OFFICE OF
UNDERGRADUATE
RESEARCH

HARNESS THE POWER OF DISCOVERY

2017 Dennis Dean Undergraduate Research & Creative Scholarship Conference

Feb. 20 / Poster presentations, orals, performances & Keynote address by Dr. Stefan Duma, Interim Director ICTAS
9am-4pm, The Inn at Virginia Tech & Skelton Conference Center

Feb. 21 / Music Convocation
2pm-3pm, Squires Recital Salon

Feb. 20-23 / Installations - art work, sculpture, models, fashion
Wallace Gallery

Feb. 23 / Meet & Greet with Scholars
4 pm-6pm, Wallace Gallery & Atrium

CREATIVITY AND RESEARCH ARE... INFINITE

SHOW VIRGINIA TECH HOW INFINITE YOU ARE...

FEBRUARY 20-23, 2017

RESEARCH.UNDERGRADUATE.VT.EDU

Welcome

Jill C. Sible, Ph.D.
Assistant Provost
for Undergraduate
Education,
Professor of
Biological Sciences

Welcome to Virginia Tech's Spring Undergraduate Research and Creative Scholarship Symposium. This event is a celebration of the creative and scholarly accomplishments of undergraduate students campus-wide. Our program features the work of students from 33 different academic programs, reflecting the quality and diversity of undergraduate research at Virginia Tech. Many of the projects are the result of collaborations among several students.

Undergraduate research is recognized as one of the high impact practices in undergraduate education. Students who participate in undergraduate research are more likely to thrive and persist in their education. They become co-creators of knowledge, makers of objects that are useful and beautiful. At the heart and soul of these projects are collaborations between undergraduates and their mentors. Many thanks to the faculty, graduate students and others who commit to these scholarly endeavors with undergraduate students.

An event such as this requires tremendous behind-the-scenes support. I am most grateful to Keri Swaby, University Undergraduate Research Coordinator, for her leadership in organizing and executing today's conference. Keri was well supported by Melissa Ripepi and Aaron Burdette.

Thanks to the Fralin Life Sciences Institute, the Louis Stokes Alliance for Minority Participation, the Multicultural Academic Opportunities Program, and the Office of Research for financial support. A special thank you to Dr. Dennis Dean for his continuous support and advocacy for undergraduate research and to the many colleagues who have contributed to building an endowment for this symposium.

Enjoy!

Jill C. Sible, Ph.D.
Assistant Provost for Undergraduate Education

Office of Undergraduate Research

Keri Swaby
University Undergraduate Research Coordinator

Welcome to the annual Undergraduate Research and Creative Scholarship conference at Virginia Tech, this year renamed in recognition of long-time research supporter, Dr. Dennis Dean. I am extremely excited about this year's week-long event that now includes installations and performances in addition to our traditional oral and poster sessions. The goal for the week is to capture and showcase the breadth of research and creative scholarship taking place every day at Virginia Tech. For the first time, cash prizes will be rewarded for best presentations in each category. Monday's oral presentations will be used to help select undergraduate research representatives to attend the ACC Meeting of the Minds at Duke University in April.

Since the last spring symposium, the Office of Undergraduate Research (OUR) has been very busy. We have personally interacted with over 650 undergraduates, and have offered mentor training and grant writing support to over 80 faculty members and graduate students. Increases were noted in the number of students applying for research fellowships and to present their research locally, at our two symposia, regionally, at the ACC Meeting of the Minds, and nationally, at the National Conference on Undergraduate Research and other disciplinary conferences. Overall, the OUR was able to provide travel support funding to almost 50 students. In addition, we worked closely with campus partners including the VT Libraries, MAOP, Fralin, BEAM REU, and UOPD to offer several services and professional development opportunities to students and faculty alike.

Critical to the growth of our services and reach were the guidance of an active 18-member advisory board, comprised of faculty, administrators, undergraduates and a graduate student, and the 14 amazing student ambassadors who tirelessly work to help students get involved with undergraduate research. Without these two dedicated groups, the operations of the OUR would not have been possible. We aim to continue along this trajectory of increased service to and engagement with the Virginia Tech community. Faculty and students are invited to take full advantage of OUR services, which are free of charge and available throughout the year.

Lastly, I would like to say 'thank you' to our conference sponsors, the Fralin Life Science Institute, the Office of the VP for Research, and the MAOP program. Without your generous support, this conference would not be possible.

I am humbled by the quality of work on show as part of this symposium and invite you to marvel at the wealth of research and creative scholarship the university has to offer.

Sincerely,

Keri Swaby
University Undergraduate
Research Coordinator

Dennis Dean Undergraduate Research Symposium Fund

The Dennis Dean Undergraduate Research Symposium Fund was established in 2015 by generous donations of faculty members in honor of Dr. Dennis Dean, Director of the Fralin Life Science Institute, and his tireless support for undergraduate research. The fund is earmarked to support this conference, the annual Dennis Dean Undergraduate Research & Creative Scholarship Conference, a week-long celebration of original work of hundreds of undergraduate students in poster, oral, installation, or performative formats.

Thank you to those who have so generously contributed to building an endowment that will provide continuous support to this conference, gifting future scientists, engineers, musicians, writers, artists, designers, and the like the opportunity to both showcase their hard work and to learn and grow through the introduction to that of others.

DSR. LISA BELDEN & IGNACIO MOORE

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DR. JANET B. WEBSTER

DR. BRENDA WINKEL & JAMES WESTWOOD

Learn more about how to give: research.undergraduate.vt.edu/Give

Thank you . . .

For sharing your knowledge, experience, advice, and hard labor with us and your fellow students, faculty, and staff at Virginia Tech. The Office of Undergraduate Resarch would not have near the impact or be able to provide near the opportunity without your incalculable dedication and support.

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Thank you to our conference sponsors

FRALIN LIFE SCIENCE INSTITUTE

The Fralin Life Science Institute strategically invests in targeted research areas within the life sciences. Such investments include recruitment and set-up support for new faculty members, retention and recognition of established faculty members, seed funds for new research projects, equipment purchases, graduate student recruitment and support, undergraduate research support, and support for outreach activities. Research initiatives within the life sciences receiving the highest priority for support include vector-borne disease, infectious disease, plant sciences, ecology and organismal biology, obesity, and cancer biology.

LOUIS STOKES ALLIANCE FOR MINORITY PARTICIPATION

The Louis Stokes Alliance for Minority Participation (LSAMP) grant is a national project funded by the National Science Foundation. LSAMP aims to increase the academic success and quantity of students successfully completing science, technology, engineering and mathematics (STEM) baccalaureate degree programs, and to increase the number of students interested in, academically qualified for, and matriculating into programs of graduate study. A primary goal of the program is to increase the number of students who are engaged in undergraduate STEM research experiences. Students are encouraged to participate in undergraduate research or internships throughout their undergraduate career.

MULTICULTURAL ACADEMIC OPPORTUNITIES PROGRAM

The Multicultural Academic Opportunities Program (MAOP) is an academic success community founded upon the principles of self- efficacy, mentoring, and peer support. Central to the goal of MAOP is the promotion of diversification within the student body of Virginia Tech. MAOP participants are supported with academic guidance, emotional and social support, and financial support. The MAOP community is open to all students who demonstrate a clear commitment to the pursuit of academic excellence and are interested in the promotion of diversity in an ever global community. MAOP provides opportunities for both undergraduate and graduate students through scholarships, tuition/assistantship support, academic workshops, and undergraduate research opportunities.

VT OFFICE OF RESEARCH

The Office of the Vice President for Research and Innovation supports the university community and its missions by fostering quality research and scholarship, providing access to funding information, enhancing the ability to respond to national research priorities and pursue opportunities, encouraging and directing inquiry into new and emerging fields, promoting solutions to problems and advances of basic knowledge in diverse disciplines and through interdisciplinary cooperation, ensuring compliance with policies and procedures related to research, marketing faculty talent and university capabilities within the university community and to external audiences, and fostering partnerships with outside agencies and businesses.

Informational Booths

We invite you to visit and talk with representatives from several graduate programs, professional and enrichment programs, and research journals.

Graduate Programs

- BIOLOGICAL SYSTEMS ENGINEERING
- BIOMEDICAL AND VETERINARY SCIENCES
- COLLEGE OF ENGINEERING
- COLLEGE OF LIBERAL ARTS AND HUMAN SCIENCES
- ENGINEERING EDUCATION AT VT
- MACROMOLECULES INNOVATION INSTITUTE (MII)
- MASTERS IN FINE ARTS (MFA) AT VT
- ONLINE MASTER OF AGRICULTURAL AND LIFE SCIENCES
- PLANT PATHOLOGY AND WEED SCIENCES
- TRANSLATIONAL BIOLOGY, MEDICINE, AND HEALTH (TBMH)

Enrichment Programs

- EUROSCHOLARS
- IMSD: INITIATIVE FOR MAXIMIZING STUDENT DEVELOPMENT
- ISCHOLARS

Journals

- JUMR: JOURNAL OF UNDERGRADUATE MATERIALS RESEARCH
- PHILOLOGIA UNDERGRADUATE RESEARCH JOURNAL

Contents

Schedule

8:30am	**Registration Opens** LOBBY
9:00-10:00am	**Poster Session 1** LATHAM BALLROOM A
10:00-11:30am	**Oral Session 1**
10:00-11:00am	DRILLFIELD
10:00-11:15am	DUCK POND
10:00-11:00am	SMITHFIELD
11:00am-12:00pm	***Beyond Boundaries VT-Shaped Experiential Learning Participatory Workshop*** SOLITUDE
11:45am-12:00pm	***Performance*** LATHAM BALLROOM B,C
12:00-1:00pm	**Lunch** LATHAM BALLROOM B,C
12:25–12:30pm	***Welcome*** DR. JILL SIBLE, ASSISTANT PROVOST FOR UNDERGRADUATE EDUCATION
12:30–1:00pm	***Keynote Address*** DR. STEFAN DUMA, INTERIM DIRECTOR ICTAS
1:15-2:15pm	**Poster Session 2** LATHAM BALLROOM A
1:30-3:00pm	**Oral Session 2**
1:30-2:30pm	DRILLFIELD
1:30-2:30pm	DUCK POND
1:30-2:45pm	SMITHFIELD
2:30-3:30pm	**Poster Session 3** LATHAM BALLROOM A
3:30pm	***Closing*** KERI SWABY, UNIVERSITY UNDERGRADUATE RESEARCH COORDINATOR

Poster Presentations
Session 1 9:00AM - 10:00AM

1	**Rachel O. Beisser** *(Literature & Language)* MASTER OF DECEIT: THE MALICIOUS AND CUNNING NATURE OF MEPHASTOPHILIS IN MARLOWE'S "DOCTOR FAUSTUS"
2	**Nicole R. Dubois** *(Psychology)* **Aaron J. Wills** *(Neuroscience)* **Samantha M. Cornwell** *(Biochemistry)* **Leah P. Cooper** *(Psychology)* EFFECTS OF STRESS ON CEREBRAL AND FACIAL ACTIVATION
3	**Carly J. Estrada-Palma** *(Biochemistry)* CELL-SURFACE RECEPTORS AND SIGNALING PATHWAYS
4	**Ricardo P. Fernandez** *(Geology)* **Caleb Shockley** *(Geology)* TRACE ELEMENTS IN DAN RIVER SEDIMENT AFTER THE 2014 COAL ASH SPILL
5	**Tara D. Helms** *(Geosciences)* EFFECT OF SWINE MANURE ON LIMESTONE DISSOLUTION
6	**Saman N. Khan** *(Biochemistry)* INFLAMMATORY CYTOKINE LEVEL RESPONSE TO WHEAT GLUTEN MODULATED IN CELIAC DISEASE VIA NEGATIVE REGULATORY NLRS
7	**Thomas J. King** *(Architecture)* **Katie Waldner** *(Architecture)* **Elyse Smith** *(Architecture)* FUTUREHAUS
8	**Meredith D. Lewis** *(Animal & Poultry Sciences)* DETERMINATION OF THE METABOLIZABLE ENERGY OF DDGS EXTRACTED CORN OIL IN COMMERCIAL BROILER CHICKS FED VARIOUS CONCENTRATIONS OF CALCIUM
9	**Miya S. Oshiro** *(Computer Science)* ROYALTY: AN INTERACTIVE EMOTIONAL AND MENTAL HEALING EXPERIENCE
10	**Garrett S. Rhyne** *(Wildlife Conservation)* EFFECTS OF ENVIRONMENTALLY RELEVANT MIXTURES OF MAJOR IONS AND COAL-CONTAMINATED SEDIMENT ON FRESHWATER MUSSELS

Poster Presentations Session 1 (continued)

11 **Megan Richardson** *(Biochemistry)*
ASSESSING THE INFLUENCE OF FLAVONOIDS IN ATTENUATING SS-STRAND FIBRIL FORMATION OF ISLET AMYLOID POLYPEPTIDE BY MOLECULAR DYNAMICS SIMULATIONS

12 **Salwa G Sadiq-Ali** *(Psychology)* **Sasha Sharma** *(Psychology)* **Sareena A. Patel** *(Psychology)*
THE EFFECT OF BOREDOM ON NEUROELECTRICAL ACTIVITY

13 **A. Slough** *(Human Development)*
ATTENTION IN INFANCY: LINKS TO CHILDHOOD ATTENTION AND ACADEMIC ACHIEVEMENT

14 **Hytham Soueid** *(Biochemistry)* **Jonathan Briganti** *(Neuroscience)* **Javier Friend** *(Biochemistry)*
EFFECT OF LIGAND PRESENCE ON CONFORMATIONAL OSCILLATION OF PPARγ

15 **Sieu Tran** *(Mathematics)*
PATTERNS OF ACTIVATION AND REPRESSION FOR A SINGLE TRANSCRIPTION FACTOR WITH MULTIPLE BINDING SITES

16 **Caitlin R. Van Wicklin** *(Biology)* **Emily Wills** *(Psychology)* **Alex Eddy** *(Psychology)* **Peter Lee** *(Biology)*
SEX DIFFERENCES IN LATERALITY IN EMOTION SPECIFIC AUTONOMIC NERVOUS SYSTEM ACTIVITY

17 **Adrianna N. Wilson** *(Biochemistry)*
THE ISOLATION AND ELUCIDATION OF ANTIMICROBIAL COMPOUNDS FROM NATIVE SOUTHWEST VIRGINIA PLANTS

18 **Brittney L Worrell** *(Biochemistry)*
STRUCTURAL DISTINCTIONS BETWEEN ISOFORMS OF HUMAN AND MOUSE SPHINGOSINE KINASES

Oral Presentations Session 1

DRILLFIELD

MODERATOR: DR. ASHLEY REED *(English)*

10:00 - 10:15am **Alec J. Masella** *(Literature & Language)*
FIRST CONTACT: THE INFLUENTIAL EXCHANGE BETWEEN THE AMERICAN FIRESIDE POETS AND THE ARAB MAHJAR POETS

10:15 - 10:30am **David S. Snyder** *(Communication)*
SHEPPARD V. MAXWELL: REVISITED

10:30 - 10:45am **Gabriella C. Scalzo** *(Psychology)*
COGNITIVE FLEXIBILITY AND COMMUNICATION ARE LINKED TO EMPLOYMENT IN YOUNG ADULTS WITH ASD

10:45 - 11:00am **Kelly L. Cooper** *(History)*
THE ILLUMINATION OF THE YORK MINSTER AND ST. PATRICK'S CATHEDRAL: TWO PRESERVATION APPROACHES

DUCK POND

MODERATOR: DR. ENDANG PURWANTINI *(Biochemistry)*

10:00 - 10:15am **Joycelynn B. Acheampong** *(Microbiology)*
COMPUTER VISION ASSISTED WATER QUALITY TESTING

10:15 - 10:30am **Allison Moser** *(Wildlife Conservation)*
USE OF CAMERA TRAPS TO SURVEY SYLVILAGUS SPP. IN HIGH-ELEVATION HABITATS IN THE SOUTHERN APPALACHIANS

10:30 - 10:45am **Anna C. Buhle** *(Biochemistry)*
GLUCOSAMINE CATABOLISM IN MYCOBACTERIUM SMEGMATIS

10:45 - 11:00am **Hannah D. Parker** *(Animal & Poultry Sciences)*
INVESTIGATING LEPTIN AS A MEDIATOR OF PLACENTAL ADHESION, INVASION AND IMPLANTATION IN RUMINANTS

11:00 - 11:15am **Katelynn M. Petrasic** *(Biochemistry)*
H-FIRE TREATMENT IN 4T1 MAMMARY TUMORS IN MICE: A PILOT STUDY

Oral Presentations
Session 1 (continued)

SMITHFIELD

MODERATOR: DR. RYAN MOWREY *(Biological Sciences / Water Resources Policy & Management)*

10:00 - 10:15am	**Parisa F. Samareh** *(Applied Mathematics)* ACCELERATING THERMOACOUSTIC TOMOGRAPHY
10:15 - 10:30am	**Alex W. Nikrant** *(Physics)* DETERMINING THE ENERGY PARAMETERS OF CORE-COLLAPSE SUPERNOVA ELECTRON NEUTRINOS
10:30 - 10:45am	**Brock A. Davis** *(Mechanical Engineering)* **Katrina Somers** *(Biological Sciences)* LEAF-INSPIRED BIOMIMETIC DESIGN FOR AERODYNAMIC DISPERSAL STRUCTURES
10:45 - 11:00am	**Ben G Spencer** *(Environmental Science)* QUANTIFYING MICROBIAL RESPIRATION WITH A FLUORESCENT DYE

Poster Presentations
Session 2 1:15PM - 2:15PM

1 **Dung T. Han** *(Biochemistry)*
INSIGHT INTO CROSS-AMYLOID INTERACTIONS IN ALZHEIMER'S DISEASE AND TYPE II DIABETES: MOLECULAR DYNAMICS SIMULATIONS OF $A\beta_{16-22)}$ AND $IAPP_{(20-29)}$ HEXAMER FORMATION

2 **Rhiannon J. Hasenauer** *(Human Development)*
THE FUTURE OF HONDURAS

3 **Grace A. Herrick** *(Neuroscience)* **Riya P. Nag** *(Psychology)*
Andrew K. Banick *(Neuroscience)* **Jong W. Lee** *(Biological Sciences)*
Hannah Hawks-Mayer *(Biological Sciences)*
CELL-SURFACE RECEPTORS AND SIGNALING PATHWAYS

4 **Nicole Kaminski** *(Biochemistry)*
EXPRESSION OF NUTRIENT TRANSPORTERS IN MALE AND FEMALE CHICKENS

5 **Arianna I. Krinos** *(Computer Science)*
Lea V. Sarment *(Biological Systems Engineering)*
BATRACHOCHYTRIUM-BATTLING BACTERIA FOILS FUNGUS FOUND ON FROGS

6 **Suzanne R. Laliberte** *(Biological Sciences)*
PROBING THE CELL TYPE SPECIFICITY OF CHEMICAL DEFENSE IN ARABIDOPSIS ROOTS

7 **Sanjna Nag** *(Human Nutrition, Foods, & Exercise)*
GLOBAL HEALTH IN UNDERDEVELOPED COUNTRIES

8 **Amy K. Plechacek** *(Geosciences)*
LASER ABLATION ICP-MS ANALYSIS OF TRACE ELEMENTS IN PYRITES OF GAS SHALES: IMPLICATIONS FOR MOBILITY

9 **Emily S. Richardson** *(Animal & Poultry Sciences)*
ECONOMIC ANALYSIS OF FEEDING COSTS FOR DIETS INCLUDING CORN SILAGE OR SORGHUM SILAGE AS THE MAIN FORAGE SOURCE

10 **Ralph Romero** *(Physics)*
CRUMPLING OF AN ELASTIC RING UNDER CIRCULAR CONFINEMENT IN TWO DIMENSIONS

Poster Presentations Session 2 (continued)

11 **Lea V. Sarment** *(Biological Systems Engineering)*
Caity M. DeAngelus *(Biological Systems Engineering)*
NOVEL DEVICE FOR RAPID ACQUISITION OF HEART RATES IN NEONATAL PATIENTS

12 **Kendall M Seeley** *(Biochemistry)*
INVESTIGATING THE EFFECT OF PPARγ, MUTATION Q286P ON 15-DEOXY-$\Delta^{12,14}$ -PROSTAGLANDIN J 2 BINDING ACTIVITY USING MOLECULAR DYNAMICS AND DOCKING SIMULATIONS

13 **James B. Simon** *(Engineering, Science and Mechanics)*
USING BINAURAL BEATS TO INCREASE BRAIN FUNCTIONAL CONNECTIVITY

14 **Benjamin S. Smith** *(General Engineering)*
EFFECT OF COMPOST ON REDOX POTENTIAL AT A CONSTRUCTED COASTAL PLAIN WETLAND

15 **Katherine I. Vlahcevic** *(Neuroscience)*
THREE-YEAR EEG PREDICTS PASSAGE COMPREHENSION AT AGE SIX

16 **Lucy L. Wagstaff** *(Animal & Poultry Sciences)*
ROLE OF URIC ACID ON FEED INTAKE IN CHICKENS

17 **Laura C Wichin** *(Biological Systems Engineering)*
THE EFFECT OF INCREASED PEPTIDE FRAGMENT ON KERATOSE HYDROGEL ENZYME MEDIATED DEGRADATION

Oral Presentations Session 2

DRILLFIELD

MODERATOR: DR. ANTHONY CATE *(Psychology)*

1:30 - 1:45pm **Philip E. Stauffer** *(Biochemistry)*
RELEVANCE OF NATURAL OCCURRING MUTATIONS IN CIRCADIAN COMPONENTS FOR CELLULAR SIGNALING

1:45 - 2:00pm **Cassidy A. Thomas** *(Biological Sciences)*
THE CANONICAL NLR INFLAMMASOME SENSES CLOSTRIDIUM DIFFICILE

2:00 - 2:15pm **Haley A. Meade** *(Biochemistry)*
EFFECTS OF QUATERNARY AMMONIUM COMPOUND EXPOSURE ON GROWTH AND DIFFERENTIATION OF NEURAL STEM/PROGENITOR CELLS

2:15 - 2:30pm **Rishi K. Devulapalli** *(Neuroscience)*
Leah Cooper *(Psychology)*
VISUAL ASPECTS OF NUMERACY NEUROIMAGING: CORTICAL SURFACE-BASED META-ANALYSIS

DUCK POND

MODERATOR: SCOTT VERBRIDGE *(Biomedical Engineering & Sciences)*

1:30 - 1:45pm **Joseph F. Krause** *(Nanoscience)*
TUNABLE VISIBLE AND NEAR INFRARED LIGHT TRANSMITTANCE AND ABSORPTION IN LAYER BY LAYER POLYMER-PLASMONIC NANOPARTICLE NANOCOMPOSITES

1:45 - 2:00pm **Ahmed M. Elnahhas** *(Mechanical Engineering)*
EXPERIMENTAL INVESTIGATION OF ACOUSTIC ENERGY TRANSFER SYSTEMS

2:00 - 2:15pm **Andrea S. Kuliasha** *(Biological Systems Engineering)*
IN VITRO BRAIN TISSUE MODEL FOR UNDERSTANDING TUMOR ANGIOGENESIS

2:15 - 2:30pm **Austin J. Wozniak** *(Biological Systems Engineering)*
WATER SCAVENGING IN APPALACHIA

Oral Presentations
Session 2 (continued)

SMITHFIELD

MODERATOR: DR. RALPH HALL *(Public & International Affairs)*

1:30 - 1:45pm	**Carolyn R. Carrithers** *(Biological Systems Engineering)* OYSTER SPAT
1:45 - 2:00pm	**Edgar Correa** *(Crop & Soil Sciences)* MOLECULAR MARKERS FOR LOW TRYPSIN INHIBITOR SOYBEAN BREEDING SELECTION
2:00 - 2:15pm	**Emma K. Buchanan** *(Applied Economic Management)* QUANTIFYING NATURAL DISASTERS' IMPACT ON NEIGHBORHOOD TRANSITION
2:15 - 2:30pm	**Maria E. Vollmer** *(Environmental Policy & Planning)* HYGIENE AND SANITATION ASSESSMENT OF PUBLIC SITES IN MZUZU, MALAWI
2:30 - 2:45pm	**Chelsea N. Cereghino** *(Microbiology)* NODULATION OF PEA PLANTS BY TWO RHIZOBIUM LEGUMINOSARUM BIOVARS

Poster Presentations
Session 3 2:30PM - 3:30PM

1 **Tariq Ayubi** *(Biochemistry)*
THE PROTECTIVE ROLE OF NLRX1 DURING INVASIVE PULMONARY ASPERGILLOSIS

2 **Savanna N. Baxley** *(Residential Environments & Design)*
CUSTOM KITCHEN DESIGN FOR CLIENT WITH DOWN SYNDROME

3 **Garrett Coffey** *(Agricultural Technology)* **Hunter Critzer***(Agricultural Technology)*
ESTABLISHING A FORAGE SYSTEM FOR COWS AND WEANED CALVES AT THE GILES COUNTY AG LAND LAB

4 **Lauren R. Delbridge** *(Landscape Architecture)*
COAL ASH WASTESCAPE: DESIGNED REMEDIATION OF CHESTERFIELD POWER STATION'S COAL ASH PONDS

5 **Christian J. Gilbertson** *(Engineering Science & Mechanics)*
A STUDY OF THE GAMMA-RAY BURST FUNDAMENTAL PLANE

6 **Brogan E. Holcombe** *(Animal & Poultry Sciences)*
DOES HOTSPOTTER REDUCE TIME SPENT IDENTIFYING INDIVIDUAL OCELOTS?

7 **Stacey Karetnyi** *(Biological Sciences)*
MYCOPLASMA GALLISEPTICUM IS RECOGNIZED BY THE CANONICAL NLRP3 INFLAMMASOME IN MACROPHAGES

8 **Alexandra B. Krebs** *(Biological Sciences)*
DOES PARENT-CHILD COMMUNICATION INFLUENCE IMPROVED TREATMENT OUTCOME FOR CHILDREN WITH OPPOSITIONAL DEFIANT DISORDER AND COMORBID ANXIETY DISORDER

9 **Melissa R. Land** *(Engineering Science & Mechanics)*
MULTIBODY DYNAMICS

10 **Thomas C. Maulbeck** *(Materials Science & Engineering)*
William A. Blankenship *(General Engineering)*
PROCESSING OF TITANIUM-CARBON ALLOYS BY THE MECHANICAL ALLOYING OF TITANIUM AND DRY CORNHUSK

11 **Bonnie L. Woodward** *(Psychology)*
TREATMENT DIFFERENCES IN PARENT-CHILD SYNCHRONY, REALISTIC PROBLEM-SOLVING, AND CHILD SYMPTOM REDUCTION FOR CHILDREN WITH OPPOSITIONAL DEFIANT DISORDER

Installations

WALLACE GALLERY
2.20.17 - 2.23.17
9:00AM - 5:00PM

Jackie D. Bertone *(Physics)*
Benjamin A. Beheydt *(Chemical Engineering)*
A.R.T.A. - ASTEROID REDIRECT: TELESCOPING ARM

Michael J. Stelfox *(Landscape Architecture)*
A QUESTION OF TECHNOLOGY - ELECTRICAL PRODUCTION IN THE YEAR 2070

Jazmine M. Copeland *(Biochemistry)*
Laura Wonilowicz *(Animal & Poultry Sciences)*
Lanie Eppers *(Biological Sciences)*
PEER TO PEER PROBLEM SOLVING STUDIO PROJECTS

Francisco Ramos Mora *(Physics)*
Andrew Farley *(Mechanical Engineering)*
Wade Foster *(Aerospace Engineering)*
Caitlyn Stone *(Aerospace Engineering)*
Genevieve Gural *(Aerospace Engineering)*
Andrew Touzinsky *(Aerospace Engineering)*
Ziomara Madero-Vargas *(Aerospace Engineering)*
Aaron Morris *(Aerospace Engineering)*
INVENTS HIGH-POWER ROCKETRY TEAM

Music Convocation

SQUIRES RECITAL SALON
2.21.17
2:00PM - 3:00PM

Featuring performances by Virginia Tech music majors, including the world premiere of

DJ Malinowski's

Alchemy

for amplified percussion quartet

DJ Malinowski *(Music)*
Steven W. Arnold *(Music)*
JD Grizzle *(Music)*
DJ Malinowski *(Music)*
Jesse W. Hughes *(Music)*
Laura E. Moniuszko *(Music)*

Abstracts

JOYCELYNN B. ACHEAMPONG MICROBIOLOGY

Computer Vision Assisted Water Quality Testing

Low resource populations have limited access not only to high tech facilities, but more importantly to the humans tasked with the laboratory work of testing water for safe consumption. As is evidenced, in Malawi from surveying lab technicians, water quality testing proves time intensive and vulnerable to variability amongst lab techs. In automating the process, an appropriate, affordable device was developed to photograph and count colonies based on color staining through media. Consequently, decreasing time and resources needed to analyze water coliforms, for low resource settings such as Malawi, Africa. Testing is conducted by plating contaminated water using the HACH method and m-Coliblue24 broth media. After incubation for 24 hours at 35C, the colonies of E. coli (blue) and coliforms (red) are cross correlated from results gained manually and automatically. The system includes a PVC enclosure, Raspberry Pi with integrated camera, LCD screen, and a power source. The Raspberry Pi hardware serves as the main hardware for the Python-developed computer vision program. Moreover, automation includes a Hough transformation, to eliminate noise; a Hue Saturation Value conversion, enhancing accurate color thresholding; and connected component analysis for variability robustness between image colonies. With current data, the computer vision is within the known range of intra-human error based on the Root Mean Square error value. Efficiency and lab application will be tested next.

Mentor(s): Dr. Penelope Muelenaer (Virginia Tech Carilion School of Medicine; Pediatric Medical Device Institute), Dr. Andre Muelenaer (Virginia Tech Carilion School of Medicine; Pediatric Medical Device Institute); Dr. John Bird (Mechanical Engineering)

TARIQ AYUBI BIOCHEMISTRY

The Protective Role of Nlrx1 During Invasive Pulmonary Aspergillosis

Invasive pulmonary aspergillosis (IPA) is a fungal infection of the respiratory system affecting a diverse array of immunocompromised individuals and is associated with high mortality rates. There is a pressing global need for the development of new antifungals due to growing incidences of resistance. The NLR family of proteins are an essential component of the plant and animal immune response towards viruses, bacteria, and fungi. NLRX1 is a negative regulator of NFï«B signaling and plays an important role in human response to viruses and bacteria. Interestingly, NLRX1 was found to be upregulated in immune suppressed murine models of IPA. Inoculation of Nlrx1-/- mice with Aspergillus fumigatus resulted in significantly higher fungal loads compared to WT mice in immunosuppressed models. A survival study indicated Nlrx1-/- mice were more susceptible to mortality earlier on during infection as well as an overall increase in mortality in an immunosuppressed mouse model. We utilized WT and Nlrx1-/- bone marrow derived macrophages and bronchial airway epithelial cells to further determine changes in conidial processing, and chemokine/cytokine signaling. Our findings show elevated levels of known and novel immune signaling molecules during IPA. This study highlights the novel role of NLRX1 during IPA, and is a proof of concept for therapeutic development centered on NLRX1.

Mentor(s): Dr. Shiv Kale (Biocomplexity Institute)

SAVANNA N. BAXLEY RESIDENTIAL ENVIRONMENTS & DESIGN

Custom Kitchen Design for Client with Down Syndrome

The goal of this project is to creatively design a kitchen space specifically suited for individuals with Down syndrome. I am developing a prototype kitchen model for my younger sister with Down syndrome, Dee, and my parents. The purpose of this study is to synthesize and organize research on Down syndrome into design guidelines for kitchens to promote independence. I am researching and going over literature review involving characteristics of people with Down syndrome and applying those findings into an ideal and functional kitchen space. My sister strives to be independent with the support of loving, encouraging parents. They are looking to buy a new home in the Blacksburg area, where I am testing my found research discoveries and guideline in search of finding their new home. My family narrowed down their selection to three homes in the area, and I am analyzing the property and kitchens to find which layout is most functional. I am using information gathered on appliances, finishes, and design from when I took Dee and my parents to Ferguson Kitchen and Bath to determine what is most accessible, functional, and aesthetically pleasing for my family. I have all that I need in the Chief Architect software to create accurate floor plans and perspective views for my clients. The outcome wanted from this research is to develop one prototype that my family would consider using, to test it in the real design field, and for Dee to be one step closer to independence.

Mentor(s): Kathleen Parrott (Residential Environments & Design); Eunju Hwang (Residential Environments & Design)

RACHEL O. BEISSER LITERATURE & LANGUAGE

Master of Deceit: The Malicious and Cunning Nature of Mephastophilis in Marlowe's "Doctor Faustus"

I conducted my research on the character Mephastophilis, the demon in Christopher Marlowe's "Doctor Faustus," in order to prove that Marlowe intended to use the demon as a purely evil character in his play. Mephastophilis's seemingly friendly behavior and appearance of reluctance in damning Faustus are read as proof that Mephastophilis is a benevolent demon. However, as I read "Doctor Faustus" for a second time, I began to see Mephastophilis's "goodness" as an act to deceive and damn Faustus more effectively. Thus, I set out to reveal exactly how deep Mephastophilis's acts of deception run in Marlowe's play. My paper was written for Honors credit during the Fall 2016 semester, under the supervisor of Dr. Katherine Cleland. I wrote a proposal, an annotated bibliography, and a rough draft throughout the semester before submitting my final research paper to Dr. Cleland. The research is largely based on my close reading of the text, specifically Mephastophilis's lines; however, I also extensively read other scholars's research on "Doctor Faustus" call on them in order to support my thesis. My results used the text of "Doctor Faustus" to demonstrate that Mephastophilis is indeed a evil and deceptive character, rather than the friendly one he seems. My conclusion's purpose is to reveal that Mephastophilis's malicious nature and deception of Faustus changes how Mephastophilis is viewed, and gives insight into Marlowe's perspective of the fallibility of human nature

Mentor(s): Dr. Katherine Cleland (English)

JACKIE D. BERTONE PHYSICS
BENJAMIN A. BEHEYDT CHEMICAL ENGINEERING

A.R.T.A. - Asteroid Redirect: Telescoping Arm

NASA's asteroid redirecting mission to put an asteroid in orbit around the moon has many stages. One such stage involves a manned craft, Orion, docking with the robotic ARV, Asteroid Redirecting Vehicle. During this stage, astronauts need to travel outside of their craft to the ARV. Unfortunately, the necessary design of Orion yields a large gap between Orion's capsule door and the ARV. Thus, a tool is needed to assist in the translation of the astronauts and their equipment from Orion to the ARV. Our design, Asteroid Redirect: Telescoping Arm (A.R.T.A.), solves this problem. The tool is designed with light weight, anodized aluminum and has a steel locking-hoop. The telescoping mechanism is achieved with a weaved high-strength paracord design, achieving a smooth single actuation that triples the base length of the arm (~20 in.). The effectiveness of the tool was tested at the Neutral Buoyancy Lab located on the Johnson Space Center campus in Houston, Texas. The data collected was both qualitative and quantitative, including ease of use, length of actuation, and stress tolerance. When testing, dive staff at the NBL worked a full-scale test within the mock-ups of Orion and ARV directed by team member Benjamin Beheydt. A.R.T.A. successfully accomplished all goals, including safely translating the dive staff across the gap in question.

Mentor(s): Dr. Stephanie Lewis (Director - Curie Living Learning Community)

EMMA K. BUCHANAN APPLIED ECONOMIC MANAGEMENT

Quantifying Natural Disasters' Impact on Neighborhood Transition

Resilience to natural disasters is the ability to prepare, plan for, absorb, recover from, and adapt to adverse events. Despite research that has been done on neighborhood transition- change of demographic composition and socioeconomic characteristics in a neighborhood- there is a lack of research connecting disasters and the changes that are taking place in neighborhoods across the US. Given this context, our team proposed to investigate the effect of natural disasters on the neighborhood transition process. Specifically, we proposed to conduct a longitudinal study on neighborhoods in New York City, which have been facing an increase in both the number of major storms and their severity. We studied the impacts of natural disasters on neighborhood transition in New York City through two lenses: that of changing housing characteristics in neighborhoods, and that of municipal service provision to those neighborhoods. Undergraduate involvement is significant to this project; therefore, my study worked with large socioeconomic datasets and analytical and visualization tools to measure different patterns emerging in coastal, storm-affected communities. We are currently analyzing data, and preliminary results indicate that transitional patterns are identifiable in post-disaster neighborhoods in New York City.

Mentor(s): Yang Zhang (Urban Affairs and Planning)

ANNA C. BUHLE BIOCHEMISTRY

Glucosamine Catabolism in Mycobacterium Smegmatis

Mycobacterium smegmatis is a prominent soil organism as well as a useful organism for studying other Mycobacterium species such as the pathogenic relatives Mycobacterium tuberculosis and Mycobacterium leprae. M. smegmatis was found to have three glucose-6-phosphate dehydrogenase (G6PD) genes in its genome. The first is an F420-dependent G6PD primarily used when the cell is under oxidative stress, the second is an NADP+-dependent G6PD active in the Pentose Phosphate Pathway, and the third is an NAD+-dependent G6PD believed to act in the Entner-Doudoroff Pathway. The NAD+-dependent and NADP+-dependent G6PD genes were previously unstudied in M. smegmatis. The gene products were characterized in order to better understand Mycobacterium metabolism using kinetic analysis. The Km, Vmax, temperature optimum, and pH optimum for these enzymes were obtained. Further research was conducted to determine under which conditions that the NAD+-dependent G6PD is expressed in the cell. Growth curves were created using four carbon sources; glycerol, glucose, glucosamine, and N-acetylglucosamine. These substrates were chosen due to the gene's proximity to a gene cluster that appears to be regulated by glucosamine. The RNA from cells grown under each of these conditions was then extracted and converted into a cDNA library through the use of reverse transcriptase. The cDNA library was analyzed using PCR and qPCR to determine if the NAD+-dependent G6PD gene had been expressed.

Mentor(s): Endang Purwantini (Biochemistry); Biswarup Mukhopadhyay (Biochemistry)

CAROLYN R. CARRITHERS BIOLOGICAL SYSTEMS ENGINEERING

An Oyster Spat

The paper 'An Oyster Spat' attempts to determine the causes behind the Oyster Wars of the Chesapeake Bay, focusing on the 1860s to 1880s. The Oyster Wars are an example of limited environmental resources creating conflict; and studying the issue can improve understanding of the relationship between citizens, the government, and the environment. The paper makes use of primary sources from the time period (newspaper articles and reports in particular) to determine stressors and attempted solutions.

Mentor(s): Mark Barrow (History)

CHELSEA N. CEREGHINO MICROBIOLOGY

Nodulation of Pea Plants by Two Rhizobium leguminosarum Biovars

Due to industrial agricultural practices, the depletion of soil nutrients essential to crop growth is inevitable, making nitrogen supplementation necessary to keep up with yield demands. Nitrogen fertilizers negatively impact human and environmental health. In response, this project aimed to devise an alternative to fertilizer by determining rhizobia that could induce the most effective nitrogen-fixing relationship with legumes. The goal of this project was to determine a biovar of Rhizobium leguminosarum that is more fit for a symbiotic relationship with leguminous plants based on measured mean dry mass and nodule count. Trifolium repens, L. plants were inoculated with R. leguminosarum biovar trifolii, and Pisum sativum, L. plants were inoculated with R. leguminosarum biovar vicaea; each biovar typically nodulates the respective host plant. Both groups were grown in Thornton agar jars for 21 days. Control groups with and without nitrogen were also grown, in addition to T. repens, L. plants inoculated with R. leguminosarum biovar vicaea and P. sativum, L. plants inoculated with R. leguminosarum biovar trifolii. Results of mean dry mass between the variable groups were not significant, and of the plants inoculated with rhizobia, only P. sativum, L. plants were nodulated. R. leguminosarum biovar trifolii and R. leguminosarum biovar vicaea nodulated P. sativum, L. which indicates that the host range of R. leguminoarsum biovar trifolii is broader than expected.

Mentor(s): Dr. Mark Williams (Horticulture)

GARRETT COFFEY AGRICULTURAL TECHNOLOGY
HUNTER CRITZER AGRICULTURAL TECHNOLOGY

Establishing a forage system for cows and weaned calves at the Giles County Ag Land Lab

The Giles County Public Schools Land Lab was created as a hands-on learning experience for students to study production agriculture. The Land Lab incorporates math, reading, social studies, chemical, physical and biological sciences into K-12 curriculum. The thirty acres of pastureland has minimal fencing and is in need of more waterers, a greater forage diversity and density, weed control, and improved utilization. We are working with county and school personnel at the Land Lab to care for the herd, as well as research and implement a rotational grazing system to help reduce feed costs and improve nutrition for the cow/calf pairs. We are partnering with county personnel to wean and feed calves. By researching and implementing a rotational grazing system on the pasture we plan to reduce feed costs and improve nutrition for the cow/calf pairs. Rotational grazing has the potential to improve forage quality, extend grazing season, and improve average daily gain. Carrying capacity and stocking rate will be calculated and a rotational grazing system designed and implemented. The body condition score (BCS) of the cows will be evaluated before pasture renovation and rotational grazing are implemented, and again after the project is complete. Pasture renovation will include increasing the diversity and density of the forage through fertilization and seeding, weed control, fencing, and installing a frost-free waterer.

Mentor(s): Wesley Gwaltney (Agricultural Technology); Rachel Kohl (Agricultural Technology)

KELLY L. COOPER HISTORY

The Illumination of the York Minster and St. Patrick's Cathedral: Two Preservation Approaches

Evolving interdisciplinary and international cooperation is influencing specialists' approaches to preserving historic structures; yet individual national preservation ideologies affect the extent to which emerging international principles influence a country's historic preservation methods. The national ideologies differ in that UK preservationists pursue strict, well-researched conservation. Meanwhile, the US considers preservation within a national development context that prizes investments, leading to a greater emphasis on restoration that includes energy-conscious efficiencies. This research investigates the approaches of international appeals for certain methods in nations with established preservation ideologies. My thesis examines the York Minster (1338-1408) in Yorkshire, UK and St. Patrick's Cathedral (1858-1897) located in New York City, USA as case studies. Both of these cathedrals, using various preservation methodologies, attempted to exercise the international call for a concentrated focus on conservation. The York Minster preservation undertaking retained a greater emphasis on conservation and, if needed, the restoration needs of the stained glass and masonry. Alternatively, St. Patrick's Cathedral underwent a more comprehensive preservation project. The preservation approaches discussed in my thesis of St. Patrick's Cathedral and the York Minster highlight how interdisciplinary and international collaboration have affected recent and current preservation projects, as well as show how national ideologies influence preservation approaches in various countries.

Mentor(s): Dr. LaDale Winling (History)

JAZMINE M. COPELAND BIOCHEMISTRY
LAURA WONILOWICZ ANIMAL & POULTRY SCIENCES
LANIE EPPERS BIOLOGICAL SCIENCES

Peer to Peer Problem Solving Studio Projects

Virginia Tech's Da Vinci and Curie ('CurVinci') Living Learning Community's consist of ~200 life, biological, physical, and quantitative science undergraduates who aspire to go beyond the classroom. CurVinci programming is designed to promote the development of skills associated with the practice of science, through a 'learn by doing' experience. First year students participate in a First Year Experience (FYE) course (COS-1016) in which they collaborate with sophomores and juniors on Peer-to-Peer projects, designed to closely reflect the problem-oriented, peer-run, participatory practices of scientists. Students work in groups to accomplish one aspect of a larger project: build a data collection rocket, construct a 2D layered representation of an anatomical model, construct a prosthetic device for an animal, or construct a 3D representation of an element on the periodic table. Students present the finished products in a showcase at the end of the semester where faculty are invited to interact with the students in order to learn about their projects and the community. Research data is collected and assessed on the problem solving process of the students and how completing the projects affected that process. The display will be representative items from the 2015-2016 projects.

Mentor(s): Dr. Stephanie Lewis (Director - Curie Living Learning Community)

EDGAR CORREA CROP & SOIL SCIENCES

Molecular Markers for Low Trypsin Inhibitor Soybean Breeding Selection

Trypsin inhibitors (Ti) are protease inhibitors, found in soybeans, reducing the biological activity of trypsin, a beneficial enzyme. Ti are denatured at high temperature by processors to produce viable soybean meal, which causes other amino acids to be biologically unavailable. Breeders are developing low or no Ti varieties to save energy and improve meal nutrition. Currently, a colorimetric bioassay is used for Ti activity measurement. The procedure is time consuming and inaccurate. The objectives of this project were to establish a quick and reliable methodology to quantify Ti activity, and to identify or confirm genetic markers associated with Ti activity using the new method for future marker-assisted selection on low Ti activity. For the Ti measurement method, a protocol using high performance liquid chromatography was developed. Ti proteins elute, and Ti activity peak could be recorded at a retention time of 6.5 min. For the marker identification, five markers were selected either from the Ti gene region or publications to screen 200 progenies of a F3 population derived from Glenn (normal Ti) x PI547656 (low Ti). The Ti activity of the F3 and F4 populations were quantified and used for marker and trait association analysis. However, none of the markers showed significant association with Ti activity, probably because the gene region targeted was not the functional region of Ti activity, and published markers were not reliable due to the inaccuracy of phenotypic method.

Mentor(s): Dr. Bo Zhang (Crop & Soil Environmental Sciences), Dr. Luciana Rosso (Crop & Soil Environmental Sciences); Dr. Chao Shang (Crop & Soil Environmental Sciences)

BROCK A. DAVIS MECHANICAL ENGINEERING
KATRINA SOMERS BIOLOGICAL SCIENCES

Leaf-Inspired Biomimetic Design for Aerodynamic Dispersal Structures

The objective of this research project is to examine the aerodynamic dispersion of leaf and leaf-inspired structures. By investigating Samaras (winged seeds), we hope to determine parameters that influence their range of dispersal and reverse engineer an "ideal" seed. This research is the result of a pilot program investigating interdisciplinary research methods between Biological Sciences and Engineering disciplines. Understanding and increasing the dispersal range of falling objects is highly relevant to many different applications. From a biological perspective, research can inform ideal growth conditions for reforestation or dispersal of pathogens. From an engineering perspective, increasing the dispersion of airborne sensors could create new opportunities for space exploration or military applications. We have modeled and modified Samara geometry with solid modeling tools, and used 3D printing to produce synthetic seeds. Using high-speed video capture, we have visualized the falling behavior of natural and synthetic samaras and tuned the 3D printed seeds to match natural behavior. We have succeeded in producing seeds that achieve rotational behavior similar to a maple seed. We are acquiring new samara species and hope to create synthetic versions in an attempt to match their behavior as well. By exploring different Samaras and manufacturing techniques, we hope to expand research into plant based dispersion mechanisms and their engineering applications.

Mentor(s): Shane Ross (Biomedical Engineering & Mechanics); David Schmale (Plant Pathology, Physiology, & Weed Science)

LAUREN R. DELBRIDGE LANDSCAPE ARCHITECTURE

Coal Ash Wastescape: Designed Remediation of Chesterfield Power Station's Coal Ash Ponds

An estimated 140 million tons of coal ash waste are produced each year in the United States. Our nation's dependency on coal-fired energy has led to a growing number of wastescapes in the form of coal ash ponds that threaten our communities, ecologies, and most importantly ground water systems. With recent EPA legislation mandating the engineered closure of active coal ash ponds, there is a great opportunity for design interventions to transform these disturbed sites into inhabitable spaces. My research is focused on the designed remediation of coal ash ponds associated with Dominion's Chesterfield Power Station located just south of Richmond, Virginia. Chesterfield Power Station is situated along the James River and is adjacent to a nature conservation area, creating an ideal juxtaposition of nature and industrial waste. Through design, I am remediating the coal ash landscape with existing ecologies, human experience, and visitor education in mind. Design interventions made on this site will make this landscape a prototype for coal ash wastescapes across the nation. To make informed design decisions, I researched the production of coal ash, potential threats, and current engineered containment strategies. I also studied applicable bioremediation and phytoremediation methods and ideal plant selections that would tolerate coal ash conditions. Remediating the degraded site with humans and ecology in mind could be the solution to our ash-covered landscapes.

Mentor(s): Wendy Jacobson (Landscape Architecture)

RISHI K. DEVULAPALLI NEUROSCIENCE
LEAH COOPER PSYCHOLOGY

Visual Aspects of Numeracy Neuroimaging: Cortical Surface-Based Meta-Analysis

Neuroimaging research has identified regions in parietal cortex related to visual numeracy. We applied a meta-analysis technique that projects stereotaxic coordinates onto a cortical surface atlas to analyze the location of functionally significant regions across studies. The Matlab toolbox VAMCA (Visualization And Meta-analysis on Cortical Anatomy; http:/nitrc.org/projects/vamca) uses a database of cortices from 60 healthy subjects to locate activations on a standardized cortical surface by extending the technique of multi-fiducial mapping. Here we used coordinates from over 100 published articles to examine the consistency of functional activations from numeracy tasks. We also compared differences in activation loci that corresponded to parameters that varied across studies, including cognitive demands (e.g. magnitude comparison vs. enumeration), visual displays (e.g. symbolic vs. analog depictions of numbers), and ranges of numbers (which interacts with perceptual grouping). Meta-analyses showed that a region in the horizontal segment of the IPS is activated during diverse kinds of number judgments. There was also evidence that symbolic (numerals) and analog (dots) representations activated relatively superior and inferior portions of the horizontal/anterior IPS. We identified subregions of occipitotemporal cortex that may respond selectively to lower (1-10) and higher (10-100) ranges.

Mentor(s): Dr. Anthony Cate (Psychology)

NICOLE R. DUBOIS PSYCHOLOGY
AARON J. WILLS COGNITIVE & BEHAVIORAL NEUROSCIENCE
SAMANTHA M. CORNWELL BIOCHEMISTRY
LEAH P. COOPER PSYCHOLOGY

Effects of Stress on Cerebral and Facial Activation

Past research experiments have been conducted to study the relationship between high- versus low-hostile participants and facial muscle tones when presented with a stressor. Most studies that test for facial muscle tones stick to only male participants to ensure homogeneity of laterality within the experiment. The purpose of this study is to incorporate sex differences in high- versus low-anxious individuals to study their facial motor tones when presented with a physical stressor. To record facial activity, two electrodes will be placed on the left and right corrugator and masseter muscles, 4 in total, and a ground electrode will be placed in between the participant's eyes. Exposure to the cold-pressor stressor will involve immersing the participant's left hand in a container with ice water for 45 seconds. The research team will record baseline data prior to and following the stressor, and facial activity will be monitored and recorded throughout the experiment. One anticipated finding of this study is that high-anxious male and female participants, following exposure to the cold-pressor test, will demonstrate increased muscle tone at the face in comparison to low-anxious participants. It is expected that high-anxious participants will show increased muscle tone at the left, versus the right, hemiface. Based on previous experiments, we propose that female subjects, whether they are low-anxious or high-anxious, will have more facial regulatory control than the male subjects.

Mentor(s): Dr. Kelly Harrison (Psychology)

AHMED M. ELNAHHAS MECHANICAL ENGINEERING

Experimental Investigation of Acoustic Energy Transfer Systems

Wirelessly transferring energy has been explored in many ways, ranging from electrical induction and capacitance to optical means. In this presentation, transferring energy using ultrasonic acoustic waves is studied using piezoelectric transducers to validate the concept. Electroelastic analytical models are presented that provide an approximation to the load resistance and the excitation frequency required to achieve maximum power. The values obtained from the model are then used as fixed parameters in a series of experiments that test the effects of the input voltage to the transmitter, the excitation frequency, the distance between the transducers and the presence of barriers in between the transducers. It is found that the energy transferred drops significantly with distance. Furthermore, the presence of barriers between the transducers introduces acoustic impedance mismatch effects that reduce the power transmitted significantly. However, when a porous media is placed in between the transducers, the amount of energy transferred does not drop substantially. The efficiency of the system is small compared to the predictions of analytical models. However, it is found that this is due to the slight deviation of the resonance frequency of the transducer from its analytical nominal value.

Mentor(s): Shima Shahab (Biomedical Engineering & Mechanics)

CARLY J. ESTRADA-PALMA BIOCHEMISTRY

SKBR3/Her2+ Breast Cancer Cells: Cell-Surface Receptors and Signaling Pathways

The objective of this study was to determine the location of specific peptide sequences relative to the cytoplasmic membrane that are involved in signaling pathways that induce proliferation and suppress apoptosis in the SKBR3/Her2+ breast cancer cell line. To accomplish this, a proteomic evaluation of the SKBR3/Her2+ cancer cells by liquid chromatography-mass spectrometry was performed after their arrest/release into the G1/S stages of the cell cycle, and after subsequent treatment with various drugs before quantitation. Specific peptide sequences from proteins of interest that were quantified by LC-MS were further studied to uncover their location. After both the G1/S and drug peptides from the SKBR3 breast cancer cells were quantified using LC-MS, the results were analyzed using various bioinformatics software packages such as DAVID Bioinformatics Resources 6.7, PhosphoSite Plus, and UniProt. For the G1/S and drug treated cells, the dataset contained ~235,000 and 311,000 peptide sequences, respectively. However, there were only 79 cell membrane receptors of interest that could have potentially contained some of these sequences. The peptides pertaining to these receptors were identified, and their location relative to the plasma membrane was determined. Determination of the location of these peptides allows for the deduction of additional information about their functions, crosstalk, and catalytic nature.

Mentor(s): Dr. Iuliana Lazar (Biological Sciences)

RICARDO P. FERNANDEZ GEOSCIENCES
CALEB SHOCKLEY GEOSCIENCES

Trace elements in Dan River sediment after the 2014 coal ash spill

On February 2, 2014, an estimated 82,000 tons of coal ash and 27 million gallons of contaminated water were released into the Dan River from a ruptured storm drainage pipe underneath the ash pond at the Duke Energy Steam Station in Eden, NC. Coal ash contains elevated concentrations of trace elements, some of which are toxic, prompting a concern that the ash spill could adversely impact human, aquatic, and environmental health over time. The objective of this study was to identify coal ash derived trace element signatures in the river sediment over space and time. Sediment samples were collected by our research group and the Virginia Department of Environmental Quality over a two year period. The samples were digested and analyzed for trace elements using ICP-MS. We used correlation analysis to examine patterns and potential relationships in the geochemical data. Results illustrated strong positive correlations of several trace elements, including As, Cd, Cr and Pb, with Fe. These correlations suggest a geochemical association, likely adsorption, of these elements on Fe-bearing minerals or mineral coatings. In addition, we examined data for outliers as potential indicators of coal ash inclusion in sediment. For example, although As showed a strong positive correlation with Fe along one linear trend, there were 7-8 samples that were enriched with As with respect to Fe, suggesting a coal ash concentration in those sediment samples. We also compared the trace element concent

Mentor(s): Madeline E. Schreiber (Geosciences)

CHRISTIAN J. GILBERTSON ENGINEERING SCIENCE & MECHANICS

A study of the gamma-ray burst fundamental plane

A class of long gamma-ray bursts (GRBs) with a plateau phase in their X-ray afterglows obeys a three-dimensional (3D) relation (Dainotti et al. 2016), between the rest-frame time at the end of the plateau, Ta, its corresponding X-ray luminosity, La, and the peak luminosity in the prompt emission, Lpeak. We extended the original analysis with X-ray data from July 2014 to July 2016 achieving a total sample of 183 Swift GRBs with afterglow plateaus and known redshifts. We added the most recent GRBs to the previous 'gold sample' (now including 45 GRBs) and obtained a relation plane with intrinsic scatter compatible within one ÿü with the previous result. We compared several GRB categories, such as short with extended emission, X-ray Flashes, GRBs associated with SNe, long-duration GRBs, and the gold sample, composed only by GRBs with light curves with good data coverage and relatively flat plateaus and evaluated their relation planes. We found that they are not statistically different from the fundamental plane derived from the gold sample and that the fundamental plane still has the smallest scatter. In an extended analysis, we found that the fundamental plane is independent from several prompt and afterglow parameters.

Mentor(s): Maria Dainotti (Physics - Stanford University)

DUNG T. HAN BIOCHEMISTRY

Insight into Cross-amyloid Interactions in Alzheimer's disease and Type II diabetes: Molecular Dynamics Simulations of $A\beta_{(16-22)}$ and $IAPP_{(20-29)}$ Hexamer Formation

The aggregation of amyloid β-peptide (Aβ) and islet amyloid polypeptide (IAPP) into cytotoxic oligomers in Alzheimer's disease (AD) and type II diabetes (T2D), respectively, has been identified as one of the pathological hallmarks of both diseases. Cross-amyloid interactions between Aβ and IAPP have been described both in vivo and in vitro, implying the role of Aβor IAPP as modulators of cytotoxic self-aggregation of each species, and suggesting that Aβ-IAPP interactions are the potential molecular link between AD and T2D. In this work, we performed 1 βs of molecular dynamics simulations (MD) of Aβand IAPP to investigate their self-aggregation. The systems were built using six $A\beta_{(16-22)}$ or six $IAPP_{(20-29)}$ fragments, selected for their critical role as core regions for the aggregation of full-length Aβ and IAPP peptides. Hexamers rich in antiparallel and parallel β-strands formed in both $A\beta_{(16-22)}$ and $IAPP_{(20-29)}$ systems. The $A\beta_{(16-22)}$ hexamer adopted a conformation of a β-strand tetramer and dimer positioned in two parallel planes, while the $IAPP_{(20-29)}$ molecules were arranged in a hexameric cylindrical structure. Secondary structure, hydrogen bonds, and solvent accessible surface area analyses confirmed that Aβ and IAPP monomers aggregated into hexamers rich in β-strands. These observations are important for the design of compounds targeting the aggregation of Aβ and IAPP by interfering with the formation of the soluble oligomers, thereby mitigating their cell toxicity.

Mentor(s): Dr. Anne M. Brown (Biochemistry); Dr. David R Bevan (Biochemistry)

ALLISON L. HARRIS MECHANICAL ENGINEERING
JOHN C. CHANDLER MUSIC
JONATHAN T. ELMORE MUSIC

National Opera Association Collegiate Opera Scenes Competition

For musicians, performing is research. Preparing for a performance entails studying the piece itself, the work it is from, the composer, the librettist, the time period, and so much more. This past January, we competed in the Opera Scenes Competition at the National Opera Association's Annual Conference. The goal of this project was to expand our understanding of 1930s musical styles, techniques, and dances. We were in the musical theatre division, and the scene we competed with was 'Me and My Girl" from the 1930s British musical "Me and My Girl" by Noel Gay. To prepare for this performance, we intensively studied (and learned to speak with) a Cockney accent, coached music with Dr. Masters, and prepared staging and dancing with Professor Wyatt. We also conducted extensive research about the composer and his other compositions and studied all available recordings. Though "Me and My Girl" is not often performed, the show won a Tony for its United States premier in the 1980s and is due for a revival. We would love the opportunity to present our scene from it to the Blacksburg community and afford this show the exposure and respect it deserves.

Mentor(s): Ariana Wyatt (Music)

RHIANNON J. HASENAUER HUMAN DEVELOPMENT

The Future of Honduras

The ACC Creativity and Innovation Fellowship provided the opportunity for me to teach for two weeks in the Villa Soleada Bilingual School in Northern Honduras last summer. The Villa Soleada Bilingual School serves the village of Villa Soleada and nearly 10 surrounding villages. VSBS provides the poorest children with the quality of education to which only children from wealthy families would have access. The summer session is structured for students to continue practicing their English skills through English immersing activities, lessons and play. Each day, my students' activities were centered around the theme Career Days. Students were engaged in making bottle rockets, participating in scavenger hunts, creating solar system hats, building s'mores solar ovens, and more. With this two-week program, my students were provided the opportunity to explore their own interests and talents and to feel inspired to be the next leaders in The Future of Honduras. Additionally, the grant allowed me to stay an extra week in Honduras to lead a group of volunteers, from both the United States and Japan, with Students Helping Honduras to work on the construction of a school in a rural village. Students Helping Honduras is a nonprofit organization aiming to alleviate poverty and violence in Honduras through education and youth empowerment. This organization has inspired me to follow my dreams of promoting global connectedness and empathy within the realm of education and youth empowerment.

Mentor(s): Dr. Katherine Allen (Human Development)

TARA D. HELMS GEOSCIENCES

Effect of swine manure on limestone dissolution

Localized wastewater sources on karst terrain that discharge directly into the subsurface can enhance the dissolution of limestone. Previous work suggests that landfill leachate leads to the formation of localized permeable fissures in karst. Based on this previous work, we hypothesized that manure application may also have an enhanced effect on dissolution of limestone. To address this hypothesis, we conducted a batch laboratory experiment where we observed the effect of swine manure on limestone dissolution. Six treatments were constructed using combinations of diluted swine manure, limestone, soils and deionized water. Limestone of the Boone Formation and overlying soils were collected from Newton County, Arkansas, a karst region characterized by extensive agriculture, including a swine Confined Animal Feeding Operation. Liquid manure was collected from the Virginia Tech swine farm. During the six week experiment, we measured pH, Ca and Mg of the experimental solution. Results show an increase in the pH and in the Ca and Mg concentrations in the treatment containing limestone and manure in comparison to the control (no manure), suggesting that the manure accelerated the dissolution of the limestone. Data will be used to calculate rates to allow for quantitative comparison of the effect of manure on limestone dissolution.

Mentor(s): Dr. Madeline Schreiber (Geosciences)

GRACE A. HERRICK NEUROSCIENCE
RIYA P. NAG PSYCHOLOGY;
ANDREW K. BANICK NEUROSCIENCE
JONG W. LEE BIOLOGICAL SCIENCES
HANNAH HAWKS-MAYER BIOLOGICAL SCIENCES

Hemispheric Asymmetry through Autonomic Nervous System Responses to Visual Stimulation

The objective of this study is to investigate hemispheric laterality using the effect of monocular bright light exposure on measures of sympathetic arousal. Light exposure has been used to study the autonomic nervous system, and has been shown to cause an arousal of the sympathetic nervous system, due to contralateral retinocollicular projections to the right hemisphere. However, few studies have assessed hemispheric asymmetries of autonomic responses to monocular light stimulation in humans. In order to provide more data on the selective activation of one hemisphere through bright light exposure, this study seeks to implement a straightforward method. Monocular light stimulation will be used to study the effect on sympathetic nervous system activity. Blood pressure, skin conductance, and electrocardiography measures will be monitored throughout the procedure. After being given 90 seconds of rest to acclimate to the room, a bright light stimulus will be presented in the periphery of the left eye for 3 minutes and then again for 3 minutes after a short break. A fluency task will be given before and after each light stimulation in an effort to further support sympathetic arousal information. We predict that participants will show an increase in sympathetic arousal following bright light stimulation presented to the left eye, indicated by enhanced performance on the fluency task and physiological responses.

Mentor(s): Dr. Kelly Harrison (Psychology)

BROGAN E. HOLCOMBE ANIMAL & POULTRY SCIENCES

Does HotSpotter reduce time spent identifying individual ocelots?

HotSpotter is a free downloadable program that can be used to identify individual animals by their unique pelage patterns. This is especially useful for species like ocelots that can be photographed by non-invasive trail cameras. However, to date, there have been no assessments of the effectiveness of such programs and whether they save researchers' time (i.e. are faster/better than manually matching by eye). This study tested the efficiency of the HotSpotter program by categorizing photographic images into three quality score (1-Poor, 2-Fair, 3-Good/Great) and using both HotSpotter and the human eye to match them to a database of known individual ocelots from remote camera studies in Belize, Central America. Preliminary results suggest that HotSpotter was able to quickly and accurately identify high quality images (score of 3) a majority of the time. HotSpotter was mostly able to identify medium quality images (score of 2). However, when images were lower quality (score of 1) HotSpotter was much less likely to identify the individual ocelot and a human eye was better at making the correct, positive identification. Overall, the HotSpotter program can speed up the matching process by reducing time and effort, especially if a researcher already has a large database of animals to compare new images to. However, it should be noted that it requires substantial effort in building this initial database.

Mentor(s): Dr. Marcella Kelly (Fish & Wildlife Conservation)

NICOLE KAMINSKI BIOCHEMISTRY

Expression of Nutrient Transporters in Male and Female Chickens

In 2014, the US chicken industry slaughtered 8.54 billion broilers for market. In most commercial chicken operations, a mix of male and female broiler chickens are used. Male chickens grow faster than females, making them more economical. Currently, male and female chickens are provided with feed of the same composition. It could be advantageous for chicken operations to separate male and female broiler chickens to provide each sex customized diets to maximize their growth. Nutrient transporters play an important role in uptake of metabolic precursors, such as amino acids, peptides, and sugars. Regulation of these transporter proteins can affect growth rate and metabolic homeostasis. The difference in growth rate between male and female chickens could be due to differential expression of nutrient transporters. The goal of this project was to compare expression of nutrient transporters in male and female chickens. Real-time PCR was used to measure the mRNA abundance of an aminopeptidase, a peptide transporter, 6 amino acid transporters and 3 monosaccharide transporters in the duodenum, jejunum, and ileum of chicks at day of hatch, day 7 and day 14 post-hatch. The mRNA abundance of 4 amino acid transporters (bo,+ AT, EAAT3, ASCT1, and y+LAT2) and a monosaccharide transporter (GLUT2) mRNA was greater in male than female chickens. Because this difference was only observed at day of hatch, it cannot be the basis for the difference in growth rate between males and females.

Mentor(s): Dr. Eric Wong (Animal & Poultry Sciences)

STACEY KARETNYI BIOLOGICAL SCIENCE

Mycoplasma gallisepticum is recognized by the canonical NLRP3 inflammasome in macrophages

Mycoplasma gallisepticum (MG) is a bacterium that causes chronic respiratory disease in chickens and turkeys. Symptoms of MG include conjunctivitis and severe respiratory issues. NOD-like receptors (NLRs) are a form of Pattern Recognition Receptors which act as intracellular sensors. Some of these NLRs are involved in the formation of the multi-protein complex known as the inflammasome, which is responsible for the activation of the pro-inflammatory molecule interleukin-1B (IL-1B) and the pro-inflammatory form of cell death called pyroptosis. Despite MG's obvious economic impact, very little is known about its pathogenesis especially in regards to the inflammsome. Here, we hypothesize that treatment of both chicken and mouse macrophages with MG in vitro will result in activation of the canonical NLRP3 inflammasome. Primary murine bone marrow derived macrophages and the chicken macrophage cell line HD11 were challenged with MG and with and without ATP at various time points. IL-1B secretion was measured in the supernatant using ELISA and cell death was analyzed using a lactate dehydrogenase (LDH) release assay. Overall we found that MG requires ATP to activate the canonical NLRP3 inflammasome in vitro. The supernatants of NLRP3 deficient cells treated with MG had significantly attenuated IL-1B release compared to WT controls. In the future, we hope to look at MG in vivo in chickens.

Mentor(s): Dr. Irving Allen (Biomedical Sciences & Pathology)

SAMAN N. KHAN BIOCHEMISTRY

Inflammatory Cytokine Level Response to wheat gluten modulated in Celiac Disease via negative regulatory NLRs

Celiac disease (CD) is an immune-mediated disorder characterized by an inflammatory response to wheat and gluten. Nod-like receptors (NLRs) are a type of pattern recognition receptor that modulate inflammatory responses in the body, and may have an impact on celiac disease pathogenesis. Two of these NLRs, NLRP12 and NLRX1, work as negative regulators of inflammation and their potential role in CD was examined by comparing macrophages from Nlrp12-/- and Nlrx1-/- mice to those of wild type mice. Bone-marrow-derived macrophages from the NLR knockout and wild-type mice were exposed to gliadin, which is an antigenic component of gluten, zein from corn, saline, and bacterial lipopolysaccharide. Their inflammatory response was measured at the gene level with real-time PCR and at the protein level via ELISA. In the absence of NLRP12 and NLRX1 we expected gliadin-mediated inflammation to increase due their regulatory function. Wild-type macrophages exposed to gliadin showed suppression of regulatory NLRX1. Nlrp12-/- and Nlrx1-/- macrophages produced higher levels of proinflammatory cytokines such as IL-1Î² and IL6 upon exposure to gliadin. We conclude that with the presence of gliadin there was increased inflammation in our NLR knockout cells, which may indicate the importance of how immune cells such as macrophages recognize and respond to gliadin using NLRs.

Mentor(s): Dr. Irving Allen (Biomedical Sciences & Pathology); Dr. Kristine Eden (Biomedical Sciences & Veterinary Sciences)

THOMAS J. KING ARCHITECTURE
KATIE WALDNER ARCHITECTURE
ELYSE SMITH ARCHITECTURE

FutureHAUS

Our research is a proof-of-concept for a building system of the future. We have developed a system of folding cartridges that integrate the technology, electrical and plumbing embedded in a typical house into a pre-fabricated, shippable component. Such a scheme condenses the volume of a room into a modular block, dramatically reducing on-site construction time and creating a space that is both efficient and customizable. A bedroom, study and interstitial moving closet were developed utilizing the proposed cartridge system, showcasing opportunities for flex living space and integrated technology. An actuated murphy bed/office desk, responsive, mood-sensitive lighting, and a smart mirror were linked to a consolidated wardrobe - forming part of a resident-sensitive Internet of Things. The student team was involved in every facet of this study, from research and prototyping to the ultimate construction and presentation of our work at KBIS, an industry show in Orlando.

Mentor(s): Bob Vance (Architecture), Joe Wheeler (Architecture) Clive Vorster (Architecture)

JOSEPH F. KRAUSE NANOSCIENCE

Tunable Visible and Near Infrared Light Transmittance and Absorption in Layer by Layer Polymer-plasmonic Nanoparticle Nanocomposites

Macroscopic properties of plasmonic nanoparticles in thin films depends on their arrangement and orientation. Herein, we have synthesized plasmonic Ag nanoprisms in the visible and near infrared (NIR) regions and prepared plasmonic polymer nanocomposites through layer-by-layer deposition technique. Polymer composites gave sharp colors when embedded with Ag nanoparticles resonating in the visible light range, while the films with NIR-light-absorbing nanoparticles were comparatively less sharp in colors. Ultraviolet-Visible-Near Infrared (UV-Vis-NIR) spectroscopy was used to determine the localized surface plasmon, λ_{LSPR}, of the nanoparticles. Transmission electron microscopy (TEM) revealed that majority of the nanoparticles had a prismatic shape, while atomic force microscopy (AFM) showed that the average thickness of the Ag nanoprisms was ~12 nm. We monitored the transmittance and reflectance using UV-Vis-NIR. Reflectance increased as the size of the nanoparticles increases. The transmittance and reflectance were tuned through incubation time and deposition of multiple layers of nanoparticles with the help of electrolytes. For films with a dense layer nanoparticles, the transmittance decreased and the reflectance increased substantially. These materials can be potentially used as coatings for windows, photovoltaics, catalysis, metasurfaces and the color imparting property can find applications in aesthetic products.

Mentor(s): Dr. Guoliang (Greg) Liu (Chemistry); Assad Khan (Graduate Student Mentor, Chemistry)

ALEXANDRA B. KREBS BIOLOGICAL SCIENCES

Does Parent-Child Communication Influence Improved Treatment Outcome for Children with Oppositional Defiant Disorder and Comorbid Anxiety Disorder

Oppositional Defiant Disorder (ODD) is a disruptive behavior disorder causing problems in and out of the home (APA, 2013). Past work shows comorbid anxiety disorder (AD) is linked to greater symptom reduction in children with ODD (Martin, 2014). We examined if parent-child communication style when resolving family conflict might cause the greater improvement. The goal was to see if parental negativity and child engagement differ for children with ODD with and without comorbid anxiety, and if this causes the differences in outcomes. We conducted a secondary analysis of data from Ollendick et al. (2015), including 49 families (57% children with comorbid AD) participating at pre-treatment, post-treatment, 6-month and one-year follow-ups. Child engagement and parental negativity were observed at pre-treatment. Families were randomly assigned to one of two treatment conditions. MANOVA showed children with comorbid anxiety had greater symptom reduction than children without. T-tests showed no difference in parental negativity and child engagement according to presence/absence of an anxiety diagnosis. For children with anxiety, parental negativity was negatively correlated with child engagement, whereas for children without anxiety, parental negativity was positively correlated with child engagement. This suggests parent-child communication may function differently when children with ODD also have comorbid anxiety. Further work is needed to study means and span of treatment effects.

Mentor(s): Dr. Julie Dunsmore (Psychology), Rachel Miller-Slough (Psychology); Dr. Thomas Ollendick (Psychology)

ARIANNA I. KRINOS COMPUTER SCIENCE
LEA V. SARMENT BIOLOGICAL SYSTEMS ENGINEERING

Batrachochytrium-Battling Bacteria Foils Fungus Found on Frogs

The amphibian fungal pathogen Batrachochytrium dendrobatidis (Bd), which causes the skin disease chytridiomycosis, has led to the decline of global amphibian populations. However, some amphibian skin bacteria have probiotic potential to protect threatened species. Previously, ~2000 skin bacterial isolates from 37 amphibian species were compiled into a database containing (1) 16S rRNA gene sequences, and (2) classification of isolate Bd interaction: inhibitory, enhancing, unknown, or not significant, for which we aimed to assess the database's predictive potential. We hypothesized the bacteria-Bd interaction for isolates sampled from the skin of Panamanian Atelopus certus and Atelopus limosus frogs by analytically comparing each isolate's 16S rRNA gene sequence with database sequences at 97%, 99%, and 100% similarity prior to experimental determination. Of the 257 isolates, 106 were predicted to inhibit Bd at 97% sequence similarity. Eighty-seven and 14 isolates were predicted to be inhibitory at 99% and 100% similarity, respectively. Notably, at 97% similarity, 106 isolates were independently classified to enhance and inhibit the growth of Bd. At 99% similarity, 40 isolates matched only the enhancing classification. Current work includes co-culture challenge assays to test the empirical interaction of the isolates with Bd and evaluate the database's predictions. Refining the database's predictive power would aid in timely solutions to amphibian disease epidemics.

Mentor(s): Dr. Lisa Belden (Biological Sciences); Dr. Jenifer Walke (Biological Sciences); Daniel Medina Lopez (Biological Sciences)

ANDREA S. KULIASHA BIOLOGICAL SYSTEMS ENGINEERING

In Vitro Brain Tissue Model for Understanding Tumor Angiogenesis

Increased angiogenesis, the development of new blood vessels from pre-existing ones, is a well-established hallmark of cancer. In tumors, angiogenesis is almost always upregulated, leading to the continuous sprouting of new vessels to help deliver nutrients to the growing mass. A physiologically-relevant tissue model is necessary to understand the relationships of these cells and will have numerous applications across many disciplines of cancer research, especially in the development of targeted therapeutics. The process of developing this tissue mimic begins with creating a 3D culture model using human brain microvascular endothelial cells (HBMECs) seeded on top of a collagen hydrogel and D1 TNC1 rat brain astrocytes seeded within the scaffold, enabling the two cell types to interact. The cells were cultured for three days in the presence of vascular endothelial cell growth factor (VEGF), a protein produced by tumor cells that induces blood vessel sprouting. Fluorescent confocal analysis of the HBMEC sprouts within the scaffold illustrated that the presence of astrocytes in the tissue mimic reduced the sprout density, but had no effect on sprout depth. Further experiments are needed to understand whether chemical or mechanical signaling from the astrocytes are driving the alterations in sprout density. This platform will serve as a more effective in vitro model of the blood-brain barrier for studying microenvironmental factors that influence angiogenesis.

Mentor(s): Dr. Scott Verbridge (Biomedical Engineering & Sciences)

SUZANNE R. LALIBERTE BIOLOGICAL SCIENCES

Probing the cell type specificity of chemical defense in Arabidopsis roots

Plants use specialized metabolites such as terpenes in communication with their environment and to defend themselves against pathogens and pests. Plants often restrict the production of these compounds to particular cell types to support optimal activity. For example, the model plant Arabidopsis thaliana expresses some terpene synthases, which catalyze the formation of terpene compounds, in distinct tissues within the roots. Among these enzymes, terpene synthase 8 (TPS08) is normally expressed in the root vascular tissue. This study will determine the extent the activity of TPS08 is restricted to a particular cell type by investigating how transcript, protein, and product levels of TPS08 are affected when it is expressed in a different tissue. To answer this question, we will examine tps08 knockout lines expressing TPS08 with epidermal and cortex specific promoters, WER and CO2, respectively. TPS08 will be expressed alone or in fusion to either a FLAG tag or yellow fluorescent protein. Our analysis of TPS08 expression and product levels in Arabidopsis will contribute to understanding the spatial regulation of specialized metabolite production in plants.

Mentor(s): Dr. Dorothea Tholl (Biological Sciences)

MELISSA R. LAND ENGINEERING SCIENCE & MECHANICS

Multibody Dynamics

The objective of this project was to implement and compare different methods to simulate the motion of multibody systems. Differential equations were developed to represent the dynamics of a double pendulum and a passively walking bipedal robot based on a Lagrangian approach using relative coordinates, which is commonly taught to students. This method often results in long and confusing equations, making it challenging for students to simulate more complex systems. Our method provides simple tools for students to simulate such complex systems. Each body of the system is associated with its own Cartesian coordinates, and constraint equations that link bodies to each other are introduced. The Lagrange approach is still used to create the equation of motion of the system but the terms are simplified as the mass matrix. MATLAB codes were created to solve the equations numerically using ODE solvers. Visual representations, including plotting the positions of the pendulum and video simulations of the motion, were used to compare the results.

Mentor(s): Dr. Adrian Sandu (Computer Science)

MEREDITH D. LEWIS ANIMAL & POULTRY SCIENCES

Determination of the Metabolizable Energy of DDGS Extracted Corn Oil in Commercial Broiler Chicks Fed Various Concentrations of Calcium.

Dietary calcium can interact with fatty acids present in supplemental oil, forming indigestible soaps that can reduce the energy digestibility of the supplemental oil. As the amount of dried distillers grains with solubles (DDGS) corn oil has increased (DDGS corn oil is produced using fermentation that could increase fatty acid content), determining the metabolizable energy of DDGS corn oil in comparison to soybean oil in diets containing either 0.9 or 2.0% calcium is important. Commercial male broiler chicks were raised for 28 days on diets including 0, 3, 6, or 9% of soy or DDGS corn oil and 0.9 or 2.0% Ca. This resulted in 14 treatments of 9 replicate cages with 5 chicks (630 total chicks). Body weight, feed intake, feed conversion ratio, and mortality were measured. Excreta from day 28 was collected and will be analyzed for gross energy, titanium and nitrogen to calculate the nitrogen corrected apparent metabolizable energy (AMEn) of the oils. All remaining birds were euthanized and four birds from each replicate were used for Dual-energy X-Ray Absorptiometry (DXA) body composition analysis. There appears to be a significant difference in body weight between the two calcium levels, but no significant difference among the dietary oil levels. Fat mass, as determined by DXA analysis, does appear to correlate with dietary oil concentration and is proposed as a supporting measurement for AMEn determination to better understand the true utilization of dietary oil by the birds.

Mentor(s): Dr. Michael E. Persia (Animals & Poultry Sciences)

DJ MALINOWSKI MUSIC
STEVEN W. ARNOLD MUSIC
JD GRIZZLE MUSIC
JESSE W. HUGHES MUSIC
LAURA E. MONIUSZKO MUSIC

Alchemy: A Composer/Performer Experiment in Acoustic Possibilities

The goal of this collaboration was to explore the role of the composer versus the performer and possibilities of those roles while creating an aesthetically pleasing modern performance. DJ, the composer, wanted a blend of two or three different aesthetic categories, which evolved into water and light. From there he developed improvisation sections notated only by flexible performance guidelines and the duration of a particular performance direction. DJ approached members of the Virginia Tech Percussion Ensemble to perform this piece. It involves minimal instrumentation options, and with discussion between the composer and ensemble, the piece evolved in acoustic possibilities. This piece challenges the performer to take an active role in the execution of the piece. Because of the few performance direction limitations in improvisation sections, the performers also take part in the construction of the piece. This allows the piece to be different each time it is performed. This piece expands modern repertoire and challenges the performer in new ways.

Mentor(s): Dr. Annie Stevens (Music)

ALEC J. MASELLA LITERATURE & LANGUAGE

First Contact: The Influential Exchange between the American Fireside Poets and the Arab Mahjar Poets

During the latter half of the 19th century, the Arab Renaissance, al-Nahda, peaked throughout the Middle East. It began several decades after a clash with the Western hemisphere via Napoleon's invasion of Egypt in 1798 and led to the modernization of Arab religions, linguistics, and, most famously, literature and poetry. Within this literary revival, a group of poets known as the Mahjar Poets, or American immigrant poets, provided the Arab World a new array of topics in poetic form. Moving away from religious and narrative subjects, the Mahjar Poets honed in on themes of globalism and Western influence throughout the Arab World through classical poetic form. They later adopted 19th century American free verse during mass immigration. During the same period, the American Fireside Poets, consisting of Henry Longfellow, William Cullen Bryant, John Whittier, James Lowell, and Oliver Wendell Holmes, became the most widely studied and popular poets of 19th century America. Due to the increase in immigration from the Middle East to America, along with the early stages of al-Nahda influence, the later works of the Fireside Poets and the early works Mahjar Poet Ameen Rihani hold similar themes, poetic forms, and cross-cultural critiques. This research analyzes those factors to show that the points of contact between the two cultures permeated written art forms in a unique, mosaic-like social context.

Mentor(s): Dr. Ashley Reed (English)

THOMAS C. MAULBECK MATERIALS SCIENCE & ENGINEERING
WILLIAM A. BLANKENSHIP GENERAL ENGINEERING

Processing of titanium-carbon alloys by the mechanical alloying of titanium and dry cornhusk

Titanium alloys exhibit high specific strength and corrosion resistance, lending themselves to mechanical applications in harsh environments. This project explored mechanically alloying titanium with cornhusk, a waste material and source of carbon, and the resulting microstructure and related mechanical properties of the Ti-C alloy. A composition of dry cornhusk (CH) and titanium (0.5 wt.% CH - 99.5 wt.% Ti) was ball milled for 1, 2, and 5 hours; compacted; and sintered for 1 hour at 1150°C. X-ray diffraction (XRD) and density measurements were performed on the sintered compacts. Optical microscopy, scanning electron microscopy (SEM), and Vickers micro hardness testing were also performed. XRD revealed a dominant α-phase titanium crystal structure. The CH carbonized after sintering, and its dispersion within the α-phase matrix became refined with milling time, according to optical microscopy and SEM. The effect of processing parameters on the microstructure and corresponding hardness will be presented and discussed.

Mentor(s): Dr. Alex Aning (Materials Science & Engineering); Ibrahim Khalfallah (Graduate student mentor - Materials Science & Engineering)

HALEY A. MEADE BIOCHEMISTRY

Effects of Quaternary Ammonium Compound Exposure on Growth and Differentiation of Neural Stem/Progenitor Cells

A neural tube defect (NTDs) is an incomplete closure of the neural tube in a developing embryo and can cause severe birth defects. Quaternary Ammonium Compounds (QACs) are a common class of chemicals found in cleaners, disinfects and cosmetics. Exposure to Alkyl Dimethylbenzyl Ammonium Chloride (ADBAC) and Didecyl Dimethyl Ammonium Chloride (DDAC), two QACs commonly used in disinfectants, has been linked to an increase in the occurrence of NTDs in mice and rats. The goal of the study is to further analyze the toxicity of QACs to neural development using neural stem/progenitor cells (NSPCs). NSPCs differentiate into neurons, astrocytes and oligodendrocytes. This study will determine if exposure to QACs affects the timing of differentiation and the distribution of cell types derived from the NSPCs. Exposure and control cells will be grown, differentiated and the quantity and classification of cell types will be quantitatively determined using immunohistochemistry. It is believed that exposure to ADBAC+DDAC will decrease the number of differentiated cells and disrupt the ratio of cell types present. The results of this study will reveal the effects of QAC exposure during stem cell differentiation of the developing embryo and may shed light on the occurrence of structural and neurobehavioral birth defects. Because QAC exposure is so prevalent, it is important to understand the repercussions of the widespread use of QACs, including the embryo toxicity of this class of chemicals.

Mentor(s): Dr. Terry Hrubec (E. Via College of Osteopathic Medicine; Virginia-Maryland Regional College of Veterinary Medicine)

ALLISON MOSER FISH & WILDLIFE CONSERVATION

Use of camera traps to survey Sylvilagus spp. in high-elevation habitats in the southern Appalachians

Little information currently exists on Appalachian cottontail (Sylvilagus obscurus). This study's objective was to assess if camera trapping is an effective survey method for Appalachian cottontails. Since two species, Appalachian cottontail and eastern cottontail (Sylvilagus floridanus), co-occur at the study site, we examined whether camera trap photos could be used to differentiate between the two species and to assess activity patterns of cottontails. Field work was conducted from June to August 2016 at the Roan Mountain Highlands in North Carolina. We randomly distributed 18 cameras and baited each camera site, checking stations every 4-9 days. We hand-processed all images and estimated activity patterns using Program R package 'overlap'. All cameras were active for a mean of 19 ∂Ò 0.30 SE (14-23) days. Appalachian and eastern cottontails were identified to genus. Cameras recorded 77 capture events for cottontails. Of these pictures, 12 could be confidently identified as eastern cottontail. We observed a peak in cottontail activity around dusk, although individuals remained active throughout the night. We were unable to identify most cottontail pictures (84.4%) to species, which prevented us from differentiating activity patterns of the two species. Adjustments to these methods could improve the utility of camera trapping for surveying lagomorphs and other small mammals.

Mentor(s): Dr. W. Mark Ford (Fish & Wildlife Conservation); Corinne A. Diggins (Fish & Wildlife Conservation)

SANJNA NAG HUMAN NUTRITION, FITNESS, & EXERCISE

Global Health in Underdeveloped Countries

I would like to gain a better understanding of advocating and advancing public health in developing countries and how that can be done without the use of monetary aid. Questions I would like to address are: How can we advance global health without monetary aid? Are developed countries making a difference in underdeveloped countries? What is the best way to advance health in these countries? I wanted answers to these questions because water is an essential component of human health, food security, economic growth, national and regional political security, and environmental sustainability. Yet 664 million people, living primarily in sub-Saharan Africa, currently lack access to an improved water supply and 2.4 billion people have no access to improved sanitation. The methods I will be using analyze these questions are focus groups and literature reviews. From a completed literature review I will have a better understanding of the research and current findings on the issue of water, sanitation, and hygiene. I will look at strategies, technologies, and interventions efforts that have been used to advance global health.

Mentor(s): Dr. Tiffany Drape (Agricultural, Leadership, & Community Education)

ALEX W. NIKRANT PHYSICS

Determining the energy parameters of core-collapse supernova electron neutrinos

My research focuses on the detection of electron neutrinos in order to determine the energy parameters of a core-collapse supernova. When a star explodes, it emits about 99% of its gravitational binding energy in the form of neutrinos over roughly 10 seconds, producing on the order of 10^57 neutrinos. Of the six types of neutrinos and anti-neutrinos, the electron neutrino has proven harder to detect and analyze than the other five. The goal of my research is to explore the viability of a potential method of electron neutrino detection analysis. Using supernova simulation data, scattering cross sections are implemented to reproduce what would be seen in a detector from all types of neutrinos. Specifically, I look at Super-K in Japan, as well as proposed detectors Hyper-K and DUNE. After the mock detector data is generated, a chi-squared fit test is performed with three parameters; average electron neutrino energy, total energy emitted, and the spectral pinching parameter. From this analysis we can create statistical contours containing the actual values at 90% confidence level, with different contours for Super-K, Hyper-K, and DUNE. This allows us, in the event of an actual supernova, to obtain constraints on the energy parameters of the electron neutrino spectrum. In addition, the method also provides a comparison of the relative precision of the aforementioned detectors, potentially motivating more funding for the construction of Hyper-K or DUNE.

Mentor(s): Dr. Shunsaku Horiuchi (Physics)

MIYA S. OSHIRO COMPUTER SCIENCE

Royalty: An Interactive Emotional and Mental Healing Experience

The 2015 annual American College Health Association National College Health Assessment, conducted by the American College Counseling Association (ACCA), reported that 35.3 percent of about 75,000 undergraduate students felt so depressed that it was difficult for them to function; 57.7 percent indicated feeling overwhelming anxiety. Video games can be used as a medium to provide accessible and engaging ways of improving a young adult's mental health. Participants will engage in a video game that will lead them through a story that parallels a journey of emotional growth and healing after a trauma. After completing the game, the experience could potentially improve the wellbeing of the participants, increase their morale and reduce stress in their everyday life. The game will include a solid foundation rooted in psychology, sociology and human development. An emphasis in color theory and creative writing will be essential to the quality of the gaming experience. This will be a non-violent 2D platformer game and will be produced using the necessary technical skills in the Unity Engine to implement the Graphical User Interface of the game and will use the QWERTY keyboard as the control system. Photoshop and traditional art techniques will be used to create the visuals of the game. The potential of this game extends to possible usage in therapy for emotional healing from trauma, a source for at-home meditation and entertainment, and helping to improve a user's mental health.

Mentor(s): Thomas Tucker (School of Visual Arts)

HANNAH D. PARKER ANIMAL & POULTRY SCIENCES

Investigating Leptin as a Mediator of Placental Adhesion, Invasion and Implantation in Ruminants

Leptin is a hormone of adiposity that originated from white adipose tissue. Numerous involvements of leptin exist, some of which consist of regulating homeostasis, energy intake, placental development and fertility. Recently, leptin has been linked to obesity in humans and other mammals. With increasing obesity, an increase in leptin production occurs. The purpose of this work was to determine the endocrine link between cattle nutrition and reproduction by examining nutritional status on pregnancy at the molecular level. The first goal was to examine the effect of leptin supplementation on bovine trophoblast (CT1) cell adhesion. In four leptin supplemented adhesion assays, we expected adhered CT1 spheres to increase with supplementation. Results varied, suggesting that no conclusions can be made supporting our hypothesis. If leptin increased adhesion rates, this would mean it has positive effects on maintaining pregnancy in cattle. The second goal is to examine leptin's effect on placental implantation via CT1 migration assays. A transwell migration assay will be used to study the migratory response of leptin-treated CT1s (at various doses). Because CT1 migration is a good indicator of conceptus development and elongation, we hypothesize that leptin treated cells will migrate more quickly and efficiently. Learning how leptin impacts early placental development and function in cattle may lead to evidence that will improve production efficiency and reproductive potential.

Mentor(s): Dr. Alan Ealy (Animal & Poultry Sciences)

KATELYNN M. PETRASIC BIOCHEMISTRY

H-FIRE Treatment in 4T1 Mammary Tumors in Mice: A Pilot Study

Breast cancer is a common and invasive cancer, which currently has no cure. Metastatic rates are often high, and mortality is normally associated with tumor metastasis. Because of this, a great deal of research is being done on novel therapeutics that address local disease, as well as, metastatic disease. One of these emerging therapies, High-Frequency Irreversible Electroporation (H-FIRE), utilizes electrical pulses to target tumor cell membranes ultimately leading to tumor cell death. We hypothesized that H-FIRE will prove a safe and efficient option for the treatment of breast cancer. To test this hypothesis, we utilized the 4T1 mouse model of mammary carcinogenesis. The 4T1 cells are derived from a spontaneous mammary carcinoma and, when injected into BALB/C mice, form a tumor that closely mimics triple negative human breast cancer. There is a similar tumor course, and metastatic pattern, in both humans and mice. The cells were injected into the mammary fat pad of the mice and tumors were grown for either 2 or 3 weeks, to mimic the varying stages. We then treated the tumors with H-FIRE. The results showed that H-FIRE treatment did not affect overall health of the animals. However, it did reduce the number of lung metastases in animals treated at earlier stages of disease when compared to no H-FIRE treatment or treatment administered later in tumor development. The conclusions of this study are that H-FIRE treatment is safe in this model and further studies are warranted.

Mentor(s): Dr. Irving Allen (Biomedical Sciences & Pathobiology); Dr. Sheryl Coutermarsh-Ott (Biomedical Sciences & Pathobiology)

AMY K. PLECHACEK GEOSCIENCES

LASER Ablation ICP-MS Analysis of Trace Elements in Pyrites of Gas Shales: Implications for Mobility

Trace elements contained in pyrite-bearing shale have the potential to be mobilized when the shale is exposed to oxygen. Although this occurs naturally, hydraulic fracturing processes may enhance pyrite oxidation, and trace element release, from the shale to water. First, the introduction of oxygenated fracturing fluid to the shale source rock may oxidize the pyrite in situ, allowing trace elements to be released into flowback water. Flowback water is typically stored in retention basins, which can leak, allowing these toxic trace elements to enter water supplies. Second, shale rock cuttings from drilling are also exposed to oxygen at the surface, producing acid drainage and allowing trace element release. Many trace elements are toxic and are regulated by the U.S. EPA; therefore, examining the mineral sources and potential mobilization mechanisms is important for protecting water supplies in areas impacted by hydraulic fracturing. In this study, pyrites and the shale matrix of gas-producing shales were evaluated for trace element content using laser ablation inductively-coupled mass spectrometry (LA ICP-MS). Four thin sections from four cores in the Marcellus Formation, the most expansive shale-gas play in the U.S., were analyzed by LA ICP-MS. NIST 612 glass was used as the external standard, and the USGS MASS-1 and BIR-1G were used as check standards.

Mentor(s): Madeline Schreiber (Geosciences)

FRANCISCO RAMOS MORA PHYSICS
ANDREW FARLEY MECHANICAL ENGINEERING
WADE FOSTER AEROSPACE ENGINEERING
CAITLYN STONE AEROSPACE ENGINEERING
GENEVIEVE GURAL AEROSPACE ENGINEERING
ZIOMARA MADERO-VARGAS AEROSPACE ENGINEERING
ANDREW TOUZINSKY AEROSPACE ENGINEERING

inVenTs High-Power Rocketry Team

The inVenTs High-Power Rocketry Team provides STEM students with the opportunity to advance their design, programming, manufacturing and technical writing kills. During the Fall 2015 and Spring 2016 semesters, a 8.5ft (2.6 meters) tall high-power rocket with an active drag system was developed and assembled in Studio 1, the state of the art design lab in the inVenTs Residential Communities, with the ability to reach an apogee of at least 3000 ft (914.4 meters) above the ground and be recovered safely in a flyable condition. Additionally, the rocket had to reach a drag-activated apogee exactly 75% of the drag-deactivated apogee. Flight performance was predicted to be 4747 ft (1447 m) with and 3543 ft (1080 m) without the drag system active, and a non-commercial on-board data collection package was constructed that would characterize the rocket's coefficient of drag over time. On May 16, 2016, the rocket was launched twice, once with the drag system retracted and once more with the drag system deployed for the 2016 Space Grant Midwest High-Power Rocket Competition. From our first flight, the target altitude for the second flight was 2416 ft (737m). Our actual apogee was 133m below this target, a difference of only 5.5%. As demonstrated, both flights with the reloadable Cesaroni P5-4G had a different performance than what was expected, which was most likely due to the last minute repairs after transportation that caused an increase in weight. The team placed 5th out of 18.

Mentor(s): Stephanie Lewis (Director - Curie Living Learning Community); Dr. Kevin Shinpaugh (Aerospace Engineering)

GARRETT S. RHYNE WILDLIFE CONSERVATION

Effects of environmentally relevant mixtures of major ions and coal-contaminated sediment on freshwater mussels

The Powell River (Virginia, USA) supports a diverse assemblage of freshwater mussels. This watershed is subject to extensive coal mining activity, and elevated concentrations of major ions have been recorded in the river. We conducted a laboratory study to determine the effects of elevated salinity and coal-contaminated sediment on energy storage and biochemical processes of adult mussels (Lampsilis fasciola). Mussels underwent a 6 ' week exposure in a 2 x 2 full factorial design including pond water, simulated Powell River water with environmentally relevant mixtures of major ions, including K+, HCO3+, Mg2+, PO4+, SO42-, and Ca2+, clean sediment, and coal-contaminated sediment from the Powell River . There was no mortality in any treatment. Activities of antioxidant enzymes including glutathione-S-transferase (GST), glutathione peroxidase (GPx), and glutathione reductase (GR) were not significantly different between treatments, but GR activity was significantly different between male and female mussels (p= 0.0092). Energy storage, measured as glycogen in mantle tissue, was found to be different between genders (p= 0.033). There was an apparent negative effect of simulated Powell River water on glycogen storage for males only, but the effect was not significant at alpha = 0.05 (p = 0.065). We expected that the combination of the simulated Powell River water and the coal-contaminated sediment would produce a significant negative effect on energy storage and change enzyme

Mentor(s): Serena Ciparis (Fish & Wildlife Conservation)

MEGAN RICHARDSON BIOCHEMISTRY

Assessing the Influence of Flavonoids in Attenuating β-strand Fibril Formation of Islet Amyloid Polypeptide by Molecular Dynamics Simulations

Diabetes mellitus type 2 (T2D) is a disease affecting 7% of the worlds' population. Islet amyloid polypeptide (IAPP) is a 37-residue hormone cosecreted with insulin making up the pancreatic amyloid deposits found in patients with T2D. These deposits exacerbate the physical expression of T2D. IAPP is conserved across multiple species. Rat IAPP does not display the hallmark trait of β-strand structure of hIAPP, indicating a lack of ability to form toxic IAPP fibrils. To assess the ability of hIAPP and rIAPP to aggregate and test the efficacy of six selected flavonoids on fibril formation, molecular dynamics simulations of residues 10-20 of both species were selected as a model system as they are the smallest fragment of the peptide capable of self-assembly per the literature. The literature also indicates a strong positive correlation with flavonoid concentration and inhibition of IAPP fibrils. Six flavonoids were simulated in a 5:3 ratio with human or rat IAPP(10-20). All flavonoids decreased β-strand formation to varying extents and epicatechin had the least effect on hIAPP trimer formation. Quercetin and taxifolin were found to be the most effective inhibitors of β-strand formation for both species. As expected, rIAPP simulations showed decreased levels of trimer formation. These simulations could be beneficial in understanding the efficacy of these flavonoids and determining key physiochemical properties to aid in developing novel therapeutics for T2D.

Mentor(s): Dr. Anne Brown (Biochemistry); Dr. David Bevan (Biochemistry)

EMILY S. RICHARDSON ANIMAL & POULTRY SCIENCES

Economic analysis of feeding costs for diets including corn silage or sorghum silage as the main forage source

The objective of this study was to evaluate the cost of diets for dairy cows with corn silage (CS) or sorghum silage (SS) as the main forage source. A data base was generated for the composition of SS, and included: dry matter (n=22), ash (n=16), crude protein (n=23), ether extract (n=13), neutral detergent fiber (n=25), acid detergent fiber (n=21), acid detergent lignin (n=18), starch (n=11), and in vitro dry matter digestibility (IVDMD; n=5). The nutritional composition of CS was obtained from the dairy NRC (2001). Diets were formulated with CPM Dairy Ration Analyzer using least cost optimization. Diets were formulated for a 635-kg Holstein cow producing 40 kg of milk (3.5% fat, 3.1% protein). Formulation constraints included: 100% of predicted DM intake, 100-110% of metabolizable energy requirement, 95-103% of metabolizable protein requirement, 28-33% dietary NDF, 30-40% dietary non-fiber carbohydrates, and 50-60% of dietary forage. Ration formulation was performed under 7 scenarios: very low, low, middle and high grain prices, with SS prices to be either 85, 70, or 55% of the price of CS. When the price of SS was 85% of that of CS, it was cheaper to include CS in the diets. When the price of SS was 70% of that of CS, marginal differences in diet costs were observed between CS and SS. When the price of SS was 55% of that of CS, it was more expensive to include CS in the diets. In conclusion, SS had to be 30% cheaper than CS to obtain diets of similar composition and cost.

Mentor(s): Dr. Gonzalo Ferreira (Dairy Science)

RALPH ROMERO PHYSICS

Crumpling of an Elastic Ring under Circular Confinement in Two Dimensions

Crumpled materials and structures arise in many aspects of nature, ranging from the micro- to the macro-world. DNA within the nucleus, graphene sheets, aluminum foil, squeezed paper, and even geological formations all exhibit crumpled structures. However, the physics of crumpling are still poorly understood. A better understanding of the crumpling of elastic objects including sheets and wires may lead to better design of smart materials and structures, which, for example, can distribute energy more uniformly upon impact. From a computational point of view, some questions naturally arise: Can we model an elastic wire (or sheet) as a bead-spring chain (or network) in a computational model? Will this chain perform and behave in a way that is consistent with experiment? The goal of this project is to numerically formulate the Seung-Nelson model, which is frequently used to model elastic sheets, by mapping an elastic ring to bead-spring chains at various resolutions and investigating their crumpling behavior under a shrinking circular confinement. Our analyses of the morphology and energetics of the ring pre and post crumpling reveal that there is an intrinsic length scale set by the elastic properties of the wire that the bead-spring chain models; the correct continuum limit is reproduced only when the bond length of the bead-spring chain is smaller than this length scale. Our results thus provide a simple criterion on the consistent formulation of the Seung-Nelson model.

Mentor(s): Dr. Shengfeng Cheng (Physics)

SALWA G. SADIQ-ALI PSYCHOLOGY
SASHA SHARMA PSYCHOLOGY
SAREENA A. PATEL PSYCHOLOGY

The Effect of Boredom on Neuroelectrical Activity

Boredom is a misunderstood and under researched phenomenon. Boredom is a neurological and psychological phenomenon that afflicts everyone in various forms. Additionally, boredom has been associated, by researchers, with several serious psychological and medical health probelms such as ADHD/ADD, depression, and anxiety. Boredom also plays a crucial role in recovering from traumatic brain injury. This research study aims to understand boredom and the neural correlates of this state. Developing a definition of boredom could elucidate psychiatric conditions such as ADHD or ADD, could contribute to the development of new therapeutic techniques, and could contribute to the overall understanding of the human condition. We hope to develop a neurological definition of boredom by means of Quantitative Electroencephalogram (qEEG). The purpose of using the qEEG is to extract electrical signals produced by the brain in real time. These signals will be received via electrodes in a cap which will be placed on the participants' head. The anticipated findings are as follows: 1) There will be differences in the qEEG data during the times during which the participant is bored. 2) There will be a lack of beta waves during the vigilance task and during the second baseline.

Mentor(s): Dr. Patti Kelly Harrison (Psychology); Dr. Dave W. Harrison (Psychology)

PARISA F. SAMAREH APPLIED MATHEMATICS

Accelerating Thermoacoustic Tomography

Thermoacoustic Tomography (TAT) is an imaging technique used to display a cross section through a solid object. TAT exceeds the health benefits of other tomographic methods such as x-ray and ultrasound because it does not require as much radiation, making it a safer alternative. However, like many inverse problems, the process of TAT is extremely involved and still under development. This research investigates computational improvements to TAT that increase the method's efficiency as well as overall accuracy. By implementing sparse matrices, parallel processors, and other techniques we have accelerated the process of the image reconstruction, saving both time and computation. Our improvements to TAT will hopefully make the method more popular, reducing the average amount of required radiation that patients must endure.

Mentor(s): Dr. Julianne Chung (Mathematics)

LEA V. SARMENT BIOLOGICAL SYSTEMS ENGINEERING
CAITY M. DE ANGELUS BIOLOGICAL SYSTEMS ENGINEERING

Novel Device for Rapid Acquisition of Heart Rates in Neonatal Patients

New guidelines, set by the American Academy of Pediatrics to create a 3-Lead Electrocardiographic (ECG) assessment, aim to improve the care for newborns transitioning from intrauterine to extrauterine life that require assisted resuscitation. In many situations, the baby will need to be resuscitated as promptly as possible, usually in the first minute after birth, to minimize negative effects. The ECG assessment is a reliable technique in acquiring the infant's heart rate, which is crucial in determining the physician's course of action. During the course of this project, the electronic component of this device was perfected and the exterior harness was envisioned to quickly capture heart rate in neonates. In the development of this design, the team applied engineering principles to guarantee the safety and suitability of the harness for pediatric patients. Utilizing human factors design principles, the team has created a device that can be applied rapidly, fits patients with a variety of physical morphologies and sizes, and will not irritate infant skin. The objective of the visual display is to provide essential information that permits the user to intervene in an appropriate method quickly. An affordable medical device prototype will soon be ready for human testing in the United States. This novel device attempts to merge new technologies to resolve issues that perpetuate this problem and hinder critical care procedures.

Mentor(s): Dr. John Bird (Mechatronics Lab), Dr. Andre Muelenaer, (Pediatrics -Virginia Tech Carilion School of Medicine); Dr. Penelope Muelenaer (Pediatrics -Virginia Tech Carilion School of Medicine); Dr. Christian Mariger (Biological Systems Engineering)

GABRIELLA C. SCALZO PSYCHOLOGY

Cognitive flexibility and communication are linked to employment in young adults with ASD

Employment rates are disproportionally low for cognitively able adults with Autism Spectrum Disorder (ASD) relative to the general population; as such, unemployment remains a significant barrier to independence and diminishes quality of life. We sought to identify differences in skills between young adults with ASD who did or did not find previous employment, as potential areas of focus for future supportive services. In this study, caregivers (n=187, 98.8% female) and their adult child with ASD (n=146, ages 17 to 45, 28% female) completed an online survey, and rated the young adult's skill level in ten areas of functioning, e.g. ability to cope with negative feelings or thoughts' and ability to self-advocate. Caregiver and young adult responses were analyzed separately. Respondents were grouped by whether or not the young adult with ASD had been previously employed. The groups were compared using a Mann-Whitney U Test, with Bonferroni correction. For caregiver and self-report, the employed versus unemployed young adults significantly differed with respect to two skills: ability to respond effectively to differing viewpoints/ideas' and ability to cope with environmental demands/challenges. For self-report, those with prior employment more often endorsed having the ability to complete a task that has been explained once and ability to express ideas to others. These group differences represent skills that can be targeted therapeutically.

Mentor(s): Dr. Angela Scarpa (Psychology)

KENDALL M. SEELEY BIOCHEMISTRY

Investigating the Effect of PPARγ, Mutation Q286P on 15-deoxy-$\Delta^{12,14}$-prostaglandin J2 Binding Activity Using Molecular Dynamics and Docking Simulations

The gamma isoform of the peroxisome proliferated-activated receptor, PPARγ, is involved in adipocyte differentiation and adipogenesis. PPARγ also has a role in cell cycle regulation suggesting its part in cancer cell death. Mutations of PPARγ have been found in sporadic human colon cancer tissue samples, given the expression of PPARγ in adipose tissue as well as in colonic epithelial tissue in similar amounts. One mutation, Q286P, was found to cause a lack of folding when exposed to ligands, in particular, 15-deoxy-$\Delta^{12,14}$-prostaglandin J2 (PGJ2). This research will determine how Q286P affects the binding site of PPARγ and identify how this mutation affects its structure and binding ability with PGJ2 by using molecular dynamics simulations and docking simulations. The mutation caused a change in structure in helix 3, which altered the shape of the ligand binding domain (LBD) as compared to the wildtype. This structure change suggests that the LBD is no longer able to accept PGJ2 and other native ligands, resulting in a loss of activation. Docking simulations were used to determine how Q286P affects the binding and interaction of PGJ2 with key residues of the PPARγ LBD. The results showed that PGJ2 was able to enter the LBD in the wildtype but was unable to do the same in Q286P PPARγ. The results of the docking simulations are helpful in determining potential agonists and antagonists that can activate Q286P PPARγ aiding in the increase of cancer cell apoptosis.

Mentor(s): Dr. Anne M. Brown (Biochemistry), Dr. David R. Bevan (Biochemistry); Dr. Stephanie N. Lewis (Director - Curie Living Learning Community)

JAMES B. SIMON ENGINEERING SCIENCE & MECHANICS

Using Binaural Beats to Increase Brain Functional Connectivity

Research has shown that using binaural beats to stimulate the auditory cortices of the brain can cause an increase in functional connectivity between different regions of the brain. Exposure to binaural beats at a frequency difference of 15 Hz has been shown to improve human performance in visuospatial working memory tasks while altering the strengths of cortical networks in ways characteristic of higher information transfer. The purpose of this research is to develop a closed-loop controller that reads electroencephalograph (EEG) data in real time from human patients, calculates connectivity between frontal and parietal regions, and alters the frequency of binaural beats to find the frequency that maximizes that connectivity despite significant noise. This research aims to both better understand the human brain and to test if controlled stimulation could be used medically to cause deliberate changes in brain functional connectivity. We are using a relatively coarse but tractable brain simulation to develop and test the controller for use in experiments with live humans. The open-source simulation, The Virtual Brain (TVB), provides fairly accurate EEG output. Using TVB, we are testing a variety of linear and nonlinear controllers for varying stimulation frequency to change functional connectivity. An original control algorithm has proven viable for maximizing a noisy function in relatively few samples, and we anticipate trials on live patients by the end of the semester.

Mentor(s): Dr. Alexander Leonessa (Mechanical Engineering); Dr. Nicole Abaid (Biomedical Engineering & Mechanics)

A. SLOUGH HUMAN DEVELOPMENT

Attention in Infancy: links to childhood attention and academic achievement

Much research has shown evidence that school readiness measures can be predicted at an early age (Diamond & Lee, 2011). The goal of our project was to explain the mechanism of this relationship starting at 5 months and continuing through 6 years. By explaining the path to school readiness, intervention strategies may be employed to better ready a child for school. The constructs included in our model were infant attention, executive functioning (i.e., cognitive control), and reading achievement. At 5 months, participants performed a looking task to differentiate attention types. This task directly predicted the participant's ability to perform on the A-not-B task at 10 months. The 10-month task predicted the child's ability to recall spans of digits and inhibit responses at 3, 4, and 6 years. Finally, the executive functioning tasks at 6 years predicted the reading achievement tasks at 6 years. Indirect effects were also significant from early executive functioning to reading achievement. The results provide significant evidence of a developmental cascade from infant attention to early childhood reading achievement.

Mentor(s): Dr. Martha Ann Bell (Psychology)

BENJAMIN S. SMITH GENERAL ENGINEERING

Effect of Compost on Redox Potential at a Constructed Coastal Plain Wetland

The destruction of natural wetlands is sometimes mitigated through the creation of constructed wetlands. Many constructed wetlands have difficulty performing the functions of natural wetlands due to low organic carbon. The purpose of this study was to describe the long-term relationship between compost amendments (organic matter) and redoximorphic potential (Eh), at a constructed freshwater wetland in the Coastal Plain of Virginia. In 2002, treatments 1 through 5 of compost were applied to plots and tilled in: 0 Mg/hectare (Mg/ha), 56 Mg/ha, 112 Mg/ha, 224 Mg/ha, and 336 Mg/ha. Treatments were applied in two discrete experiments: CCW-Wet and CCW-Dry, based off the initial presence or absence of hydrophytic vegetation and apparent depth to water table. CCW-Wet was further separated into four blocks along an elevation contour to separate apparent wetness differences. In 2016, the Eh was measured at each plot using five platinum-tipped electrodes. Temperature and pH values were also measured to calculate adjusted Eh values. One-way ANOVA tests were used to test for significance. In CCW-Dry there was no correlation between compost treatment and adjusted Eh. In CCW-Wet, blocks 1 and 2 negatively correlated with compost treatment, and blocks 3 and 4 did not correlate. This indicates that development of low Eh may be largely independent of initial organic matter amendment at constructed wetlands 14 years later due to carbon equilibration as a result of advanced decomposition.

Mentor(s): Dr. John Galbraith (Crop & Soil Environmental Sciences)

DAVID S. SNYDER COMMUNICATION

Sheppard v. Maxwell: Revisited

The goal of this study was to focus on news coverage of the criminal trial of Samuel Sheppard to determine whether first-hand accounts might have supported either the criticism by the Court or the response by the journalists in the 1966 U.S. Supreme Court case Sheppard v. Maxwell. The purpose of the study is to explore an apparent conflict relating to Sheppard v. Maxwell. In said case, the Supreme Court described the courtroom during the trial as a virtual circus. In addition, the Court indicated that the judge did not sufficiently control the courtroom. Following the opinion, the Justices received a letter from a group of reporters who had covered the trial. The group objected to the Court's characterization of the trial, indicating that it was handled with a decorum comparable with the best that they had covered. The methodology used when conducting this study consisted of selecting two newspapers and evaluating each day's coverage of the trial to determine if courtroom decorum was mentioned. The newspapers selected were not from which any of the journalists who wrote the Supreme Court worked, but did provide complete coverage of the trial. background reading in books and articles on the trial was also conducted to look for any mention of courtroom decorum. The research results yielded very little mention of courtroom decorum in the daily newspaper coverage. Secondary source research yielded some mention of courtroom decorum, but few specific in-trial examples.

Mentor(s): Dr. W. Wat Hopkins (Communication)

HYTHAM SOUEID BIOCHEMISTRY
JONATHAN BRIGANTI NEUROSCIENCE
JAVIER FRIEND BIOCHEMISTRY

Effect of Ligand Presence on Conformational Oscillation of PPARγ

Peroxisome proliferator-activated receptor-gamma (PPARγ) is a key drug target for the regulation of Type II Diabetes (T2D), due to its role in mediating the levels of glucose in the bloodstream. The relationship between the conformational states of PPARγ which are influenced by ligand binding, are relatively unstudied and could be influential in determining ligand binding type and functional state. By determining the conformational states adopted by PPARγ with and without ligand presence, we can better assess the landscape of structures adopted by PPARγ which can influence future drug design. Molecular dynamics simulations were used to simulate the apo, active, inactive, unbound, and bound structures of PPARγ to compare local and global structural changes. Of interest is the state of Helix 12 (H12), which undergoes the most significant conformational change in the presence of a ligand and is one of the first indicators of the active or inactive state of PPARγ. Ligand presence influences H12 to remain or move into the active position. In the absence of a ligand, H12 oscillates freely between the active and inactive position. Our initial results allowed us to see minor distinctions between the test systems. Further research includes identifying key binding residues that affect this conformational oscillation and quantify the movement of H12. A deeper understanding of the conformational states adopted by PPARγ would allow for a more robust model of novel drug interaction.

Mentor(s): Dr. Anne Brown (Biochemistry)

BEN G. SPENCER ENVIRONMENTAL SCIENCE

Quantifying Microbial Respiration with a Fluorescent Dye

Microbial respiration is integral to many soil functions including carbon cycling and fertility. Given the important services soils provide, it is useful to have methods to accurately quantify their microbial activity. Applications for such methods range from agriculture to climate research. There are methods that currently exist for quantifying soil microbial respiration, but they are often inaccurate, complicated, and lengthy. This project's purpose was to develop a new method of soil respiration quantification using a fluorescent dye called resazurin (RAZ) that was originally designed for bioassays. This dye reacts biochemically with enzymes present in heterotrophic microorganisms during respiration, becoming irreversibly reduced into another chemical called resorufin (RRU), which is highly fluorescent. Theoretically, the rate of RAZ reduction (RRU production) in a soil could indicate the microbial respiration levels. This project focused on observing the rate of RRU production in soil samples inoculated with RAZ. RRU concentrations were estimated using a standard curve of RRU fluorescence. RRU production rates were compared across different soil types and were correlated to other measures of soil microbial activity. One final aim of this project was to test sterilized soil samples to verify a lack of RRU production, or observe purely physiochemical RRU production. If shown to be efficacious, this RAZ based method could help many in a wide range of fields and industries.

Mentor(s): Dr. Ryan Stewart (Crop & Soil Environmental Sciences), Dr. Micheal Strickland (Biological Sciences)

PHILIP E. STAUFFER BIOCHEMISTRY

Relevance of natural occurring mutations in circadian components for cellular signaling

The mammalian circadian clock is a cell autonomous molecular clock that oscillates over a period of roughly 24 hours thus regulating physiology and behavior through differential gene expression in concordance with the time of day. Remarkably, perturbations in the mammalian clock due to genomic alterations or abnormal feeding cycles result in various health issues ranging from sleep disorders to proliferative diseases. For example, mice knockdown in the core circadian gene, Period 2 (Per2), are arrhythmic and show a rate of tumorigenesis that is increased when exposed to irradiation. Our laboratory has uncovered the molecular basis leading to this phenotype by identifying the tumor suppressor p53 as a cellular target of the circadian component Per2. Furthermore, the Per2:p53 association stabilizes p53 in unstressed cells and modulates p53's transcriptional activity in response to genotoxic stress. More recently, we have identified a group of hot-spot mutations in Per2 that influences its association to p53, stability, subcellular location, and transcriptional function. Mutations in Per2 are clustered in a regulatory region and represented in a large group of individuals known to develop spontaneous cancers. Thus, our work would contribute to define the molecular basis by which individuals exposed to circadian disruption are more likely to develop spontaneous cancers.

Mentor(s): Dr. Carla Finkielstein (Integrated Cellular Responses Laboratory, Biocomplexity Institute; Biological Sciences)

MICHAEL J. STELFOX LANDSCAPE ARCHITECTURE

A Question of Technology - Electrical Production in the Year 2070

Electricity is a luxury that Americans benefit from every day, yet does the public understand where this electricity comes from and how it's produced? Oftentimes inadequate management of natural resource energy production requires public municipalities to weigh between disrupting the biological, cultural, or technological systems in order to compensate for the other. The technology that is then powered from American energy is also more complex and difficult to understand by the average user. This paper explores how future landscapes can educate the public about technological impacts biological systems, and therefore shifts socio-cultural responses in favor of a greater harmony between the two. By writing a narrative of a day in the life in 2070, I look at the trends in these three systems worked to shape a future design of Dupont Circle in Washington D.C. On the day that this narrative takes place, I have brought my grandson to the city with me as I file a post occupancy report on the state of the piezoelectric paving system that our firm installed 50 years ago. Stopped in my tracks by the sight of his joy as he dances atop these pavers, I am filled with inspiration. Ultimately I believe that if this simple footpath could respond to my grandson's movements, either through light or sound, then he might understand the Newtonian law that we took advantage of on the sidewalk, as well as the moral principle that every positive step he takes can light the path ahead of him.

Mentor(s): Terry Clements (Landscape Architecture); Susan Piedmont-Palladino (Architecture)

CASSIDY A. THOMAS BIOLOGICAL SCIENCES

The Canonical NLR Inflammasome Senses Clostridium difficile

Clostridium difficile infection is caused by two virulent toxins A (TcdA) and B (TcdB), which target and disrupt the host cytoskeleton. C. difficile colonization is the leading cause of antibiotic-associated pseudomembranous colitis, an inflammatory GI disease that develops when gut flora have been ablated. Both commensal and pathogenic bacteria in the gut are regulated by NOD-Like Receptors (NLRs). A subset of NLRs form what is known as the inflammasome, a multi-protein complex that is responsible for cleaving pro-IL-1β/pro-IL-18 into mature pro-inflammatory cytokines. The inflammasome can signal through the canonical or noncanonical pathway. In the absence of an inflammasome, particular bacteria grow unchecked in the gut, resulting in a greater inflammatory response, diminished mucous layer, and epithelium exposure to bacteria. To evaluate inflammasome formation with C. difficile, we harvested bone marrow from mice lacking components of either the canonical or noncanonical inflammasome, and challenged with five C. difficile strains. The various strains expressed: TcdA and TcdB; TcdB only; TcdA, TcdB, and a binary toxin TcdX; TcdX only; or no toxins. After 24 hours, the absence of the canonical pathway resulted in no detectable inflammasome formation relative to the other genotypes, leading us to conclude that C. difficile is sensed by a canonical inflammasome. Future work will determine which specific NLR is responsible for activating the canonical inflammasome pathway.

Mentor(s): Dr. Irving C. Allen (Biomedical Sciences & Pathobiology), Veronica M. Ringel-Scaia (Translational Biology, Medicine, & Health)

SIEU TRAN MATHEMATICS

Patterns of Activation and Repression for a Single Transcription Factor with Multiple Binding Sites

We seek to understand how a single type of transcription factor regulates gene expression (in eukaryote) by studying the previously introduced linear framework-based model of the gene regulation function (GRF), which employs higher-order cooperativities of transcription factors (TFs) and DNA polymerase. We looked at whether it is possible to have multiple windows of "activation" and "repression" and the necessary mechanisms, such as numbers of sites or forms of higher-order cooperativity, to achieve such pattern.

Mentor(s): Jeremy Gunawardena (Systems Biology - Harvard Medical School); Daniel Orr (Mathematics)

CAITLIN R. VAN WICKLIN BIOLOGY
EMILY WILLS PSYCHOLOGY
ALEX EDDY PSYCHOLOGY
PETER LEE BIOLOGY

Sex Differences in Laterality in Emotion Specific Autonomic Nervous System Activity

The goal of this research is to investigate brain laterality by looking at the differences in how males and females differ in their autonomic nervous system response to emotional stimuli. Though similar research done by Dr. Paul Ekman has been previously documented, his experiment did not look at the differences in males and females. This research will give new insights into laterality differences between the sexes and gain further insights into laterality in emotion. This is observed by measuring the response of distinct emotions through the coordination of specific facial expressions. First participants are given verbal directions in the emotions of anger, disgust, fear, happiness, sadness and surprise, then the participants are asked about which emotion(s) that they felt and the intensity of the emotion. Physiological measures such as heart rate, skin conductance, and respiration will be obtained using BioPac. Thermistors and electrodes will also be used to obtain finger temperature and forearm flexor muscle tension, respectively. It is expected that though both males and females will have a physiological response, but only the females will effectively communicate the emotions that were felt.

Mentor(s): Dr. Kelly Harrison (Psychology)

KATHERINE I. VLAHCEVIC NEUROSCIENCE

Three-year EEG Predicts Passage Comprehension at age Six

This study examined if language ability and brain function at three years of age could predict the level at which a child performed on passage comprehension test at six years. This information from early childhood could predict the reading level at age six and could enable children to get early intervention and help them develop better reading skills. Three years old children completed the Peabody Picture Vocabulary Test (PPVT), measure of receptive language ability and verbal IQ. Children pointed to the picture that matched the word the experimenter said. Electroencephalogram (EEG) was collected via a 32 channel cap that was placed on the child. EEG was recorded while the child watched a one-minute clip of turtles swimming from Finding Nemo. The EEG electrical activity from the F7, F8, F3 and F4 electrodes was our measure of frontal lobe functioning. We used a hierarchical regression model with passage comprehension as the dependent variable. The Woodcock-Johnson Passage Comprehension tests the children's understanding of written text and vocabulary at age six. The first step showed that PPVT predicted scores in the passage comprehension, $F(154) = 7.469$, $R2 = .047$, $p = .007$. Then EEG was added at step 2 $\Delta R2 = .144$, $p = .003$. The results show that by age three, frontal EEG predicts the level at which a child will perform at six-years-old on the Woodcock-Johnson Passage Comprehension above and beyond their receptive vocabulary score at age three.

Mentor(s): Dr. Martha Ann Bell (Psychology); Alleyne Broomell (Psychology)

MARIA E. VOLLMER ENVIRONMENTAL POLICY & PLANNING

Hygiene and Sanitattion Assessment of Public Sites in Mzuzu, Malawi

Although significant progress has been made in recent years in relation to water, sanitation, and hygiene (WASH), the World Health Organization (WHO) reported that in 2015, an estimated 2.4 billion still lacked access to improved sanitation facilities. Fecal contamination of water and poor personal hygiene are attributed as two of the main causes of diarrhea. Annually, nearly 1.7 billion cases of diarrhea are reported globally. This study aims to evaluate the sanitation conditions in 10 public sites in the urban and peri-urban area of Mzuzu, Malawi. Selected sites include markets, medical facilities, transportation centers, and schools. Data were collected using observation checklists, interview questionnaires, and sampling of suspected areas of fecal contamination. The study identified flush toilets as the cleanest and most commonly used in urban and peri-urban areas, followed by flush latrines and pit latrines. Out of a total 165 samples, 12 (8%) had E. coli, predominantly found in latrine blocks and on hands. Coliforms were present in 74 (49%) samples, mostly found in latrine blocks and on surfaces around the latrine. Of the sites studied, markets, medical facilities, and transportation centers had the highest concentrations of bacteria. While the contamination data was inconclusive, the facilities observed do not promote adequate public health for the residents of Mzuzu and improvements need to be made to address the uncovered barriers to proper hygiene and sanitation.

Mentor(s): Dr. Ralph Hall (Urban Affaris & Planning), Dr. Rochelle Holm (Centre of Excellence in Water and Sanitation - Mzuzu University)

LUCY L. WAGSTAFF ANIMAL & POULTRY SCIENCES

Role of Uric Acid on Feed Intake in Chickens

One of the most important aspects for broiler production is feed intake regulation. This is because if chicks are fed too much they will become obese, yet for meat production food intake must be high. The physiological mechanisms controlling feed intake have not been fully understood to solve this issue. Chickens produce uric acid instead of urea and the role of uric acid in feed intake has not been investigated in avian species, so the purpose of this project is to investigate such a relationship. Elevated serum uric acid levels have been associated with obesity and diabetes in humans. At Virginia Tech, there are two lines of chickens, low (LWS) and high (HWS) body weight chickens. Plasma uric acid levels were measured colorimetrically using a uric acid assay. It was predicted that the plasma uric acid levels would be higher in the HWS line. The results did support this prediction but the data was not significant ($P > 0.05$). Also, the HWS and LWS lines will be used in a feed intake experiment. Chickens from both lines will be given feed containing allopurinol and monitored for feed intake. Allopurinol is a drug that lowers plasma uric acid levels in chickens and humans. The chickens will be on this feed and monitored for five days to determine if decreasing plasma uric acid levels with alter feed intake. It is anticipated that feed intake will decrease in both lines, with the HWS chickens maintaining higher plasma uric acid levels.

Mentor(s): Dr. D. Michael Denbow (Animal & Poultry Sciences)

LAURA C. WICHIN BIOLOGICAL SYSTEMS ENGINEERING

The Effect of Increased Peptide Fragment on Keratose Hydrogel Enzyme Mediated Degradation

Tissue engineering has evolved to include numerous protein-based biomaterials. Their advantage over synthetic biomaterials lies in their biological compatibility when introduced to the body. Keratin possesses an additional advantage over other structural proteins in its ease of acquisition. Oxidized keratin, keratose (KOS) shows promise as a scaffolding system in the regeneration of multiple tissues. Limitations arise in this application as the rate of degradation in a natural biomaterial is less tunable that that of synthetic. This study aims to manipulate the rate of degradation by decreasing the purity of the protein. Prior data shows that KOS hydrogels made with less pure material result in less susceptibility to enzymatic degradation. KOS powders with varying weight percent peptide fragment were hydrated in ultrapure water and crosslinked with BDDE. Hydrogels were exposed to five enzyme solutions at a 2:1 ratio of solution to gel. Sample supernatants were extracted at set time points to monitor the degradation of the gels. To quantify gel degradation, Bradford-Lowry assays were performed using the collected supernatants. It was hypothesized that an increase of the peptide fragment of the KOS gel would result in a slower rate of degradation. Only chromatography data is currently available to distinguish the differences between KOS samples , but visually, gels with high percent peptide appear to have a larger volume of intact gel than the control at the end of the study.

Mentor(s): Dr. Mark Van Dyke (Biomedical Engineering & Mechanics)

ADRIANNA N. WILSON BIOCHEMISTRY

The Isolation and Elucidation of Antimicrobial Compounds from Native Southwest Virginia Plants

Each year in the United States, at least 2 million people become infected with bacteria that are resistant to antibiotics and at least 23,000 people die each year as a direct result of these infections.1 Medication resistant microbes are not restricted to bacteria, the incidence of antifungal resistance is also increasing. Antifungal resistant Candida albicans is of particular threat to public health because Candida is the most common cause of healthcare-associated bloodstream infections in the United States.2 After analyzing Native American ethnobotanical records, several plants were selected because of their history of use in treating Candida albicans infections. These plants were collected from Southwest Virginia and processed. Ethanolic extracts of these plants were screened for Candidacidal activity, as well as activity against other microbes. Out of the 19 plants collected, 7 were found to be active against Candida, and the activity of the extracts against gram positive, gram negative, and mycobacterium is currently being explored. The isolation and structure elucidation of the compounds responsible for the observed antifungal activity will be discussed.

Mentor(s): Dr. David Kingston (Chemistry); Dr. Joseph Falkinham (Biological Sciences)

BONNIE L. WOODWARD PSYCHOLOGY

Treatment Differences in Parent-Child Synchrony, Realistic Problem-Solving, and Child Symptom Reduction for Children with Oppositional Defiant Disorder

Oppositional Defiant Disorder (ODD) is an externalizing behavior disorder characterized by hostility and oppositional behavior towards authority figures (AACAP, 2009). There are two equally effective treatments for diminishing ODD symptoms (Ollendick et al., 2016). Parent Management Training (PMT) works to improve parents' methods of disciplining children (Barkley, 1997). Collaborative and Proactive Solutions (CPS) involves children and parents working to solve problems that impact behavior (Greene, 1998). Parent-child synchrony comprises parent and child working to understand one another (Miller-Slough et al., 2015). In earlier work with the current sample, synchrony at pre-treatment related to children's overall improvement at post-treatment (Miller-Slough et al., 2015). The current study examines whether treatment condition alters relations of synchrony with families' realistic problem-solving. Realistic problem-solving refers to families generating solutions to problems (Antony et al., 1996). We conducted a secondary analysis of data from Ollendick et al. (2016), including 48 families randomly assigned into PMT or CPS. Treatment placement did not moderate the relation between synchrony and realistic problem-solving. However, MANCOVAs showed that synchrony increased post-treatment for CPS families and decreased for PMT families. Thus, each treatment may differentially impact synchrony and families' problem-solving.

Mentor(s): Dr. Julie Dunsmore (Psychology)

BRITTNEY L. WORRELL BIOCHEMISTRY

Structural Distinctions Between Isoforms of Human and Mouse Sphingosine Kinases

Changes in cell proliferation and signaling pathways carry significance given their connection to multiple diseases including cancers. Current research efforts focus on sphingosine kinases (SphKs), which exist in two isoforms, SphK1 and SphK2, and are the sole enzymes that catalyze the phosphorylation of sphingosine to sphingosine-1-phosphate (S1P). S1P is important to cellular processes like cell differentiation but is present in elevated levels in certain cancer cells making these kinases potential drug targets. Mouse SphKs produce different levels of S1P in certain conditions compared to human SphKs, so it is necessary to determine the structural qualities that result in varied cavity binding. Homology models of both mouse enzymes were created. Molecular docking to isoform specific inhibitors, analysis of key residue positioning in the binding pocket, and binding site volume analysis were performed to compare the four enzymes and elucidate differences in the cavity. Compounds docked to mouse SphK1 were positioned in a manner most similar to human SphK2, based on distance measurements to key residues in the binding pocket. Additionally, surface images and volume analysis showed that SphK1 in both species has a larger binding cavity than SphK2. This study has the potential to aid in SphK inhibitor design and studies involving mice models by highlighting structural distinctions and identifying the role of key residues that cause functional differences in isoforms and species.

Mentor(s): Dr. Anne Brown (Biochemistry), Dr. David Bevan (Biochemistry)

AUSTIN J. WOZNIAK BIOLOGICAL SYSTEMS ENGINEERING

Water scavenging in Appalachia

Roadside springs are piped water access points near highways that are unregulated and untested. This work aims to: 1) quantify how often these water sources are contaminated and 2) determine how many people use them for what reasons in order to understand the potential public health hazard they pose. Conductivity, pH, and temperature were recorded at each spring on-site. A sample was also collected and transported back to Virginia Tech for E. coli and coliform testing. For some springs, sensors were set to record how many people collected water and/or short pre-addressed questionnaires about spring use were placed nearby. Preliminary results suggest these springs are used in local households despite a high probability of E. coli contamination. To date, 25 samples from 15 springs across three states have been collected. Of the 15 springs tested, 53% tested positive for E. coli and 100% tested positive for total coliforms. So far, cameras have been deployed on 6 occasions at three different springs, from time periods ranging from 40 hours to 5 days. All 3 springs recorded visitors, with daily average totals of 5.5, 4.3, and 4.4 users/day. Returned questionnaires suggest that users collect water on average once a week, and use it commonly for cooking and drinking because of perceived good taste and health benefits.

Mentor(s): Dr. Leigh-Anne Krometis (Biological Systems Engineering)

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