone detection, three-axis accelerometer, and microphone, plethysmography (PPG) allows for a more complete physiological understanding. Dual wavelength PPG allows for the measurement of respiratory rate, heart rate and arterial oxygenation (SpO2), and can be used in unison with ECG to provide an estimation of blood pressure via pulse transit time (PTT). The development of a robust, biologically compatible optical probe is crucial in achieving accurate results. Flexible conformation to the tissue, time multiplexing of the differing wavelengths, protective polymer coating, and the overall power consumption are some of the main concerns in our design of the probe.
Session 1 - A11
Developing NC State’s First Personal Rapid Transit System
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The next step in public transportation is the Personal Rapid Transit system. EcoPRT is an environmentally friendly, economical, and efficient electric vehicle designed to autonomously carry two people from point A to point B. It will benefit NC State by reducing traffic congestion, easing stress on commuters, and making transportation easier and cleaner. For example, in 2012, 28% of all US greenhouse gas emissions were derived from the transportation sector. EcoPRT can help lower that number as well as help spread this system into Raleigh while also inspiring people across the country and across the world to join in on this new form of transportation. EcoPRT has grown from an idea into a feasible means of transportation at NC State with the support from Dr. Hollar and multiple engineering disciplines. Starting in the spring of 2014 and finishing in March of 2015, a 96” x 72” x 31” prototype vehicle was built and tested. The team’s first vehicle runs off of four 12V batteries and a single electric motor in the rear. The team is in the design stages of a second vehicle with a goal of making it more aerodynamic, lighter, and cost effective, as well as constructing a track outside of EB3. These two goals are set to be completed by November 2015. With the two vehicles and a test track, we will have a test bed for experimenting and demonstrating the system as a whole beginning early next year.

Session 1 - D9
Production of Technetium-99m via Optimized Cyclotron Targetry
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Thomas Gomez Nuclear Engineering, NC State University;
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Technetium-99m ($^{99m}$Tc) is a metastable isomer with a half-life of 6.01 hours. Its short half-life, combined with its low-energy gamma ray emissions of 140 keV, make it very desirable as a radioactive tracer in nuclear medicine. Optimized cyclotron targetry methods utilizing the $^{100}$Mo(p,2n)$^{99m}$Tc and $^{96}$Zr(α,n)$^{99}$Mo reactions are explored for the ultimate production of this radioisotope, keeping in mind the fact that $^{99}$Mo decays to $^{99m}$Tc with a half-life of 2.75 days. The objective of this target design optimization process is to maximize production yield with respect to target volume such that material costs are minimized, while maintaining satisfactory absolute yield quantities in order to keep up with $^{99m}$Tc dose demand. The target assembly must also be cooled sufficiently such that melting does not occur due to energy deposition from incident particles. Range-thin and range-thick target configurations with incident proton and alpha particle energies ranging from 18.1 to 23.0 MeV and incident angles of 6.0 to 39.0 degrees are considered and modeled in MCNPX. Thermal hydraulic analysis is performed in Ansys 15 Fluent to model target cooling for beam currents of 300 to 600 µA, and coolant is kept below saturation temperatures to avoid the presence of two-phase frictional losses within the assembly.
Session 2 - A8
Design of a High Efficiency Single Volume Neutron Scatter Camera (SVNSC)
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Stephen Fawcett Nuclear Engineering, NC State University;
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Saeed Alrayssi Nuclear Engineering, NC State University;
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The goal of this project is to design a single volume neutron scatter camera (SVNSC) which will determine the direction relative to the camera of a source of fast neutrons from fission. The device will be designed on the principle of elastic neutron scatter imaging. Using an optically segmented organic scintillator coupled to a light data acquisition system, position and a timestamp for each scattering event may be estimated. Provided this information, a cone can be constructed using a vector between a pair of interaction coordinates and the lab frame angle of incident scattering during the first event. The camera will be designed with a target angular precision of 5 degrees (polar and azimuthal), meaning that for a point source 10 m away, the camera would indicate its position within approximately 90 cm of its true location. In a test case of one million neutrons simulated in MCNPX-PoliMi from a source location of (200, 400, -200) cm relative to the detector origin, 606 hydrogen-1 scattering event pairs were measured. Using a mesh of 72 polar bins and 144 azimuthal bins resulted in an indicated direction of 113.75 degree polar and 63.75 degrees azimuthal angle. The actual direction relative to the detector was 114.09 degrees polar and 63.43 degrees azimuthal, which validates the implementation of the codes used for the detector design. As a result, this team has demonstrated that it is possible to design a high efficiency SVNSC that can determine the direction of incoming neutrons relative to itself. Additional testing will be performed to evaluate how precise the SVNSC will be and what design parameters (optical channel width and length, digitization rate) will give yield the most precise estimate of source direction.

Session 1 - B12
Accuracy of Affordable 3D Printers for Engineering and Veterinary Applications
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Jamie Cone Biomedical Engineering
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3D printing is becoming increasingly popular in both biomedical and industrial engineering applications, as well as in veterinary care. The Additive Manufacturing and Logistics lab is part of North Carolina State University’s Industrial and Systems Engineering Department and is a major supplier of 3D printed bone models for the vet school. The lab contains a variety of 3D printers used for polymer additive
manufacturing that differ in size and price. The four printers used for this study include the 3D Systems CubePro Trio, the BFB, the FDM, and the Objet Connex 350. The purpose of this research is to determine the accuracy of low-cost printers in comparison to the gold standard. For this case, the original CT scans of veterinary patients as well as the highest quality printer, the Objet Connex 350, were considered “gold standard”. This comparison was accomplished by taking measurements from original CT scans, editing the CT scans using Mimics software, 3D printing the parts, and taking measurements of the parts using the FARO laser scanner and calipers. After the data is collected and analyzed, it can be concluded whether or not affordable consumer machines can be used as equivalents to the high cost machines. Furthermore, the impact of the work in a larger context can be addressed by applying findings to possible improvement of quality of life in developing countries.

Session 1 - B8
Strain Rate Effects on the Muscle-Tendon-Bone Tissues
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Tendons are responsible for transmitting contractile load from the muscles to the bones, thus enabling locomotion. Muscle-tendon-bone tissues are subjected to physiologic loading on a daily basis. However, it is often a single, supra-physiologic loading event that causes irreversible damage or injury to these highly specialized tissues. The purpose of this research project is to understand the effect of localized stress-strain states on these classes of biological tissues. The study used porcine muscle-tendon-bone samples to test increasing uniaxial strain rates and the effect of the strain rate on the elastic modulus and ultimate tensile strength. It was found that these mechanical properties of the biological tissues are highly dependent on the strain rate. The result from the current work will ultimately contribute to biomechanical therapies and the development of effective design rules for tissue remodeling.

Session 1 - D25
Nano/Macroscopic Swelling of Block Ionomers Prepared from Solvents Differing in Polarity
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Thermoplastic elastomer gels (TPEGs) derived from multiblock copolymers swollen with a midblock-selective hydrocarbon oil are a fascinating class of soft materials due to a combination of unique mechanical properties and tunable morphological attributes. Specifically, their physically cross-linked nature enables them to exhibit greater elasticity and elongation than typical chemically cross-linked elastomers, such as natural rubber and silicones, while also being reproducible and recyclable. However, one challenge of TPEGs that has yet to be addressed is replacement of hydrocarbon-based oils with water to form physically cross-linked hydrogels. One way to overcome this challenge is to introduce charged groups into the copolymer midblock. Using this design strategy, a new commercial material, a midblock-sulfonated block ionomer (SBI), has been found to absorb up to ~150% water by mass. In the present work, three SBI grades differing in degree of sulfonation are solvent-casted to form films with two different nanostructures based on the casting solvent employed: tetrahydrofuran (THF) and an 85/15 v/v mixture of toluene/isopropanol (TIPA). The swelling kinetics of the resultant SBI films are investigated using macroscopic water uptake measurements, whereas the nanostructural details are interrogated by small-angle X-ray scattering (SAXS) performed at Argonne National Laboratory. The kinetics of the swelling process are fitted to kinetic models to permit quantitative comparisons among samples and experimental techniques. Two interesting findings observed here are that (i) the rate of swelling in these materials is
independent of the starting nanostructure and (ii) good agreement exists between swelling kinetics measured on the nano- and macroscopic scales.

Session 1 - A24
Incorporation of High-Aspect-Ratio Cd-Se Nanorods into Hyperelastic Thermoplastic Elastomer Gels
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Thermoplastic elastomer gels (TPEGs) have been the focus of many studies due to their interesting morphological and physical properties. Triblock copolymers such as poly[styrene-b-(ethylene-co-butylene)-b-styrene] (SEBS) in combination with one or more low-volatility, midblock-selective oils constitute one of the most commercially relevant examples of TPEGs. In a different vein, research pertaining to nanorod assemblies has advanced considerably in recent years and is proving to be a source of continued interest and investment in both industry and academia. Here, we have sought to pair a TPEG composed of SEBS/mineral oil with high-aspect-ratio (~10) cadmium-selenide (Cd-Se) nanorods and subsequently characterize the nanorod dispersion within the gels. Gels composed of 20/80 w/w SEBS/mineral oil and varying concentrations of Cd-Se nanorods have been prepared in toluene and allowed to dry overnight. Resultant gels were then melt-pressed into ~1 mm thick sheets. Synchotron small-angle X-ray scattering (SAXS) and UV fluorescence observation were used to confirm (i) the presence of nanorods within the gels, (ii) the spatial distribution of the nanorods throughout prepared films and (iii) the effect of dispersed nanorods on the copolymer nanostructure. The Percus-Yevick hard-sphere model provides detailed analysis of the SAXS data and allows changes in structural parameters to be quantitatively compared between gels with and without the Cd-Se nanorods. In addition, calculations utilizing Flory-Huggins solution theory provide guidance with regard to the microphase that selectively contains the Cd-Se nanorods.

Session 1 - A9
Characterization of Functional Origami for Programmable Cell Signaling
Hannah F Fennell Materials Science and Engr-BS, NC State University
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DNA origami is one of the few tools researchers have that maintains its precision and accuracy down to the nanoscale. This property can allow for DNA origami to be an invaluable resource when conducting experiments when specificity is needed regarding placement and quantity of nanoscale objects. In a collaboration with the Zhu Lab in the Biomedical Engineering Department of Georgia Institute of Technology, we are using this unique tool to quantify adhesion forces of protein-protein interactions, specifically the bond strength between T-Cell Receptors (TCR) and peptide-major histocompatibility complexes (pMHC). Through this collaboration, we are able to utilize a one of a kind cell adhesion system available at Georgia Tech, and showcase the applications of DNA self-assembly.

Session 2 - C18
Mesoscopic Modeling of Polyelectrolyte Block Copolymer Micellization
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In an effort to minimize free energy, disordered systems will organize into orderly structures through their own interactions. Such systems are known as self-assembling, and have numerous potential applications as “smart” materials, because of their ability to change their physical properties in response to external stimuli. Computational modeling allows us unique insight into the dynamics of such self-assembly processes. However, many systems are too complex to simulate within a reasonable period of time, due to the numerous long-range interactions that must be considered. One prevalent example, is modeling polyelectrolytes dissolved in aqueous solution. Although, the recently developed Implicit Solvent Ionic Strength (ISIS) model utilizes the the repulsive parameters in Dissipative Particle Dynamics (DPD) simulations as a way to implicitly represent the effect of ionic strength on the stiffness of the polyelectrolyte blocks or chains. For this project, we have applied the DPD-ISIS model to simulate amphiphilic polyelectrolyte copolymers assembling into compartmental micelles and physical gels which are responsive to changes in ionic strength and pH. Through our simulations, we were able to derive morphological phase diagrams for triblock polyelectrolyte copolymers with respect to polyelectrolyte block length and implicit ionic strength, as well as measure the change in their physical properties with respect to these parameters. We aim to better understand the mechanisms behind their micellization so that we can tailor their properties and design novel nanomaterials which are optimized for capture and delivery of insoluble or ionic nanoparticles.

Session 1 - C14
Design of a Safe, Secure, and Sustainable Submerged Nuclear Power Plant
Cody Joe Gilbert Nuclear Engineering-BS, NC State University
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Kyuvaugn Ferguson, NC State University;
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The ever-increasing demand for energy has spurred the new development of diverse solutions in the nuclear power industry. A response to the demand of safer and cheaper energy has been to explore the concept of underwater off-shore nuclear power plants, or the Submerged Nuclear Power Plant (SNPP). The design proposed by this team delivers 175 MWe per plant to on-shore distribution centers, utilizing the passively safe mPower SMR, coupled with innovative safety systems to allow for indefinite hands-off cooling under accident conditions. This SNPP design will provide negligible radiological release to the surrounding waters, and allow for smaller initial capital investment by employing centralized modular construction and refueling centers.

Session 1 - A27
Vacuum Filling of EGaIn in Microfluidic PDMS Channels
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Eutectic gallium indium (EGaIn) is a liquid metal comprised of 75% gallium and 25% indium. This unique alloy has several interesting properties, such as being liquid at room temperature and forming an oxide skin when exposed to air. From current studies, it appears that this oxide layer is primarily comprised of gallium oxides. The oxide layer allows for EGaIn to retain metallic properties such as conduction of electricity while also being able to flow as a liquid. However, the oxide skin can also be quite difficult to work with, as it is typically removed by applying either an acid or a base to the oxide skin. The skin can also be removed through electrochemistry by applying a voltage to the liquid metal. Though this oxide layer can be challenging to work with, it allows for the EGaIn to be painted onto a surface or to be injected into a polymer device while still retaining its metallic properties. At present, there are many ways to inject liquid metals into microfluidic channels, and this project focuses on a new way to fill these devices.

Session 1 - C29
Breeding Mo-99 in the PULSTAR Nuclear Reactor
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Luke Obenauf Nuclear Engineering, NC State University;
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Tc-99m is a radioisotope which has significant implications in the medical field. Its parent isotope, Mo-99, can be bred in a nuclear reactor as a fission product or by neutron absorption in Mo-98. The primary objective of this project was to determine the feasibility of breeding Mo-99 in the PULSTAR nuclear reactor at North Carolina State University through either of these two methods. For modeling the reactor core, MCNP6 was used for neutronics simulations and COBRA-EN for the thermal hydraulics. Two separate targets were designed to evaluate each production method. A low enriched Uranium (LEU) target was modeled in the fuel rod position with the highest thermal neutron flux. Given that the pressure of the reactor is 22.4 psia, 6% enrichment was the highest target enrichment which did not violate the temperature threshold to induce bubble formation, which proved to be the most limiting thermal constraint. With this 6% LEU target, a yield of 255 Ci was predicted after a 5 day cycle. For the Mo-98 target, a 90% enriched target was modeled in the vacant control rod shroud. Under the same simulation, this target yielded 1200 Ci. Finally, a computer simulator has been created to model the Tc-99m generators which will ultimately receive the Mo-99. This provides the background to begin economic analysis to determine the feasibility of these designs.

Session 2 - C13
Parameterized Complexity of Hydrophobic-Polar Protein Folding
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Hydrophobic-polar (HP) protein folding is a simplified model of protein folding which is well studied in both biology and computer science. It is known to be NP-complete, but its parameterized complexity was heretofore unstudied. This provides more fine-grained information about the complexity of HP protein folding, and can potentially be used to find optimal solutions faster than was previously possible. One potentially useful parameter is the maximum energy the folded protein could have; this parameter was the
main focus of research. First, HP protein folding parameterized with the number of times the protein is bent during folding was shown to be in the complexity class XP. This parameter does not appear to be very practical however, so examination of the energy parameter continued. To try to find the complexity when parameterized by maximum energy, a reduction to the number of bends was tried. However, it was shown that this direct reduction does not exist. This was done by finding a family of proteins for which an arbitrarily large number of bends could be required to obtain a particular energy. The complexity of HP protein folding parameterized by maximum energy remains an open question. Possible future work includes exploring other parameterizations of the problem which could be practical on their own, or to which a reduction from maximum energy is possible.

**Session 1 - C22**

Dry, ambient storage of C. ljungdahlii paper-based biocomposites: steps toward continuous, modular, high intensity bioprocessing of syngas into liquids

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Despite the product flexibility and specificity offered by cells as biocatalysts, bioprocessing has not made much penetration into the conversion of gases to commodity chemicals. This is due to the inherently slower rates of transport of poorly soluble gases into water and the slow growth rate of many microbes that assimilated C₁ gases (CO, CO₂, CH₄). We are creating a novel continuous bioprocessing system using coating technology, inexpensive composite flexible fibrous materials and ambient drying. By combining these methods, we are engineering biocatalysts for falling film gas absorbers which enable concentrated microorganisms to be stored dry for extended periods at ambient conditions and rehydrated immediately prior to use. Significant reactivity was seen after storage at 11% relative humidity compared to 76%. Higher reactivity was observed when cells were rehydrated with growth-limiting media at 25°C compared to media warmed to 37°C. Paper gas absorbing biocomposites lost <1 log of reactivity after optimized drying and rehydration. The goal of this work is stabilizing highly concentrated cells (>10¹² cells/m²) within a high intensity gas absorbing reactor module that can be stored dry. This will enable centralized manufacture of the modules for distribution to the gas source without a cold chain for bioprocessing of gaseous carbon emissions (CO₂, CH₄, CO) into commodity chemicals. A laboratory scale model paper biocomposite batch falling film reactor has demonstrated comparable gas-to-liquid mass transfer (~40h⁻¹) to some CSTR configurations at 1 to 2 logs less power (<10W/m²). This technology may lead to a paradigm shift in gas bioprocessing using high intensity dry stabilized biocatalysts and novel gas-processing reactor designs.

**Session 2 - A4**

Slippery When Wet: Liquid Metal Interfaces

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Gallium (Ga) and its liquid alloys are promising alternatives to toxic mercury (Hg) for use in microfluidics, soft and conformal electrodes, and stretchable electronic devices. This family of alloys is liquid at room temperature (viscosity ~2x of water), possess virtually no vapor pressure and display high conductivity (~1/16 of copper). However, Ga and its alloys spontaneously form a surface oxide, which dominates its rheological behavior. In addition, this oxide layer adheres to most surfaces and poses a challenge for reconfigurable metallic structures. To prevent adhesion, current methods use acid-treatment or an interfacial slip layer of water. This work investigates the use of non-wetting nanoporous structures to
prevent adhesion of Ga oxide. We examine the EGaIn interface with these structures using contact-angle
goniometry and inverted optical microscopy. We also demonstrate reversible actuation of EGaIn on non-
wetting surfaces by pneumatics and low voltages.

Session 1 - D26
Soft Composites Derived from Hydrogels and an Electroactive Polymer
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Electroactive polymers are macromolecules that exhibit a change in shape or size when stimulated by an
electric potential. A dielectric elastomer is a type of electroactive polymer that transforms electric energy
into mechanical work upon exposure to an external electric field. Dielectric elastomers afford very useful
properties, such as large strains, and are used in microfluidics, (micro)robotics, and prosthetics. The
common design of a dielectric elastomer places a soft elastomer membrane between two conformal
electrodes. When a voltage is applied across the electrodes, the electric field promotes a compressive
Maxwell stress that induces a decrease in film thickness and a corresponding increase in transverse area.
The purpose of this project is to create a DE composed of a hydrogel that has a sufficiently high
permittivity to reduce the voltage required for actuation and to improve actuation efficiency. A challenge
with this strategy is that hydrogels alone do not typically exhibit the needed mechanical properties. Because
of this, this project focuses on sandwiching a dielectric elastomer between two hydrogels. When subjected
to an electric field, this design causes the dielectric elastomer to reduce in thickness and expand in area. At
this stage in the project, the focus is to create a hydrogel composite that possesses a low density and is polar
to remain in place when sandwiched between two hydrogels. Results obtained thus far have shown that
hydrogels containing glycerol, acrylamide, bis-acrylamide, and ammonium persulfate, could create an ideal
hydrogel composite.

Session 1 - B31
Platforms to Characterize the Biobotic Capabilities of Manduca sexta Moths
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This study examined the payload capacity of the tobacco hawkmoths, Manduca sexta, for determining their
suitability for the potential application of remotely controlled aerial biobots. A rare earth magnet was
attached to the thorax of the moth using super glue and allowed to dry for 24 hours. The magnet allowed
either a string with a specific mass per cm or a larger weight to be easily attached to the thorax. The
Manduca sexta payload tests were performed on both males and females who were further separated into
three groups: a control, a weighted string, and a large mass. The potential payload of the moth could be
determined based on the maximum height of the insect during flight compared to the control group. Further
studies with this method will allow the long term effects on the flight payload after electrode insertion to be
studied. The results of this payload test are being used to design an electronic backpack that wirelessly
records flight EMG and stimulates flight muscles. This backpack will be used in conjunction with an LED
arena to study the flight dynamics of the Manduca sexta.
Session 1 - A1
Toward precise genome editing of Clostridium ljungdahlii using a CRISPR-based approach to improve ethanol production

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Clostridium ljungdahlii is a gram-positive fermentative bacterium that naturally produces ethanol from syngas. A strain of C. ljungdahlii that had been exposed to oxygen for a long period of time was discovered to overproduce ethanol. Consequently, precise genomic-editing was needed to investigate which mutation caused the overproduction of ethanol. One of the mutations is within a carbon monoxide dehydrogenase gene, a single nucleotide difference that causes an amino acid codon change. This specific mutation is hypothesized to cause the increase in ethanol production. The single nucleotide specificity requires the use of a CRISPR-based approach to edit the genome, using Streptococcus pyogenes Cas9. With a CRISPR-based system, a single guide RNA (sgRNA) is required to specify where the Cas9 targets and cleaves. The current work has been focused on constructing a targeting vector, utilizing three pieces: the Cas9 protein, the sgRNA, and the pQexp Clostridium replication vector. Additionally, the ligase chain reaction has been applied to attach these linear double stranded DNA pieces at an equimolar concentration with single stranded bridging oligos and a thermostable ligase. Once the targeting vector is constructed, a repair sequence will be added separately using restriction enzyme cloning. Any cells that integrate this template will be the only ones to survive after the targeting vector is added. The successful assembly of this construct will allow precise genome editing of C. ljungdahlii, permitting further investigation of ethanol production in the species.

Session 1 - C18
Electroactuation Properties of Thermoplastic Elastomer Gels with Conductive Channels

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Electroactive polymers constitute an emerging class of soft materials that are capable of actuating and generating a wide range of strains upon exposure to an applied electric potential. In this class of materials, dielectric elastomers (DEs) in particular possess electroresponsive properties that result in large changes in shape and thickness when an electric field is applied. Upon application of the field, oppositely-charged conformal electrodes attract each other and compress the DE by applying a Maxwell stress. Because this process is isochoric, compression in the direction normal to the DE surface is accompanied by the expansion in the transverse direction. Most DEs do not, however, display evidence of efficient actuation because they expand isotropically rather than directionally. To enhance the actuation performance of DEs, previous studies have demonstrated that the addition of fibers possessing a high dielectric constant (HDC) to a DE matrix composed of an acrylic elastomer yields DEs that actuate anisotropically. This concept is extended to include fabricated channels in the present work by infusing thermoplastic elastomer gels (TPEGs) composed of a poly[styrene-b-(ethylene-co-butylene)-b-styrene] (SEBS) triblock copolymer and solvated in the presence of a midblock-selective aliphatic mineral oil with channels of a poly(alkylene glycol) into which conductive nanoparticles are incorporated. The actuation properties of these channel-containing TPEGs have been measured.
Session 1 - C27
Plutonium-Thorium Hydride Pressurized Water Reactor Fuel Design
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Due to global concerns regarding proliferation and storage of weapons-grade plutonium, it is necessary to re-examine the use of thorium fuels. The goal is to provide a viable thorium-based reactor fuel for safely eliminating existing stockpiles of weapons-grade plutonium while maintaining operational power for an eighteen-month cycle. The chosen fuel for this study is Plutonium-Thorium Hydride (PuH$_2$-ThH$_2$), which is composed of thorium-232 and weapons-grade plutonium. When used as fuel, thorium-232 yields the fissile isotope uranium-233. A deterrent to proliferation is one of uranium-233 daughter products, uranium-232, that leads to high levels of radiation associated with its decay. The benefits of hydrides originate from the hydrogen bound throughout the fuel, providing an almost uniform power density in the fuel.

Preliminary assembly level calculations have shown the disposition of approximately 60% of plutonium upon completion of the first cycle. However, hydride fuels suffer from volumetric swelling. This obstacle provides the opportunity to investigate the incorporation of a liquid metal alloy (33% lead, 33% tin, 33% bismuth) for use as a filler between the fuel and cladding. Another material chosen for this design is plutonium-240 used as the burnable absorbers, resulting in the production of fissile plutonium-241 upon neutron capture. According to currently generated burnup curves, the fissile uranium-233 and plutonium-241 as additive fuel sources contribute to the extension of the fuel life as the concentration of weapons grade plutonium depletes. Overall this fuel provides both electricity and an effective alternative to the costly process of storing and guarding weapons grade materials.

Session 1 - C24
Obstacle Detection with regards to the ecoPRT Autonomous Vehicle Platform
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Autonomous Vehicle platforms present many new challenges for modern engineers, one of which is the concern for user safety. One such concern is the need to collisions with other objects by avoiding obstacles in the vehicles line of travel. Most of the current solutions to this problem are prohibitively expensive for our test platform, the Economical Personal Rapid Transit for North Carolina State University. In order to approach the issue of safety while minimizing the cost, we researched a number of different sensors and open-source technologies. We determined that the most effective way to move forward was to utilize a combination of short- and long-range sensors to achieve the safety goals necessary. By utilizing both types of sensors, we have been able to design a system that can provide safe vehicle speed recommendations to the vehicle's master control system. Through our research, we have designed a system that will function in a variety of circumstances without being overly expensive.
Session 2 - D17
Graph-Theoretical Analysis of Rotator Cuff Tear 3D MRI Data
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Up to 50% of older adults (≥65 yrs) are affected by a degenerative rotator cuff injury. This project provides a unique analysis of 3D MRI biomechanics data describing the physiological state of older adults with a rotator cuff tear. By treating the percentage fat at each location in the muscle as a weighted node, the data can be viewed as a network, allowing the application of graph-theoretic methods. The network is then separated into muscle and fat groups via clustering algorithms, providing a uniform method of measuring fatty infiltration in the muscle. As fatty infiltration correlates with poorer results from surgical treatment, the created pipeline may serve as a tool for clinicians regarding treatment planning.

Session 2 - B2
Impact of Asymmetric Deformation on Recrystallization in Spin-Formed Aerospace Structures
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In order to increase the efficiency of manufacturing aerospace structures, NASA researchers have investigated spin-forming (SF) using aluminum alloy 2219 to enable fabrication of single-piece structures. This near net shape manufacturing technique has been explored for components and full-scale vehicles, including the Orion Crew Module forward pressure vessel bulkhead. Single-piece construction eliminates the need for a significant number of welds and reduces the material waste associated with machined, multi-piece constructions, while increasing the reliability of the structure and reducing vehicle mass and cost. However, deformation during forming appears to be asymmetric about the mid-thickness of the plate and results in non-uniform microstructures after post-forming heat treatment. Significant variations in recrystallization and grain growth were observed in SF components following solution heat treatment (SHT) and may cause non-uniform material properties through the thickness of the structure. This study investigates the impact of SF deformation and the associated through-thickness strain distribution on the extent of recrystallization and grain growth following SHT. To evaluate this relationship, an asymmetric strain distribution was produced by hot rolling two plates on top of each other. Through-thickness strain gradients and recrystallization before and after rolling were analyzed using Digital Image Correlation (DIC), electron backscatter diffraction (EBSD), and optical microscopy. Results from before and after rolling were compared to determine the relationship between asymmetric deformation and degree of recrystallization.

Session 2 - A9
Exploration of 3D Printing of Liquid Metals Near Room Temperature
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As 3-D printing has developed rapidly over the turn of the century on the polymers front with the fused deposition modeling (FDM) being the widely used technique, expansion into printing new materials has been slow. This is especially noticeable in the field of metals printing which has a great potential to aid or replace the current subtractive manufacturing techniques like Computer Numerical Control (CNC) milling which leads to a lot of material waste. Current metal printing methods require high temperatures, very low pressures, are expensive and hence not compatible with soft polymers and plastics that are used in near
room temperature printing. In this work, we explore the printing of liquid metals at and near room temperature. It involves the development of proper equipment and setup for the printing process alongside testing of new materials and substrates. The gallium-based metals are liquid at room temperature and therefore allow programmable micro patterning with the benefit of printing with polymers on the same print bed.

Session 2 - B18
Incorporation of an Ionic Liquid into a Sulfonated Block Copolymer

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Ionic block copolymers possess an exciting potential for various applications, including water purification and fuel cell membranes, and even artificial muscles. Each of these applications relies heavily on ionic conductivity, which may be further increased by incorporating additional components. Here, it is sought to combine an ionic liquid, specifically eutectic mixtures of urea and choline chloride (UrCC), with various grades of a sulfonated pentablock copolymer (SPBC). The optimal conditions for UrCC uptake into SPBC films are investigated and reveal temperature-, time-, and SPBC grade-dependence. To explore these parameters, ½” SPBC discs were punched from cast films ≈100 µm thick and subsequently immersed in pre-formulated UrCC solutions. Mass uptake measurements of UrCC into SPBC films were used to establish a comparison between the parameters under optimization. The results show that the higher sulfonation grade of the SPBC and higher temperatures produce the largest uptake of UrCC. However, SPBC films that absorbed less UrCC had a higher mechanical robustness based on qualitative observation. In summary, the presented results suggest that the incorporation of an ionic liquid, such as UrCC, into a sulfonated pentablock copolymer is feasible and should, theoretically, increase the resultant material’s ionic conductivity. It is also concluded that an apparent inverse relationship between ionic liquid uptake and mechanical robustness exists.

Session 1 - C7
Conductive Physical Elastomers based on CNF-Modified Thermoplastic Elastomer Gels

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The purpose of this research is to examine the actuation behavior and electrical conductivity of thermoplastic elastomeric gels (TPEGs) modified with conductive nanoparticles. Although previous studies have examined TPEGs containing nanoparticles, no studies have thus far sought to make TPEGs, which are remarkably elastic, conductive. The objective of this project is to create a conductive physical elastomer that is able to be stretched repeatedly without failure or dynamic fatigue and that would maximize its electrical properties with little dielectric loss. Solutions containing 10 wt% poly[styrene-b-(ethylene-co-butylene)-b-styrene] (SEBS) triblock copolymer Kraton and 90 wt% aliphatic mineral oil are prepared in and cast from toluene, a highly volatile solvent. Once the solutions are homogenized, carbon nanofibers (CNFs) are added in different compositions ranging from 2 to 10 wt%. After these CNF-containing solutions are sonicated, they are drop-cast onto a hot plate at 90°C. During this process, most of the toluene evaporates quickly, leaving behind a film of the conductive TPEG. Optical images of the elastomer have been acquired using a light microscope operated in transmission mode to determine how well the CNFs are dispersed in the matrix. These results are augmented with images from scanning electron microscopy. Conductivity measurements have been collected using a 4-point probe and modeling the elastic nanocomposite as an Ohmic resistor. These measurements are used to interpret conductivity of each specimen as a function of CNF loading and strain. Results show that the conductivity percolation threshold at which the conductivity abruptly increases is roughly 1.5 wt%.
Session 1 - D21
Process intensification of CO consumption by C. ljungdahlii in a low power input biocomposite gas absorber
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Single carbon gases are inexpensive sources of carbon for conversion to commodity chemicals but there currently are no efficient bioprocessing methods to convert them to useful multi-carbon compounds using engineered microbes. Our investigation is a new approach to increasing the processing rate and decreasing the power input for large scale gas phase biocatalysis through using cellular biocomposite materials where concentrated cells are immobilized within an inexpensive porous matrix in contact with the gas phase through a thin liquid film. Process Intensification (PI) in a cellular biocomposite concentrates cells, reduces mass transfer resistance using thin liquid films, decreases water consumption and can significantly reduce power input for carbon recycling into fuels and chemicals. Our model system, C. ljungdahlii OTA1, takes up CO/H2 and produces ethanol/acetate. Using an extrusion coating method, the CO specific uptake rate of OTA1 is ~10% faster in a biocomposite than in suspension. However, at 25rpm (97% power reduction) the biocomposite is ~300% faster. The k_La_apparent (a minimum value) of this unoptimized system is ~40 h⁻¹ at <10 W/m³ power input which compares favorably with a CSTR (k_L a is ~100h⁻¹ at ~100W/m³). Further reactor optimization (e.g. porous substrate characteristics, biocomposite surface area/reactor volume, cell loading) will enhance biocomposite performance. This batch system is being used to develop design parameters using a computation fluid dynamics model for a continuous low power biocomposite gas absorber falling film system. A low power system is necessary for remote gas capture and reforming using biocatalysts to access untapped commodity chemical markets.

Session 2 - A10
Finite Element Analysis of Composite Materials for Wind Turbine Blades
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In order to meet increasing global demand for renewable energy, larger and higher-capacity wind turbines are being developed. Increasing turbine size increases weight-induced stresses in the blades during operation. E-glass fiber-epoxy composites (GFRP) are currently the dominant material used in wind turbine blades. Implementing lighter and stronger materials like carbon fiber-epoxy composites (CFRP) would reduce inertial loads on the blades, but may also adversely affect stress levels due to aerodynamic loads. Research was performed to determine if CFRP is structurally preferable to GFRP in turbine blades for wind engineering applications. In this study, finite element models of GFRP and CFRP wind turbine blades were developed and analyzed using ANSYS APDL. Flapwise pressure loading cases were run for axially-aligned unidirectional laminates for each material and for similar sandwich composites using an isotropic foam core. Maximum local stresses and stress locations were identified for each case. These stresses were the primary basis of material comparison. Results were also normalized by their respective strengths to consider damage resistance. CFRP produced lower deflections and mostly higher stresses than GFRP, but had lower normalized stress levels. Sandwich core results show a five-fold increase in axial stress over the basic laminate. Results show that CFRP is a structurally viable replacement for GFRP for static loading conditions, though CFRP may be most effective in low-strain areas of a hybrid-material turbine blade.
**Session 2 - B8**  
**Manipulating the flow of EGaIn, via the addition of an oxide layer.**  
**Erik Kristopher Vosburgh** Environmental Engineering-BS, NC State University  
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**Michael Dickey** Chemical Engineering, NC State University

Gallium, especially when combined with Indium, is a metal with incredible properties. Gallium is non-toxic, and a fluid at 29 degrees Celsius. It is both a potential candidate for replacing Mercury in its remaining uses, and a fascinating substance on its own. When Gallium is exposed to air, its surface tension is lowered via the formation of a skin-like oxide layer. The presence or absence of this oxide layer grants Gallium, and its Indium hybrid EGaIn, myriad possible applications. Electrochemically, the presence of EGaIn's oxide layer can be manipulated with the application of an electrical potential. This research project examines the behavior of EGaIn under flowing conditions, within a range of these potentials. Beginning with oxide-free conditions, an oxidative potential is gradually introduced. Within a certain range of voltages, in relation to a reference electrode, an interesting thing happens: droplets of EGaIn begin to form liquid wires of constant diameter. With this project, the aims are to quantifying these conditions, and better understand the factors at play.

**Session 2 - A15**  
**Implementation of a High Temperature Antibiotic Resistance Selectable Marker in the Hyperthermophilic Biomass Degrading Bacterium Caldicellulosiruptor bescii**  
**John Horton Wright** Chemical Engineering-BS, NC State University  
**Mentors and/or Co-Authors:**  
**Robert Kelly** Chemical & Biomolecular Engr, NC State University

*Caldicellulosiruptor bescii* is a species of hyperthermophilic bacteria, which thrives in high temperature environments (>70°C) and is capable of breaking down plant biomass including cellulose. These unique qualities of *C. bescii* make it a rich reservoir for robust industrial enzymes and give it significant process advantages as a biofuel production host. To be able to develop *C. bescii* into a biofuel production strain, a system to allow genetic manipulations of the chromosome is necessary. A genetic system using complementation of a uracil auxotroph mutant is currently functional, but is encumbered by significant non-transformant background. The goal of this work is to improve this genetic system by implementing a High Temperature Kanamycin resistance gene (HTK) as a selectable marker in *C. bescii* for more rapid and effective selection of mutant strains. Experiments have determined the concentration range where kanamycin is effective for selection of *C. bescii*, and HTK selection is currently being used for various gene “knock outs” and “knock ins” using two different selection strategies. These genetic manipulations will be used to test hypotheses about the importance of selected biomass degradation enzymes, with the goal of producing strains with improved biomass degradation ability for biofuels production processes.
Session 1 - D27
Digital Games and Older Adults: an Exploration of Gender Differences in Emotion
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Previous research notes that digital games can be used as a training tool to improve cognitive functioning, but do video games have the ability to also impact emotions in older adults? This study aimed to investigate the differences in positive and negative affect between males and females sixty years and older during a digital games-based cognitive intervention. Based on prior research, we hypothesized that females would show a greater increase in positive affect than males over the duration of the video game interventions. 32 participants were randomly assigned to one of three digital game training conditions: Variable Priority (VP), Single Priority (SP), and Single Priority Old (SPO). Each condition was different in terms of the level of attention and memory skills needed to be successful in the game. Participants completed up to 20 (mean = 9 sessions; SD = 5) training sessions where they completed a self-report measure of affect and played the digital game for which they were assigned. Preliminary results indicate that over the course of training, females experienced significantly more positive emotions than males. In particular, females in the SP condition experienced significantly more positive emotions than other participants, p<.05. No gender differences were found for negative emotions. However, participants in the VP condition experienced, on average, significantly more negative emotions than participants in other conditions, p<.05. These findings support past research on gender differences in affect and can be utilized to understand the emotional state of female and male older adults in relation to digital games.

Session 1 - D29
Red on the Sun: How Rwanda's Gacaca Courts Divide through Collective Identity Assignments
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The African state of Rwanda experienced an explosive genocide in 1994, and the brutal massacre of upwards of one million of its citizens calls for a reconciliation process that adequately addresses both the intense human suffering and lack of national unity. International and state actors celebrate continental Africa’s ‘Truth and Reconciliation’ systems as state-building tools that resolve post-genocide conflict. However, Rwanda’s Gacaca courts serve not as a model of unification, but as a highly politicized, assembly-line justice system, which favors prosecutorial expediency over individual justice. Utilizing and expanding on existing social constructions, the assembly line begins with the restricting of victim status to the presumably innocent Tutsi, thereby assigning collective guilt to Hutu. Ultimately, Gacaca does not produce a coalescent and unified Rwanda but instead relies upon, and fuels, harmful collective identities rooted in decades of ethnic power struggles and tension that divisively moves Rwanda even further from national unification. The Truth and Reconciliation framework should be replaced by a participatory community based approach less focused on ethnicity and more dedicated to community building, so that wounds may heal and another genocidal conflict can be avoided.
Session 2 - D14
Partisan Polarization on the Supreme Court of the United States
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It cannot be doubted that polarization is steadily increasing in the United States. Partisanship is at an all time high, with both legislators and citizens alike identifying with their political party more so than ever. The gap between Republicans and Democrats has grown over time, and the result of this has been all time high levels of polarization in both the House of Representatives and the Senate. Yet what degree of partisan loyalty is to be expected from the justices sitting on the nation’s highest court? There has been a considerable amount of scholarly work devoted to polarization in the Supreme Court, but most research is focused on surveying the composition of the Court over time to understand polarization in terms of the divisiveness of specific voting blocs on the Court. My particular research is distinct in that it seeks to understand Supreme Court polarization in terms of the extent to which individual justices vote in accordance with partisan ideology. As will be shown, in general, party polarization has increased over time, especially since the 1980s. Additionally, the results of this study support the existing literature, which holds that, in general, later presidents have had a more substantial and influential impact on the Court through the appointment process.

Session 1 - C8
Body, Mind, and Spirit: Spiritual Development and Integration in the New Age community of San Marcos la Laguna, Guatemala
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This study concentrates on analyzing the role of the New Age community in San Marcos la Laguna, Guatemala in the lives of foreigners who travel there, particularly on those concerned with spirituality. Employing techniques including in-depth interviewing, quantitative questionnaires, free-listing, pile sorting, cognitive drawing, and participant observation, the study focused on the knowledge that people possess about New Age religion, the way subjects implement such knowledge in their lives, and the way the community of San Marcos fits into these details. The study shows that there are multiple therapies and activities available to travelers, and that these spiritually-minded people use their time in San Marcos to integrate their spiritual lives with their practical lives and shape their understanding of these often separated realms.

Session 1 - D24
Vietnamese Mail Order Brides in Taiwan
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Many Vietnamese women pursue economic opportunity in neighboring countries such as Taiwan through mail order bride agencies in order to provide for their natal families. In 2013, the GDP of Vietnam was reported as just $4,012 per capita while Taiwan was measured at $39,767 per capita and this per capita difference makes Taiwan an appealing destination for mail order brides with 17,559 spousal applications from Vietnam in 2004. While many women are able to find work in Taiwan to help support their families in Vietnam, 85.2% of them were shown to experience a low level of acculturation or an inability to adopt the attitudes, values, customs, beliefs, and behavior of the new culture. Many of these women are plagued
by discrimination, depression, isolation, and loneliness. Suicide and domestic abuse are also prominent among this vulnerable immigrant population. Additionally, many children born to transnational families experience low literacy rates and have poor attendance records to health screening appointments. Through literature based research this project identifies several solutions that would help Vietnamese immigrants and their children in the acculturation process. Primarily, making reforms to Taiwanese legislation to provide legal protection for these immigrants, providing increased support to currently existing support groups, offering language classes to help increase language ability, and requiring the marriage agencies to provide more accurate depictions of conditions of life in Taiwan. These changes would enable the girls to become better accustomed to Taiwanese life and make a more informed decision.

Session 1 - D3
Systematic Review of Religious Affiliation and Beliefs as Correlates of Attitudes Toward Capital Punishment
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Capital Punishment is a controversial policy internationally, prompting states to judge factors such as morality, cost, non-discriminatory application, and effectiveness when adopting or abolishing its use. Research has demonstrated that demographic factors including race, gender, religious affiliation, and political ideology are correlates of public opinion on the death penalty. However, religious affiliations and associated beliefs are commonly identified among the strongest predictors of attitudes toward capital punishment, especially within American culture. Many studies have focused on religious affiliation specifically, as the variety of religions and associated denominations may suggest differences in attitudes toward capital punishment across groups. Moreover, the inclusion of specific religious beliefs or behaviors (e.g., forgiveness, church attendance) may serve to better explain differences between individuals within religious groups. This study utilized a systematic review approach to synthesize the current research on religious affiliation and beliefs as correlates of public attitudes toward capital punishment. A review of five databases (PsycINFO, Web of Science, NCJRS, ProQuest Dissertation & Theses, Sociological Abstracts) identified 12 studies from 1990-2014 that met inclusion criteria. Preliminary findings revealed that most studies have investigated Christian denominations, particularly Catholicism, Protestantism, and Fundamentalism. However, affiliations are often defined using different parameters, leading to inconsistencies in methodology and results. In addition to religious affiliation, many studies assessed religious beliefs and behaviors, such as biblical literalism and church attendance, as significant predictors of attitudes toward capital punishment. Findings suggest that religious beliefs and behaviors may serve as better predictors than religious affiliation of attitudes towards capital punishment.

Session 1 - B14
El Pacto Hambre Cero and the Chronic Malnutrition of Indigenous Infants in San Andres Semetabaj, Guatemala
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Chronic Malnutrition is Guatemala is a serious problem with over half of all children exhibiting stunting and anemia, especially within indigenous, extremely poor, and rural communities. In 2012 the Guatemalan government, in partnership with USAID and the WHO, began a national nutrition relief program known as El Pacto Hambre Cero (the Zero Hunger Plan). Goals of a 10% reduction in malnutrition by 2015 and a 24% reduction by 2022 of malnutrition in children under 5 years of age were established in line with the
global WHO Millennial Goals. This study evaluates the efficacy of El Pacto Hambre Cero in the municipality of San Andrés Semetabaj. SAS was identified as an appropriate case study because it exemplifies all three targeted vulnerable characteristics: rural, ethnically indigenous, and extremely poor. Secondary quantitative standard anthropomorphic data was aggregated for all municipality children under 5 years of age over the last 5 years. From this 29 focus families where identified and interviewed on their use of the program over the last 2 years and other pertinent familial food security issues. These questionnaires were analyzed for both overall efficacy of the program thus far, as well as to illuminate any additional barriers not yet addressed by the municipality clinic community health staff.

Session 1 - B9
How Regional Differences Affect Pre-Service Teachers' Responses to Critical Language Pedagogies
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Despite persistent calls for teachers to be equipped with sociolinguistically informed content knowledge (CCCC/NCTE, 1974; Delpit, 1988; Godley, et al., 2006), studies find teachers still hold some language myths (Cross, et al., 2001; Blake & Cutler, 2003; Godley, et al., 2007; Dyson & Smitherman, 2009). However, recent studies found that current pre-service teachers (PSTs) may be better informed than previous generations (Reaser, et al., 2014), making it important to assess what PSTs now know about sociolinguistic information and if regional or ethnic differences correlate with different sociolinguistic perspectives. The data in this paper draw from a four-week, online “mini-course” on language variation (Reaser and Godley, 2014) designed to better equip PSTs with the sorts of sociolinguistic perspectives and critical language pedagogies needed to be effective literacy instructors for diverse learners. The course promoted foundational sociolinguistic principles based on research on Critical Language Pedagogy (Godley & Minicci, 2008), an approach that guides students to critically examine and challenge the ideologies surrounding language, dialects, and power. This paper examines data from two Southern universities and one non-Southern university to assess how Southern identity affects PSTs’ knowledge and development of sociolinguistic perspectives on linguistic diversity. Examining the ways in which Southern identity shapes sociolinguistic ideologies in PSTs’ online discussions of sociolinguistic content knowledge and pedagogy, including teaching writing and literature, provide some preliminary findings which suggest that Southern PSTs are more comfortable discussing ethnic dialects than their non-Southern peers and employ fewer “white talk” discourse strategies (Haviland, 2008).

Session 2 - C17
Falling Standards of American Political Discourse
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American political discourse across the public sphere in recent years has exhibited troubling trends. While policy discussions shared with the public by political elites hit a high point around the time of Abraham Lincoln's Gettysburg Address, recent discourse has turned to bumper-sticker phrases and talking points. This is problematic because the US has many urgent problems that are multi-faceted and nuanced, and one-dimensional, single-sided arguments both fail to add anything of value to political discourse and catabolize growing partisanship. One way to examine what politicians are saying is to examine Congressional floor speeches. I analyzed the floor speeches from among nineteen of the longest currently-serving legislators for complexity, grade level and other metrics during the two most important discussions of healthcare reform in the last twenty-five years: the failed Health Security Act of 1993 through 1994, and the debate and passage of the Affordable Care Act over 2009 through 2010. I also analyzed the floor speeches of forty
Senators and forty House members, twenty from each party, on a variety of subjects during the years 1989, 1994, 2004 and 2014. Based on these metrics, even when controlling for age, education, region, party, and years served in either legislature, within these two data pools I expect to see an overall decline in the complexity of Congressional floor speeches. My analysis should help add to the burgeoning political science research regarding the change in political discourse in the United States.

Session 2 - D18
Brain Drain in India: An Evaluation of the Social and Economic Impacts
Katherine Susanna Kristoffersen International Studies-BA, NC State University
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When highly trained or educated people leave a country, it is often described as “brain drain.” In India, opportunities are available for employees and students to go abroad to pursue careers or studies, resulting in a shortage of highly skilled professionals in the country. The aim of this study is to focus on key areas on the country’s social infrastructure to examine the effects of “brain drain” on both society and the economy. This research argues that the “brain drain” of highly skilled workers has negatively impacted the economy by slowing the country’s social infrastructural development. This study focuses on three sectors of social infrastructure: medical care, science and technology, and education, which include hospitals, universities, and other social services. Drawing on statistics and scholarly literature it examines how migration patterns have affected the social infrastructure, and how the economic development is slowed as a result. This approach demonstrates that ‘brain drain’ is detrimental to India’s social infrastructure and economic development because it creates a shortage of people needed to improve the social infrastructure of the nation. Policy suggestions are offered that could help reverse the effects of “brain drain” and facilitate development of India’s social infrastructure and economy. With the ever-increasing movement of people across borders, this study contributes to literature concerning globalization, development, and effects of skilled emigration from developing countries. Solutions proposed consider measures which India may take to ensure that migration of skilled workers will not have long-term, detrimental effects for India’s economic development.

Session 2 - D16
Shine a Light: The Perpetuation of Neglect in the Ongoing Plight Against the Occupation of the Western Sahara
Erin Shetley Sigmon International Studies-BA, NC State University
Mentors and/or Co-Authors:

In this research project, the following two questions were posed: (1) When a speaker reads the same passage at a "comfortable" rate and at an "accelerated" rate, what relative durational differences are observed among consonants and vowels between the two versions? and (2) How do these differences compare with a software-manipulated version of the reading set to the same pace as the speaker-generated faster rate? Spectrographic analyses were employed to determine how a speaker, talking at a faster rate, adjusted the length of consonants and vowels relative to acoustic software set to match the overall duration of the passage.

Session 2 - D16
Shine a Light: The Perpetuation of Neglect in the Ongoing Plight Against the Occupation of the Western Sahara
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The Western Sahara is one of the last two remaining occupied territories in the world. Like most of the African continent, it was colonized by European powers following the Berlin Conference; Spain controlled the region until Moroccan forces invaded and forced Spain to concede power in 1975. This research examines the tactics used to justify and maintain the occupation, as well as the social, political, and economic challenges experienced by the native peoples of the Western Sahara as a result. I argue that this oppression is made possible and legitimized through Moroccan nationalist rhetoric and by its laws, which continue to prevent Western Saharan self-determination. Through an analysis of the historical relationship between Morocco and the Western Sahara, I trace the roots of the situation and relate them to Morocco’s justification for the occupation. I combine this with an outline of the legal practices used to codify Morocco’s claim to the Western Sahara, such as forced abandonment of homeland and the prevention of basic economic development by the Sahrawis. In an effort to shed light on an issue largely unacknowledged by the international community, the allowance for the Sahrawi narrative to become a primary voice in the discussion is the first step in stopping the perpetuation of oppression in the region. We must examine what is being done now and what has continued to be left undone in the process of the “de-occupation” of the Western Sahara.

Session 1 - A31
Exploring Interdisciplinary Collaboration at the Laboratory of Analytic Sciences
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The Laboratory for Analytic Sciences (LAS) is a collaborative, long-term research enterprise funded by the National Security Agency (NSA) and housed on North Carolina State University’s Centennial Campus. The LAS promotes new advances in the science of big data analytics and intelligence analysis through innovative collaborations between industry, academia, and government. This study reports on the work of the Collaboration Group, which was created to facilitate interaction among team scientists and study the process of multidisciplinary collaboration and innovation. The Collaboration Group designed a multi-method study of the LAS team dynamics including participant observation, interviews with key informants, and a survey instrument. This project reports the findings of the Collaboration Group's observations and interviews with LAS participants. Based on the method of affinity diagramming (Hanington & Martin, 2012) Collaboration Group members recorded their team observations on separate sticky-notes, and the collection was then sorted using an open-coding process. The sorting process and ensuing reflection and discussions produced a set of six themes that describe important factors that create challenges for interdisciplinary collaboration: (1) Cultural Alignment & Integration; (2) Meeting Logistics & Team Membership, (3) Team Goals; (4) Motivation; (5) Communication; and (6) Power & Leadership.

Session 1 - A30
Turkey, Human Rights, and Internet Regulations
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The internet creates avenues where users can distribute content on a globally connected network and access to information through the internet emerges as a fundamental human right, a way to exercise freedom of expression, protected by most functioning democracies. Although Turkey accepted several reform packages promoting democratization and human rights from the European Union in 2005, Turkey still fails to protect this human right, instead instituting restrictive legislation. In power since 2003, Tayyip Erdogan and his
Justice and Development Party (AKP) have implemented several controversial laws regarding the regulation of internet content in Turkey. In particular, Law 5651 implemented in 2007, known as the Internet Law, heavily regulates publications on the internet and allows the AKP to block or ban websites and search-words nationwide without providing a reason to the public or the publishers as to why. This law also includes provisions allowing for the imprisonment of anyone connected to these publications, which heavily restricts the flow of information on the internet. In 2013, peaceful protesters gathered in Gezi Park to raise awareness about Erdogan’s oppressive rule in Turkey, and gained international support through the popular social media site Twitter. As a result, Erdogan effectively banned twitter in Turkey claiming that social media was a menace and blocking the site was a way to keep the public safe from lies and exaggerations. The Gezi Park protests underscore how Erdogan and the AKP blatantly disregard human rights and create a restrictive atmosphere on the internet.

Session 1 - B30
Tracing the Communication of Linguistic Localness over Distance through North Carolina Toponym Pronunciations
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North Carolina is known for its place names ("toponyms") that have difficult or unlikely pronunciations. Such difficulties in pronunciation result from linguistic varieties of North Carolina's settlers and the preservations of names associated with diverse American Indian groups (Wolfram and Reaser 2014, 11-13). Given the importance of "localness" to individual identity (seen in idiolectical speech patterns), we investigate the role toponym pronunciation plays in defining a person as being either “local” or “non-local.” The data for this study is comprised of 203 speakers who read a list of thirty-one toponyms at the North Carolina State Fair. Each individual also listed their hometown, other places lived, and how long they have lived in North Carolina. The data were then coded according to local and some non-local pronunciations. Distance of the speaker to the toponym was calculated by absolute space, driving distance, and predicted driving/travel time to see which model best accounts for "localness.” Measures of distance alone are not sufficient to predict pronunciation. Instead, we also have to include a measure of "prominence." For example, the Hatteras Lighthouse is one of North Carolina’s most iconic landmarks, so the "local" pronunciation might have a greater range than a lesser known landmark, like the Sauratown Mountains. Located just north of Winston-Salem, these mountains might have a greater localness envelop than Uwharrie, which is not widely known or adjacent to a metropolitan area. With this investigation, we consider the ways in which preservations of toponym pronunciation might be influenced by the same types of factors that govern hierarchical or gravity models of linguistic diffusion.

Session 1 - D12
Carbon and Oxygen Isotopes Investigate Dietary Trends Among Pre-Agriculturalists and Early Agriculturalists from Michoacán Mexico
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This study uses carbon and oxygen isotopes to study whole dietary shifts among pre and post agricultural populations in Mexico. Isotopic analysis of teeth and bone can indicate past diet, and can clarify dietary change over time. Experimental data has indicated that different bone tissues reflect different components of the diet (Ambrose and Norr, 1993). The study's sample population consisted of 35 individuals from the Tarascan Empire of Michoacán Mexico. The social elites of the Tarascan Empire were bestowed food from the common people as tribute (Pollard 1982). Therefore, Tarascan elite populations should demonstrate
evidence for a focus on C4 (maize) in the diet (Cahue, 2001). Sex differences were investigated for any potential impacts on dietary access. I hypothesize that there will be a statistically significant difference between δ¹³C and δ¹⁸O of whole diet values of the pre and post agriculturalists from the Tarascan empire. Specifically that the pre-agriculturalist will show a δ¹³C value that is more negative, more consistent with a C3 focused diet (-28 ‰), and the Tarascans will show a dietary shift toward a C4 focus (-12‰). A Mann-Whitney U test was conducted (using SPSS version 22) to determine differences in values for δ¹³C and δ¹⁸O between Pre Tarascan (Median -5.6 ‰ and 21 ‰) and Tarascans (Median -5.3‰ and 21.8‰). Median δ¹³C and δ¹⁸O were not significantly different between groups U=183, Z=.713, p=.492. Only Tarascans could be tested for sex differences due to sample size. A Mann-Whitney U test found no significant differences between N=27 Tarascans (F=13, M=14), U=109, Z=.874, p=.382. This suggests that both population's major source of food was rich in C₄ plants.

Session 1 - A29
Allergic to Change: Female Soldiers and the Right to Serve in Combat
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In 2013, the US Secretary of Defense Leon Panetta and Chairman of the Joint Chiefs of Staff General Martin Dempsey announced the removal of the combat exclusion rule and all unnecessary gender-based barriers to service. Drawing on Brigadier General Barrye Price’s claim that “the last 11 years of warfare have really revealed to us there are no front lines,” the role of women in combat has shifted from exclusively being a role of support. War and combat are no longer limited to hand-to-hand warfare and nor are they clearly defined by national combat forces, but rather an ever-evolving cell comprised of the deployment of new technology, humanitarian intervention, peacekeeping, and enforcement and postwar reconstruction. The disappearing front lines requires both the redefinition of combat and the reconsideration of the role of female soldiers within military combat spheres. Furthermore, instead of viewing combat branches as solely comprised of harsh physical quotas that the female body cannot traverse, one should view the capacity in which women can effectively serve as an asset to these branches rather than as crutches. Drawing from the research of higher-ranking officers in the US military, females in the military, personal experience, and military subject matter, this research seeks to redefine combat and redefine the capacity in which women can serve in combat.

Session 2 - B17
A Spoonful of Cooperation Helps the Medicine Go Down: Integrating traditional and western medicine for Southeast Asian refugee welfare
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This research focuses on the utilization of traditional medicine among Southeast Asian refugees and the challenges they face in practicing it after displacement. Traditional medical practices are a vital aspect of culture and health for many Southeast Asians. However, they are often dismissed or rejected by western health practitioners who work with Southeast Asian refugees in refugee camps or in sites of resettlement in the United States and Canada. The different medical systems and beliefs of Southeast Asians and westerners can also lead to misunderstanding, frustration, and avoidance of western medical care. The aim of this study is to determine the best way to maximize the wellbeing of Southeast Asian refugees, which involves avoiding further mental trauma and respecting cultural beliefs while ensuring they abide by the health standards of their new environments. This research proposes that the integration of traditional and western medicine is an effective way to reduce distress and improve their quality of life. It investigates the
common mental, physiological, and acculturative problems that refugees face in refugee camps and resettled communities, pulling from psychological, anthropological, and medical literature; it then examines case studies of integrated health practices in each setting to analyze their effectiveness and potential for further application. With the refugee problem increasing worldwide, keeping forcibly displaced populations healthy while preserving their culture is of the utmost importance to help them through the difficult process of displacement and resettlement. Greater cross-cultural awareness and an attempt to embrace others’ beliefs are key steps toward this goal.

Session 2 - D19
Toward a multi dimensional model of gender identities
Nicholas Lee Vaught Psychology-BA, NC State University
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N Vaught proposes a revised model of gender identity traits. Having developed a bidirectional model of gender identities, using masculinity and femininity as the axes, the researcher proposes that social and personal attitudes about gender can be quantified. At the theoretical and functional level it is more practical to view gender as a wide model of various possibilities rather than as a dichotomous relationship between two possibilities. Developing a survey to measure social perceptions of masculinity, hyper masculinity, femininity, hyper femininity, androgyny, and gender fluidity will put this theory to the test. Following that, it is possible to develop a survey to be used as a psychometric of individual gender expression and attitudes. The initial survey has been adapted from numerous existing, relevant questionnaires. As such, it is intended as both a glimpse into current psychological measurements as well as societal perceptions. The point of this research is to broaden society and academia’s view of gender from the binary model to a less rigid model and to change the way we collect data on gender. As of now, IRB approval is pending.
Session 1 - D28
Fascioloides magna and larval tapeworm infections in white-tailed deer
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James Flowers, Population, Health, Pathobiology, NC State University

Fascioloides magna, the giant liver fluke, is a parasite that infects the liver of several species of mammals. F. magna infections are not usually fatal in wildlife that are adapted to infection (e.g., white-tailed deer (Odocoileus virginianus)); however, infections may be fatal in some livestock (e.g., sheep (Ovis aries) and llamas (Llama glama)) that are not adapted to infection. Recently, in North Carolina, a llama, two alpacas (Vicugna pacos), and a cow (Bos taurus) were infected by F. magna and died. Because financial losses can affect livestock producers, our objective was to determine the distribution of F. magna in white-tailed deer in select river basins across North Carolina. From September 2014 to January 2015, we collected, froze, and necropsied livers from hunter-harvested white-tailed deer within the Cape Fear, Roanoke, Catawba, Pasquotank, Lumber, Tar-Pamlico, Neuse, and Yadkin-Pee Dee River Basins. F. magna was detected in livers from five river basins with a prevalence of 13.4 percent. Larval tapeworms were detected in livers from six river basins with a prevalence of 14 percent. Previous research indicated the Tar River and Roanoke River Basins composed the range of F. magna in North Carolina. Based on our research, it appears the range of F. magna has expanded into the Catawba, Yadkin-Pee Dee, and Neuse River Basins since the 1970s. Range expansion of F. magna could threaten the North Carolina livestock industry, and could be related to the increase in populations of white-tailed deer, which is the natural definitive host of F. magna.

Session 2 - B7
Perceptual Range of a Fossorial Rodent (Tamias dorsalis) in Fragmented Forests
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Forests are becoming increasingly fragmented due to climate and anthropogenic changes. In fragmented habitats, perceptual range, the distance at which animals detect habitat features, could influence important life history processes such as dispersal. Our objective was to elucidate the perceptual range of the cliff chipmunk (Tamias dorsalis) in the Pinaleño Mountains of Arizona, which has been fragmented by recent fire and insect outbreaks. We placed animals in a clear behavior arena, divided into two quadrants, and located in a 144 m wide meadow to record an individual’s ability to detect habitat at two distances (34 m and 72 m) from a forest edge. We found that 77.8% of the 9 individuals spent the majority of their time in the arena side closest to the forest edge. At 72 m (equidistant from forested habitat on each side), individuals favored the same side of the arena. Our results indicate the perceptual range of cliff chipmunks is likely greater than 34 meters. These data will be used to understand movement decisions during juvenile dispersal of Tamias dorsalis in fragmented habitats.

Session 2 - B14
Downed wood in the neighborhood: availability of woody debris in an urban-exurban matrix
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Urbanized landscapes may contain low volumes and coverage of downed woody debris because land managers often remove it for reasons of aesthetics or safety. Yet, woody debris provides food and cover for wildlife and plays a pivotal role in energy and nutrient cycling. Because woody debris distribution and characteristics are not well understood in urban greenspaces, we characterized woody debris along urban greenways and compared values there to values in exurban managed and unmanaged forests. Specifically, we measured the diameter, estimated decay class, and calculated the volume for all pieces of woody debris found in three sub-plots nested within 60 greenway, 8 managed forest, and 6 unmanaged forest plots. In the greenway plots, we measured sub-plots 5, 15, and 25m from the greenway trail. All study sites were surrounded by urbanized land in Raleigh, North Carolina. We estimated the effects of each type of urban greenspace and distance from the greenway trail on characteristics of woody debris. Average diameter and volume of woody debris, regardless of decay class, were greater in the unmanaged forest than in the managed forest and greenways. The greenways had a greater volume of undecayed debris than the managed and unmanaged forest. Volume and diameter of woody debris were unaffected by the distance from the greenway trail. Trees along the greenway may be younger than those in the managed and unmanaged forests, and the lack of senescing older trees may affect the availability of woody debris along greenways. The relatively low availability of woody debris along greenways has implications for their wildlife habitat value.

Session 1 - B28
Volatile Organic Compound Emissions from Biomass
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A study is being conducted to determine the types and categories (i.e. value-added product, health hazard, and/or safety hazard) of the volatile organic compounds (VOC’s) emitted from biomass. There are few studies of this type, and thus, potential hazards and value-added products are unidentified. The method used in determining the VOC’s from the biomass involves headspace sampling and gas chromatography-mass spectrometry. Specifically, samples are obtained using solid phase microextraction in an enclosed headspace above a small sample of biomass. Current results show several potential health and safety hazards such as acetone(flammable) and methyl eugenol(carcinogen). Value-added products include gibberelic acid(plant hormone) and dehydrobietic acid(diabetes aid). Future plans for this project include quantifying the VOC’s present and devising methods for their separation and containment.
Optical Properties of Greenland’s Glacial Lakes

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Dissolved organic matter (DOM) is an important property of lake ecosystems, resulting from the decomposition of organic matter stored in soils and of plankton in the water column. Colored dissolved organic matter (CDOM), the fraction that absorbs ultraviolet (UV) and visible light, is the controlling factor for the optical properties of many surface waters. The aromatic content of DOM is the primary control on its light absorption. Little is known about the mechanisms by which DOM and CDOM evolve in lakes formed during glacial retreat. As part of a larger study of the ecosystems in glacial lakes, the present project examined the quality of DOM and CDOM in lakes in SW Greenland. Three lakes in Kangerlussuaq, Greenland were studied. The specific ultraviolet absorbance (SUVA) of a water sample at 254 nm (SUVA254), computed by normalizing absorption (a254) to dissolved organic carbon (DOC) concentration, is related to the aromatic carbon content of DOM. SUVA254 values were compared between three clusters of lakes: coastal (near Atlantic coastline), inland (tundra), and ice margin (near glaciers). Degradation experiments over the course of 72 hours examined the use of CDOM by lake bacteria. Results of this work will contribute to our understanding of lake ecosystems in Greenland during rapid climate warming in the Arctic.

Imidacloprid’s effects on the mayfly Isonychia sp.

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Imidacloprid is a neonicotinoid insecticide and among the most widely used insecticides in the world. Imidacloprid acts on the central nervous system of insects by blocking the nicotinic acetylcholine receptors, leading to immobility, and eventually paralysis and death. Due to its wide usage and high solubility, imidacloprid is highly mobile and contaminates surface waters, sometimes at concentrations harmful to aquatic insects. To better understand the physiological effects of imidacloprid in this context, we performed acute toxicity tests in the mayfly Isonychia sp. (Ephemeroptera: Isonychiidae). We estimated 96 hr EC50 and LC50 values of 5.75 ug/L and 35.16 ug/L, respectively. We recorded molting frequencies and mortalities associated with molting and found that molting increases the vulnerability of larvae to imidacloprid exposure. Respirometry experiments were conducted at concentrations below (2 ug/L) and above (20 ug/L) the EC50 value for immobility. Both concentrations stimulated changes in oxygen consumption profiles relative to unexposed larvae, but only the higher concentration resulted in immobility. Taken together, this data suggests that during the first 36-48 hrs of imidacloprid exposure, the added stress of molting may cause mortality in Isonychia sp. The respiratory disturbance caused by imidacloprid is something to consider for all aquatic insects when concentration limits are set for streams and rivers, considering they are the some of the most fundamental elements in maintaining stream health.
The brain has the ability to adapt and rewire itself in response to changes in the environment by constructing new neurological pathways. Neuroplasticity is the ability of the brain to create new connections. It is influenced by physical, mental, behavioral, and environmental factors. Changes in the brain can be detected by employing MRI scans and examining cross sections of the brain. In this study, the effects of various factors on the brain’s neuroplasticity were examined. Sustained attention tasks were used to assess changes in the subjects’ abilities. For example, environmental enrichment affected the brain in a positive manner, increasing cognitive ability. However, neuroplasticity can also have negative effects that lead to addiction and obesity, as a result of a reduction in D2 receptors. In addition, neuroplasticity can reverse anatomical changes in the brain caused by physical injuries such as concussions. By studying neuroplasticity, neurological treatments can be improved by identifying changes that are caused by external factors. Most of the studies regarding neuroplasticity utilize rodent models, which cannot be readily applied to humans. In order to gain a deeper understanding of human neuroplasticity, technological advances are needed to study the inside of the brain using ethical and non-intrusive methods. Further research could also identify factors that enhance cognitive abilities, such as learning and memory formation.

College coursework is rigorous. Both students and professors struggle with the amount of material that must be taught and learned in any undergraduate introductory science course. Students feel overwhelmed by the amount of material and supplement rote memorization in place of higher levels of learning. Therefore, many of these students tend to score poorly on synthesis and application questions when being formally assessed. This project aims to enhance the student learning experience and augment student scores on practical assessments. A problem-based learning case study was developed on the topic of epidemiology and public health using a patient’s experience. The case study was based on an infectious disease contracted by a patient while traveling overseas. Students were provided the medical records, laboratory tests performed, and background information on the vaccination and health practices of the patient. Students were then asked to take this information and answer a series of questions based on the patient data. To increase student engagement, a scenario to which students will relate and a character to whom students can empathize was provided in the context of the case study. Case study assignments were completed in 1-week by 3-person student teams, with a total of 32 teams in the class. Student learning will be assessed based on student performance on the case study and the application questions on the third exam. Students who are considering going to medical school may find this method of learning valuable because the use of case studies is commonly employed in such fields.
Session 1 - A2
Controlling gene expression with small molecules via engineered riboswitches
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Riboswitches are gene regulators found in the 5’-untranslated regions of mRNA. Riboswitch activation occurs when a small molecule ligand binds to a genetically encoded RNA aptamer which results in a conformational change that either upregulates or down-regulates gene expression in a manner proportional to ligand concentration. This differs from protein regulation of gene expression because riboswitches act in a dose-dependent manner while most proteins do not. Riboswitches are nature’s biological sensors. By utilizing riboswitches, it is theoretically possible to regulate any metabolic pathway. Most current riboswitch engineering requires that they be individually and rationally constructed for each given purpose. Few new riboswitches have been created using this technique due to the amount of time and work involved in creating each new switch. By modifying existing riboswitches to recognize new ligands, the rate of riboswitch discovery would be greatly improved. Mutating the aptamer region of existing riboswitches provides large libraries which can be screened against new ligands, with the goal of finding mutant riboswitches that display shifts in activity or specificity. Current methods of screening riboswitches are often labor intensive, low-throughput, and not generally applicable. Finding a higher throughput and more universal screening method is of paramount importance to this field. Described herein is the development of a dual selection method that can identify riboswitches in their OFF state (in the absence of ligand) and then in the ON state (in the presence of ligand) without sub-cloning or other manipulations. Such a dual screening/selection platform will be extremely valuable for the creation of novel riboswitches with new functions.

Session 1 - B11
The Effects of Urbanization on Wing Symmetry in the Periodical Cicada (Magicicada septendecim)
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Insects are continuously exposed to environmental stressors, especially those imposed by urbanization such as habitat loss and temperature change. Little is known about the effects of urbanization on insect development, and such information is needed because insects help sustain ecosystems. One possible effect of urbanization is altering the symmetry, and deviations from normal symmetry are termed fluctuating asymmetry (FA). High levels of fluctuating asymmetry indicate the inability of the genome to stabilize development within a given environment. In this study, we evaluated the effects of urbanization or loss of forest cover on the periodical cicada (Magicicada septendecim) during the Brood II emergence. Due to the slow-developing life cycle and dependence on plant sources, we predicted that periodical cicadas would be highly susceptible to the effects of disappearing forest cover; therefore, periodical cicadas would exhibit high levels of fluctuating asymmetry. As part of the Urban Buzz: A Periodical Cicada Citizen Science Project, we enlisted citizen scientists to collect cicada samples along a gradient of increasing urbanization: forest, yard, park, and street median. We measured fluctuating asymmetry in the shape and length of the forewings. Our results show that loss of forest cover did not have a significant effect on fluctuating asymmetry in both the shape and length of the forewings. Our results suggest that, in terms of maintaining symmetry of the forewings, Magicicada septendecim may be able to cope with loss of forest cover. These results may provide insight into how insects may buffer their development against rapid environmental change.
Active Teaching Styles Positively Impact Student Learning Gains
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Miriam Ferzli  Biological Sciences, NC State University

To determine the impact of teaching style and learning format on student learning gains a traditional lecture course, a modified lecture course, and a Student Centered Active Learning Environment with Upside-down Pedagogies (SCALE-UP) course were evaluated. Traditional lecture courses (n=240) are taught with little peer-to-peer collaboration or active learning. A modified lecture (n=240) is similar to the traditional lecture setting with implemented active learning techniques and activities modeled after the SCALE-UP format. SCALE-UP courses are taught in a smaller classroom (n=96) that involve active learning via extensive use of technology and interactive, collaborative activities. Learning gains were measured in each teaching format based on identical subject material students are supposed to master in BIO 181, by the end of the course. A pre-test was administered as a baseline for each student and matched to each students’ post-test using a simple random sample, between groups comparison approach. Due to the interactive format in SCALE-UP and modified lecture, students within these courses should have a higher average in learning gains between the pre-and post-test compared to traditional lecture formats. Findings are consistent with other studies which indicate active learning styles have a higher increased average learning gain compared to traditional formats. No significant difference was found between the modified lecture and SCALE-UP. Many introductory science courses are taught in lecture settings, and these findings support the notion that integrating active learning into any course format has the potential to positively impact student learning gains and decrease the rate of student failure.

Exploring Future Applications of Nanotechnology in the Treatment of Diseases
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Waleed Ahmed  , NC State University;
Abir Chowdhury  Biological Sciences, NC State University;
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Lisa Paciulli  Biological Sciences, NC State University

Diseases that affect the cardiovascular and nervous systems affect millions of people across America. There are a variety of treatments for these diseases such as drug therapy and surgery. For example, cardiac arrhythmias and conduction disorders are correlated with the development of rheumatoid arthritis and systemic sclerosis. Surgery is sometimes required to either repair and/or replace affected heart areas. The most successful treatment for bacterial endocarditis is early surgery as well, although newly introduced drugs such as daptomycin have been effective. Multiple sclerosis (MS) is caused by an inflammation of the central nervous system (CNS) and is commonly treated with drugs such as rituximab. These diseases could likely benefit from another type of treatment, nanotechnology. Current research indicates a great potential for the use of nanotechnology in therapeutics, diagnostics, and imaging. Nanotechnology has been shown to help treat diseases such as pneumonia, liver cancer, and autoimmune diseases, and can penetrate the blood-brain barrier for the treatment of CNS disorders. The advantages of nanotechnology include its relative inexpensiveness, ability to target specific diseases, and a decrease in drug-related side effects. Research into nanotechnology has the potential to provide more effective treatments for rheumatic diseases, bacterial endocarditis, and MS. The role that nanotechnology can play in medicine and therapies is a very new and growing area of research, as it is likely to provide revolutionary methods for treating numerous illnesses.
Session 2 - B3
How does popular media's portrayal of animals affect viewer perceptions?
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Anthropomorphism is the alteration of animals or objects to make them appear more human-like and is seen throughout popular media. Walt Disney Studios utilizes anthropomorphized animals in their animated films to create characters that are relatable to audiences and emphasize the film’s themes. These anthropomorphic representations can lead individuals to draw inaccurate conclusions about animals and unintentionally influence viewer attitudes towards their “personalities”. In this study, we were interested in Disney's portrayal of predatory species and how these depictions affected viewer perceptions of these animals. NC State undergraduate students were divided into one of three groups and shown a 3 minute video based on their treatment group. Students assigned to the documentary style group were shown nature documentary footage of four predatory species. Students assigned to the Disney style group were shown footage from animated Disney films of the same predatory species, while students assigned to no film were shown neither video clip. Participants completed a multiple choice questionnaire asking them to describe the animals shown in the video. We hope the results from this study will provide further insight towards the field of anthrozoology, in addition to other disciplines that explore the human-animal relationship.

Session 2 - A16
Apoptosis TRAILS cytokine pathway in prions and tumors
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Mentors and/or Co-Authors:
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Against the backdrop of the 21st Century, the treatment and control of cancer cell proliferation in human biological systems has become a central theme in modern medical research. Countless projects across the world are today deeply involved in developing new mechanisms through which a variety of cancer-related afflictions can be more effectively treated. One such mechanism of treatment may lie in the activity of TRAIL (tumor necrosis factor-related apoptosis-inducing ligand), which is a common apoptosis pathway protein found in many cell types. When aided by cytokines from the bodies’ immune system, the TRAIL protein binds to specialized receptors on the cell membrane, activating signaling pathways that facilitate the apoptosis of cancerous tumor cells, leaving normal cells unharmed as a result. Despite the potential that this pathway possesses in the fighting of cancerous tumors, evidence has shown that certain environmental factors may lead to inhibition of this signaling pathway. For example, the presence of the Human Prion Protein, or PrP, has been shown to be highly correlative with inhibition of the TRAIL protein and exponential tumor growth in human tissue. In this review, we explore various methods, including exploitation of PrP infection, to detect or prevent disruptions of the TRAIL pathway in order to find new, more specific treatments for cancer and other TRAIL-associated diseases.

Session 2 - C5
Seeing Stress: Visual adaptation of zebrafish (Danio rerio) ASC in response to external stressors
Melodi T Charles Biological Sciences-BS, NC State University
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Antonio Planchart Biological Sciences, NC State University
The inflammasome is a component of the innate immune system that is responsible for detecting foreign threats to the cell. It is a protein complex responsible for activating caspase-1 proteins, which trigger the inflammation response. The inflammasome is composed of several proteins, including multiple copies of the protein, *ASC*, and assembles in response to an external stressor. This project aimed to create vectors to deliver the *ASC* gene tagged with green fluorescent protein (GFP) to zebrafish (*Danio rerio*) in order to visualize the immune response to stress via the assemblage of the inflammasome, a ‘speck’ of concentrated GFP expression. Plasmids were constructed by the insertion of *ASC* into the vectors pEGFP-N1 and pEGFP-C1. Zebrafish embryos were transfected with these plasmids and exposed to known stressors to create the ‘specks’ of a GFP-tagged inflammasome. Due to the similar function and structure of the zebrafish and human inflammasomes, the zebrafish is an appropriate model for studying the assemblage of the inflammasome and the immune response to environmental stressors. The vectors created in this project can be used as a sensitive detection system for harmful exposure to even low-level toxins that are currently believed to be safe for humans.

Session 2 - D15
**Brain Transplants and Neural Prosthetics as Potential Treatments for Neurological Diseases and Injuries**

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Over the past few years, the array of treatments for brain injuries and neurological diseases such as tetraplegia and Parkinson’s Disease (PD) has broadened significantly. Various studies examined treatments for brain injuries, tetraplegia, and PD, such as peptide nanofiber scaffolds, tissue and electrode transplants, and deep brain stimulation (DBS). Based on research findings, for brain injuries, patients treated with peptide nanofiber scaffolds showed the greatest regeneration of brain tissue. Another treatment for brain injuries that showed promising results was a hyaluronic acid hydrogel, which aided in regeneration of neurons after injury similar to the peptide nanofiber scaffolds. In addition, a combination of invasive and non-invasive neural prosthetic treatments yielded the most effective brain-electrode functionality. Studies showed regeneration in various parts of the brain in patients with prosthetic body parts. For PD, patients who had fetal homotransplants showed the most positive improvements. However, DBS is a more suitable therapy for PD for a variety of reasons including ethical issues. Further research concerning neurological issues is being conducted, focusing on manipulating patients diet, Ayurveda approaches, various surgical treatments, and prescription medications. Although the search for more suitable treatments is ongoing, current successful experimental findings show potential for improving treatments in the coming years.

Session 1 - B24
**Epidural Leading to Breastfeeding Complications**

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Epidurals are given to many women during labor to ease pain. The epidural block has been used increasingly over the past fifty years. More and more women plan epidurals to avoid pain. Although epidurals can ease pain, they can lead to a plethora of complications such as induced cesarean sections, prolonged labor, pelvic sensory blockage, and postpartum depression. There is often risk for the fetus and newborn as well as the mother. One important complication that affects both mother and baby is the ability
for the mother to breastfeed. Breastfeeding’s advantages include having balanced nutritional content that is vital for the infant’s immune system for the first year of life. Through breastfeeding, antibodies from the mother help fight infection in the baby, the babies digestion is eased, possible obesity prevention, higher IQ’s, and an intimate bond between mother and baby occurs. Mothers who have difficulties breastfeeding opt to feed their infants formula milk. Babies who are bottle fed are more likely to develop illnesses, have an increased risk of obesity likely up until the age of six. Also, the mixture of formula for each feeding is not always correct or equivalent to the proper nutritional amount. This hindrance of breastfeeding effect of epidurals is often overlooked. Each woman should be educated and consider the potential benefits and risks of epidurals and apply them to her own circumstances.

Session 2 - A7  
Measuring the Quality Assurance of Knee Surgery by Examining Patient Outcomes  
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Mentors and/or Co-Authors:  
Huong Nguyen Administration, Raleigh Orthopaedic  

Quality assurance is an important component of successful patient care and rehabilitation. This is especially true for orthopedic surgery. The purpose of this study was to evaluate the outcome of knee surgeries performed at Raleigh Orthopaedic Clinic. In this study, patients completed a survey before surgery and then three months, nine months, and twelve months after surgery. The survey assessed knee pain and function as well as patient satisfaction. Survey results showed a steady reduction in knee pain and an improvement in knee function from before surgery to twelve months after surgery. Additionally, the results showed consistently high patient satisfaction ratings. These findings suggest that Raleigh Orthopaedic Clinic upholds high standards of quality in knee surgery. Surveys should continue to be given in order to track quality assurance, and ensure it remains at high levels.

Session 2 - D13  
Impacts of Keystone Species on Maintenance of Foundation Species in Ecosystems  
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An ecosystem is a delicate balance, which depends on sustainability and management of resources. When managing ecosystem resources, it is important to be aware of the effect keystone species have on foundation species. Keystone species are species that have a large impact on the ecosystem. Foundation species play an important role in the structure of the ecosystem, such as native plant species. To understand this relationship better, we examined various studies on keystone species in three different regions of the world; the Appalachian forests of North Carolina, Catalina Island off of California, and Indian River Lagoon on the Atlantic Coast of Florida. In the Appalachian, pollinators are vital for biodiversity. Pollinator populations, such as the native honeybee (Apis mellifera), are declining due to human development and monoculture agriculture. Mechanical shrub control and prescribed burn treatment techniques have successfully stabilized pollinator populations. Bison (Bison bison) are non-native herbivores in Catalina Island whose grazing regulates the non-native plant concentration. Bison cows on Catalina Island received fertility control, which effectively reduced the birth rate and resulted in approximately zero population growth of the herd. Earlier studies in the Indian River Lagoon looked at Trichechus manatus’ feeding behavior to determine the effect it had on seagrass, such as Halodule wrightii and Syringodium filiforme, they concluded that T. manatus preferred H. wrightii to S. filiforme. By using
these techniques, we can maintain healthy populations of native plants that serve as foundation species in each research focus area through the conservation of the target keystone species.

Session 1 - B18
The effects of an ER beta-b to ER alpha reciprocal mutation in the ligand binding domain of teleost estrogen receptors on the binding affinity of endoxifen.
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Endoxifen, a potent antiestrogen, is the primary metabolite responsible for tamoxifen effectiveness in the treatment of estrogen receptor-positive breast cancer. Endoxifen (EDX) is thought to act in breast cancer cells by binding to and degrading estrogen receptor (ER)a while stabilizing ERb. To further elucidate the differential binding characteristics of EDX to ER subtypes, we performed competitive binding studies with bacterially-expressed estrogen receptor fusion proteins isolated from a teleost fish, the Atlantic croaker, Micropogonias undulatus (acERa, acERbb). Teleost ER subtypes have highly conserved amino acid residue substitutions in regions that are important to ER structure and function, making them a good model system for reciprocal site-directed mutagenesis studies. Our previous results demonstrated that amino acid residues corresponding to human hERaMet421 of the ligand binding domain (acERaMet, acERbbIle) were important to the differential binding of tamoxifen. In this study, we characterized the binding profile of endoxifen to fusion proteins acERa(Met), acERbb-I and acERbb I-M. The binding affinities of acERa and acERbb for EDX were not significantly different, with EC50s of 22nM (+/-1.61nM) and 24nM (+/-1.47nM) respectively (n=3,4). The EC50 for the acERbbI-M mutant was significantly lower than both wild type ERs, with an EC50 of .99nM (+/- .5nM)(p=.025). These results support our hypothesis that this position is important to binding tamoxifen and its metabolites. It is interesting that the I-M substitution causes ERbb binding affinity to increase over that of either wild type ER. Further studies will confirm this result and explore possible interactions with other amino acid residues.

Session 1 - D14
The Design of a Pressure Gauge for Cryogenic Applications
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David Haase Physics, NC State University

Experiments at near absolute-zero temperatures often require a high quality vacuum for insulation and temperature control. A pressure gauge that operates inside the cryogenic volume itself is helpful to determine the remnant gas density. One method for determining gas density is to measure the thermal conduction through the gas. I have designed and am testing such a thermal conductivity gauge to operate at 4 Kelvin in a cryocooler. The gauge includes parallel copper plates separated by a sub-millimeter gap. One of the plates is heated and its temperature change is measured with a resistance thermometer monitored by an AC resistance bridge. I discuss the theory of heat flow through gases, the design of the cell and electronics, as well as the potential applications to cryogenic experiments.

Session 2 - D7
Seminal Fluid's Intricate Effects in the Prairie Vole
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Seminal fluid plays an important role in many aspects of reproduction. It has been shown to affect acrosome initialization, fertilization, embryo implantation, and development of the embryo in both invertebrates and vertebrates. Seminal fluid proteins have also been shown to affect behavior and physiology of the mated female in Drosophila melanogaster. A recent study in Mus musculus has shown that paternal seminal fluids affect conception and pregnancy maintenance, and interestingly may also affect adult metabolism in male offspring. We examined these claims in Microtus ochrogaster, the prairie vole. Males received one of three treatments: removal of the seminal vesicles, sham surgery, or no surgery. They were then mated to females, and the offspring were weighed at 1 day old, weaning (21 days old), and as adults (70-77 days old). We found significant differences between male and female vole weights. We also observed an unexpected effect of surgery and/or anesthesia on the ratio of male/female pups born.

Session 1 - D22
Conservation Psychology: Determining potential motivating factors behind pro conservation behaviors.
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Reshma Patel Zoology, NC State University;
Tia Simon Biological Sciences, NC State University;
Marissa Rosen Zoology, NC State University
Mentors and/or Co-Authors:
Jennifer Campbell Biological Sciences, NC State University

In order to determine what motivates a lifetime of pro conservation behavior, our research group has conducted a series of interviews with individuals that have been distinguished as exhibiting pro conservation behaviors based on their career choices or PHD research. The participants of this study completed a preliminary survey that assessed how they ranked the following motivating factors in their lives: family, mentor, travel, environmental news, education, internship/volunteer/employment, books and media, influential animal connections, and time spent in nature. Their survey responses were then used to create in depth questions for a follow up interview. The interview questions delved into their specific life experiences and conservation efforts in order to see how different experiences influenced their lifetime of pro conservation behaviors. The participants were also asked about their careers, ongoing research, and efforts on educating people (especially children) about conservation. After gathering information on all participants, the data was compared and analyzed in order to determine a pattern of motivators that show how pro conservation attitudes can be converted into long term pro conservation behaviors. Scientists should continue this research to promote pro-conservation behaviors in generations to come.

Session 1 - A19
Conservation Psychology Research
Alexis Dupont Zoology-BS, NC State University
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Session 2 - D10
Variation of Parental Behavior to Offspring Behavior
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The prairie vole, *Microtus ochrogaster*, has been used as a model organism in autism studies for over twenty years, due to their monogamy. However there is little studied on variation in pairbonding among this species. In our studies, we found significant variation of pairbonding and related behaviors among male voles. Alloparental care was of particular interest due to it’s relationship with monogamy. It is common for organisms where both parents display parental care to be monogamous, leading to questions about the necessity of parental care leading to monogamy. As we observed males practicing Alloparental care in the prairie vole, we question where this behavior comes from. Is this an innate or learned behavior? Is it heritable? Using forty-one families, we tested for heritability using a father and two sons, all of whom were tested before and after mating to unrelated female.

Session 1 - A25
An Outside Analysis of the Patient Surveying Process of Raleigh Orthopedic Clinic
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The direct purpose of this project was to analyze the patient surveying process of Raleigh Orthopedic Clinic and determine if effective data was able to be drawn from it to provide to the physicians and surgeons. During that processes, it was also brought up that an attempt be made to improve the procedures if the need arose. Upon reviewing all of the data gathered throughout the course of the Raleigh Orthopedic Clinic trial, it was noted that the data could not be put toward any positive correlation as a result of several possible flaws in their data collection process. After talking with physicians and surgeons and analyzing the process, it was decided to subdivide Raleigh Orthopedics survey groups, reorganize the data collection process, and include groups for those who chose not to undergo a surgical process.

Session 1 - D18
Simultaneous detection of real-time brain glucose and dopamine fluctuations using glucose oxidase-modified carbon-fiber microelectrodes coupled with background-subtracted fast-scan cyclic voltammetry in live animals
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Mentors and Co-Authors:
Leslie Sombers Chemistry, NC State University

Glucose is the major energy source of the brain, and consumption of drugs of abuse may alter brain glucose levels. Therefore, real-time detection of glucose is essential to advance the research community’s
understanding of brain energy and its role in substance abuse. Substantial evidence indicates that phasic dopamine (DA) fluctuations influence habit-formation and other aspects of motivated behavior. Our research aims to simultaneously examine brain glucose and DA dynamics in response to cocaine administration at a single, spatially discrete recording site in intact rat striatum. Several studies suggest that brain glucose concentrations change slowly, however these techniques lack the time resolution necessary to examine changes on the time scale of neuronal signaling. Our lab has developed and characterized glucose oxidase-modified carbon-fiber microelectrodes coupled with background-subtracted fast-scan cyclic voltammetry. This approach provides chemical selectivity, revealing sub-second glucose fluctuations with unprecedented temporal and spatial resolution while also maintaining sensitivity to DA at a single recording site. This work will provide insight into physiological brain function and pathological states involving glucose regulation and phasic DA signaling under baseline or drug-induced conditions. As there is evidence of glucose dysregulation in DA-innervated brain regions, this approach may also prove useful for investigating other disease states such as diabetes and neurodegeneration in Parkinson’s disease. The National Science Foundation is acknowledged for their generous financial contribution on this project.

**Session 1 - D4**
**Estimating Missing Values through Hierarchical Clustering of Soil Moisture Measurements within North Carolina**
*James Frank Gilman Statistics-BS, NC State University*
*Maria Jahja Economics, NC State University*
*Mentors and/or Co-Authors:*
*Brian Eder Statistics, NC State University*

Soil moisture is a leading component in agricultural research and applications including flood and runoff potential, drought forecasting, soil erosion, and irrigation scheduling. Without adequate understanding of soil moisture conditions, climate and environmental studies are markedly limited. Yet failure of in situ weather monitoring remains a consistent issue, hindering progress of hydrologic research through compromised data quality and subsequent analyses. While there are extensive models for several major climate indicators, few studies have made further investment into a practical process for soil moisture estimation. Accordingly, the State Climate Office of North Carolina (NCSCO) requested that we develop a statistical model to construct clean, practical soil moisture records for use in analysis. Considering the data limitation from the relatively recent implementation of equipment (available data stretched from 2009 to early 2015), this study examines the remaining 29 valid ECOnet stations distributed across the state for reliable associations. This research provides a solution for estimating missing and spurious soil moisture measurements using a spatial approach with univariate data from surrounding stations. Using hierarchical clustering with Ward’s minimum variance measurement for Euclidian distances, the historical soil moisture measurements resulted in a data-driven model that quantifies the clearest relationship cluster between a target station and neighboring areas. Further use of the model identifies linked soil moisture locations and minimizes redundancy in monitoring stations.

**Session 1 - C15**
**Investigating Sub-second Dopamine Fluctuations associated with Impulsive Decision Making**
*Brennen Tyler Guzik Chemistry-BA, NC State University*
*Mentors and/or Co-Authors:*
*Leslie Sombers Chemistry, NC State University*
*Jose Ascencio-Ibanez Biochemistry, NC State University*

Impulsivity is a trait that is prevalent in numerous neurological disorders such attention deficit hyperactive disorder and substance abuse. For the purposes of this study, impulsivity can be quantified in animal models using delay discounting paradigms, which can measure the cognitive impulsivity actions. In the
delayed discounting task, each of the animals were allowed to choose either an immediate, small reward or delayed, large reward. Using an operant conditioning chamber equipped with visual stimuli, retractable levers and sucrose pellet dispenser, the rats will in turn develop a preference for an instant and smaller reward or a delayed and larger reward. Using this animal model, we investigated the role of dopamine in the individual difference in delay discounting behavior. Dopamine, an electroactive neurotransmitter in the brain, is highly implicated in motivated behavior and is elicited in the ventral striatum by cues that can predict reward availability. In this work, fast scan cyclic voltammetry is used to measure sub-second dopamine release at discrete locations in the shell of the nucleus accumbens in rats performing the delay discounting task. This approach provides real time concentrations of dopamine elicited in the vicinity of the carbon-fiber microelectrode as the animal made decisions based on learned associations and preference. We hypothesize that a positive correlation will develop between the preferred reward type, and the dopamine release magnitude during decision-making. In the future, we will investigate the effects of chronic cocaine exposure on the patterns of dopamine release that underlies the animals’ individual preference in impulsivity.

Session 2 - A19
Mutation of a single ligand binding domain amino acid of the teleost estrogen receptor beta-a increases its binding affinity to diethylstilbestrol
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Estrogen receptors (ER) are intracellular proteins that are activated by binding to estrogens and estrogenic compounds. These complexes regulate gene transcription in multiple female and male body organ systems, including the reproductive, cardiovascular, nervous, and skeletal systems. There are 3 known subtypes of ERs in teleost fish: ERα, ERβα, and ERββ. In mammals, only 2 of these are seen: ERα and ERββ. Each ER subtype has its own binding properties for various estrogenic compounds. Diethylstilbestrol (DES) is a synthetic form of estrogen that binds to ERα with a higher affinity than to ERββ. Each ER subtype has its own binding properties for various estrogenic compounds. In this study, we investigated the role of another amino acid position, hERαC530, which is changed to Met in the ERβα subtype. We used site directed mutagenesis to create an acERβαMet-Cys fusion protein for binding studies using DES as a ligand. The binding affinity of DES to the ERβαM-C mutant increased compared to that of ERββ and was 21x higher than that of ERα. This suggests that the hERαC530 position occupied by methionine in ERβα and cysteine in ERα plays a significant role in the differential binding affinities of DES to ER subtypes.

Session 1 - C25
A Holistic Approach to HIV: Transmission, Progression, and Treatment
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To examine the transmission of HIV, we focused on maternal-infant transmission and the variables associated with birth that may increase transmission in the three phases of pregnancy. Researchers
concluded that high maternal viral load increases both intrauterine and intrapartum transmission. Low fetal birth weight and CD4+ T-cell percentages increase intrauterine and intrapartum transmission respectively. Maternal breast health, infant oral health, and length of breastfeeding increased postnatal transmission. To examine the progression of HIV, we examined the development of HIV comorbidities in populations at different stages of HIV infection. These studies concluded that the development of HIV comorbidities were dependent upon a multitude of factors, including geographic location, lifestyle, socioeconomic status, and age. Patients treated with antiretroviral therapy were monitored for the development and causes of drug resistance. These studies found that early and regular testing for resistance and adherence to prescribed treatment schedules were large factors in successfully treating and avoiding further development of drug resistance. To further evaluate treatment options and research on the cure of HIV, we examined methods of gene therapy and stem cell transplantation. In gene therapy, the genetic sequence of the target cells of HIV is modified in order to create resistance. Stem cell transplantation involves transplanting stem cells that are already resistant. In preliminary studies, both methods have been successful for creating resistance to HIV. All of these findings show development in the comprehensive understanding of HIV, which could help provide efficient treatments and more importantly, save millions of lives worldwide.

Session 2 - C4
The pH Dependence of Dehaloperoxidase Enzyme Using Michaelis-Menten Kinetics
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Dehaloperoxidase (DHP) is from the terebellid polychaete, Amphitrite ornata, is the first hemoglobin has been studies that has peroxidase activity as part of its native function. [1] In the class of heme peroxidases, previous experience showed the substrate 2,4,6-trichromophenol could bind to DHP at the external site near the exterior heme β- or δ-edge at a low concentration. [2] This study is interesting in determining if the pH change will affect the kinetics of the binding process of 2,4,6-trichromophenol, also by applying the Michaelis-Menten Kinetics, optimizing the certain pH range and the concentration for the substrate to find the turnover rate of the product. The study found that at high concentrations of the substrate, the turnover rate decreased due to substrate inhibition. This experiment also showed that the maximum turnover number was at pH 7. The Kcat/Km was the highest when the pH was at 6.5, which was indicating, at pH 6.5, the enzyme was converting a substrate into a product most efficiently. At pH 7.5, both Kcat and Kcat/Km were the lowest compared to the other pH values, which suggested that the enzyme had the lowest efficiency to convert substrate into product at that pH.

Session 1 - D19
Synthesis and Photocatalytic Investigations of n-type SnNb2O6
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Mentors and/or Co-Authors:
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SnNb2O6 was successfully prepared using solid state synthesis methods in order to study the effects of Bi- and Mo-doping on the visible-light sensitive photocatalyst. The crystal structure, photoelectrochemical properties, and photocatalytic properties were studied to gain a better understanding of the effects of n-type doping. The SnNb2O6 phase was n-type doped with 1-7% Bi(III) for Sn(II) cations and Mo(VI) for Nb(V) cations. Phase purity was determined using powder X-ray diffraction, which showed no change in crystal structure for the 1-5% doped-SnNb2O6. Lattice parameter refinements were performed and showed that the
unit cell volume decreases with an increase of the n-type dopants. As previously reported, the bandgap size of SnNb$_2$O$_6$ is 2.3 eV. However, the absorption edge of the n-type doped semiconductor exhibited a red shift with higher percentages of Bi(III)/Mo(VI) dopants; decreasing the band gap size. Polycrystalline films were prepared to test the photoelectrochemical properties of SnNb$_2$O$_6$. Initial testing has shown that the photocurrent increases with increasing pH. Further testing will shed new light into the impact of n-type doped SnNb$_2$O$_6$ semiconductors for solar energy conversion.

Session 1 - C4
North Carolina's trends in PM 2.5 and Ozone
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Despite improvements in overall air quality across the state of North Carolina, due in part to the Clean Air Act and various EPA regulations, the two most widespread air pollutants, Particulate Matter 2.5 (PM2.5) and Ozone still remain problematic. PM2.5 includes the particulates of a 2.5 micrometer diameter or less. Tropospheric, or Ground-level, Ozone is created by numerous chemical reactions between oxides of nitrogen and volatile organic compounds. Ozone typically reaches its highest and most dangerous levels during hot summer months, and affects both urban and rural areas alike. Together, Ozone and PM2.5 affect the lives of millions of Americans as they are proven to cause various respiratory illnesses. Using data collected by the North Carolina Department of Environment and Natural Resource's Division of Air Quality (NCDENR-DAQ) in all 7 of the state's designated air shed regions, and quantified differences in both Ozone (1997-2012) and PM2.5 (2007-2012) through one-way Analysis of Variance (ANOVA) methods. We then used regression of the mean values for each year to analyze the decrease in trend lines at each location. Our analysis revealed a general decreasing trend in both pollutants across all regions.

Session 1 - C3
Determination of Enzyme Activities using Various Biochemical Assays
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Enzymes are macromolecular biological catalysts that are responsible for thousands of metabolic processes that sustain life. These enzymes can be isolated and extracted from cells and sold commercially. Novozymes core business is industrial enzymes, microorganisms and biopolymers. I focused primarily on the enzymes manufactured. Assays are performed to quantitatively measure the presence or amount or the functional activity of specific enzymes produced by Novozymes. All assays are run based on the premise that if the amounts of all exogenous reactants, reagents, are kept constant across all the samples then the activity is the only limiting factor for the assay process. SAP is used to review product specifications and post batch approvals as well as a LIMS database for entering and reviewing of data and creating reports. Anaadm is also utilized to record the raw data and print results.

Session 1 - C6
North Carolina record maximum and minimum temperature trends
Julia Kostura Statistics-BS, NC State University
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The national daily record maximum and minimum temperatures have been collected for the US and analyzed to find a relative increase of record maximum high temperatures. Our client, the NC State Climate Office (SCO) has asked our team to determine the increase in record high temperatures that is occurring in North Carolina. By focusing on local weather stations within North Carolina, we can determine how the increase in global temperatures affects our local climate. Ideally, the ratio of maximum high temperatures to minimum low temperatures should be one to one. In 2009, the national ratio was two to one, which is not unexpected as the global surface temperature has increased. Global models have predicted record temperatures twenty to one, maximum to minimum temperatures, by mid-century. For North Carolina, we looked at the record temperatures from eight stations across the state, covering all the different climate regions within North Carolina. Using the data from roughly 1900 to 2014, we can see the significant increase in record maximum temperatures and the drop in record minimums within the past century. Using linear regression, we can predict how the increase in record maximum temperatures will continue to grow in North Carolina.

Session 1 - A13
Analysis of Website Usage: Logistic vs Linear Models of “Stickiness”
Clayton Alexander Kramer Statistics-BS, NC State University
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Brian Eder Statistics, NC State University

The goal of this project was to develop a model to predict whether or not a user would return to a website based on their first use of the website. The data were 5 years of click-level user data from an educational instruction website. Data included information about different aspects of the first use of the website, how many times the user returned, and which web pages were accessed. Initial statistical models focused on predicting a Yes/No classification using a logistic statistical model (SAS Proc Logistic). For example, under one definition, users who returned the next day or any later day ever were defined as Returning Users = “Yes” and others as “No.” Initial models seemed better than they were. For this Returning User definition, one model predicted all of the users in one category and since that category included 55% of users, the model seemed correct 55% of the time. The model had sensitivity, but not specificity. Furthermore, because of the Yes/No definition, there was no way to separate users who would return only once from heavy future users. The target variable was re-defined as a linear variable – how often the user returned – and modeled with a linear model (Proc Glm). Using a combination of simple business rules and the linear model, we were able to predict whether a user would return with greater than 90% accuracy. This presentation describes the data definition and model building process, including what worked and what did not.

Session 2 - D11
Characterization and evaluation of hypersensitivity and anaphylactic reaction adverse events in a Phase III clinical study
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Most monoclonal antibodies produce a wide variety of adverse events. Both hypersensitivity and anaphylaxis are common adverse events in monoclonal antibody clinical trials. Reactions which are allergic in nature occur immediately after exposure and are mediated by immunoglobulin E (IgE); whereas, infusion reactions are not mediated by IgE. A data review was performed on Grade 3+ events of hypersensitivity and anaphylaxis reported during a Phase III clinical trial with ch14.18 in patients with high-risk neuroblastoma. These events were analyzed along with eosinophils, dosing times, and serious
adverse event reports to better characterize these events and evaluate if they were true allergic reactions or infusion reactions. 17 patients of 105 experienced Grade 3+ hypersensitivity or anaphylaxis. Seven patients discontinued study therapy early due to hypersensitivity or anaphylaxis. Prior to discontinuation, all experienced the same additional adverse events of severe bronchospasm and coughing when re-challenged with ch14.18. After reviewing the data, it appears that six of the seven patients had an allergic reaction suggestive of a true IgE mediated allergic reaction to ch14.18. Although both infusion reactions and allergic reactions can be severe, given the data available, infusion reactions appeared to be more prevalent than true IgE-mediated allergic reactions in this study. Ideally, future research would include more specific laboratory testing to support clinical judgement of a true allergic reaction via immunologic mechanism.

Session 2 - C1
Domoic Acid Production throughout Pseudo-nitzschia australis Growth Phases
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*Pseudo-nitzschia* is a ubiquitous diatom known to produce the neurotoxin Domoic Acid (DA). The phytoplankton genus has been implicated in harmful algal blooms which are increasing in frequency and duration worldwide. In the past, these toxic blooms have resulted in the death of seabirds and mammals. Multiple incidences of human illnesses as a result of consuming shellfish contaminated with DA have been documented, and organizations responsible for seafood safety now regularly monitor concentrations of DA. A previous study suggests that DA not only affects organisms feeding in the upper water column, but that DA is also rapidly transported to depth by sinking aggregates. The absence of light and lower temperatures at these depths slows degradation of the toxin providing a source of DA to benthic organisms. Herein, we describe a microcosm experiment that simulated this process. DA production started in late exponential phase and reached a maximum concentration of 7.7 pg DA·cell⁻¹ in late stationary phase. Dissolved DA concentrations began to rise after intracellular DA was detected and continued throughout the experiment. Physiological and chemical analyses from this experiment will allow us to further understand fluctuations associated with the release and downward transport of DA.

Session 2 - C15
Preventing Schizophrenia on an Individual Basis: Exploring genetic and environmental causations of Schizophrenia to develop preventative treatments through deep brain stimulation
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Schizophrenia is a psychological disorder that is characterized by a disjointed view of reality accompanied by hallucinations, disorganized thinking, and delusions. Development of schizophrenia is caused by a poorly understood combination of environmental and genetic factors, making determination of an individual’s susceptibility difficult. There is a strong heritable component to developing schizophrenia, and several genetic markers have been identified. However, no specific genes have been directly linked to its development. In addition, the range of environmental factors correlated with a schizophrenia diagnosis is broad and include: maternal illness during pregnancy, childhood trauma, substance abuse, and many others. The polygenic nature of the disease combined with myriad environmental influences makes it difficult to develop a single cure or identify those predisposed. Although many treatments, such as drugs controlling dopamine levels, can reduce symptoms after they arise, there are currently no treatments to prevent
symptoms from developing at the earliest stages. To successfully develop preventative treatments for schizophrenia, a multifaceted approach that considers both genetic risk and environmental factors is needed. As the ability to provide an early diagnosis of schizophrenia improves via genetic screening and environmental risk factor evaluation, treatments to prevent the onset of symptoms should be developed. DBS is an experimental treatment that aims to reduce hallucinations and delusions by normalizing aberrant hippocampal activity via direct electrostimulation of the hippocampus. We propose DBS treatment as a possible early treatment of schizophrenia in at-risk individuals manifesting few or no symptoms but with a high probability of schizophrenia diagnosis in the near future.

Session 2 - A12
Vibrational Properties of Granular Packings
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Simulations of disordered solids show an increase in the density of low frequency vibrational modes as a function of decreasing packing density. These excess modes are associated with loss of rigidity. Recent experiments have confirmed this result for an athermal granular system using particle-scale piezoelectric vibration sensors and fourier methods. We investigate how to extend the technique to additional materials. We perform experiments comparing the density of modes for particles of different stiffness, using bidisperse polymer disks of two different stiffnesses. We report on changes in the density of modes resulting from both material stiffness and confining pressure.

Session 2 - C6
NO and Nitrite with Dehaloperoxidase-Hemoglobin A from Amphitrite ornata: Binding or Reaction?
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Kinetic assays were conducted by UV-visible spectroscopy to study the characteristics of the binding between nitric oxide (NO) and dehaloperoxidase hemoglobin (DHP-A) from Amphitrite ornata. Sodium dithionite (Na2S2O4) was utilized to reduce the heme in DHP-A from ferric form (Fe3+) to ferrous form (Fe2+), as well as to reduce sodium nitrite (NaNO3) to NO for the study of NO binding with deoxyferrous heme. After adding in the inhibitor, 4-bromophenol (4-BP), to study the mechanism of competitive binding between NO and inhibitor, the resulting UV spectra showed similar patterns as the UV spectra for nitrite (NO3−) binding with deoxyferrous heme. Therefore, we hypothesized that DHP-A might have the ability to reduce NO3− to NO as observed in many heme proteins. Samples of DHP-A mixing with NO3−, and DHP-A mixing with Na2S2O4 and NaNO3 as control group were then tested by resonance Raman spectroscopy and Attenuated Total Reflectance Fourier-transform infrared (ATR-FTIR) spectroscopy to monitor changes. The UV-vis absorption spectrum of this species had a maximum absorbance at 419 nm for the Soret band. No significant changes were observed by either technique for the entire duration of the experiments. However, after running the DHP-A / NO3− mixture down the ion exchange column, the Soret band shifted back to 406 nm from 419 nm. This result indicated that DHP-A returned to the original ferric form. This result was the key reason to reject the hypothesis that NO3− was reduced to NO because it indicated a reversible binding of NO3−. Results from other groups showed that dithionite (S2O42−) did not efficiently reduce NO3− to NO in the absence of a heme protein suggesting that NO3− could be present under all experimental conditions tested by our methods. In order to test this new finding, mixture of DHP-A / Na2S2O4 / NaNO3 was run down through the ion exchange column as well, and the corresponding soret band was shifting from 419 nm to 432 nm, which also indicated a reversible binding between the substrate
and deoxyferric DHP-A. This result supported that there was no NO generation from the reaction between Na$_2$S$_2$O$_4$ and NaNO$_3$ in the presence of DHP-A. We concluded that DHP-A might not have the ability to reduce NO$_3^-$ to NO with or without the presence of dithionite. This surprising result may be another indication of the unique reactivity of DHP-A.

Session 1 - B25
Element Creation Through the Neutrino-p Process in Supernovae

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An understanding of the creation of elements heavier than Fe has remained an open question in Astrophysics. The r-process is thought to create the heavier elements beyond Fe, and simulated r-process match well with observed abundances. However, there remains a discrepancy in abundances in elements such as Sr, Y, and Zr. This discrepancy is hypothesized to be a result of a possible Lighter Element Primary Process (LEPP) (Travaglio et el). The neutrino-p process provides a candidate for the LEPP, and better predicts the abundances of heavier elements through simulation. Following core collapse and explosion of a massive star, the newly formed proto-neutron star powers a neutrino-driven wind. As this neutrino wind drives ejecta outward, a very proton rich environment is created for further nucleosynthesis of Sr, Y, and Zr. The goal of this project is to investigate the neutrino-p process nucleosynthesis resulting from varied conditions in the neutrino wind of core-collapse supernovae.

Session 2 - A11
The Impact of Gender on the Human-Animal Relationship

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We will test how gender influences a person’s choice of discipline in animal-related studies. We will do this by using two points of view on the human-animal relationship, Darwinian and Romanticism. A Darwinian view focuses on logic and rationale while the Romantic view focuses on emotion. We predict that men will fall under the Darwinian view and women will fall under Romantic view. Previous studies have shown that men are more likely to have a Darwinian point of view and women are more likely to have a romantic point of view. Using these predictions as a baseline, we will survey a sample population of graduate students to test their point of view. We will have two groups that we have defined either Darwinian or Romantic fields of study. Within these two groups, there will be subgroups of typical students and atypical students. For the Darwinian fields of study, atypical students would be females, and the atypical students in the Romantic fields of study would be males. The subgroups will help determine whether field of study or gender has a larger impact on perspective. The graduate students will be provided a Likert scale survey consisting of 26 randomized questions that focus on the following categories: animal rights, animal research, environmental factors, Darwinism, and Romanticism. The environmental questions will help us test whether these factors contribute to a person’s attitude towards animals.

Session 1 - B20
Signaling Pathways and Gene Expression in Disease and Applications of Therapeutic Alginate

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Causes of disease in humans have been linked to cell signaling pathways and gene expression. Lung cancer and Ankylosing Spondylitis (AS) are two examples of diseases that have been linked to these factors. Disruptions in cell signaling have been shown to cause tumorigenesis, specifically in the case of lung cancer. Discoveries have shown the importance of tyrosine kinases in identifying lung cancer, namely epidermal growth factor receptor (EGFR). The mutations in these tyrosine kinases that drive the development of cancer have the potential to act as future therapeutic targets. The expression of the Human Leukocyte Antigen (HLA) B27, Tumor Necrosis Factor (TNF) gene is known to be the cause of the autoimmune disorder AS. Mutations in the Endoplasmic Reticulum Aminopeptidase 1 (ERAP1) gene, which codes for the ERAP1 enzyme involved in the recognition of antigens in humans, also plays a significant role. The most effective treatment that helps lower the progression of AS is etanercept, a drug that inhibits the action of TNF-gene in conferring immunity, is also accompanied by adverse side-effects from immunosuppression. Utilizing biomolecules could provide improvements to current treatments of diseases. Alginate is a biomolecule that has been shown to be extremely versatile in its medical applications due to its resemblance to an extracellular matrix. This multipurpose polymer is currently being applied to medical treatments such as drug delivery, tissue regeneration, and wound healing. With further research, it is possible for alginate to be incorporated into current treatments of lung cancer and AS to improve patient prognosis.

Session 1 - B22
Determining Effects of Leflunomide on Early Neurodevelopment using In Situ Hybridization
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Parkinson’s disease (PD) is the 14th leading cause of death in the United States (US). Exposure to exogenous factors, such as pesticides and drugs, has been implicated in PD etiology. Zebrafish are becoming an increasingly important model system for toxicological and drug discovery studies. Leflunomide is a disease-modifying antirheumatic drug that is widely prescribed to treat rheumatoid arthritis. When exposed to leflunomide, zebrafish embryos were shown to lack melanin. Melanin is derived from tyrosine in a pathway common to both melanin and dopamine. Therefore, we hypothesized that leflunomide may also perturb dopamine biosynthesis and associated behaviors. In order to test this hypothesis, we exposed zebrafish embryos to leflunomide (250 nM – 2.5 uM) and showed that exposed larvae (four days post-fertilization) exhibited reduced movement in response to visual stimuli as compared to controls. Previous quantitative PCR showed that leflunomide reduced transcription of tyrosine hydroxylase, which is responsible for the rate-limiting step in dopamine synthesis. Whole mount in situ hybridization was used to determine the spatial and temporal effects of leflunomide, using a tyrosine hydroxylase (th) RNA probe. Fixed embryos at 48, 72 and 96 hours post-fertilization that were exposed to control (DMSO) or exposed (250 nM or 500 nM leflunomide) conditions were used. Leflunomide-exposed embryos exhibited altered expression patterns of th in the developing brain. Future research will consist of developing additional probes to interrogate other members of the dopamine synthesis and signaling pathways to determine whether there is a potential link between PD and leflunomide.

Session 1 - B5
Soil Temperature Estimation Across North Carolina
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Soil temperature is important to North Carolina residents for many reasons. Understanding when black ice will form is vital to driver safety. Soil temperature is also directly related to the agricultural industry in terms of planting, maturation, and harvesting of crops; improper data in this regard can devastate the local economy. There are numerous weather stations throughout North Carolina, but few of these weather stations have soil monitoring equipment. Our client, the NC State Climate Office, has asked us to develop a model to predict soil temperature at these sites using the data that they do have available. Data will be collected from seven weather stations representing a variety of geographic locations and soil types. A multivariate linear regression model for each location, as well as a general model for all seven sites combined, will be created using air temperature, humidity, wind speed, solar radiation, and precipitation. The prediction models will be tested against data from additional stations to determine the best model for any given site.

Session 2 - C19  
**Reduced Reaction Approximation Nucleosynthesis: A Case Study**  
Aaron Lucas Mahler *Physics-BS*, NC State University  
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The relative abundance of the elements observed in the universe can give insight into their origin. One of the most robust abundance patterns found is that from barium to lead, which is also known to be a characteristic pattern of the r-process. Due to the fact that the r-process traces through the neutron-rich side of stability where many isotopes reside, it requires a large network of nuclei to be tracked. Since this is computationally expensive, it has traditionally been accomplished with a reduced reaction approximation that only includes the dominant reactions to make it computationally feasible. However, it has now become possible to solve a full, unreduced network with new computation techniques along with faster processors. We investigate the traditional r-process regime conditions and compare abundance patterns from a full network compared to a reduced network to characterize where it is accurate.

Session 1 - A3  
**Rheology of Cheese Mites**  
Michael Everett Mann *Physics-BS*, NC State University  
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Karen Daniels *Physics*, NC State University

Granular materials, such as sand or flour, are large collections of discrete particles. A property that characterizes these materials is that they act as a solid when at rest, but tilting or agitating them can lead to flow like a liquid or a dense gas. Research into the transition between the liquid and gaseous regimes has applications in geophysical processes such as avalanches or debris flows. Here, we examine how the presence of active particles (mites) can change the spreading rate of a pile of granular material (flour). The mites are small arthropods, similar in size to flour particles that live and feed in flour, cheese, and other agricultural products. They rearrange the grains, thus internally driving the system similar to vibrations in a granular material or temperature in a gas. We measure how changing the fraction of mites in the system affects the spreading rate of the leading edge of the material in a quasi-2D dam-break geometry. We find that there is a critical activation fraction, at about 0.06, where the pile begins to spread out due to the presence of the mites. We also find that the position of the leading edge is dependent on the fraction of...
mites as a power law spreading rate with an exponent of approximately 0.6.

Session 2 - B13
Environmental Influences on Chronic Respiratory Diseases
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Respiratory disease is the fourth leading cause of death worldwide, and is projected to rank third among all causes of death by the year 2020. Asthma, chronic bronchitis, and emphysema are three of the respiratory diseases that are becoming more prevalent worldwide. Respiratory diseases are correlated to environmental stressors that have been linked to epigenetic modifications, therefore, affecting gene expression. It has been shown that environmental factors may not only affect the organism initially exposed to the environmental factor but also the organism’s offspring and their germ cell line. Multiple surveys, questionnaires, and spirometry and plethysmography diagnoses were collected and analyzed from various populations. The studies we reviewed found that risk factors associated with gender and the environment; such as tobacco smoke, occupational exposure to toxins, air pollution, and indoor allergens, had a direct relationship to the increasing prevalence of respiratory disease. Findings also showed that with the presence of the alpha 7 nicotinic acetylation receptors, nicotine affects pulmonary resistance and dynamic lung compliance. These effects can be traced through PPAR gamma and fibronectin proteins. Contrary to popular belief, respiratory disease is linked to numerous risk factors in addition to cigarette smoking. Reduction of indoor pollution, enforcement of pollution limitations on larger areas, and minimization of school size are some preventative techniques that have been developed in order to address the issue of increasing mortality associated with these diseases.

Session 1 - A5
Quantifying the Impact of El Nino/La Nina on North Carolina's Climate
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The El Nino Southern Oscillation (ENSO) is characterized by unusually warm ocean temperatures in the eastern tropical Pacific Ocean, causing changes in the distribution of tropical rainfall from the Eastern Indian Ocean to the tropical Atlantic, which affects wind patterns over much of the globe. On a local level, a strong El Nino causes more storms and winter precipitation while also causing a decrease in summer precipitation in North Carolina. A strong La Nina event causes the opposite phenomenon to occur. Using data provided by the North Carolina State Climate office, we were charged with examining if there has been a change in the relationship between the Oceanic Nino Index (ONI), which quantifies how strong or weak ENSO is over a three month period, and precipitation and temperature values. This will be determined using the ONI and standardized temperatures and precipitations, which show how far values are above or below the 65 year average for the season, for the three regions of North Carolina, Coastal Plains, Piedmont, and Mountains. Changes in the relationship will achieved using regression models and 3-dimensional plots for each season in the different regions, and tracking shifts in the data trends over time.
Investigating the role of a conserved amino acid substitution found in the ligand binding domain of estrogen receptor beta-a (ER beta-a Phe396) in the differential binding of 4-hydroxytamoxifen to estrogen receptor subtypes.

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Estrogens mediate their effects by binding to estrogen receptors (ERs) in target cells and regulating gene transcription. Drugs called Selective Estrogen Receptor Modulators (SERMs) can specifically activate or inactivate ERs in a tissue or subtype-specific manner, making them effective tools against estrogen-related diseases like breast cancer. However, much is still unknown about the differential actions of SERMs. For example, TOH acts as an ER antagonist in the breast to block cell proliferation, but is an agonist in the uterus, leading to an increased risk of endometrial cancer. The differential actions of TOH are mediated through two ER subtypes, ERa and ERb with different binding affinities and transactivation properties for estrogens and SERMs. A third ER in teleost fish, acERBa, also exhibits distinct binding characteristics along with notable amino acid substitutions at key positions of the ligand-binding domain (LBD) when compared to ERa, ERb, and acERBb subtypes. We previously reported that TOH binds acERa and acERBb with a higher affinity compared to acERBa. To investigate the role of acERBa substitutions on the differential binding of TOH, we mutated the acERBa-Phe396 substitution to acERBb-Ile, and performed competitive binding assays using a bacterially-expressed acERBa(F396-I) fusion protein. The binding affinity for TOH was higher for the mutant compared to wild type acERBa. This supports our hypothesis that amino acid position acERBa(Phe396) of the ER LBD plays a critical role in the differential binding of TOH to ER subtypes.

Quantifying the activity of Dehaloperoxidase B using a colorimetric assay

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DHP B or Dehaloperoxidase B Protein is a dehalogenating peroxidase with a hemoglobin structure. DHP appears to be a dimer in the crystalline form, but is mostly monomeric in solution. The DHP B protein was tested using a kinetic assay with ABTS (2,2'-Azinobis [3-ethylbenzothiazoline-6-sulfonic acid]-diammonium salts) as the substrate and H2O2 as the co-substrate. The kinetic assays were measured using 2.4 uM of DHP B, 200 uM H2O2, and increments of 100 uM of ABTS starting at 100 uM to 2000 uM. In the Kinetic assay we monitored the reaction by observing the absorption band of the product. The order in which the solutions were added to the buffer is important for the Kinetic assay as the protein and H2O2 needed to be added first and the ABTS added last. Once the ABTS is added, a reaction occurred between the enzyme and substrate that changed ABTS into its product form which has a absorption of 414nm. ABTS is used as a substrate because it is a standard peroxidase substrate used in many experiments. Multiple assays were done in order to create a data spectrum by UV-vis with sufficient accuracy for Michaelis Menten analysis. After graphing the Michaelis Menten data, analysis and comparison against prior ABTS- peroxidase experiments were performed. The data showed that DHP B’s affinity for ABTS was higher than other hemoglobin proteins, such as Horseradish Peroxidase.

Using Rock Eval pyrolysis as a proxy to identify and characterize native versus anthropogenic sediments

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When European settlers arrived in the Piedmont region of North Carolina they began an extensive period of forest clearing and land conversion for agricultural purposes. Extensive forest clearing led to high rates of soil erosion due to the high clay-content and poor infiltration capacity of the soils. In the 1700’s settlers in the Wake County area began building mill dams along local streams. Thick accumulations of sediment, eroded from the uplands, were deposited in the pond accommodation space created by the mill dams. These deposits are known as legacy sediments. The purpose of this study is to use a relatively new technique, Rock Eval pyrolysis, as a proxy method for identifying the type and maturity of organic matter found in pre and post-settlement sediments. Stream bank sediment along Reedy Creek (William B. Umstead State Park) that expose layers associated with “Betty’s” mill pond (c. AD 1800) were collected and investigated. Previous studies differentiated Pre-European and post settlement legacy sediments based upon radiocarbon dating and magnetic susceptibility signatures at the Betty’s mill pond site. Samples were collected from this location and prepared in the lab by centrifuging them down to particle sizes smaller than to be sent to GeoMark Research for pyrolysis. Data returned from GeoMark was then analyzed for identifiable differences in valley bottom sediments of different age and anthropogenic provenance. Research is ongoing and results the effectiveness of Rock Eval pyrolysis as a proxy for identification of pre – and – post European settlement sediments along regional stream banks will be presented at the Spring Undergraduate Research Symposium.

Session 2 - A3
Changes in Understanding of Mutation, Camouflage and Natural Selection with Participation in Game Activity
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People have many misconceptions relating to evolution and natural selection. About a third of the general adult population rejects evolution. Even with traditional instruction, it can be difficult to overcome the mental and emotional barriers. Educational games may help overcome these barriers and encourage active learning about evolution and natural selection. We hypothesized that the educational game would be effective in improving understanding of mutation and natural selection. We created a game, the Coloration Mutation Station, which combined the randomness of mutations, change of the amino acid sequence, final phenotype represented in the population, and consequences of climate change on a population of butterflies. Each aspect of the station was designed to make the participant think about mutations, amino acid changes, and environmental constraints in the context of a butterfly population. Our data indicate no statistical difference between those who did or did not play the game. However, in a question-by-question analysis, the group that did play the game showed a positive shift in understanding mutation as a direct cause of variation in butterflies. Those who played the game may only be able to apply direct subject matter rather than apply the information in another context. Difficulties in the testing protocol are addressed for future research.

Session 1 - D16
Engineering the substrate specificity of enzymes involved in secondary metabolite biosynthesis: a route to new small molecule therapeutics
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Polyketides are a class of natural products with high therapeutic value as anticancer, antifungal, antiviral, antibacterial and immunosuppressant drugs. These complex molecules are biosynthesized by the selection and condensation of small molecule building blocks via the action of mega-enzyme assembly lines called polyketide synthases (PKSs). Due to the dense structural and stereo complexity of polyketides, traditional chemical routes to produce new analogs have been limited, and biosynthetic approaches to diversifying polyketides are highly sought after. Yet, the acyltransferase (AT) domains of PKSs, known as the “gate-keeper” domains, display strict control over the identity of building blocks installed into polyketides. We aim to engineer these domains to allow for new chemical functionality to be inserted into polyketides. Herein, we describe our efforts to engineer ATs to alter substrate specificity. Mutant ATs will allow for the diversification of polyketides and the potential to discover new therapeutics.

Session 2 - A13
Effective Strategies for Mammalian Conservation in Africa, Asia, and Europe
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Nearly one-quarter of the world’s mammalian species are currently threatened or extinct. In this study, effective strategies for mammalian conservation were examined on several continents. In Africa, isolated elephant populations are decreasing because of the close proximity to human settlements. These human-elephant interactions have caused habitat fragmentation and limited genetic diversity in elephants. In Asia, the tiger population has declined due to an interaction of factors, including a decrease in prey. In Europe, invasive species such as the American mink and grey squirrel have caused the decline of the native European mink and red squirrel, respectively. The reasons for this decline of native species include interspecific competition, disease transmission and hybridization. Elephants were collared, tracked, and observed to determine the dispersion of populations throughout proposed corridors. Tiger and prey abundance surveys were conducted to see if there was a correlation between the two. Prey recovery after the cessation of poaching was studied as well. Species surveys and computer modeling techniques were used to determine the effects that invasive species have on native species. The results indicate that by reducing habitat fragmentation in Africa through the use of habitat corridors, reducing the effects of poaching on prey species in Asia, and early prevention in addition to the removal of invasive species in Europe, will positively affect population numbers. These findings should be used to develop better management strategies for mammals. In today’s changing world, it has become paramount to focus on the conservation of mammals before their numbers decrease even further.

Session 2 - C2
A study of Richland Creek: How legacy sediments impact the Neuse River.
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Suspended sediments in surface waters are the most common nonpoint-source pollutant in streams and reservoirs within the United States (US Environmental Protection Agency 2012). The effect of legacy sediments on river systems is not a temporary problem, but rather one that will continue for decades-to-centuries. A better understanding of this local nonpoint-source contribution of turbidity to the Neuse River
will help in understanding how the Neuse River basin is affected by all the legacy sediments stored in its tributaries. In this study, historical records of the Richland Creek area were used to determine possible sources of legacy sediment. Stratigraphic profiles of the stream banks were analyzed in order to better understand the composition of Richland Creek legacy sediments. Stream bank samples were collected for geochronologic analysis and compared to geochronologic data from a preliminary study conducted during the summer of 2014. Coring through the legacy sediments was completed in six locations along the Richland Creek floodplain in order to determine the depth to the buried pre-European floodplain surface. Using GIS, the amount of legacy sediment already exported out of the Richland Creek valley bottom as well as the legacy sediments still remaining were estimated. The geochronologic data collected correlates with data collected from the summer of 2014. Estimates of the total amount of legacy sediment removed and remaining are currently still being processed. These estimates will help with estimating how long this local nonpoint-source contribution of turbidity will continue to affect the Neuse River.

Session 2 - D2
Teratogenicity of Zinc dimethyldithiocarbamate on Japanese medaka skeletal development
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Dithiocarbamates (DTCs) are an important class of pesticides used as agricultural fungicides. One of the most extensively used DTCs is Zinc dimethyldithiocarbamate, or Ziram, which is demonstrated to have significant teratogenic effects. In this study, Ziram was assessed for its potential to cause adverse skeletal maladies following embryonic exposure in Japanese medaka (Oryzias latipes), a small teleost fish model of human skeletal development. Orange-red hd-dR (wildtype) embryos were exposed to Ziram (0.01-10 µM) between 10 or 20 dpf, corresponding to key developmental stages. Individuals were assessed for systemic toxicity and adverse gross skeletal morphologies and bone and cartilage matrix were assessed by whole-mount Alizarin red or Alcian blue staining respectively. Lethal Concentration 50 (3.61) as well as a half-maximal effective concentration 50 (EC50) for abnormal skeletal morphology, including notochordal kinking, lordosis, kyphosis, and scoliosis was established. Staining of Ziram-treated medaka demonstrates an overall attenuation rostro-caudal mineralization of the axial vertebrae. To assess whether these compounds impact differentiation of bone-forming osteoblasts, exposed osx:mCherry transgenic embryos were imaged under confocal microscopy to qualitatively assess number and localization of mCherry+ osteoblast populations. Ziram-treated animals display reduced mCherry+ osteoblasts and overall reduction in mineralized vertebrae. Current work will further describe these effects at the transcriptional level, by assessing whether Ziram impacts expression of key gene regulators and markers of bone, cartilage, and neuromuscular development. Overall, the initial results suggest that dithiocarbamates may have a significant impact on skeletal development, which may be a secondary effect to a neuromuscular mode of action of the toxicant.

Session 2 - D20
Initial Steps Toward Antimicrobial Photodynamic Textiles
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According to the CDC, 5-10% of all patients admitted into a hospital will acquire a new infection from exposure to local pathogens, resulting in approximately 1.7 million healthcare-associated infections in the United States each year. Such infections are the sixth leading cause of death in America, as well as a $30-45 billion burden on the healthcare system. In order to reduce the rates of such infections, we have envisioned employing textile products with antimicrobial properties to prevent pathogens from transmitting to immunocompromised patients in hospitals and in other high-risk environments. We have focused on
antimicrobial photodynamic inactivation (aPDI), which employs a non-toxic photosensitizer, visible light, and molecular oxygen to inactivate microbial pathogens. Upon illumination, the photosensitizer generates singlet oxygen (1O2), a highly reactive species that has been shown to cause non-specific cell damage. In addition, singlet oxygen rapidly decays back to its triplet ground state if unreacted, so it is environmentally benign. Our strategy is to first test a textile coated in a photosensitizer dye, and if successful prepare a covalently modified textile product. With this in mind, we have synthesized a porphyrin-based photosensitizer, zinc(II) 5,10,15,20-tetrakis(N-methylpyridinium-4-yl)porphyrin, and characterized it by NMR and UV-vis spectroscopies, and electrospray ionization mass spectrometry. We tested the photosensitizer’s antimicrobial properties against two model species of bacteria: a Gram-positive strain of Staphylococcus aureus and a Gram-negative strain of Escherichia coli, and demonstrated its ability to inactivate both strains under reasonable illumination conditions (400-700 nm, 30 min). In the future, we will continue to explore the antimicrobial activity of this photosensitizer against other strains while preparing our antimicrobial photodynamic textile.

Session 1 - B3
Selective isolation and culture of Lactobacilli bacteria from fermented foods with the potential for bacteriocin production
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Mentors and/or Co-Authors:
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The Centers for Disease and Control estimates approximately 2 million people acquire bacterial infections that are resistant to one or more antibiotics, and 23,000 die as a result of these infections. Concurrently, there has been a rapid decline in the discovery and development of new antibiotics in the last 40 years. As a result, there is a critical need for the production of new antimicrobials. One group of antimicrobial compounds are bacteriocins, which are small, peptide products from bacteria. Bacteriocins exhibit valuable properties as an antimicrobial: they exhibit low toxicity, high potency, activity against antibiotic-resistant strains, and are amenable to gene-based peptide engineering. Many bacteriocins are produced by lactic acid bacteria (LAB) and hold great promise as viable alternatives to antibiotics. The aim of this study is to isolate and identify bacteriocin producing LAB from fermented food products. Media variations of deMan, Rogosa and Sharpe (MRS) were used to isolate Lactobacilli species. Isolates were screened for antimicrobial production by culturing against safe relatives of ESKAPE pathogens and observing for zones of inhibition. Identification via 16S rRNA analysis was performed on 4 isolates that demonstrated activity against various indicator strains. Next steps will be to determine the bacteriocins by testing culture supernatants against selected indicator strains, antibiotics (vancomycin), and proteases. The potential identification of a novel bacteriocin from isolated LAB strains would serve as a promising candidate for further characterization, with potential applications in the field of medicine and could contribute to the control of the emergence of antibiotic resistance.

Session 1 - A26
Noise and Air Pollution Effects on Marine Life
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Noise and air pollution are not commonly thought to be associated with significant impacts on aquatic environments; however, they both have direct and indirect effects on aquatic life. For example, noise from industrial and tourist vessels has been shown to discourage bottlenose dolphins from inhabiting areas with high nautical traffic, resulting in ecological changes due their absence. Natural noise is an important
component of the behavior of coral larvae, which give rise to the coral reefs in which many marine species
dwell. Foreign noise has been shown to interfere with the settlement of these coral larvae, potentially
 displacing many other dependent species. There has also been a substantial amount of research done on the
effects of air pollution on aquatic ecosystems. Particulate matter is a broad category of air pollution that
includes a variety of dusts and metal particles. Although these particles cannot directly affect aquatic life,
they can still impact the water quality in which organisms live through processes such as wet deposition
and acid rain. As a result, dangerous fluctuations in pH and nutrients such as nitrogen and phosphorous can
occur in aquatic ecosystems. For example, in Nanjing, China, increases of atmospheric nitrogen caused a
dramatic increase in the rate of deposition of inorganic nitrogen (0.5 kg per year) in water sources.
Inorganic nitrogen pollution can lead to increased acidity in water and in severe cases, hypoxia
(unsustainably low oxygen levels).

Session 1 - D20
Responses to Environmental Stimuli: Companion Animals, Invertebrate Sensory Responses, and
Non-Human Primate Behaviors
Indya Jade Thompson Environmental Sciences-BS, NC State University
Kristen Wade, NC State University;
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To examine factors associated with sensory stimuli and behavior, we focused on companion animals,
invertebrate sensory responses, and non-human primate behaviors. We examined studies on how service
dogs respond to commands and learned social cues. Sensory factors, such as voice tone and body language
help a dog decide how to act in a given situation, for example, with an autistic child. Observational data on
dogs’ reactions to cues was categorized by type of behavioral response. Results showed that the dogs were
able to learn and distinguish children’s reactions, and move to help or protect the child. While a very
different organism, the box jellyfish have remarkable movement capabilities that rely on visual cues. They
also rely on physical features such as the velarium to interact with their environment and perform prey-
finding and avoidance behaviors. Jellies were collected, placed in different experimental tanks, and
exposed to different stimuli such as obstacles or light intensities to test reactions. Results showed that the
jellies avoid dark stimuli and are likely colorblind. Studies of non-human primates looked at hand
dominance in relation to tool usage and language processing. In one study, hand preference tests were
performed and parietal lobe structure was examined. The conclusion was that non-human primates show
dominance for left-handedness, allowing for better usage of tools. Another study involving the size of
temporal lobe structure found that larger temporal lobes, as present in higher order non-human primates,
presents the potential for greater language processing abilities.

Session 1 - C9
Effects of A251 on Tight Junction Integrity and Cytokine Production in Epithelial Cells
Sarah Haoleen Tong Poultry Science-BS, NC State University
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Alkylamides are a fatty acid derived compound commonly found in a variety of plants, including the genus
Echinacea. Previous studies have determined that alkylamides possess anti-inflammatory properties. Thus,
they have potential as a treatment for gastrointestinal inflammatory illnesses like IBS, irritable bowel
syndrome. This study aimed to address the anti-inflammatory effects of alkylamide 251, dodeca-2E-4E-
dienoic acid on epithelial cell tight junctions, and on the secretion of chemokine interleukin-8. Tight
junctions form between cells as a barrier to outside enviornments, such as the intralumen of the intestine;
occludin is a plasma membrane protein that is an important component of tight junctions. HT-29 and Caco-2 cell lines were used to model the epithelial cells; LPS, lipopolysaccharide, was used to stimulate the cells. Anti-occludin antibodies were used to label the tight junctions, and were examined with immunofluorescence imaging for changes in epithelial wall integrity. Supernatants of the cells were collected and the interleukin-8 concentration was quantified by enzyme-linked immunosorbent assay.

Session 1 - A18
Gut Morphology of African Cichlids across Trophic Levels
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African cichlids are a highly relevant model of genetic evolution due to their recent adaptive radiation, but almost nothing is known of their basic gut morphology. In this study three representative species from different trophic levels were examined histologically: Aulonocara baenschi (Auba, carnivore), Metriaclima pyrsonotus (Mepy, omnivore), and Labeotropheus trewavasae (Latr, herbivore). The objective is to identify differences along the length of the gut within species, as well as any differences in morphology between species. To allow morphological analysis, individual fish from the lab’s breeding pool were dissected and the gut tissue was divided into eight sections before hematoxylin and eosin staining. Five main characteristics were measured in each section from each individual: villi number, villi length, cross-sectional area, smooth muscle thickness, and epithelium thickness. Bivariate analysis was utilized to compare these characteristics and revealed that the villi length correlated significantly with the number of villi, cross-sectional area, and epithelial thickness, and that the relationship between the villi number and gut thickness was also significant. These correlations were different in each species and should allow for the distinguishing of the different species. Additionally, the distinctions between different regions of the gut were investigated in each species, but definitive locations for the transitions were not found. From this study it is hoped that the methods created and the basic morphology documented can be used in the future to concretely determine the regions of the gut in these species and allow genetic or microbiome gut studies in African cichlids.

Session 1 - B26
The Effects of Companion Animals on the Mental Health of Undergraduates
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The validity of the idea that companion animals confer health benefits to their owners, or other individuals, is not definitive. However, research suggests that interaction with companion animals—particularly canines—can provide numerous physical and psychological benefits. This has been coined the “pet effect.” An individual’s perception of a situation has been shown to influence the stress response, and that individual’s interpretation of a scenario can be manipulated by the presence of an animal. Two hypothesized mechanisms for these benefits are the biophilia hypothesis and the social support hypothesis. The first hypothesis proposes that humans accrue mental benefits due to their innate ability to focus attention on an animal, and away from stressors. The latter suggests that a lack of social support is a large proponent of mental and physical health problems. Owning or interacting with a pet can ameliorate this by pets functioning as social support themselves as well as fostering human-human interactions. Many universities, such as the University of Connecticut, UNC-Chapel Hill, and NCSU, have offered events featuring companion animals during times of intense undergraduate stress, such as end-of-semester exams. Our research goal was to see if a random sample of undergraduates were positively influenced by being in close proximity to one or more companion animals when faced with an anxiety-producing stimulus.
Session 2 - B15

Index of Refraction Measurements of Aerosol Materials
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The absorption of light by aerosols in the atmosphere is important in a range of applications, from visibility calculations to climate change estimates. Aerosols are irregularly-shaped particles with varied composition and strong variations in index of refraction in the LWIR. Thus, determination of the index of refraction directly by standard methods is not possible. We measure dust indices using transmission through KBr pellets. Milling of the dust makes the scattering unimportant, so that extinction is dominated by absorption. Corrections for surface effects and that of the surrounding medium must be calculated. Surface effects are eliminated by using two sample thicknesses, and effective medium theory can correct for the dilution in KBr. Measurements show that the spectrum of a milled Arizona Road Dust (ARD) approaches that of pure quartz, indicating that the decrease of absorption efficiency for particles larger than the absorption length substantially affects the results. ARD is not a simple, single component system, however, so we describe an approach to separate the constituents, measure their indices, and put them back together using first principles calculations and SEM images as a guide to particle configuration.

Session 1 - A14

The Hydration of Zinc Chloride: A Dissolution Study
Michael Lawrence Williams Chemical Engineering-BS, NC State University
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The process of hydration is one of the most ubiquitous chemical reactions, and yet molecular level detail of the process is not well understood. In this study, the hydration of zinc chloride is probed using an environmentally controlled microbalance to determine the equilibrium sorption isotherms as a function of temperature and water partial pressure. Sorption isotherms have been measured for 4.6 Torr and 18.4 Torr of water vapor over a temperature range from just above the water vapor saturation temperature (0 °C and 21 °C, respectively) to 65 °C. There is evidence of particularly stable compositions with around 3 and 21 equivalents of water for the 4.6 Torr H₂O sorption, and about 21 and 120 equivalents of water for the 18.4 Torr H₂O sorption. This indicates that the hydration process proceeds through a sequence of compound formation of specific hydrates, likely corresponding to hydration shells around molecular ions rather than by classic dilution and ion dissociation concepts. Structural characterization of the 3 equivalent hydrate points toward an ionic liquid description of concentrated solutions. Building on our group’s previous discovery of the strong correlation between liquid and crystalline structures, a study was initiated to use temperature/time resolved synchrotron diffraction to understand the rate of hydrate crystallization. While complicated by inhibited nucleation, initial data on the kinetics of crystallization of [Zn(OH₂)₆][ZnCl₄] will be reported.

Session 2 - B4

Measurements of rat caudate-putamen, nucleus accumbens core, and nucleus accumbens shell volumes reveal region-specific lateralization but not sex differences
Jordan E Wong Biological Sciences-BS, NC State University
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Sex differences and hemispheric bias are widespread across vertebrate nervous systems. Such differences are sometimes reflected in the neural substrate via neuroanatomical differences in brain region volume. One brain region that displays sex and hemispheric differences in associated behaviors and pathologies is the striatum, including the caudate-putamen (dorsal striatum), nucleus accumbens core and shell. The extent to which these differences can be attributed to alterations in volume is unclear. We thus tested whether the volumes of the caudate-putamen, nucleus accumbens core, and nucleus accumbens shell differed by region, sex, and hemisphere in adult Sprague-Dawley rats. For a positive control for detecting sex differences in brain region volume, we measured the sexually dimorphic nucleus of the medial preoptic area (SDN-POA). As expected, SDN-POA volume was larger in males than in females. No sex differences were detected in the volumes of the caudate-putamen, nucleus accumbens core or shell. Nucleus accumbens core volume was larger in the right than left hemisphere across males and females. These findings complement previous reports of lateralized nucleus accumbens volume in humans, and are the first to suggest that this may be driven via hemispheric differences in nucleus accumbens core volume. In contrast, striatal sex differences seem to be mediated by factors other than striatal region volume. This conclusion is presented within the context of a detailed review of studies addressing sex differences and similarities in striatal neuroanatomy.

Additional Abstract:

Session 2 – C22
Study of the Female-specific Lethal System, FL3 #2, in Drosophila melanogaster
Samantha Potter Human Biology & Genetics
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Katherine Myers Genetics

Field trails of a genetically modified strain of the mosquito Aedes aegypti, a vector of dengue fever, are currently underway in Brazil and other countries. Larval offspring of the released mosquitoes die due to overexpression of tTA, a potent transcription factor. To investigate the potential for the development of genetic resistance, I have studied the Drosophila strain FL3 #2, which overexpresses tTA in females. I will test this construct in the Canton-Sb strain of Drosophila melanogaster when crossed to a subset of 205 highly inbred wild-type strains of the Drosophila Genetic Reference Panel (DGRP). The construct uses a tetracycline-controlled transactivator gene, tTA, which is sex-specific spliced, leading to high expression of tTA in females, causing them to die before becoming adults. The genome sequences for the 205 lines of the DGRP have been completed so a Genome Wide Association Study (GWAS) can be conducted to find the genetic variants that could be related to the resistance development to tTA overexpression. Female and male offspring will be counted for each DGRP cross to determine the offspring ratio. I found that there was a large amount of variation in the number of female offspring produced between the DGRP lines. This means that a GWAS could be beneficial to determine the genetic variants that are related to the resistance development to the FL3 #2 construct. This information will be useful to ultimately use construct as a population control technique in insects that carry disease.
College of Textiles

Session 1 - B29
Textile Transformer: Wireless Energy Transfer in Textiles
Victoria Jae Rind Textile Engineering-BS, NC State University
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One of the major limitations of wearable electronic textiles and handheld electronics (smart phones, iPods, google glasses) is the inability to recharge and supply power conveniently and quickly to these devices. One possible solution is to create a textile that can inductively generate power that is wirelessly transmitted to it. In the textile “transformer”, two conductive coils are present. The first coil acts as the power source and is attached to an AC power source. The second coil is integrated into a knit textile. Because knit textiles form helices of looped yarn, a conductive yarn can be knitted into a textile with other non-conducting yarns (such as cotton or polyester) in such a way to form conductive coils imitating that of a coil in a transformer. The knit textile is being tested by putting the power source coil’s induced magnetic field in parallel with the induced magnetic field of the knit coil, creating an inductance between the two coils. This inductance allows for a transfer of energy from one coil to another, and thus producing a current in the garment.

Session 1 - D15
Analysis of Wi-Fi Location Services Through Network Number and Type
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Wi-Fi based location services are still a very new technology. Additionally, they do not function in the same way as many other location based services in that ping response time cannot be easily used to determine a distance, and therefore triangulate the user, as the distances involved are very small and the instrumentation is typically not that accurate. Instead, Wi-Fi location uses a “fingerprint” in which network strengths are mapped, and then later called upon to determine location. However, in many areas where this service may be of use, a user is only in range of one or two access points. This limits the resolution of the location. This research serves as an analysis of the effect the number of access points has on the resolution of Wi-Fi location protocols, and the relation it has with other location services.

Session 1 - A7
Testing Gel Spun Fibers and the Effects of Lignin
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For this study gel spinning was used to spin polyvinyl alcohol (PVA) fibers and to compare those fibers and their mechanical properites to PVA gel spun fibers infused with lignin. Gel spinning is used to spin high performance fibers and it is a method of spinning filaments of manufactured fibers and does so by using a polymer that is not in true liquid state during extrusion. The polymer chains are not completely separated and are bound togethe at various points in liquid crystal forms. This process produces strong inter-chain forces in the resulting filaments, which can significantly increase the mechanical properties of the fibers. When the gel state polymers undergo drawing, the amorphous regions are converted into
crystalline regions and polymers become highly oriented which contributes to the superior mechanical properties of the gel spun fibers. For this research, lignin will be infused in the PVA gel spun fibers and the strength and modulus will be recorded so it can be observed how lignin affects the strength and modulus of the PVA gel spun fibers. Also the cross sections of the PVA gel spun fibers, including the ones infused with lignin, using a SEM (scanning electron microscope) to have an in-depth look on the fibers' cross sections. These properties will be compared between the pure PVA gel spun fibers and the PVA fibers infused with lignin.
Session 1 - D2
Do phytoceutical products used for maintaining udder health in dairy cows trigger positive reactions from milk antibiotic residue tests?
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Keena Mullen Animal Science, NC State University

Mastitis is the most economically detrimental disease for dairy farmers. Antibiotics can be used to treat mastitis in conventional herds but not in organic dairy herds. Alternative strategies for organic producers include use of phytoceuticals for treating mastitic cows. Because phytoceuticals have antibacterial properties, their ability to trigger positive readings by milk screening tests needs to be determined to ensure that milk meets regulatory standards for human consumption. The research objective was to determine if any of three marketed phytoceutical products would test positive using either of two antibiotic residue screening tests. The three phytoceutical products examined were Phyto-Mast®, Uddersol™, and Dr. Paul’s CEG Tincture. Each of the phytoceutical products were tested at eight concentrations (1.5% to 5% volume/volume in 0.5% increments) spiked into composite milk samples from ten healthy organic cows, and each concentration sample was tested using two antibiotic residue screening tests, Delvotest P and Charm SL Beta-Lactam Test, according to manufacturer’s protocol. Each concentration level was replicated three times on each milk antibiotic residue screening test. All concentrations of each phytoceutical product tested were negative using the Delvotest P. The Charm SL Beta-Lactam Test yielded positive results for one replicate of 1.5% vol/vol Phyto-Mast® and one replicate of 3% vol/vol Uddersol™, but overall, >95% of all tests were negative. We conclude that both the Delvotest P and the Charm SL Beta-Lactam Test would unlikely detect any of the three phytoceutical products in cow milk tested after treatment with the recommended dose.

Session 1 - D17
Dissemination patterns, antimicrobial resistance profiles, and genotypic characterization of Salmonella isolates in North Carolina and Iowa swine farms following land application of manure
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Mentors and/or Co-Authors:
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The goal of this study was to understand the dissemination of Salmonella following the land application of swine manure, which has potential important public health implications. Soil samples were collected from Iowa (IA; n=7) and North Carolina (NC; n=3) farms immediately before and following land application of swine manure (0, 7, 14, and 21 days after). In NC, swine manure is stored in lagoons whereas in IA the pit system is used. There were a total of 330 samples taken from NC (300 soil, 30 lagoon) and 770 samples taken from IA (700 soil, 70 lagoon). All samples were tested for Salmonella invasion gene A (invA) using PCR; those tested positive were serotyped, and further characterized for antibiotic resistance profile against a panel of 15 antimicrobial drugs using Sensititre (broth microdilution). Genotypic characterization to determine similarity in fingerprint patterns was done by pulse field gel electrophoresis (PFGE). Overall Salmonella prevalence was 12.27%. The prevalence of Salmonella in IA (2.73%) was significantly lower (p<0.001) than the prevalence of Salmonella in NC (34.55%). In IA, Salmonella prevalence was highest
immediately following application of swine manure and dropped over the 21 day sampling period. In NC, \textit{Salmonella} was most prevalent on day 7 following application, and declined over the rest of the 21 day sampling period. Serotyping distribution in the NC farms sampled was distinctly different than those from the IA. The most common serotypes in NC being Typhimurium (31.58%), Muenster (14.04%), and Altona (12.28%) and the most common serotypes in IA being Anatum (61.9%) and Litchfield (33.33%). The majority of the samples (87.5%) exhibited resistance to at least one antimicrobial, with 55.47% resistant to three or more classes of antimicrobials (multi-drug resistant). The most common resistance was against streptomycin (82.03%), sulfisoxazole (71.9%), and kanamycin (60.16%). These results show a disparity between \textit{Salmonella} profiles and distribution in NC and IA, suggesting that distinct manure storage techniques and spreading patterns in the two states has a potential impact on serotype distribution and drug resistance profiles in \textit{Salmonella}.

\textbf{Session 1 - A4}
\textbf{Viral Effects on the Interferon Autocrine Amplification Loop}
\textbf{Ethan James Fritch} \textit{Microbiology-BS}, NC State University

\textit{Mentors and/or Co-Authors:}
\textbf{Barbara Sherry} \textit{Department Molecular Biomedical Sciences, NC State University}
\textbf{Shannon Chiera} \textit{Dept Molecular Biomedical Science, NC State University}

Viruses are obligate intracellular pathogens that must infect cells in order to create new viral progeny, often leading to cell death. Cells can defend themselves however through innate immune effectors, such as interferon (IFN), which upregulate antivirals. The main purpose of IFN is to act as a messaging system from the initially infected cell to warn adjacent cells that there is virus present, referred to as the \textit{paracrine} response. However, IFN also binds to the initially infected cell to induce production of even more IFN, referred to as the \textit{autocrine} amplification loop.

Some viruses, such as reovirus strain T3D-T1LM1 (T), repress IFN signaling, while other viruses, such as reovirus strain P208S (P), do not. Viral repression of IFN signaling can subvert the \textit{paracrine} warning system. We hypothesized that viruses can inhibit \textit{autocrine} IFN signaling too, as a means to reduce induction of IFN in initially infected cells. To test this hypothesis we infected mouse embryo fibroblasts (MEFs) derived from wild type mice and mice lacking the IFN receptor, and used qRT-PCR to quantitate IFN. We predicted that P induction of IFN would be greater in wild type cells than in cells lacking the IFN receptor, while T induction of IFN would be equivalent in the two cell types. However we found that deletion of the IFN receptor had a similar impact on P and T virus induction of IFN. Thus, there was no evidence that viral repression of IFN signaling reduces the IFN autocrine amplification loop. Future experiments could test this hypothesis for other viruses.

\textbf{Session 1 - D10}
\textbf{Influence of TGF-beta 2 on MHC class I and II expression on equine bone marrow-derived mesenchymal stem cells}
\textbf{Elizabeth Ann Harris} \textit{Animal Science-BS}, NC State University
\textbf{Alix Berglund} \textit{Comparative Biomedical Sciences, NC State University}

\textit{Mentors and/or Co-Authors:}
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\textbf{Julie Long} \textit{Dept of Clinical Sciences, NC State University}

Use of autologous bone marrow derived mesenchymal stem cells (MSCs) is an effective form of regenerative therapy for the treatment of musculoskeletal injuries, but has an associated lag time and can be affected by patient age and health. Allogeneic MSCs would be a preferable alternative to provide an immediate, “off-the-shelf” source of quality MSCs. Due to Major Histocompatibility Complex (MHC)
class I and II expression, however, allogeneic MHC-mismatched MSCs are immunogenic, making it necessary to develop a method of reliably downregulating this expression. TGF-β2, a cytokine observed in immunoprivileged areas, has been shown to downregulate MHC molecules on other cell types in human studies as well as on equine MSCs in our preliminary studies. The purposes of this study were to (1) test the downregulatory effect of TGF-β2 on MHC expression on MSCs treated from time of initial culture, (2) confirm multipotency of treated cells, and (3) challenge the effects of TGF-β2 using the inflammatory cytokine IFN-γ. MSCs were isolated from bone marrow aspirates and cultured in media containing bFGF and 0, 1, 5, or 10 ng/mL of TGF-β2 in addition to a control media with no bFGF or TGF-β2. Passage 2 cells were grown to 80% confluency and analyzed via flow cytometry. Results revealed the 1 ng/mL concentration of TGF-β2 to be the most effective for downregulation of MHC molecules on MSCs and that this concentration did not alter MSC trilineage differentiation potentials. This concentration was used in the IFN-γ challenge experiments, the results of which are currently pending.

Session 1 - A17

Regulation of macrophages by luteal steroidogenic cells in the porcine corpus luteum

Mary M Jordan Animal Science-BS, NC State University

Mentors and/or Co-Authors:

John Gadsby Dept Molecular Biomedical Scie, NC State University

Macrophages have been shown to infiltrate the corpus luteum (CL) throughout the estrous cycle in several species, including pigs. Furthermore, luteal resident macrophages are believed to play critical roles in the development, function and regression of the corpus luteum (CL). However, little is known about how macrophages interact with, and may be regulated by, luteal steroidogenic cells (LC) within the CL. Based on preliminary studies showing that luteal-derived macrophages (MAC) were inhibited in the presence of LC, in this study experiments were designed to examine the hypothesis that LC exert inhibitory effects on MAC. MAC were isolated from CL collected at the mid (~d. 7-12) stage of the estrous cycle and were co-cultured for 24h, in the presence or absence of LC isolated from the same tissue. After culture, MAC were lysed, RNA extracted, and mRNA expression of cell surface markers (CD40 – M1; CD163 - M2; CD68 – M1 & M2) and cytokines, (M1 specific: IL-1b, IL-6, and TNF-a; M2 specific: IL-10 and TGF-b), was evaluated by qPCR using porcine-specific primers. Results indicated that cell-surface marker and cytokine mRNA expression by MAC co-cultured with LC was inhibited, compared to MAC cultured alone. In conclusion, these data support our hypothesis that LC inhibit macrophages within the CL, and although the exact identity of the inhibitory factor is unknown, related studies carried out in our laboratory, suggest that it is probably the major LC product, progesterone. Supported by USDA/NIFA Grant no. 2012-67015-19349 (JG), and NCSU Undergraduate Research Scholarships (MJ, NT, JA).

Session 2 - D11

Characterization and evaluation of hypersensitivity and anaphylactic reaction adverse events in a Phase III clinical study

Sarah Elizabeth Lackey Biochemistry-BS, NC State University

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Allison Lim Product Development, United Therapeutics Corporation

Most monoclonal antibodies produce a wide variety of adverse events. Both hypersensitivity and anaphylaxis are common adverse events in monoclonal antibody clinical trials. Reactions which are allergic in nature occur immediately after exposure and are mediated by immunoglobulin E (IgE); whereas, infusion reactions are not mediated by IgE. A data review was performed on Grade 3+ events of hypersensitivity and anaphylaxis reported during a Phase III clinical trial with ch14.18 in patients with high-risk neuroblastoma. These events were analyzed along with eosinophils, dosing times, and serious adverse event reports to better characterize these events and evaluate if they were true allergic reactions or infusion reactions. 17 patients of 105 experienced Grade 3+ hypersensitivity or anaphylaxis. Seven
patients discontinued study therapy early due to hypersensitivity or anaphylaxis. Prior to discontinuation, all experienced the same additional adverse events of severe bronchospasm and coughing when re-challenged with ch14.18. After reviewing the data, it appears that six of the seven patients had an allergic reaction suggestive of a true IgE mediated allergic reaction to ch14.18. Although both infusion reactions and allergic reactions can be severe, given the data available, infusion reactions appeared to be more prevalent than true IgE-mediated allergic reactions in this study. Ideally, future research would include more specific laboratory testing to support clinical judgement of a true allergic reaction via immunologic mechanism.

Session 1 - D30
Beef-based Fast-food Items as a Means to ‘Extend’ Commercial Dry Dog Food for Low-Income Households
Ashley Martin Animal Science-BS, NC State University
Mentors and/or Co-Authors:
Korinn Saker CVM-Molecular Biomedical Science, NC State University

Many households throughout North Carolina struggle to budget monthly expenses on a limited income. Financial assistance programs assist low income households with monthly food costs. However, they do not cover pet food costs, which often make it difficult for income-challenged households to purchase adequate food for their pets each month. The goal of this study was to determine if low-cost beef-based fast food items could be utilized to extend a bag of commercial dry kibble, ideally making it last for an entire month. Using standard guidelines, minimum daily nutrient requirements for growing and adult dogs were determined. Diets consisting of fast food (FF) only; dry, kibble (K) only; and a mixture of fast food and kibble (FF+K) were evaluated based on their ability to meet the life-stage nutritional needs of dogs. Feeding options, across dog life-stage, were evaluated based on monthly cost. The FF feeding approach resulted in excessive fat and sodium intake, deficient calcium and phosphorus intake for both life-stages; and deficient protein intake for growing dogs. The FF+K feeding approach met daily nutrient requirements and allowed for successful extension of the bag of kibble food to 30 days or longer, with dollar savings to the pet owner, for adult life-stage dogs 2.5 to 33 lbs. This was not the case for adult dogs weighing >33 lbs or growing dogs of all breed types. Our study suggests that feeding beef-based, dollar menu fast food has limited value based on nutritional completeness, dog size and dollar savings.

Session 2 - B9
Comparison of Two Sampling Techniques to Assess Antimicrobial Concentrations in the Airways of Steers
Morgan Mccafferty Animal Science-BS, NC State University
Mentors and/or Co-Authors:
Derek Foster Department of Population Health and Pathobiology, NC State University

This study compared two sampling techniques to assess antimicrobial concentrations in the airways of steers in order to confer predict potential antimicrobial efficacy. Currently, there are two approaches for bronchial sampling in live cattle, including bronchial swab and bronchoalveolar lavage (BAL), but no study has directly compared the two. This study involved two groups of four steers from the NC State University Dairy Education Unit in a cross-over design. Each steer received two different antibiotics, enrofloxacin (Baytril 100) and tilmicosin (Micotil) with a one-week washout period in between trials. Samples of blood, interstitial fluid, pulmonary epithelial lining fluid (PELF), and BAL fluid were collected over at least three half-lives of the drug. With enrofloxacin and its metabolite ciprofloxacin, there were no significant differences in the measured airway concentration with either technique. The results of the tilmicosin trial are still pending. This determination will help select the most appropriate technique in future pharmacokinetic and pharmacodynamic studies respiratory antimicrobials in cattle.
**Session 1 - C23**  
**Effects of the Presence of Fish in the Rearing of Juvenile Freshwater Mussels**  
**Mackenzie Leigh Richards** *Natural Resources-BS, NC State University*  
**Mentors and/or Co-Authors:**  
**Jay Levine** *Dept-Population, Health, Pathobi, NC State University*  
**Christopher Eads** *Dept-Population, Health, Pathobi, NC State University*;  

Freshwater mussels are filter feeders of bacteria and algae and are critical to the health and function of the freshwater ecosystems; however, many species are imperiled due to destruction of suitable habitat. Consequently, successful propagation of these species has become crucial for their conservation. Most mussel propagation labs utilize an algal diet, but previous studies indicate that bacteria might play an important role in juveniles’ diet in nature. To ensure freshwater mussels are thriving in captivity, research is necessary for developing a complete diet. We hypothesized that bacteria in the gastrointestinal tract of fish might be contributing to this complete diet, so we conducted an experiment to investigate if cohousing largemouth bass with juvenile mussels fed an algal diet would increase the survival and growth of juvenile Atlantic Pigtoe (*Fusconaia masoni*) in a controlled hatchery environment. This experiment included 38-liter tanks equally divided into two treatments: (1) fish absent (algae only) and (2) fish present (algae and largemouth bass). Each freshwater tank supported an upweller system that housed 15 juvenile mussels, and we assessed their survival and growth on day 35 and day 62 of the trial. Largemouth bass were fed ½ mL of commercially available pellet food and mussels were fed 6 drops each of nano and shellfish algae daily. There was no significant difference (Man-Whitney U test, p>0.05) between the treatments for survival or growth of the juvenile freshwater mussels. While we saw no benefit to mussels in the culture environment, additional research on providing bacterial supplements to juvenile mussel diets is needed.

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**Session 1 - D7**  
**Reovirus Induction of Interferon through the Syk Pathway**  
**Joshua William Schuyler** *Chemical Engineering-BS, NC State University*  
**Mentors and/or Co-Authors:**  
**Barbara Sherry** *Department Molecular Biomedical Sciences, NC State University*  
**Shannon Chiera** *Dept Molecular Biomedical Science, NC State University*;  

Viruses infect animal cells to propagate, but this often results in cell death. Cells prevent subsequent viral spread by producing interferon (IFN) to alert nearby cells. Those cells then produce antivirals to combat their infection by progeny virus. Most viruses induce IFN by stimulating conventional sensor pathways within the cell. Reovirus appears to differ from other viruses by stimulating a second pathway as well, using an immunoreceptor tyrosine-based activation motif (ITAM), which is a short amino acid motif located in the virus capsid. Most ITAMs are cellular and are associated with cell receptor proteins, transducing extracellular signals through the cell Syk protein kinase. Stimulation of cell ITAMs can induce IFN, and previously we found that a reovirus mutated to lack its ITAM induces less IFN. Here, we hypothesized that the reovirus ITAM induces IFN by stimulating the Syk pathway. To test our hypothesis, siRNA was used to knock down Syk, and qRT-PCR was used to measure the impact on reovirus induction of IFN. The results suggested that siRNA specific for Syk did not have an effect on reovirus induction of IFN. However while there was successful knockdown of a control protein by its siRNA, there was no evidence that Syk knockdown was successful. Therefore results were inconclusive. In future experiments, a lentivirus vector can be used to create a cell line that would be conditionally activated to produce anti-Syk siRNA, for more effective Syk knockdown.
Intestinal ischemic injury and recovery in nursery-grower pigs
Jenna Anne Scott Animal Science-BS, NC State University
Tiffany Pridgen, NC State University;
Liara Gonzalez, NC State University;
Vassili Kouprianov Comparative Biomedical Sciences, NC State University
Mentors and/or Co-Authors:
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Intestinal ischemic injury is common in both humans and animals. Ischemic injury and recovery have been studied in swine intestine in two separate labs. One lab evaluated recovery in 10-12 day-old suckling neonates while the other assessed 6-8 week-old nursery-grower pigs. A comparison of the results indicated that the level of intestinal recovery following ischemic injury may be age dependent. The current study was conducted to begin the process of replicating the results in a single lab and to evaluate age dependent recovery. The study’s specific objective was to determine the appropriate duration of ischemia that would create a level of injury sufficient to stimulate recovery ex vivo that could be observed over a 4 hour time period. 6 nursery-grower pigs were subjected to a surgery that created ischemia in vivo by occluding the mesenteric blood supply for 30, 45, 60, or 120 minutes. Jejunal samples were then collected and placed on Ussing chambers for a 240 minute ex vivo recovery. The level of recovery was measured electrophysiologically as transepithelial electrical resistance (TER), by mucosal-to-serosal flux of 3H-mannitol, and histological measurements. TER readings were taken every 15 minutes while flux readings were taken 3 times at 1 hour intervals. Histological measurements included villus height and % epithelialization. Tissue subjected to 30 minutes of ischemia had the highest level of recovery when compared to all other treatments. Therefore, this duration of ischemia appears to be the best treatment to use in nursery-grower pigs. A similar study is planned for suckling neonates.

Session 1 - C17
Survey of Tick-Borne Diseases in Black Bears (Ursus americanus) of North Carolina
Erica Ashley Sheppard Animal Science-BS, NC State University
Mentors and/or Co-Authors:
Ricardo Maggi Dept of Clinical Sciences, NC State University

Due to an increase in population size, American black bears (Ursus americanus) are becoming more prominent in urban areas of North Carolina. Bears have the potential to act as a reservoir for certain pathogens. This has caused an increase in the number of bear and human interactions. Thus, bear blood and ticks from Western North Carolina have been screened for several pathogens in an attempt to establish their health status. Tick-borne pathogens of the genus Bartonella, Mycoplasma (Hemotropic group), Ehrlichia, Anaplasama, Babesia, Theilaria, Leishmania, and Rickettsia were screened using blood and ticks. Blood DNA analysis shows the presence of Ehrlichia, Anaplasma and Piroplasma (Babesia). Tick DNA analysis shows the presence of Mycoplasma haematoparvum and Francisella tularensis. Monitoring the health status of these urban bear populations and their carrier ship potential for vector-borne pathogens (that could impact humans and domestics animals such as dogs and cats) could help wildlife management practices in this area.

Session 1 - C20
Efficacy of E. coli O157:H7 Vaccine in Orally Challenged Goats
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Mentors and/or Co-Authors:
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Escherichia coli O157:H7 sickens nearly 265,000 people in the US each year. North Carolina has
experienced three highly publicized public outbreaks that sickened numerous individuals and, in some cases, were fatal. Each of these outbreaks was traced back to sheep and goats, which along with cattle, serve as reservoirs for the organism. *E. coli* O157:H7 is also significant in the production of safe food and is estimated to cost producers $196.6 million annually due to recalls and public perception. This highlights the importance for an effective vaccine to reduce shedding in ruminants. We examined the efficacy of an SRP® vaccine against *E. coli* O157:H7 in goats orally challenged with four outbreak strains of *E. coli* O157:H7. Mixed-breed goats (n= 14) were randomly allocated into vaccinated and unvaccinated treatments (n = 7 per treatment). Goats were housed in 7 pens, with an unvaccinated and vaccinated animal in each; there was no contact between pens. Feces were collected for three weeks and at necropsy, gastrointestinal contents were obtained and evaluated for the presence and concentration of *E. coli* O157:H7. We also evaluated recovered isolates to determine if a predominant outbreak strain was found in the feces. The mean concentration of *E. coli* O157:H7 in the feces of goats was decreased in the vaccinated treatment, however we have not yet evaluated this association for statistical significance. If vaccination reduces the colonization of *E. coli* O157:H7 in goats the application of this technology for improved petting zoo and food safety practices should be evaluated.

Session 1 - A21
Changes in Luteal Macrophage Cytokine and Cell Surface Marker Expression Following Treatment with Progesterone
Caroline Nicole Trader Polymer and Color Chemistry-BS, NC State University
Mentors and/or Co-Authors: 
John Gadsby Dept Molecular Biomedical Scie, NC State University

Macrophages have been shown to infiltrate the corpus luteum (CL) during early stages of CL development, and to be present in increasing numbers during the mid and late luteal phases, in multiple species including the pig. However, little is known about how macrophages might interact with, and/or be regulated by, luteal cells within the CL. In preliminary studies carried out in this laboratory, it was found that luteal steroidogenic cells (LC) had an inhibitory effect on luteal macrophages (MAC). Thus, since progesterone is the major product of the corpus luteum, this study was designed to examine the hypothesis that progesterone is the LC-derived factor responsible for inhibiting MAC. Thus, in this study, we designed experiments to characterize the effects of progesterone on porcine luteal macrophage cytokine and cell surface marker (mRNA) expression. Macrophages (MAC) were isolated from CL collected at the mid (~d. 7-12) stage of the estrous cycle and were cultured for 24-48h in medium containing progesterone (0, 0.005, 0.05, 0.5, 5 mg/ml). After culture, MAC were lysed, RNA extracted, and mRNA expression of cell surface markers (CD40 – M1; CD163 - M2; CD68 – M1 & M2) and cytokines (M1 specific: IL-1b, IL-6, and TNF-a; M2 specific: IL-10 and TGF-b) was evaluated by Q-PCR using porcine-specific primers. Our results showed that progesterone dose-dependently decreased mRNA expression of these cell-surface markers and cytokines by MAC. From these preliminary results we tentatively conclude that luteal macrophages are functionally suppressed in a dose-dependent fashion by progesterone, a finding consistent with our hypothesis.
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<td>Plutonium-Thorium Hydride Pressurized Water Reactor Fuel Design</td>
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<td>Vartanian, Haley</td>
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<td>A Spoonful of Cooperation Helps the Medicine Go Down: Integrating traditional and western medicine for Southeast Asian refugee welfare</td>
<td>Sociology &amp; Anthropology</td>
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<td>An Overview of Bacillus anthracis and its Potential Risks to</td>
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<td>Biomedical Engineering (Joint Degree with UNC-Chapel Hill)</td>
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<td>The effect of thermophilic anaerobic digestion co-substrate ratio on biogas yield for bioregenerative life support</td>
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<td>Manipulating the flow of EGaIn, via the addition of an oxide layer.</td>
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<td>Wade, Kristen</td>
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<td>Responses to Environmental Stimuli: Companion Animals, Invertebrate Sensory Responses, and Non-Human Primate Behaviors</td>
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<td>A Review on Ethics and Regulation of Preimplantation Genetic Diagnosis</td>
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<td><strong>Weeks, Reagan</strong></td>
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<td>Index of Refraction Measurements of Aerosol Materials</td>
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<td><strong>Weeks, Ryan</strong></td>
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<td>Tetradselmis chuii, A microalgae with Putative Biofuel Potential</td>
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<td>Design of a High Efficiency Single Volume Neutron Scatter Camera (SVNSC)</td>
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<td>What To Eat: How Popular Diets Stack Up Against the US Dietary Guidelines &amp; Current Research</td>
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<td>Toward precise genome editing of Clostridium ljungdahlii using a CRISPR-based approach to improve ethanol production</td>
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<td>Design of a High Efficiency Single Volume Neutron Scatter Camera (SVNSC)</td>
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<td>Exploring Issues and Making Recommendations Regarding the Subtherapeutic Use of Antibiotics in Animal Production Agriculture</td>
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<td>Session 1 - A14</td>
<td>The Hydration of Zinc Chloride: A Dissolution Study</td>
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<td>Design of a Safe, Secure, and Sustainable Submerged Nuclear Power Plant</td>
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<td>Measurements of rat caudate-putamen, nucleus accumbens core, and nucleus accumbens shell volumes reveal region-specific lateralization but not sex differences</td>
<td>Biological Sciences</td>
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<td>Impact of Concussions on Athletes</td>
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<td>Implementation of a High Temperature Antibiotic Resistance Selectable Marker in the Hyperthermophilic Biomass Degrading Bacterium Caldicellulosiruptor bescii</td>
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<td>Impacts of Keystone Species on Maintenance of Foundation Species in Ecosystems</td>
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<td>Noise and Air Pollution Effects on Marine Life</td>
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<td>Exploring Future Applications of Nanotechnology in the Treatment of Diseases</td>
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<td>Yessayan, Raffi</td>
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<td>Yin, Ziyu</td>
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<td>Second Generation Sidewall Inlet for Poultry and Swine</td>
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<td>York, Donald</td>
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<td>Potential of Camelina sativa as an Oil-Seed Feedstock for Bio-based products</td>
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<td>Session 1</td>
<td>Testing Gel Spun Fibers and the Effects of Lignin</td>
<td>Textile Engineering, Chemistry &amp; Science</td>
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</table>
Summary of Symposium Participants

Overall Summary
Total Participants = 444 (Lead Student Presenters : 208 / Co-Presenters : 236)
Total Posters = 209

Summary of Presentations by Content Area
Animal Science = 12
Biochemistry = 10
Biological & Agricultural Engineering = 18
Biological Sciences = 31
Biomedical Engineering = 1
Chemical & Biomolecular Engineering = 14
Chemistry = 12
Civil, Construction & Environmental Engineering = 1
Clinical Sciences = 3
Communication = 2
Computer Science = 2
Crop Science = 1
Electrical & Computer Engineering = 2
English = 2
Entomology = 2
Fisheries, Wildlife, and Conservation Biology Program = 3
Food, Bioprocessing, and Nutrition Sciences = 17
Industrial & Systems Engineering = 1
Interdisciplinary Programs = 5
Marine Earth and Atmospheric Sciences = 5
Materials Science & Engineering = 3
Mechanical & Aerospace Engineering = 3
Microbiology = 3
Molecular & Structural Biochemistry = 1
Molecular Biomedical Sciences = 6
Nuclear Engineering = 6
Physics = 6
Plant and Microbial Biology = 9
Plant Biology = 1
Political Science = 3
Population Health & Pathobiology = 4
Poultry Science = 1
Psychology = 3
Social Work = 1
Sociology & Anthropology = 3
Statistics = 5
Textile Engineering, Chemistry & Science = 3
Wood & Paper Science = 1
Zoology = 3

Summary by College (Participant's Main Mentor)
Agriculture and Life Sciences = 69
Engineering = 34
Humanities and Social Sciences = 19
Natural Resources = 4
Sciences = 67
Textiles = 3
Veterinary Medicine = 13

Summary by Participant's Classification
Seniors : 151 (Lead Student Presenters) / 126 (Co-Presenters) (277)
Juniors : 29 (Lead Student Presenters) / 51 (Co-Presenters) (80)
Sophomores : 20 (Lead Student Presenters) / 41 (Co-Presenters) (61)
Freshmen : 9 (Lead Student Presenters) / 18 (Co-Presenters) (26)
Total: 444
Thanks & Acknowledgments

24th Annual NC State Undergraduate Research Symposium

April 14, 2015

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, Vice Chancellor and Dean, 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 social and reception followed by the new member initiation ceremony and awards recognitions.

Categories

- Colleges of Agriculture and Life Sciences/Vet Med
- College of Design
- College of Education
- College of Engineering
- College of Humanities and Social Sciences
- Poole College of Management
- College of Natural Resources
- College of Sciences
- College of Textiles

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

- Division of Academic and Student Affairs
- NC State University Vice Chancellor for Research and Graduate Studies
- Office of Undergraduate Research
- Sigma Xi: The Scientific Research Society

Special thanks to Kim Cox for serving as the Web Master for the creation and layout of the symposium and Anthony Buckner for setting up and printing the posters.

The Undergraduate Research office especially appreciates the efforts, time and expertise of the symposium judges.
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Interdisciplinary Programs = 5
Marine Earth and Atmospheric Sciences = 5
Materials Science & Engineering = 3
Mechanical & Aerospace Engineering = 3
Microbiology = 3
Molecular & Structural Biochemistry = 1
Molecular Biomedical Sciences = 6
Nuclear Engineering = 6
Physics = 6
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Plant Biology = 1
Political Science = 3
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Poultry Science = 1
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