



**2016**

# **Undergraduate Research and Creative Scholarship Conference**

**February, 22-26**

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*Book of Abstracts*

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 over 164 students from 62 different academic programs. This year, we have expanded the program to a multi-day celebration that embraces all forms of undergraduate scholarship. The oral presentations, posters, performances and installations taking place throughout the week reflect the quality and diversity of undergraduate research at Virginia Tech. Many of the projects are the result of collaborations among several students. 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 and for our newest team member, Aaron Burdette for all of his work to make the conference a success, Willie Caldwell for his planning and production at Haymarket Theater, and all the Ambassadors for their continued help.

Thanks to the Fralin Life Sciences Institute and the Office of Research for financial support. A special thank you to Dr. Dennis Dean for agreeing to serve as a keynote speaker and for his many years as a champion for undergraduate research.

Enjoy!

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



## Introduction

Welcome to the annual Undergraduate Research and Creative Scholarship conference at Virginia Tech. We are extremely excited about this year's expansion to a week-long event that includes installations and performances in addition to our traditional oral and poster sessions. Throughout the week, we hope to truly capture and showcase the breadth of research and creative scholarship taking place every day at Virginia Tech.

It has been a busy year for the Office of Undergraduate Research (OUR). We have personally interacted with over 730 undergraduates during office hours, information sessions, on-campus events, and during class and club presentations, and we have offered mentor training and grant writing support to over 60 faculty members. Increases were noted in the number of students applying for research fellowships and to present their research locally, at our two symposia, and nationally, at the ACC Meeting of the Minds, National Conference on Undergraduate Research and other disciplinary conferences. During the summer, 9 different research programs participated in common programming coordinated by the OUR, serving over 150 students. We launched the first centralized searchable database of research opportunities at Virginia Tech and secured grant funding for 6 summer National Institute of Standards and Technology (NIST) scholars, 7 ACC Creativity and Innovation scholars. We were only able to expand our services and reach with the guidance of an active 18 member advisory board with representatives from across the campus landscape, including faculty, administrators, undergraduates and a graduate student, and the help of 9 amazing student ambassadors who are the "face" of the office and 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.

Our goal is 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. We are open to ideas and willing to meet with departments and colleges to learn what additional services we can offer to best support the undergraduate research community.

We are extremely humbled by the quality of work on show as part of this symposium and welcome you to enjoy and marvel at the wealth of research and creative scholarship the university has to offer.

Sincerely,

*Keri Swaby, MS, MBA*  
University Undergraduate  
Research Coordinator



# Thank You To Our Sponsors

Virginia Tech Office of Research

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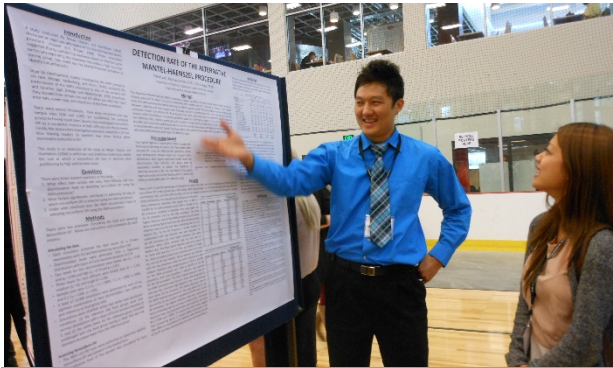
# Special Thanks To:

OUR Ambassadors, who have been the tireless face, feet and muscles of the office:

Alex Flavarakis (Wildlife Conservation)  
Chentelle Guest (Psychology)  
Matthew Johnson (English, Medieval & Early Modern Studies)  
Rachel Ladenburger (Biological Sciences)  
Amina Rahimi (Biochemistry & Nanoscience)  
Sarah Sam (Neuroscience/ Biological Sciences)  
Shane Taylor (Chemical Engineering)  
Colby Weit (Aerospace Engineering)  
Diana Woodrum (Food Science and Technology)

And a special thank you to Willie Caldwell, for helping us bravely forge the unknown, Aaron Burdette, who was thrown directly into the fire from day one and didn't once retreat, and Najla Mouchrek, for a talented creativity, critical eye for details, and always gentle guidance. This conference would not be possible without you and your hard work behind the scenes.

# 2016 National Conference on Undergraduate Research: 30<sup>th</sup> Anniversary



UNC Asheville is located less than two miles from the heart of downtown Asheville, considered the #1 small city in America to visit. Come for the conference to share your research and celebrate your accomplishments. Then take in the beautiful scenery and investigate the region's thriving arts, entertainment, and food scene.

## Student testimonials

"This research experience has been really great for me. I learned a lot, collaborating with professors- I got a chance to know a lot of people. I also got the chance to go on an academic conference and learn about other researchers and improve myself as an aspiring researcher." - Daniel Lee, Statistics



"I really enjoyed this experience because I've always enjoyed sociology, but I ended up loving the research." - Michelle Oh, Sociology/History



"I was able to come to some conclusions I had always wondered about while working there and I am glad that I took the next step and followed through on that. It was really rewarding." - Nick Lucchesi, Biological Sciences



# National Conference on Undergraduate Research (NCUR)

*This is a national meeting to showcase undergraduate research, with thousands of representatives from universities across the country. Students apply directly to NCUR and, if accepted, all expenses are paid by Virginia Tech.*

The National Conference on Undergraduate Research (NCUR), established in 1987, is dedicated to promoting undergraduate research, scholarship and creative activity in all fields of study by sponsoring an annual conference for students. Unlike meetings of academic professional organizations, this gathering of young scholars welcomes presenters from all institutions of higher learning and from all corners of the academic curriculum. Through this annual conference, NCUR creates a unique environment for the celebration and promotion of undergraduate student achievement, provides models of exemplary research and scholarship, and helps to improve the state of undergraduate education.

Traditionally, Virginia Tech has sponsored 2-4 students annually to attend NCUR which is held at campuses around the country. In 2016, a record 17 Virginia Tech presentations, in both oral and poster format, were selected for NCUR held at UNC Asheville.



**Top Left-Right:** Alyssa Brunal, Joe Mrava, Dimple Mozhi  
**Middle Left-Right:** Xiao Fu, Mellanee Gilkerson, Robert Fuchs

**Bottom Left-Right:** Hayden Tse, Austin Parris, Amber Jurgensen

**Missing:** Alyssa Debra, Hyun Kang, Katherine Olson, Kendall Hammer, Adam White, Megan Richardson, Ali Roghanizad, Kendall Seeley

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# Symposium Schedule at a Glance

2016 Spring Symposium Program

## Tuesday, Feb 23: Installations

9am-5pm Installations, Wallace Gallery

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## Wednesday, Feb 24: Installations

9am-5pm Installations, Wallace Gallery

4pm-5pm Scholars Reception, Wallace Gallery

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## Thursday, Feb 25: Installations

9am-5pm Installations, Wallace Gallery

## Thursday, Feb 25: Performances and Orals

5pm-7:30pm Performances and Oral Presentations, Haymarket Theater, Squires

Keynote: Dennis Dean, Director, Fralin Life Sciences Institute

7:30pm-8pm Reception, Lobby outside Haymarket Theater, Squires

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## Friday, Feb 26: Installations

9am-5pm Installations, Wallace Gallery

## Friday, Feb 26: Posters, Orals and Scholarly Demonstrations

### Session 1: 9am-10:30am

#### Poster session 1, Old Dominion Ballroom, Squires

9am-9:10am Scholarly demonstration/presentation

9:10am-10:20am Poster session 1

10:20am-10:30am Scholarly demonstration/presentation

Oral session 1, Squires  
9am-10:30am STEM, Room 341  
9am-10:30am History, Room 345

**Session 2: 11am-12:30pm**

Poster session 2, Old Dominion Ballroom, Squires  
11am-11:10am Scholarly demonstration/presentation  
12:10am-12:20pm Poster session 2  
12:20pm-12:30pm Scholarly demonstration/presentation

Oral session 2, Squires  
11am-12:30pm English & Foreign Languages, Room 341  
11am-12:30pm HNFE and Marketing, Room 345

**Session 3: 1pm-2:30pm**

Poster session 3, Old Dominion Ballroom, Squires  
1pm-1:10pm Scholarly demonstration/presentation  
1:10pm-2:20pm Poster session 3  
2:20pm-2:30pm Scholarly demonstration/presentation

Oral session 3, Squires  
1pm-2:30pm CNRE & CALS, Room 341  
1pm-2:30pm Poli Sci, Eng, Sci, Room 345

**Session 4: 3pm-4:30pm**

Poster session 4, Old Dominion Ballroom, Squires  
3pm-3:10pm Scholarly demonstration/presentation  
3:10pm-4:20pm Poster session 4  
4:20pm-4:30pm Scholarly demonstration/presentation

Oral session 4, Squires  
3pm-4:30pm CLAHS, Room 341  
3pm-4:30pm Mix, Room 345



# Installations

# Motorcycle Engine

Jeffrey Badstubner, Landscape Architecture

To study design and understand why parts of a machine are the way they are. We studied the inner workings of a motorcycle engine and reverse engineered the parts by drafting them. Drawing/photoshop. Result was a complete rendering of a motorcycle engine from the top down. The project couldn't have been done in such a timeframe weren't it for a dozen or so students who drafted several parts.

Chris Pritchett (cpritch@vt.edu)

## Monster Maker

Hannah M. Comstock, Studio Art

This project looked into how visual art and coding could be combined to create an interactive piece of work. With this project I was able to research new ways I could incorporate my drawings into a form of making art that I had not done before. It uses traditional art in the sense of hand drawn images and combines it with technical art like coding. I created the idea to make a work that let people customize a monster in various areas such as its eyes, mouth, feet, and tail. I began this project by writing code in Processing. I then added images drawn in Photoshop that used transparent layers to create the ability to change what the base monster looked like. By pressing different keys on the keyboard, the user is able to cycle through over one hundred options to create a unique monster. The monster can be customized in fifteen different spots and each spot has at least seven different options for customization. The project finished with good results and was later shown at ICAT's Tech or Treat where children interacted with it and created their own monsters.

Dr. Dane Webster (webster@vt.edu)

## Sticks and Stones

Alison P. Flanagan, ARTF

My goal for this project was to create a cohesive set of visual art pieces to be displayed in a senior show. I chose to explore photography, drawing and embroidery in my work to try to address the questions of personal truth and beliefs. I was specifically interested in exploring how the truth and facts seem different depending on your circumstances (religions all claim to know the truth, eyewitnesses in court cases have conflicting truth statements and even siblings will have very different memories of growing up). My work has sought to represent this tension visually and explore historical content (such as the four gospels in the Bible that tell the same story from different perspectives) or the narratives from *How to Make a Murderer* [from 1988 - 2015]). My work has evolved into exploring how text can be disguised and hidden among other visual elements. The majority of my work has become graphite drawings. Working on a large scale, I paint words in gold acrylic paint and sketch in a background of graphite to the work. My pieces have a striking visual result. It would take the viewer an extensive amount of time to read all the text in the pieces and identify the initial purpose for being made. However, they have enough visual interest to keep viewers engaged for several minutes. Having had the work already displayed in a show, I am satisfied that it is visually appealing to viewers and leads to questions from its audience.

Dr. Travis Head (head\_travis@yahoo.com)

## Experimenting with Consumer Electronics

Alex J. Froelich, Studio Art

The purpose of this artwork is to reframe our thinking around prepackaged devices that are streamlined to execute specific tasks. Within streamlined consumer electronics there is still room for creativity, despite the rigid limitations that prevent the user from altering the function of the product. In these art pieces I wanted to discover the artistic possibilities that these objects afford. By figuring out how each device functioned, I discovered ways in which I could change the user interface and the function of the product in order to create new objects. I found that dismantling and reframing these objects was a very violent process. I also found the resulting artwork to be comical and absurd.

Dr. Carol Burch-Brown (cbb@vt.edu)

## Abstraction

Jenny L. Kelm, Fine Art

My intention with these pieces of art was to create images out of a plethora of materials that you normally wouldn't find together- but that can be seamlessly integrated in a digital space. I am playing with tension, leaving things up to chance, and abstraction. These works are from my senior studio thesis. I went out and looked for/made textures. I made photoshop brushes out of the images I took with my DSLR. Bark, sand, oil, talcum powder, mold, fibers, soap and more make up the textures. I brought these photographs into photoshop, converted them to black and white, upped the contrast, and isolated the parts that made for the best photoshop brushes. I then took those isolated moments and converted them to brushes. The process of painting and merging the textures together in a seamless manner took roughly four months. My intention was to create an abstract image that encompassed many different emotions around my experience of Trichotillomania, a hair loss disorder. As personal as this artwork is, I take joy in the fact that everyone sees something different in it, and perhaps they can see their own struggles in life mirrored back at them.

Dr. Simone Paterson (simpat@vt.edu)



## Cyrophoenix

Emily M. Parrish, Fashion Merchandising and Design

The purpose of this project was to make a distinctive and thought-provoking garment design using unique materials and methods of construction. My inspiration came from two documentaries, one on the worlds melting glaciers entitled Chasing Ice and a second on the great pacific garbage patch called Plastic Paradise. My idea behind the design was to create a wearable piece of art that would create discussion and greater awareness of the earth's environmental condition. I wanted the piece of art to look and feel as though it is a glacier melting of bottles. To create my design I began by creating a floor length dress made from clear vinyl fabric. I then had to decide how I was going to create my glacier. I decided to use a natural aluminum screening in which I bent and crimped in order to look like a glacier. I then draped cut plastic water bottles from the glaciers crevices to make it look as if it were melting. My final task was figuring out how to attach this sculpture to the wearers back. I decided to use Plexiglas cut in the shape of four candy canes pieces. I then attached two of the pieces together using bottle caps as spacers and plastic bottle wire. The final piece hangs off the wearers shoulders. Through my unique design I hope to create discussion and greater awareness of the earth's environmental condition. Although the garment is not intended for daily wear, I do hope to inspire others to become environmentally conscious through a differing medium.

Dr. Peggy Quesenberry (ppqberry@vt.edu)

## Millennial

Brennan Young, Studio Art

My intentions for this body of work were to reveal any possible relationships between the western consumer culture and the chaotic, racing mind of your average millennial. I have always been perplexed by the origins of my own hypomania; a disorder labeled by grandiosity, a decreased need for sleep, continuous flight of ideas, attention deficit hyperactivity disorder and involvement in pleasure seeking activities. As I've grown, I have come to realize patterns in my mental thinking that I believe are more common than society is led on to believe. Mental disorders are relatively new labels, and have therefore gone undiagnosed due to our lack of understanding our own minds and neurology/psychology in general. I can't help but wonder if these newly discovered disorders, particularly hypomania, ADHD and bi-polar disorder, have a connection with the lifestyle and rituals of the average millennial. My work is not bounded by a particular medium for I believe that exploring various relationships through many different mediums provides a more holistic perspective and result, enabling oneself to form stronger correlations between concepts being researched. In this particular body of work I use sculpture, graphite, ink, collage, code (max patches), and video projection to create multi-media works that hint at a deeper connection between the infrastructure of my own mind, and the restlessness of the globalized, urban society we live in.

Dr. Sam Blanchard (sam1@vt.edu)



# Performances & Oral Presentations

## A Pilot Study: The Exploration of the Management of Hypertension and Diabetes in a Nurse-Led Primary Health Center in Limpopo Province, South Africa

Taylor E. Allen, HNFE

In South Africa there is a growing concern for non-communicable diseases such as diabetes mellitus (DM) and hypertension (HTN). Because of the out-migration of nurses and physicians from rural areas, there is an increased need for community health workers (CHWs) to fill this gap. The primary aim of this study was to describe DM and HTN management in nurse-led community clinics in Limpopo province. Individual and focus group interviews were conducted at two community clinics in Limpopo province. Forty-six health care providers were recruited using convenience sampling and assigned to interview groups based on profession (CHWs, nursing, pharmacy, nutrition and medicine). Participants provided written consent to be interviewed and audio-recorded, and the audio files of the interviews were translated and transcribed. The transcripts were analyzed using thematic analysis and sociogram mapping. Analysis of participant interviews revealed common themes between the groups related to the management of DM and HTN, namely, resource scarcity, the importance of inter-professional collaboration (especially in the CHW role), clinic-patient partnership and the aspects of disease management. Sociogram mapping identified a lack of interaction between CHWs and physicians. Inter-professional collaboration and CHW involvement, knowledge and training are a necessity in rural clinics and may help close gaps in patient care and disease management.

Dr. Cathy Campbell (clc5t@virginia.edu)

## Exploring the Flamenco Vocal Tradition through Trumpet Performance

Caroline A. Amodeo, Music - Trumpet Performance

The goal of my project is to transcribe and edit Flamenco vocal music for the trumpet in a manner that demonstrates the tendencies of the Spanish language and preserves the integrity of the original sung performance through effectively representing the vocal text in the parameters of trumpet performance. I began this study to explore Flamenco music tradition in conjunction with trumpet performance practice; it will continue as a contribution of new music to the trumpet repertoire as well as an informed insight into the traditional performance practice of Spanish Flamenco vocal music. In this study, I employ traditional research methods, perform harmonic and melodic musical analysis, study the relationship between the Spanish language and trumpet articulation, and investigate musical notation. Many factors must be taken into consideration, such as the diction, inflection, and ornamentation unique to the Flamenco vocal tradition, which then must be accurately conveyed in the music. I anticipate this study to produce both tangible music for trumpet, for future publication, and a deeper understanding of the various aspects of traditional Flamenco music. As the trumpet is not a common instrument in Flamenco music I believe my contribution will be both professionally significant and culturally relevant.

Dr. Jason Crafton (jcrafton@vt.edu)

## Airglow: A Glimpse into Electroacoustic Music Composition

Galina Belolipetski, Computer Science

The motivation for composing this piece came from a desire to manipulate time and space thanks to access to an eight channel surround system, while also getting a grasp on technologies and concepts present in the electroacoustic music world. Throughout the piece, time and space are altered through the incorporation of a variety of timbres and the use of surround sound to move instruments and musical themes throughout the room. The first and most complex section is an introduction to the expressive range of the timbres as they intertwine in space. The listener is meant to take in both the manipulation of the melodic content and changes in their placement in the physical environment. The second section invites the listener to explore the space, where they can select and follow each timbre, as the interplay between the timbres circles around. The final section is a mix of the first two, allowing a peaceful resolution to the cacophony. By taking on the challenge of exposing my compositional style to the electroacoustic sphere of knowledge, I gained confidence in another medium of writing, and can now share these results with my peers in the music composition department, who wish to gain expertise in the subject at hand.

Dr. Charles Nichols (csnii@vt.edu)

# The Occupancy Dynamics of Ground-Dwelling Forest Birds in Ranomafana National Park, SE Madagascar

Hailey M. Boone, Biological Sciences

Little is known about Madagascar's ground-dwelling forest birds throughout Madagascar, despite the increasing threats from habitat disturbances and exotic predators. From 2008 to 2013, we used photographic surveys of terrestrial wildlife from five sites having varying levels of disturbance in or near Ranomafana National Park. In 11,476 trap nights, we obtained 1,125 photographic captures of 29 bird species. We used the photographic captures to estimate landscape occupancy and monitor multi-season occupancy trends at three resurveyed sites for six species. All six birds decreased as landscape fragmentation increased. Landscape occupancy probabilities ranged from 0.50 (SE 0.12; Madagascar magpie Robin *Copsychus albospectularis*) to 0.12 (SE 0.06; Pitta-like ground roller *Atelornis pittoides*). Three species were detected more often at sites with high Ring-tailed vountsira *Galidia elegans* trap success. For our multi-season analyses, by year three two of the birds demonstrated an occupancy probability of 0. We provide the first landscape-scale study to simultaneously examine the effects of habitat disturbance and exotic species on multiple ground-dwelling forest bird species in SE Madagascar. The overlap in occupancy and/or detection between these various birds and multiple native and exotic predators, and humans, highlights a potential threat and calls for targeted management plans to ensure the protection of these endemic, threatened bird species.

Dr. Zachary Farris (zjfarris@vt.edu)

## The Phrenological Holmes: Selden, and Doyle's Pseudoscientific Criminal Practice in 'The Hound of the Baskervilles'

Andrew M. Burlile, Language and Literature: Pre-Education

My desire for this project was to look into the pseudoscientific influences of phrenology in Sir Arthur Conan Doyle's story "The Hound of the Baskervilles." This study will aid in understanding how the Victorian writers were in communion with the scientific understandings of the time, and, by specifically analyzing Selden in Doyle's story, we can corroborate the evidence of Sherlock's ideal manhood and the Victorian ideal of genetic atavism, and the innate moral deficits of the poor. I analyzed an enchyridion on phrenology from 1894, working directly with contemporary texts to fuel my analysis of the story. As I found, Sir Arthur Conan Doyle imbues Sherlock Holmes with a surplus of superhuman abilities as per a diagnosis in the beginning of the text, which makes his reaction to Selden's death the ideal reaction to the death of a poor man who became criminal. It reflects the Victorian sentiments of the time on atavism and eugenics, and, likewise, Doyle attempts to use the popularity of his stories to further his beliefs on eugenics and moral atavism.

Dr. Nancy Metz (nmetz@vt.edu)



## Distributed Thermistor for Temperature Monitoring of Malnourished Infants

Lauren E. Cashman, Biological Systems Engineering

One of the complicating effects of widespread malnourishment in low-resource communities is the tendency for calorie-conserving bodies to produce too little body heat and become hypothermic. Left untreated, this dangerous state can quickly lead to death. Additionally, the temperature of a hypothermic infant must be continually monitored as they are warmed to insure they do not become hyperthermic. To meet this need in the low-staff conditions common to low-resource health environments, we have developed a system designed to continually monitor the axillary temperature of infants and report the temperature wirelessly to a user's wireless device. The system uses an armband to secure a thermistor in the axilla to monitor temperature and Bluetooth technology to transmit regular temperature updates to an Android portable device. The device will be equipped with an app interface that can report which sensor is transmitting out-of-range temperature readings. The system was tested using an array of six bottles containing heated water under varying insulation and wireless thermistors were used to monitor their falling temperatures. This demonstrated preliminary success of the concept, showing a clear difference between the insulated bottles and a non-insulated control as they dropped in temperature. Human validation testing is planned in the USA in early 2016, with a limited deployment and additional testing in Malawi in mid-2016.

Dr. Andre Muelenaer ([aamuelenaer@carilionclinic.org](mailto:aamuelenaer@carilionclinic.org))

## Food Production Records Study - What students are choosing in the lunch line

Susan Chen, Human Nutrition, Foods, and Exercise

Children are consuming increased amounts of solid fats, added sugars, and lower amounts of fruits and vegetables than recommended. This study examined the National School Lunch Program food choices of elementary aged children in southwest Virginia. Existing food production records were examined from two elementary schools in rural Virginia for five consecutive weeks and analyzed for descriptive statistics. Of the 23 days of records examined, 11,567 servings of entrees, 9,731 vegetables, 9,034 fruits, and 31,844 dairy were produced. The most frequently chosen menu items in each category were flavored milk, canned pineapple, hamburgers, and French fries. Least frequently chosen menu items in each category included white milk, canned mixed fruits, tuna salad sandwich, and side salads. Students chose foods that were high in fat, sodium, and sugar. These menu items include high carbohydrate main entrees and starchy vegetables. Schools with lower socio-economic status tend to serve more entrees and less fruits varieties. Additional research is needed on changing the food preferences of children and encouraging fruit and vegetable selection.

Dr. Alisha Farris (alisha@vt.edu)

## O-GlcNAc Nutrient Sensor Mediates Muscle-Fat Crosstalk

Morgan R. Daughtry, Animal and Poultry Sciences

UDP-GlcNAc, a product of the hexosamine biosynthetic pathway, is a nutrient sensor that links major cellular biochemical pathways. O-GlcNAcylation, a dynamic process that is catalyzed by O-GlcNAc transferase (OGT) and O-GlcNAcase, represents a signal transduction pathway that plays critical roles in a variety of cellular processes. Skeletal muscle composes 40-60% of body weight and accounts for 70-90% of insulin-stimulated glucose disposal. However, the functional role of O-GlcNAcylation in the regulation of skeletal muscle and whole body glucose metabolism and insulin sensitivity remains elusive. To address this, we employed the Cre-lox system to eliminate OGT specifically in skeletal muscle during embryogenesis and in adulthood. These mice were utilized to test the functional significance of O-GlcNAc signaling in metabolism under normal physiological condition along with dietary obesity. We show the removal of OGT in skeletal muscle resulted in greater whole body energy expenditure and less fat mass accumulation. Additionally, OGT deficient skeletal muscle exhibited a more oxidative phenotype characterized by increased mitochondrial content but compromised mitochondrial structure and function. OGT deficiency also protected mice from high-fat-diet-induced obesity likely through OGT mediated epigenetic regulation of gene expression of interleukin-15. These findings suggest that manipulation of O-GlcNAcylation may have potential therapeutic value to improve metabolic disorders

Dr. Hao Shi (haoshi@vt.edu)

## Uncovering Antiquity: Hubert Robert's The Finding of the Laocoon

Stephanie P. Dolezal, Classical Studies

This research investigates the painting, *The Finding of the Laocoon*, by 18th century French artist Hubert Robert, and its role in Robert's oeuvre of architectural landscapes. Anglo-American scholars have oddly remained relatively silent to date about this painting and this research sheds light onto the importance of this work. The goal of this research is to prove that *The Finding of the Laocoon* is not only a portrayal of St. Peter's Basilica, but also is the foundational painting in Robert's oeuvre that establishes a formula for constructing architectural landscapes. This has been done by examining Robert's professional relationship with a prominent Roman interior painter, Giovanni Panini, the inventories of Robert and influential patrons, elite collecting practices in 18th century France, and Robert's works in chronological order to document the development of his architectural landscapes. The research shows that *The Finding of the Laocoon* not only mimics Giovanni Panini's painting *Interior View of St. Peter's Basilica*, but is also indeed the foundational architectural landscape painting in Robert's oeuvre which is repeated in his later works. This research reveals how the formula established in *The Finding of the Laocoon*, which is based upon the art and architecture of the Vatican, stands as influential in Robert's subsequent architectural landscapes, eventually influencing Hubert Robert's design for the Grande Galerie in the Louvre.

Dr. James Jewitt (jjewitt@vt.edu)

## Functional Conductivity Maps for Hole Perception, An fMRI Analysis

Agilay Dones, BIT OSM

I will conduct statistical analyses of an existing fMRI data set using the PLS (Partial Least Squares) toolbox for MATLAB. I will examine patterns of functional connectivity between cortical brain regions that are active during the visual perception of 3D shape. I identified the relevant cortical brain regions in previous analysis that he conducted in fall 2015. The goal of functional connectivity analysis is to determine whether distinct brain regions form parts of a neural network that functions together as a unit, or whether they might perform separate cognitive functions. The PLS software provides algorithms for conducting the appropriate statistical tests on areas of interest in functional conductivity. I expect results to be comparable to the contrast maps made using the same data set of brain images where each increase in blood flow or area of activation in its distinct category is correlated with the comparable stimulus condition conducted in functional conductivity.

Dr. Anthony Cate (Acare@vt.edu)

# Antimicrobial Resistance of *Salmonella enterica* Environmental Isolates from the Eastern Shore of Virginia

Minh D. Duong, Biological Sciences

With the global food system becoming increasingly intertwined and with the implementation of the new Food Safety Modernization Act, discovery of antibiotic resistant [ABR] *Salmonella enterica* isolates in small communities can drastically impact the supply chain and future farm tracebacks. Tomatoes grown on the Eastern Shore of Virginia [ESV] have been associated with four laboratory confirmed *Salmonella* outbreaks. The same pulsotype pattern of *Salmonella enterica* serovar Newport has been implicated in these ESV outbreaks. The objective of this study was to identify ABR profiles of *S. Newport* isolates recovered from irrigation water and poultry litter-amended soil on ESV. *S. Newport* (n=301) isolated from ESV irrigation ponds and wells of four vegetable farms and 14 chicken-manure fertilized farms in 2015 were tested for ABR using Sensititer Gram-negative Narms plates. Resistance among isolates was defined following the National Committee for Clinical and Laboratory Standard criteria. 57 isolates (19%) were resistant to at least one of the tested antibiotics; 10 isolates from pond water, 4 from well/creek water, and 43 from soil samples. Resistance to tetracycline (13%), streptomycin (3%), cefoxitin (1%) and ampicillin (1.3%) was noted. Seven isolates (2%) were resistant to two antibiotics, mostly tetracycline and streptomycin. Four isolates (1.3%) were resistant to more than two antibiotics; these isolates, recovered from chicken manure amended soils, were resistant to 3-7 Abs

Dr. Renee Boyer (rraidn@vt.edu)

## Steinway Creek: Recalling the Industrial Heritage of a Waterfront Neighborhood in Astoria, NY

Amy. Eliason, Landscape Architecture

This undergraduate research in landscape architecture investigates the industrial heritage of a neighborhood bordering the East River in Queens, NY. Research methods included site visitation and historical references. In North Astoria, a wide, canal-like creek resides. Steinway Creek is hidden from view by a landscape plagued by industry. Steinway & Sons Piano Factory is one of the lasting industries on this waterfront and has been hand-crafting world class pianos directly adjacent to Steinway Creek since 1870. Research on Steinway revealed this industry's significant influence on the community which has left a lasting legacy on the physical landscape. When Steinway moved his factory to Astoria he bought 400 acres of surrounding land for employee housing. He believed his employees should live in a community with recreational and social amenities, including an amusement park, public beach, beer gardens, schools, churches and a library. The implications of this research is a neighborhood redevelopment project that provides amenities for the present community in the form of a waterfront park that celebrates Steinway's lost, historic neighborhood. The design resolution goals are to provide green-space to a community that currently lacks parks, reconnect the public back to nature and the waterfront, and celebrate Steinway & Son's historical influence on the physical and cultural landscape of this community.

Dr. Terry Clements (tclement@vt.edu)

## Integrating Dance, Technology, and the Environment

Serena L. Emanuel, Biological Systems Engineering

The object of this project is to explore choreographic perspectives by recording a dance from various camera angles and then digitally re-choreographing the dance. This is done by integrating the newly choreographed dance with text, audio, and visuals of nature. This process of deconstructing a traditional method allows for innovation and challenges the limitations of creating dance and video. This new method also allows for the use of dance to inspire a greater message—in this case a new approach to environmental interaction. The process began with rehearsal and recording of student choreography, and then evolved with digital manipulation and compilation using Adobe Premiere video editing software. This fluid process resulted in a four minute video compilation of choreography and natural settings, motivating new approaches to both choreography and the environment.

Dr. Billie Lepczyk (lepczyk@vt.edu)



## Depictions of Martin Luther King Jr. in Public Art from 1967 to the Present

Alison P. Flanagan, ART

The goal of this project was to explore how public art of Martin Luther King Jr. has changed since 1967. The starting hypothesis was that depictions of King told the viewer more about the funders behind the art than the man himself. This study is valuable because looking at art, particularly public, gives us a rare look into people's honest opinions from history. / All research for this study was taken from historical documents, books and art. These were analyzed in two ways. First, the artist's intent through direct imagery was explored. Then, the funding behind each piece was discussed. Each decade included a summary of public art changes in those ten years followed by several specific case studies. / After looking at many public art pieces from the past decades, it is clear there has been a shift in how Martin Luther King Jr. has been portrayed. Even among African American communities, King's methods and philosophies were not always viewed so positively. King went from being excluded from public art, to be displayed as a cautionary tale, to being applauded as a hero. Most interestingly, this shift in public opinion is due, at least partly, to the funding behind different art.

Dr. Kevin Concannon (Kevinc1@vt.edu)

## Useful by Nature, Defensive on Demand: Topography and Sieges in the Gothic Wars

Peter Francis S. Guevara, Classical Studies

This project aims to show how the use of topographical elements impacted the development of siege warfare during the Gothic Wars in the 6th century A.D. A number of scholars have studied topography and archaeology within the context of warfare in Italy during Late Antiquity but they often omit non-natural topographical features such as tombs, bridges, and aqueducts. Analyses undertaken for this project include comparison and contrast of the three sieges that the city of Rome endured during the Gothic Wars of a contemporary eyewitness, the Greek historian Procopius of Caesarea. The analysis also includes studies of other sieges that occurred during the same period such as the sieges at Ravenna and Rimini, two cities near the Adriatic Sea. Christopher Lillington-Martin's essay *Procopius on the Struggle for Dara in 530 and Rome in 537-38: Reconciling Texts and Landscapes* (2013) is a critical source for this paper because it sets the framework for the role of topography during the wars. In summary, the use of topography effected different outcomes for the various sieges of the Gothic Wars and can be expressed in a narrative history.

Dr. Glenn R. Bugh (gbugh@vt.edu)

## Discontinuous Realities: The Study of Space Through Cinematic Construction

Brian J. Heller, Architecture

Architecture is cinematic. By studying the construction of cinema with a focus on sequencing and editing, a series of films and drawings were created to explore different editing constructs and various modes of capturing the image: pan, track, zoom, 1-point and 2-point perspective. The research yielded that film successfully presents space through a discontinuous reality. This discontinuity is accomplished through visual and audible discontinuity within film. Cinema breaks up reality by visually separating spaces from shot to shot. The moment the viewer is presented with this discontinuity, they construct a reality based on the two images that have been joined. In order to test ideas of discontinuity a film and a set of drawings were produced. The film tested the joining of two realities into a single reality: the chaotic city and the rural home. Shots were edited together to form a depiction of the calmness in the rural home intercut with the chaos of the city. Audio editing joins certain shots together to form the contrasts between spaces: the quiet nature of the rural, and the loud chaos of the city. The perspective drawings further studied the way in which the camera looks at space, and examined how the location of the camera allows for the viewer to interpret and imply a movement. Similar editing techniques of omission and compression give the space an implied movement through discontinuity.

Dr. Shelley Martin (sfmartin@vt.edu)

## Sequence-Dependent Structure/Function Relationships for Peptide-enabled CoPt Nanoparticles

Hunter Jacobs, Chemical Engineering

Peptide-enabled synthesis of bimetallic nanocatalysts represents a means to fine-tune surface structure through peptide sequence manipulation in an effort to create materials with optimized properties. Unfortunately, there is limited information correlating peptide sequence to metal affinity and particle structure. In this presentation, sequence-dependent catalytic properties of peptide-enabled CoPt nanocatalysts are determined using electrochemical techniques. Peptide-enabled CoPt nanocatalysts exhibit sequence-dependent catalytic properties for methanol oxidation in alkaline environments. Cyclic voltammetry was used to measure peak current densities versus applied potential for methanol oxidation reactions with various CoPt nanocatalysts, allowing quantitative analysis of the catalytic properties of these CoPt nanocatalysts. High-energy X-ray diffraction (HE-XRD) and extended X-ray absorption fine-structure spectroscopy (EXAFS) will be used to uncover these differences in surface structural disorder. Nanoparticle configurations will then be determined directly from experimental data using reverse Monte Carlo methods, which provide nanoparticle configurations based solely from the experimental data. This information is used to explain catalytic properties of peptide-enabled nanocatalysts, which can potentially lead to the development of rational sequence design rules for the creation of nanocatalysts with enhanced properties for fuel cell applications.

Dr. Nicholas Bedford ([nicholas.bedford@nist.gov](mailto:nicholas.bedford@nist.gov))

## Gender and Online Identity

William A. Jennings, Philosophy

This research focuses on what factors comprise online identity and how gender shapes Internet experience. The research is intended to serve as a beginning point for a future theatrical performance about Internet culture. Data will be collected from individuals in the form of stories and experiences and used to create a piece of image theatre. This is also intended to create a movement language based on user experience of the Internet. Data collection methods include Story Circles and Theatre of the Oppressed. Anticipated results include a 10-20 minute performance. The exact form of the performance will be determined during the devising process of creating this piece of theatre.

Dr. Ann Kilkelly (akilkell@vt.edu)

## Person & Place in Wuthering Heights

Matthew W. Johnson, English--Literature & Language

In *Wuthering Heights*, Bronte develops the characters and settings together, creating specific ideas of placehood and peoplehood that inform each other. The characters of the Heights and the Grange embody characteristics and identities that reflect and impact the identities of these settings and further inform a reading of mobility between locations. This informs both our understanding of the imprisonment within certain boundaries and the assimilation of other characters as a result of moving between the Heights and the Grange. Ultimately, the two locations begin to converge as light and dark, Grange and Heights, intermingle through the crossing of these boundaries by various characters.

Dr. Nancy Metz (nmetz@vt.edu)

## "The Same Neutral Hue': Phoebe Marks's Inconspicuous Success"

Demetria K. Lee, Political Science

This paper analyzes the role of the servant character in Mary Elizabeth Braddon's novel, *Lady Audley's Secret* (1862). I argue that the servant, Phoebe Marks, is more successful than the woman she serves. When other scholars such as Elizabeth Lee Steere and Katherine Montweiler have studied Phoebe's role, they have either given her character too much weight, or they have underestimated her abilities. I claim that she subverts the typical role of the servant, using blackmail to gain power over Lady Audley while also learning from her lady's mistakes. Braddon constructs this subversive relationship by toying with the servant-master relationship and through imagery related to the Pre-Raphaelite painters. This paper uses a combination of textual analysis and synthesis of relevant scholarly research. I give sufficient evidence to suggest Braddon intentionally made Phoebe's character subversive to the Victorian social hierarchy and left the possibilities for her future unspecified.

Dr. Nancy Metz (nmetz@exchange.vt.edu)

## Publius v. Brutus: A Ratification Debate Over The Federal Courts and Judicial Review

Derek J. Litvak, History

The purpose of this project was to examine two key players in the ratification debates over the Constitution, Publius and Brutus, in respect to their opinions on the proposed federal judiciary. In particular, this project set out to show how the arguments of these two men showed the existence of judicial review from the very onset of the Constitution. With the amount of attention the Supreme Court, and lower federal courts, receive today, I wanted to delve into the creation of this branch and analysis what powers people thought the federal judiciary would hold if the Constitution were ratified. By examining Publius's Federalist Papers and Brutus's essays, I was able to ground my research largely on primary sources, and use the words of these two men themselves as a basis for my analysis. The resulting paper showed how the many aspects of the federal judiciary that Publius argued for, and Brutus against, were important not only in their own right, but because they ultimately were the very parts of the proposed judiciary that gave it the power, on top of authority, to exercise judicial review.

Dr. Daniel Thorp (wachau@vt.edu)



## The X-15: The Precursor to the Space Program

Jared B. Luebbers, History and Philosophy

Aviation and space served as a major front for the US and USSR to exhibit technological supremacy during the Cold War. The conquest for the skies included the development of tactical nuclear bombers, fighter-interceptors, spy planes, and most notably experimental aircraft to push the limits of flight. Throughout the 1950s, the United States employed several experimental aircraft in an effort to augment its flight capabilities. Not only did these research aircraft serve as vessels to learn more about flying, but they also served as geopolitical tools as the two super powers contended for international influence. Reaching space soon became the ultimate goal for both nations. In 1947, the United States' development of the X-planes program temporarily established the U.S. as the world's premiere nation in aviation technology. However, in a crushing counter-move, the Soviet Union beat the United States into space with the launch of her Sputnik satellite just a decade later. In order to demonstrate to the world it was not lagging behind, the United States decided to surpass all aeronautical feats by putting a man in space. The American answer came in the form of the latest X-Plane. North American Aviation's experimental rocket plane, the X-15, had just come into fruition, and the United States intended to use the up and coming aircraft as the initial retort to Sputnik in order to put itself back in the lead of the Cold War aviation contest.

Dr. Richard Hirsh (richards@vt.edu)

## Epigenetic Effects in the African Malaria Mosquito *Anopheles Coluzzii*

Kerry A. Maguschak, Microbiology

The African mosquito *Anopheles coluzzii*, a malaria vector, is responsible for transmission of *Plasmodium falciparum*, which causes malaria in humans. The ultimate goal of this study is to understand how development and reproduction in *An. coluzzii* are regulated. We studied the effects of the epigenetic drug 3-Deazaneplanocin A (DZNep) on development and mortality of larva, and on fecundity of females. Microscopy was used to compare morphology of eggs obtained from control and experimental groups. Larvae were exposed to different concentrations of DZNep, and we found that even at low concentrations larvae were less likely to emerge as adults. High concentrations of DZNep resulted in lower fecundity of adult females. They produced fewer and less viable eggs. At 2.5  $\mu\text{M}$  of DZNep, differences in number, sizes, and timing of eggs laid were observed. Semi-quantitative PCR identified specific genes such as those encoding acetylcholinesterase, voltage-gated sodium channel, and long leucine-rich immune protein that were up-regulated in adult females exposed to the drug via blood. Finally, we found that the epigenetic effects of DZNep are likely reversible; once the drug was no longer introduced to the adult females, they appeared to have fully recovered from the negative effects on fecundity and offspring survivability. Our results suggest epigenetics are a promising area of research for design of novel vector control methods.

Dr. Igor Sharakhov (igor@vt.edu)

## Translucent: The Effect of Composer Intentionality on the Listener's Experience

David J. Malinowski, Music

The goal of this project is to study how asserting or negating the intent of the music composer, or introducing external factors, such as algorithms and randomization, affects the listener's experience. The purpose of this creative work is to further develop my music composition skills. This piece is in the tradition of Musique Concrete, an experimental technique in which an abstract sound mosaic is created by recording and multitracking natural and processed sounds. After creating this montage of sounds, I produced both octophonic (8-channel) and stereo mixes of my piece. To carry out my study, I used compositional techniques that varied the degrees by which I incorporated composer intentionality and the influence of external forces. Listed from highest to lowest degree of composer intentionality, these techniques included intuition, algorithm, varying degrees of randomization, and counter-intuition (doing the opposite of what one would normally do). For example, I inputted 634 digits of pi into parameters of granular synthesis and delay. When listening to the final piece, people could not tell that there were different degrees of composer intentionality. This demonstrates that there is little correlation between the degree of composer intentionality and the listener's experience. Other project outcomes include an expanded knowledge of Musique Concrete, Logic Pro X (music software), music production; and how different compositional techniques affect the resulting piece.

Dr. Charles Nichols (csnii@vt.edu)

# Role of Water Hardness Precipitation and Disinfectants in Erosion Corrosion of Copper in Potable Water Systems

Kristine M. Mapili, Civil Engineering

Flow-induced failures (or erosion corrosion) of copper plumbing are increasingly being reported in potable water systems, especially those carrying hot water, where they fail prematurely owing to localized wearing away of pipe material. Factors including high velocities, temperatures, water chemistry, water hardness, particles, etc. are believed to contribute to erosion corrosion but there has been little fundamental research investigating these variables. Calcium carbonate that is typically present in hard waters can precipitate as aragonite particulates at very high temperatures and cause severe damage via impingement, and conventional disinfectants like chlorine generally added to treat drinking water can also contribute to copper corrosion. The roles of particulate size as well as disinfectants in copper erosion corrosion were investigated. Synthetic waters, known to cause erosion corrosion, at pH 7.5, 60 °C and typical velocities of 2-3 ft/s were stirred in 1L beakers clamped with copper wires for two weeks for three aragonite particle size conditions – small (< 1mm), medium (<5mm) and large (<1cm) – and three disinfectant conditions – chlorine, chloramine, chlorine dioxide, and no disinfectant/control – for the small sized particles. The medium-sized particles condition witnessed the highest weight loss over the large particles which was attributed to their reduced entrainment and consequent impingement owing to their higher masses. For disinfectants, copper weight

Dr. Marc Edwards (edwardsm@vt.edu)

## National Security and the Security of Nations in the Republic of Lithuania

John V. Marcantonio, International Studies

This research examines the relationships between various ethnic groups in the modern Republic of Lithuania. The research sought to compare current ethnic tension with historical tensions, as well as to examine the veracity of popular conceptions of history in Lithuania and their role in influencing current events. This review was then used to understand the actions of the Lithuanian government and people - both in domestic affairs as well as in international conflicts - namely the situation in Ukraine. Media, historical records, and personal perspectives gathered in Lithuania and Poland in July/August of 2015 informed this research. "National Security and the Security of Nations in the Republic of Lithuania" challenges positive and progressive perceptions of Lithuania and suggests that their dispute with Russia arises from competition for common interests rather than differences in ideology.

Dr. Edward Weisband (weisband@vt.edu)

## "Conversation for One" for Solo Tenor Saxophone

Michael L. Mills, Music

The inspiration behind "Conversation for One" is the inner conflict experienced by an individual faced with making a difficult decision. The ultimate goal of the piece was to illustrate this conflict by forming the work around two very distinct themes that constantly interact and interrupt each other. Each theme represents an opinion trying to be heard in the decision making process. In order to come up with the themes, I focused on the shape of the phrases rather than the specific pitches themselves. In addition to this, I wanted to give the impression that the piece is not constrained to a key signature by constantly shifting the melodies and changing tonality. The tenor saxophone is a metaphor for the human soul, beautiful and full, which is greatly juxtaposed with the tense situation of going back and forth on a difficult decision. All of these aspects combined with the soulful nature of the tenor saxophone work perfectly to embody the torn nature that is making a decision.

Dr. Charles Nichols (csnii@vt.edu)

## : “I Miss School Because There Are No Latrines”: Exploring the Real Costs of Poor Sanitation Facilities for Schoolgirls in Underserved parts of Africa

Nneoma E. Nwankwo, Political Science

For thousands of girls in underserved areas of sub-Saharan Africa, the onset of menstruation makes schooling very difficult. Famed researcher, Marni Sommer, refers to this clash of womanhood and education as the “body-school collision.” This ‘collision’ often leads to menstrual-related absenteeism, mental and physical exhaustion, amongst other factors, which often end in withdrawal from school. These outcomes are not inevitable. However, due to widespread lack of access to menstrual hygiene facilities, harmful cultural attitudes toward menstruation, and the missing contextual knowledge required to manage menstruation properly, these outcomes are too often realized. By taking the voices of the young girls most affected into account, my research identifies measurable steps that leaders at all levels could employ to alleviate this issue. Interweaving my own experience in the field with peer-reviewed research, I recommend three key steps, termed ‘I-3 approach’: impart, invest and implement. My research shows that when effectively combined, these steps prove successful in promoting proper menstrual hygiene practices, eliminating negative socio-cultural norms towards menstruation and ensuring the education and long-term economic empowerment of the girl-child.

Dr. Ralph Hall (rphall@vt.edu)

## Conceptualization of Meaning Among Eritrean Refugee University Students

Elizabeth A. Pelishek, Psychology  
Joshua Godby, Economics

Eritrea's multi-decade war for independence from Ethiopia, and the following border conflicts, have left thousands of Eritreans displaced. Many have sought refuge in neighboring countries, and the number is continuing to increase as more people escape Eritrea each year looking for better opportunities. The UNHCR estimated approximately 131,660 Eritrean refugees sought their aid in Ethiopia by the end of 2015. The Ethiopian government, in partnership with the UNHCR, have sponsored out-of-camp schemes to provide Eritrean refugees an opportunity to attend an Ethiopian University. Adigrat University in Adigrat, Ethiopia, due to its close proximity to the Eritrean border, has sponsored hundreds of students. Numerous students from the refugee camps have chosen a degree in human services. Limited research has been completed on this population, especially in regards to prosocial behavior. Using a narrative approach, the participants were given free reign to describe their life in their own terms, fostering a greater understanding on how different components come together to form an individual's perception of meaning. Furthermore, I hope to identify how integral prosocial behavior is in their lives and how their conceptualization of hope has evolved. An analysis of the students chosen to attend University could provide a greater understanding of the sustainability for the out-of-camp initiative, and foster further out-of-camp scheme development.

Dr. David Brinberg (brinberg@vt.edu)



## Temporal and Longitudinal Hg Trends in Burbot (Lota lota) in Eastern Arctic Rivers

Alexander R. Pelletier, Fisheries Conservation

Mercury (Hg) concentrations in animals of the North American and European arctic, including humans, are increasing and exceed Hg concentrations in most other animals worldwide. However, little is known about biological Hg trends in the Russian arctic, which constitutes one half of the pan-arctic watershed. Hg data from Russian arctic animals are necessary to understand Hg trends across the global arctic and the possible factors which most influence these trends. Here, we report temporal and longitudinal Hg trends in burbot (*Lota lota*) from eight rivers of the Russian arctic between 1980 and 2001. Over 2,100 burbot were collected using a long line ice fishing technique during peak burbot fishing season. Hg concentrations were measured in the dorsal tissue of each fish, and Hg trends were quantified using log-linear regression models in PIA contaminant analysis software. Mean biological Hg concentrations decreased in seven of the eight rivers by an average of 2.5% annually and by 1.8% per 10° longitude from west to east. These findings suggest that biological Hg trends across the global arctic are spatially and temporally heterogeneous. We also discovered that increasing Hg trends in western arctic animals appear to be directly correlated with increasing Hg emissions from human activity in southeast Asia, while decreasing Hg trends in eastern arctic animals appear to be directly correlated with decreasing Hg emissions from human activity in North America and Europe.

Dr. Leandro Castello (leandro@vt.edu)

## The Comic Machine: In Practice

Anna E. Ross, Industrial and Systems Engineering; Theatre

The comic machine describes the idea that each working part of a comedy works together, in precise synchronicity, to create the best comic performance. Fine tuning and tweaking each individual piece therefore betters the whole of the work. The comic machine is a collaborative effort between all aspects of theatrical production, including actors, director, props, costumes, and technical direction. The emphasis on precision and accuracy in a comedy is best observed when working on directing a comedic work. Through my research experience, as a Student Assistant Director on *Boeing, Boeing*, the inner workings of the comic machine were discovered. Ultimately, the discovery made was that the development of the comic machine starts with big picture pieces, such as line readings and blocking, and then moves, over the course of the rehearsal process, towards minute details, including the addition of "bits" and lazzi.

Dr. David Johnson (dajohns6@v.edu)

## "The Writer" - A Meditation on Blank Spaces

Molly S. Ryan, Creative Writing

"The Writer" is a poem written for Aileen Murphy's Creative Writing: Poetry class during Fall 2015. The poem is a dual meditation – it considers the thematic processes of poet Robert Frost, specifically his fixation on blankness and emptiness, while also considering the presence of these blank spaces in the world today, and how they affect society and the individual. This creative expression addresses the increasingly contested role of the writer in society, and brings a point of view arguing for the necessity of the writer specifically in reference to how humanity faces bleakness, absence, and loss. This piece was generated after extensive reading of and writing on Robert Frost, in combination with creative exploration of the societal place of writing in a world of rapidly evolving technology. After in-depth analysis of thematic messages in Frost's work, particularly poems such as "Home Burial" and "Desert Places," as well as thorough revision of the poetic expression with particular focus on word choice, structure, and thematic deliverance, the finished product was complete, with notes of personal experience and point of view as well as broad-spectrum contemplation.

Dr. Aileen Murphy (aileen@vt.edu)

# Cognitive Dissonance, Chipotle, and Contemporary Farming

Elizabeth K. Sagebiel, Public Relations

This discussion is an exploration of the ways Chipotle Mexican Grill uses two advertisements to create cognitive dissonance in message receivers in order to promote positive behavioral change and market sustainably farmed food. The use of cognitive dissonance theory in conjunction with six essential research questions reveals the key strategies utilized in advertisements “Back to the Start” and “The Scarecrow.” After identifying the strategies used by the advertisements, the paper will also determine whether the elements used in both advertisements were successful in achieving the perceived goals of the company they promote.

Dr. Beth Waggenpack (bwaggen@vt.edu)

## Determining the role of the 3 CheW adaptor proteins in *Sinorhizobium meliloti*

Amanda L. Sebastian, Microbiology

Through studying bacterial chemotaxis, we can learn more about the physiology of bacteria and how bacteria react to the environment. Symbiotic bacteria such as *Sinorhizobium meliloti* are important to the field of agriculture in their ability to improve crop yields. To facilitate chemotaxis in *S. meliloti*, the adapter protein CheW mediates binding of the chemoreceptors to the histidine protein kinase (HPK) CheA. After autophosphorylation, CheA donates a phosphate group to the response regulator CheY which controls bacterial flagellar motor rotation. *S. meliloti*, however, possesses three genes coding for the adaptor protein CheW. A bacterial two-hybrid system based on adenylate cyclase (AC) reconstitution was used to dissect the communication between CheA and the three different CheW adaptor proteins. By fusing CheA with the T18 subunit of the AC gene and fusing the three CheW proteins (CheW1, CheW2, CheW3) with the T25 subunit of the AC gene, protein interaction was observed through the restoration of AC activity on MacConkey plates. Additionally, the chemotactic behavior of single, double, and triple cheW deletion strains were assayed on swim plates. CheW1 was shown to interact with CheA via positive reaction on MacConkey media. Further, creating a cheW1 deletion reduced the bacteria's swimming behavior dramatically, implying that CheW1 is the primary CheW protein used for chemotaxis.

Dr. Birgit Scharf (bscharf@vt.edu)

## Is Diversity on Their Minds? Perceptions of Diversity in an Undergraduate Population Using a Multi-Method Survey

Rebekah J. Slabach, Agricultural Sciences  
Ambrosia Church, Agricultural Sciences  
Gabrial T. Anderson, Psychology  
Sachi K. Jain, Economics

In an increasingly global society, cross-cultural interactions have become common. Promoting diversity across college campuses can encourage students to engage in their global competence, which better prepares themselves for the workforce. Diversity education relies on understanding the perception of diversity from multiple viewpoints. The goal of the study was to understand the intrapersonal definitions and interpersonal differences of diversity in an undergraduate student population at a mid-Atlantic university. A multi-method survey was created and disseminated to students consisting of open-ended response and likert scale questions. Survey questions were created based on the constructs of race, socioeconomic status, and culture/environment used to define diversity. Likert scale questions gauged student perceptions of diversity and open-ended questions provided intrapersonal data for defining diversity, what students perceived made them unique, and opinions about efforts to improve diversity and inclusion at the university. Results from this study offer a formative and summative look at the landscape of student perception of diversity and will help construct effective inclusive programming to foster a diverse learning environment for positive cross-cultural interaction.

Dr. Tiffany A Drape (tdrape@vt.edu)

## "Dissecting Comfort: How Twentieth Century Definitions of Health Created the Modern Grilled Cheese Sandwich"

Rachel J. Snyder, Applied Economic Management

Evoking childhood memories and feelings of comfort, the grilled cheese sandwich joins the ranks of foods like the chocolate chip cookie and apple pie in its significance in American culture and society. Today the popularity of the grilled cheese sandwich is explosive with whole restaurants, cookbooks and festivals devoted to the coveted sandwich. However, how did the combination of melted cheese between two slices of toasted bread come to be associated as a comfort food? Key events, such as World War I, the Great Depression, and World War II impacted Americans' consumption, forcing them to change their eating habits. Meanwhile, companies like Kraft and Ward's Baking Company transformed and transferred cheese and bread from the home and farm to the laboratory. By breaking down the grilled cheese sandwich into its major components, bread and cheese, and then examining Americans' changing relationship with these two foods, a picture emerges of how twentieth century American society redefined the healthy diet. Advertisements, newspaper articles, cookbooks and government publications from the late nineteenth century to the 1940s illustrate the emergence of a complex definition of health that encompassed nutrition, sanitation and scientific and technological innovation. The new definition changed how Americans relate to their food and lives on in the American industrial food system, nutrition education and diet.

Dr. Melanie Kiechle (mkiechle@vt.edu)

## Measuring the effectiveness of exposure and response prevention behavior therapy regimes on treating symptoms of OCD and social anxiety

David A. South, Neuroscience

Treatments for mental and neurological disorders, such as obsessive-compulsive disorder (OCD), paruresis (shy bladder syndrome), individualized manifestations of social anxiety disorder (SAD), and depression have typically relied on drug prescriptions. The exposure and response prevention approach to behavioral therapy allows patients to reinforce positive behaviors and underlying neural mechanisms through practice without pharmacological dependence. Three anxiety patients and two OCD patients were recruited to meet with the behavioral therapy aide 3-4 times a week across 7 weeks. Each session lasted approximately 2 hours, during which patients were constantly exposed to triggers for their anxiety and compulsions. Compulsive itches, anxieties, and other reactions were reported to and observed by the aide, without allowing relief via the rituals developed from the disorders. Subjective units of distress (SUDs) were discussed with each patient as he/she experienced the discomfort. A score of 0 represented absolute comfort, while a score of 10 represented profound distress. Results showed that SUD scores taken at the peak of exposure activities decreased by a range of 23.3% to 53.3% amongst the five patients during the study period. Further analysis showed that controlled increase in exposure intensity correlated with a gradual decrease in SUD scores during exposures, suggesting that behavioral therapy can be an effective, drug-independent approach to treating distress symptoms.

Dr. Hsiao-Wei Tu (hsiaowei@vt.edu)



## Log of a Shocked System

Jacob Stenzel, Computer Science

Jacob Stenzel currently studies Computer Science at Virginia Tech with a focus on human computer interaction. He has remained active in the field of music composition by studying composition under Charles Nichols and serving as instrument builder and composer for the L2Ork Laptop Orchestra under Ico Bukvic.

Dr. Charles Nichols (cnichols@vt.edu)

## Unraveling Nucleic Mysteries with Molecular Dynamic (MD) Simulations

Kyle Titus-Glover, Engineering Science & Mechanics

The details of how the genomic DNA is packed inside the small volume of the nucleus is critical to many vital cellular processes. This project aims to investigate possible effect of the topoisomerase enzymes on 3D architecture of the fruit fly genome. Topoisomerases are enzymes in the nucleus that regulate the overwinding or underwinding of DNA; we will investigate how fast key characteristics of the 3D organization of the genome change depending on the level of topoisomerase and whether the chromosomes are bound to the nuclear surface. The results may have relevance to many aspects of cell function, including aging. The project utilizes molecular dynamics simulations of coarse-grained models of chromosomes in fruit fly. We will use well-established code Espresso and Matrix Laboratory (MatLab). Preliminary results indicate strong effect of the topoisomerase: chromosome territories, needed for proper cell function, deteriorate much faster in the presence of topoisomerase.

Dr. Alexey Onufriev (alexey@vt.edu)

# Discrete Boundary Problems via Integro-differential Algebra

Sieu Tran, Mathematics

The notion of integro-differential algebra was introduced to facilitate the algebraic study of boundary problems for linear ordinary differential equations. In this report, we construct a discrete analog in order to investigate boundary problems for difference equations. We restrict ourselves to the standard forward difference operator and accordingly the left Riemann sum operator. Key properties of the (discrete) integro-differential algebra are proven, including the discrete analog of the variation-of-constants formula. Our next goal is to build up an algorithmic structure for specifying difference equations as well as the boundary conditions, and to solve them via integro-differential operators. We have written the relations between these operators in the form of rewrite rules, and we prove that the resulting reduction system is Noetherian and confluent. Thus it corresponds to a noncommutative Groebner basis for the relation ideal of the operator ring. We derive the normal forms modulo this reduction system for every discrete operator and every boundary condition. Using these ingredients and a given fundamental system of the difference operator, we construct a solution algorithm for linear boundary problems over a discrete ordinary integro-differential algebra. We conclude with an example that might be called a discrete analog of an ill-posed boundary problem from which we extract its Green's function.

Dr. Daniel Orr (dorr@vt.edu)

## Development of An Algal-membrane Bioreactor as a Post Treatment for Microbial Fuel Cells Treating Municipal Wastewater

Hayden (Hei Tsun) Tse, Civil and Environmental Engineering

Microbial fuel cells (MFCs) have been studied and developed as a promising technology for sustainable wastewater treatment. Despite low energy treatment in MFCs, nutrient removal and the quality of the final effluent remains as great challenges. In this study, an algal bioreactor was linked to two tubular MFCs for improving nutrient removal. In addition, ultrafiltration membranes were installed in the algal bioreactor to separate algal biomass from the final effluent. The developed system was examined for its performance of organic and nutrients removal, bioelectricity generation, and biomass production. We simulate municipal wastewater as the influent of MFC. It remove organic in the wastewater influent and convert organic substrates directly into electrical energy. The effluent of the MFC is connected directly into the 6L algal bioreactor tank. Algae consumes and removes rich nutrients effluent from MFC. Hollow fiber membrane system is applied to improve the quality of the final effluent. A total current of 20mA is produced from MFC. Chemical Oxygen Demand decreases to 30mg/L in the final effluent. Ammonia and Nitrate in the final effluent decreases to 0 mg/L and 5mg/L respectively. With the algae that we harvest, bio fuel could be produced to increase power generation of this system. With the help of MFC on COD removal and Algal membrane bioreactor on nutrients removal, we can obtain high quality effluent and algae biomass production and bioelectricity generation.

Dr. Zhen He (zhenhe@vt.edu)

## Angel CW Research Presentation

Angelynne A. Walsh, Fine arts

Was asked by Willie Caldwell to present work and research. Contemporary writing works made in the past year during undergraduate time at Virginia Tech, through much creative research. Pieces being presented have not yet been confirmed.

Dr. Matthew Vollmer (vollmer@vt.edu)

## Beethoven's Andante Favori and the Compositional Process

Travis D. Whaley, Music

For my Honors Baccalaureate Thesis, I am studying Beethoven's compositional process in the 'Waldstein' Sonata by examining his sketchbooks and other primary sources related to the work. Beethoven was one of the most successful composers of his time and an obvious choice of study. I aim to reconstruct the sonata in the order it was sketched and compiled to define a process of composition that is still relevant for composers and musicians to utilize today. The second movement, the Andante Favori, evolved significantly over the course of its composition and Beethoven spent the most time on this movement. The Andante Favori affords an excellent opportunity to examine the compositional process as there are many sketches devoted to it and one can easily track the progression of Beethoven's thoughts as he composed. In my research, I have catalogued every sketch pertaining to this movement and defined general "stages of composition." In my analysis of the sketches, I trace the evolution of the main themes, showing why Beethoven made the changes he did. From this research, a method of composition is revealed.

Dr. Debra Stoudt (dstoudt@vt.edu)

## Race and Gender: Signs of Misfortune in Sab (1841)

Lauren A. Williams, Spanish

Sab, a Romantic novel written by Cuban author Gertrudis Gómez de Avellaneda, goes against social norms to strongly criticize 19th-century Cuba. This essay examines the manner in which Gómez de Avellaneda establishes race and gender as the most influential and powerful determiners of destiny in her novel. The author suppresses the characteristic Romantic notion of free will to criticize the hierarchical and patriarchal society maintained in Cuba. The physical characterization of the main characters, as well as their lack of social mobility within these aforementioned social and economic systems, reveal a profound criticism of the restrictions imposed by a society structured by race and gender in 19th-century Cuba.

Dr. Elisabeth Austin (elaustin@vt.edu)

# Central Injection of Neuropeptide Y Affects Dietary Macronutrient Composition-Mediated Changes in Broiler Adipose Tissue mRNA Abundance

Carli A. Williams, Animal and Poultry Sciences

Neuropeptide Y (NPY) is a potent orexigenic factor that also promotes adipose tissue development in birds and mammals. The purpose of this study was to investigate how dietary macronutrient composition and exogenous NPY affect expression of lipid metabolism-associated factors in different fat depots of chickens. Chicks were fed one of three isocaloric and isonitrogenous diets: high carbohydrate (HC), high fat (HF) or high protein (HP). On day 4 post hatch, 0.2 nmol of NPY or vehicle was injected intracerebroventricularly and abdominal and subcutaneous fat were collected 1-hour post injection. Total RNA was isolated, reverse transcribed and real-time PCR performed to quantify expression of genes associated with adipogenesis: Krüppel-like factor 7, GATA-binding protein 2, CCAAT/enhancer-binding protein alpha and beta, peroxisome proliferator-activated receptor gamma, sterol regulatory element-binding transcription factor 1, and fatty acid binding protein 4. The data indicate consumption of diets differing in fat content affect adipose tissue physiology, with differences in gene expression of some adipogenesis-associated factors; in general mRNA was greater in chicks fed HC than the HF or HP diet. Injection of NPY affected expression of these factors in an adipose depot-dependent manner. These results may have implications for understanding how early-life nutrition and appetite-regulatory neuropeptides affect development of different adipose depots in birds.

Dr. Elizabeth Gilbert (egilbert@vt.edu)





# Poster Sessions

## Toward a Smartphone-based Functional Ophthalmoscope for Next-generation Mobile Healthcare

Zainal Ariffin, B. Abdul Rahman, Electrical Engineering

Mobile devices such as smartphones are becoming globally ubiquitous and are transforming healthcare. An emerging trend is the integration of mobile devices with medical imaging as smartphone cameras provide a low-cost yet high-performance imaging platform. This integration promises to bring affordable healthcare to patients globally, especially in low-resource settings, for timely diagnosis. The proposed technique is based on laser speckle imaging (LSI) of blood flow, whose simple implementation makes it ideal for smartphone integration. In LSI, moving objects such as red blood cells cause blurring and reduced contrast while surrounding static tissue does not. Therefore, LSI can not only visualize blood flow but quantify its velocity as well. In the proposed setup, a low-cost, eye-safe laser diode will be used to illuminate the subject and images are captured by a smartphone camera with custom software controlling focus, exposure and frame rate that optimize LSI performance. To demonstrate the feasibility of this technique, a system configuration that consisted of compact camera, laser diode, syringe, and a glass-made capillary tube were first used. The photos were taken and processed in MATLAB program that will generate a line plot that shows the contrast variation as the speed of flow in the capillary tube is changed with time. The main focus of the research is to demonstrate the feasibility of LG Nexus 5 smartphone for retinal vascular flow imaging.

Dr. Yizheng Zhu (yizhu1@vt.edu)

## Creating Amarone Style Wines Using an Enhanced Dehydration Technique

Dustin C. Addington, Food Science and Technology

Due to changes in climatic conditions, wine grapes may need harvested prior to what is considered optimum maturity. Some producers use fruit dehydration to increase wine quality from fruit that must be harvested early. Merlot and Cabernet franc grapes were treated with selective safflower oil to help increase the dehydration rate and potentially enhance wine quality during the 2014 and 2015 growing season. Six replicates of fruit were sprayed on-the-vine prior to harvest at approximately nineteen degrees Brix. All fruit was harvested at approximately twenty-two degrees Brix. Fruit that was treated differed in Brix, malic acid, pH, and phenolic content. Berry weights of treated grapes were different from those untreated. Electronic nose measurements on berries and wine produced demonstrated different volatile levels among treatments. Experimental wines were identified as different using the triangle difference test and hedonic testing identified flavor and aroma differences. /

Dr. Molly Kelly (mkkelly@vt.edu)

# Initial Testing Of A Dual Activation and Deactivation Illumination System For Visualization Of Flow Using Phosphorescent Particles

Elizabeth J. Angel, Civil Engineering

Flow visualization is important to the study of fluid mechanics. Fluorescent dyes and particles are commonly used for flow visualization techniques, but the use of longer-lasting phosphorescent materials is fairly uncommon. This study explored commercially-available phosphorescent particles in conjunction with laser pointers for visualizing various flow conditions. The phosphors tested were primarily doped strontium aluminate ( $\text{SrAl}_2\text{O}_4$ ) or zinc sulfide ( $\text{ZnS}$ ) and had particle diameters ranging from 2 to 80 microns. Jar testing was done to analyze material properties and the particles were observed and imaged in stagnant and moving water. The particles were excited using a 405 nm 5 mW laser pointer. Some phosphors could be extinguished using a red (650 nm) or infrared (808 nm) laser pointer, allowing for variety in set-ups. This technique does not match the analytical capabilities of PIV or PLIF, but it can be assembled at a lower cost and it offers some benefits over standard dye injection methods: the tracers can be "erased" and reactivated when desired, which is useful in recirculating systems; and the noninvasive nature is well-suited for situations in which the flow is enclosed or should not be disturbed. Light conditions relative to velocity can limit image capture, but this can be mitigated using cameras with good low-light performance. The particles studied have a density and size such that they might also be used to trace sediment movement in the water column and bed.

Dr. Kyle Strom (strom@vt.edu)

## Unraveling the Eugenic Movement in Mexico

Leticia Ayala, Humanities, Science, and Environment

The idea that an individual can improve is hardly unique to any culture. However, when it becomes applied biology through the process of selective and coercive breeding, then it becomes the movement that is often associated with Nazi Germany. Similar ideas of nationalism and race improvement can be seen in Mexico, an area that had its own eugenics movement. Drawing on journal articles, the work of Nancy Stepan, and an essay by José Vasconcelos, this research looked at the history of eugenics in Mexico, specifically at the reasons why Mexicans believed that genetic improvement was necessary. The eugenic practices in Mexico included government policies, mestizaje, and education to tackle the issues of race and health. The devastating impact of the Mexican Revolution on society, the underlying racism towards the indigenous, and the desire for better health procedures were factors that allowed the Mexican eugenic movement to emerge.

Dr. Barbara Reeves (reeves@vt.edu)

## Flying snake landing: How limbless gliders dissipate energy on impact

Grant A. Baumgardner, Mechanical Engineering

Nearly all gliders use limbs when landing, which lessens the impulse on the body and prevents injury. However, gliding snakes (genus: *Chrysopelea*) land by impacting with their bodies, which must absorb localized forces and dissipate the body's kinetic energy. Snakes have been anecdotally observed to land on many complex substrates, including the ground, tree branches, tree trunks, and leafy vegetation, but the physics of impact have not been studied. Here we ask, what strategies do snakes use to dissipate the energy of impact to land safely on branches and leaves? To investigate this question, we recorded and analyzed high-speed video (500 and 2000 fps, Photron APX-RS) of *C. paradisi* landing after short trajectories (0.5 to 0.8 m horizontally and 0.8 m vertically) onto a horizontal pole as well as into an artificial tree. For snakes landing orthogonally on a bar, the dorsal surface was tracked throughout the landing event and the curvature of the body calculated. At impact, curvature changed near the contact location and propagated anteriorly and posteriorly from the impact site. Curvatures posterior to impact were greater as the body swung below the bar. When landing on a leafy tree, the snakes sometimes used the neck region to hook onto branches and leaf stems, with the neck bending up to 180 degrees laterally. This analysis shows that snakes can successfully land on complex substrates using passive and active changes to local body curvature. Supported by NSF 1351322

Dr. Jake Socha (jjsocha@vt.edu)

## Understanding Different Factors Affecting Type 2 Diabetes Caused By Variations in IAPP Sequence

Michael C. Bittner, Biology

Type 2 diabetes (T2D) affects millions of people worldwide and causes the inability to utilize insulin. T2D is caused by islet amyloid polypeptide (IAPP) because this protein is known to cause  $\beta$ -cell death, stopping insulin from reaching the bloodstream. When excess IAPP is secreted from the pancreas, IAPP aggregate and form plaques which penetrate cell membranes and cause  $\beta$ -cell dysfunction. Multiple studies have been done to determine how to stop IAPP aggregation but whether or not the variation in the sequence of IAPP across species or salt concentration affects the function of the protein has not been studied. Two separate models for each organism were created using 150 mM NaCl and 0 mM NaCl settings to see how the environment can affect structure formation. Both macaque monkeys and humans experience similar symptoms due to the lack of variation in their respective amino acids sequences. DSSP shows that macaque monkeys experience less  $\beta$ -sheet formation in 150 mM NaCl but more in 0 mM NaCl while humans experience the opposite, signifying a higher potential for T2D in a higher salt environment for humans. By studying the disparities between the amino acid sequences and the change in salt concentration, we will elucidate how the protein functions and possible methods of preventing the formation of plaques.

Dr. David Bevan (drbevan@vt.edu)

## Redlining Roanoke

Eleanor Boggs, History

This research project was an investigation of redlining in Roanoke and the local individuals in Roanoke County who were responsible for "redlining," as well as the homeowners impacted by this process. During the New Deal, the Home Owners Loan Corporation (HOLC) provided rescue capital and federal mortgage guarantees to help the finance industry recover from the Great Depression. HOLC rated neighborhoods for their riskiness in receiving government residential mortgage aid, relying on local realtors and lenders to provide much of this information. This was part of a national project that eclipsed the U.S. Census in its neighborhood-level demographic detail. While scholars have investigated a handful of cities and redlining, researchers have never taken on Roanoke, the closest city to Blacksburg surveyed and mapped by HOLC. However, so little is known about the Roanoke case that it is difficult to predict how this effort played out. For this project, I conducted primary source research in local archives and used regional sources. I compiled profiles of the informants and mapped patterns of real estate lending in this New Deal home finance rescue program in order to illustrate the role of race and class in economic recovery in Roanoke during the Depression. The project will be related to but distinct from "Mapping Inequality," the multi-institutional research project in which Professor LaDale Winling, the faculty mentor, is a participant.

Dr. LaDale Winling ([lwinling@vt.edu](mailto:lwinling@vt.edu))



## Community Sustainability in Floyd, VA

Eleanor L. Boggs, History

This project evaluates the sustainability of the community of Floyd, Virginia. My research revealed the community's strengths and weaknesses, with recommendations on expansion and development of the community's assets. The purpose of this research is to answer the question of how to develop a sustainable future for Floyd as an Appalachian community. Rural Appalachian communities face different issues than suburban and urban communities, who have direct access to resources that rural communities do not. This presents a crisis of sustainability in an area that is already experiencing a rash of dying towns. However, using research models like this one can predict individual communities' sustainability, as well as provide recommendations for improvement and therefore elevate sustainability. This evaluation is based on analysis of the seven types of capital: human, social, cultural, financial, political, built, and natural. I conducted primary and secondary source research into how these types of capital operated in Floyd. I concluded that the community holds much promise for lasting sustainability (with some room for improvement) and can act as a model for other Appalachian communities. /

Dr. Anita Puckett (apuckett@vt.edu)

## Comparison of Commercial Clinical Diagnostic Kits for Shiga Toxin-Producing Escherichia coli

Elizabeth L.I Brown, Microbiology  
Michelle Stark, Microbiology

Shiga toxin-producing Escherichia coli (STEC) are pathogens that cause bloody diarrhea, vomiting, and hemolytic uremic syndrome. Immunological diagnostic kits are able to differentiate illnesses caused by STEC by detecting the presence of Shiga toxin antigens. The objective of this study was to compare the performance of four diagnostic kits: Premier® EHEC, ImmunoCard STAT!® EHEC, SHIGA TOXIN CHEK™, and SHIGA TOXIN QUIK CHEK™. Fecal samples were tested using Premier® EHEC, SHIGA TOXIN CHEK™, and SHIGA TOXIN QUIK CHEK™ according to each kit's directions. The ImmunoCard STAT!® EHEC is not intended for direct fecal samples. Limits of detection (LOD) for each of the kits were determined in ng/mL using a standard curve created with purified Shiga toxin toxoids and in CFU/mL by testing dilutions of 12 different STEC strains isolated from foodborne illness. Direct fecal testing was compared to PCR detection of stx genes. Sensitivity/specificity for Premier® EHEC = 81.6%/ 97.3%; SHIGA TOXIN CHEK™ = 86.8%/98.6%; SHIGA TOXIN QUIK CHEK™ = 94.7%/99.3%. Between rapid tests, SHIGA TOXIN QUIK CHEK™ detected lower toxin levels compared to ImmunoCard STAT!® EHEC in purified toxin tests. Between ELISA tests, Premier® EHEC detected lower levels of toxin than SHIGA TOXIN CHEK™. No consistent LOD (CFU/mL) was determined in broth cultures because toxin production varied between the strains; due to this discrepancy, the concentration of bacterium in broth is not accurate determination for LOD.

Dr. Renee Boyer (rraiden@vt.edu)

## The effect of humidity on insect retention by spider orb-webs

Katrina E. Buccella, Biology

Malik X. Rivas, Biology

Meaghan K. Goodwin, Animal and Poultry Sciences

Orb-webs are used by spiders that live in a variety of habitats to capture and retain prey. These webs derive their stickiness from prey capture threads formed of regularly spaced, moist, hygroscopic glue droplets. Environmental humidity affects the adhesive and viscoelasticity of the glycoprotein core of each droplet. However, the impact of these changes on prey retention is unknown. This study determines if humidity also affects the time that prey capture threads retain insects. We collected samples from webs spun by 14 *Araneus marmoreus* females and from each subsample thread strands. Three strands were placed across the parallel bars of each of three thread supports. Each support was then placed in a separate chamber, where relative humidity (RH) was maintained at 37%, 55%, or 72%. An anesthetized fly was placed on the strands and its escape captured in a video. Bouts of active escape behavior were timed and summed. After correcting these for temperature differences among the chambers, we found that insect retention increased with humidity, being 81% longer at 72% than at 37% RH. Thus, the effects of humidity on glycoprotein performance translate into significant differences in prey retention and spider fitness.

Dr. Brent Opell (bopell@vt.edu)

## Caspase-11 Plays a Key Role in the Immune Response to Reduce *Toxoplasma gondii* Pathogenesis

Caroline V. Campbell, Biology

*Toxoplasma gondii* is an intracellular parasite that causes Toxoplasmosis and infects about a third of the world's human population. Nod-like receptors (NLRs) are vital in the body's response to infection with *T. gondii*. When canonical NLR inflammasomes form, caspase-1 is activated, which in turn cleaves IL-1 $\beta$  and IL-18. Newly published research suggests that a non-canonical inflammasome uses caspase-11 to perform many functions that were thought to be fully credited to the canonical inflammasome and caspase-1. In order to test the role that the non-canonical inflammasome plays in the body's response to infection, *Asc*<sup>-/-</sup> and *Casp11*<sup>-/-</sup> mice were infected with *T. gondii*. Morbidity and mortality were monitored over the course of the infection. To evaluate mechanism, bone marrow derived macrophages were harvested and challenged in vitro. Results show that caspase-11 does indeed play a role in the pathogenesis of *T. gondii* through IL-1 $\beta$  cleavage and neuroinflammation, which ultimately helps to protect against cysts later on in the chronic stages of infection.

Dr. Irving C. Allen (icallen@vt.edu)

## Testing for The Presence of Periglacial Processes in Rockfalls in The Southern Appalachians: Devil's Marbleyard, VA

Summer A. Caton, Geosciences

The Last Glacial Maximum (LGM) of the Laurentide Ice Sheet in North America, significantly modified the glaciated northern Appalachians. It also brought periglacial conditions to the southern Appalachians that notably affected the landscape (Braun, 1989). However, quantitative data that addresses how far south LGM periglacial conditions prevailed is sparse. The Devil's Marbleyard is a large rockfall (approximately 28,277 square meters) composed of quartzite boulders of the Cambrian Chilhowee Group in the Virginia Blue Ridge province. The origin of the rockfall is generally understood to be the result of periglacial processes although neither quantitative nor qualitative data currently exist to support this theory. To address this, we will carry out a field-based comparison of the site to places with known periglacial origins. The deposit will be mapped including the morphology of the deposit overall and the distribution of different size and shape blocks, as well as fracture mapping of the bedrock scarp itself. We will also use cosmogenic isotope surface-exposure dating and lichenometry to determine if the timing of the rockfall is consistent with the LGM and could therefore be periglacial in origin. This research is significant for understanding the extent of periglacial processes as well as erosional regimes of the southern Appalachians, which together provide a baseline for understanding how the landscape will respond to future climate change and anthropogenic modification.

Dr. James Spotila (spotila@vt.edu)

## Sustainability of the Town of Buchanan, Virginia

Taylor B. Church, Environmental Science  
Laura Leigh Venable, Religion and Culture

This poster session reports on undergraduate community research on the future sustainability of Appalachian communities collected and analyzed in the Fall 2015 Appalachian Communities class. Sustainability is a serious issue for small, rural Appalachian towns, where many experience declining populations and little work and school opportunities. This study applies a theoretical model offered by Cornelia Butler Flora, Jan L. Flora, and Stephen P. Gasteyer in *Rural Communities: Legacy + Change*, 5th edition. This model considers seven types of capital, not just financial capital. These types of capital are natural, political, cultural, built, social, financial, and human capital. In applying this model, we could conduct a richer and more robust analysis to determine the viability of our community over time. We chose to study the Town of Buchanan, Virginia because of its interesting story in the Virginia Tech series "Save Our Towns". Our data was collected from online sources, print sources and site interviews. Our results indicate that Buchanan is at a medium level of sustainability. The town has taken many steps in the right direction, however still needs improvement with political, social, human, and financial capital if the community desires to be fully sustainable.

Dr. Anita Puckett (apuckett@vt.edu)

## Exploring the Feed Potential of Mungbean: A New Forage Crop for Virginia

Katelyn N. Cox, CSES

Management systems that predominantly utilize cool-season grasses expose growers to risk of feed shortage during mid-summer months. Use of warm-season annual forages is one way to cope with feed shortage. Since Mungbean (*Vigna radiate* L.) is a warm season crop it is possible that it could be used to fill this gap and boost animal performance. The objectives of this experiment were: To evaluate mungbean's potential as alternative forage and grain crop in Virginia and to identify mungbean varieties suitable for Virginia climate. The experiment was conducted at the Shenandoah Agricultural Research Extension Center (SVAREC) in Steeles Tavern, Virginia. Two varieties of Mungbean, Oklahoma 2000 and Berken, were planted in June and July. Each treatment combination (2 varieties, two planting dates and with or without teff (*Eragrostis tef* (Zucc.)) were replicated 3 times. Treatments were arranged in randomized complete block design. Throughout the growing season, plant growth and development was recorded. At harvest, samples for biomass and grain yield and nutritive value analysis were obtained. No yield difference was observed between varieties. Crude protein content of mungbean plant varied from 22-26%. The one year data showed mungbean as promising alternative summer forage crop for Virginia.

Dr. Ozzie Abaye (cotton@vt.edu)

## “Investigation of breeding seasonality in *Leopardus pardalis* using a comparison of captive and wild ocelot cubs in northeastern Belize.”

Paige M. Crane, Wildlife Conservation

A comparison of captive and wild ocelot cubs will be done to determine if there is any evidence for the existence of seasonal breeding in the Belizean population. The ocelot is an elusive species that is difficult to study and thus little is known about breeding habits and influences of seasonal variation on the species. Individual identification is possible using ocelots' unique spot patterns, thus, individuals can be tracked throughout the study period. This study uses camera trap data from sites across northeastern Belize from 2002-2014 in which co-occurring felid species such as *Panthera onca*, *Puma concolor* and *Leopardus pardalis* were captured. Cubs are identified and compared to pictures of captive ocelots, which are obtained from zoos and captive facilities. We anticipate to find that ocelots in northeastern Belize do not time breeding to reflect seasonal changes such as wet and dry seasons.

Dr. Marcella Kelly (makelly2@vt.edu)



## Separation and Purification of Poly(ethylene glycol) Cholestanyl Oligomers

Anton S. Dahbura, Chemistry

Amy M. Davis, Chemistry

Sean J. Reiter, MATHematics

Poly(ethylene glycol) (PEG) polymers find use in various applications from consumer products— especially topicals (e.g., cosmetics, creams, and ointments)<sup>1</sup>—to drug delivery.<sup>2</sup> To deliver multiple drugs with different physiochemical properties, we are developing a lipid-bilayer-coated nanoparticle that requires spacers of discrete, monodisperse lengths. Current work aims to separate low molar mass ( $n < 10$ ) cholestanyl-PEG polymers into pure oligomers. The three aims of the project were (1) to find the best eluents for thin layer chromatography (TLC), which will be used to characterize various lengths ( $n$ ) of the PEG segment of cholestanyl-PEG, (2) to find the best eluents for column chromatography, which will be used to fractionate crude polymers of various PEG lengths, and (3) to find the best eluents for column chromatography of the fractions produced in separation of crude polymer. Exploring the use of fractionation chromatography provides a means to accomplish this separation. This strategy involves physically separating compounds with column chromatography by dividing an early column into sections, from a crude polymer mixture then running successive columns on those materials.

Dr. Rich Gandour (gandour@vt.edu)

## Muscle Stem Cells in the Pathogenesis of Woody Breast Myopathy in Poultry

Morgan R. Daughtry, Animal and Poultry Sciences

In recent years, the broiler industry has turned to genetic selection to increase meat production by generating broilers that reach maturity twice as fast and are three times heavier than broilers thirty years ago. As some birds reach nine pounds, areas of the breast muscle become damaged and the texture of meat becomes woody, a myopathy that causes significant losses to the poultry industry. We hypothesized that fast-growing muscle in chicken exhausts muscle stem cells (SCs), the major contributor of myonuclei to post-hatch muscle growth. To this end, we chose chickens different in body weight from a cohort of 1000 birds and compared their SC properties in vitro and in vivo. We show that SCs have compromised proliferative and differentiative capacities in 12-pound birds compared to their 9-pound counterparts in vitro. In vivo analysis reveals that 12-pound birds have larger myofibers containing more nuclei and increased nuclear domain, and these myofibers contain less SCs. Additionally, the larger birds have profound muscle damage characterized by widespread immune cell infiltration. Together, these findings support the notion that SC exhaustion in response to the greater demand of muscle growth may account, at least in part, for the woody breast myopathy in poultry industry.

Dr. Hao Shi (haoshi@vt.edu)

## Effects of Stress on Cerebral Activation and Cardiovascular Regulation in High Hostile versus Low Hostile Individuals

Lauren A. Davidson, Psychology  
Kelly Hipskin, Neuroscience  
Salwa Saqqi-Ali, Psychology

The purpose of this study is to help advance the findings in behavioral neuroscience research, particularly in sex differences, as little research has included females. We hope to help further advancements and knowledge of how high and low hostile females operate differently than males. Participants in this study are screened via the Effects of Stress on Cerebral Activation and Cardiovascular Regulation survey on SONA. In the in-lab portion of the study, quantitative EEG data is collected through quantitative EEG equipment and corresponding computer. Heart rate data is recorded manually. The cold pressor stress task is used in this experiment as the main stressor on all subjects. In our male subjects, we expect to find results similar to those in past experiments: high hostile males are expected to have a higher heart rate and elevated cerebral activation in certain areas in response to stress. We are proposing that the low and high hostile female subjects will have more regulatory cerebral and cardiovascular control than the male subjects. We also expect that high hostile females will still have an elevated cardiovascular response and slightly elevated cerebral activation response to stress compared to low hostile female, but these differences will be lower than the high hostile male subjects.

Dr. Kelly Harrison (kellyh07@hotmail.com)

## Undocumented Students in Higher Education

Juan O. de la Rosa Dia, Political Science

Diana Cerda, International Studies

Lucas Colon, General Engineering

Comprehensive overview of legislation regarding undocumented students and higher education as well as obstacles these students face. 65,000 undocumented students graduate from high school every year. This is meant to be a resource for educators who seek to help these students. The poster offers history of the undocumented student movement, overviews on student activism and current legislation and information on how educators can be involved and become an ally for these students. As a comprehensive overview, the poster is informative rather than one that hypothesizes or makes a specific argument.

Dr. Zac Zimmer (Zz@vt.edu)

## Isolation of New Antimicrobials From Growth Inducing Soils

Alyssa N. Debr, Biochemistry

Our student led research entailed the use of established methods and the incorporation of new methods to cultivate and search for new antimicrobial compounds from collected soil samples. Once there was evidence of new compounds discovered, the research proceeded to identify, purify, and isolate potential organisms for further reproduction and study. New antimicrobials will lead the way in the fight against the ever increasing drug resistant strains of bacteria. A suspected soil sample that could contain new antimicrobial producers is serially diluted and plated to establish isolation of the colonies. Once isolated, a pure colony is grown from one of the colonies on a plate then grown in a broth. After, they are then collected at different points of the growth cycle, establishing which growth phase produces the product. These possible producers are plated against susceptible *S. Aureus* and *E.coli* strains with standard Gram Positive and Negative controls to establish effectiveness. After testing various soil samples, a sample collected down river of a sewage treatment plant has shown to have antibiotic properties. Through shotgun cloning and DNA sequencing the identity of the bacteria can be determined. This evidence supports the idea that environmental conditions have a bigger role in soil bacterial diversity.

Dr. Nammalwar Sriranganathan (nathans@vt.edu)

## Using Molecular Dynamic Simulations to Assess Inhibitor Specificity between Sphingosine Kinase One and Two.

Nikolas E. Dimitry, Biochemistry

Cancer affects 13 million people worldwide and there are families of enzymes that play a key role in proliferation of tumor cells. Sphingosine kinases are lipid kinases that affect many biochemical processes along the eukaryotic plasma membrane that generates secondary messengers to create anti-apoptotic activity. There are two different isoforms of sphingosine kinases, sphingosine kinase 1 (Sphk1) and sphingosine kinase 2 (Sphk2). The native ligand of Sphk1 and Sphk2 is sphingosine, which turns into sphingosine-1-phosphate (S1P) by sphingosine kinases. Increased levels of S1P help promote angiogenesis and tumorigenesis. Understanding the binding cavities of these two enzymes can lead to the design of therapeutic drugs that can inhibit Sphk1 and Sphk2 enzymatic activity that could reduce the rates of tumor growth. Molecular dynamics simulations were performed to study the key differences between the binding cavities of each enzyme. Molecular dynamics simulations were utilized to understand transient movement of key active site residues as based on ligand binding. Results show there are key residues that aid in the stabilization of sphingosine in the binding cavity of Sphk1 and Sphk2. Learning the key differences between the binding cavities of the two isoforms of sphingosine kinase will lead to further insight on making a therapeutic drug to inhibit these kinases.

Dr. David Bevan (Drbevan@vt.edu)

## Will The Good Wasp Inside Survive? Effect of Varied Insecticides on Squash Bug Egg Parasitoid, *Gryon pennsylvanicum*

Casey L. Federovitch, Animal and Poultry Sciences

This research was conducted to determine the effect of different insecticides on *Gryon pennsylvanicum*, an important natural enemy of squash bugs, which are detrimental pests of squash and pumpkins. *Gryon pennsylvanicum* is a small wasp that aids in the reduction of squash bug populations by parasitizing squash bug eggs, which are deposited on the leaves of plants. For this project, parasitized squash bug egg masses were collected and dipped in different insecticide treatments. After two weeks, the number of emerged squash bug nymphs and adult parasitoids were recorded for each egg mass. The difference in mortality of parasitoids between the 5 insecticide treatments was not significant. This indicates that the egg chorion (outer shell) of squash bugs likely protects the eggs and any developing *G. pennsylvanicum* from dangerous pesticide residues.

Dr. Thomas Kuhar (tkuhar@vt.edu)

## Computational Insights into Binding of a Repeat Unit of an Antiviral Copolymer to Glycoprotein 120 in Four Strains of HIV

Robert L. Fuchs, Biochemistry

HIV currently affects approximately 35 million people worldwide and accounts for the deaths of 1.5 million annually. Alternative, affordable strategies for preventing HIV transmission will attenuate the spread of the disease in the absence of a vaccine. Anionic polymer microbicides have been in development with some levels of success in anti-HIV activity and provide a platform for novel drug development and optimization. Poly(4,4'-stilbenedicarboxylate-alt-maleic acid) (DCSti-alt-MA), a polyanion, shows excellent anti-HIV activity against several viral strains. In order to assess mechanistic details relevant to anti-HIV properties of DCSti-alt-MA and assess strain specificity, a combination of semi-empirical calculations and molecular docking studies of a repeat unit of the polyanion with glycoprotein 120 (gp120) have been performed. Semi-empirical computations on the repeat unit of the precursor polymer and the polyanion identify the minimum energy configuration and conformation for multiple DCSti-alt-MA species and provide essential details for developing potent, specific anti-HIV polyanions. Molecular docking studies show differences in affinities for certain DCSti-alt-MA species based on net charge. Future studies include docking selected DCSti-alt-MA variants into multiple strains of HIV in order to determine potential polyanion specificity and performing molecular dynamics studies to assess effects of polyanion binding on protein structure-function relationships.

Dr. Richard D. Gandour (Gandour@vt.edu)



## Kids' Tech University: STEM Education Beyond the Classroom

Alexander T. Gagliano, Computational Modeling & Data Analytics

The goal of The Virtual Kids' Tech University is to improve literacy in primary math and science education to ensure a strong STEM workforce of tomorrow. The Virtual Kids' Tech University targets elementary and middle school students at a critical point in their education and introduces Virginia Math and Science Standards of Learning through online games, lessons, and quizzes. Current expansion of previous KTU modules has led to the development of a multi-faceted cell game, Cell Life. By harnessing the developmental process of exploration, Cell Life presents concepts of cellular physiology in an approachable and entertaining manner. The culmination of resources provided within each module facilitates both a formal educational lesson as well as a home-based learning experience, exposing students to previous, current, and upcoming standards of learning. Future work on the KTU program will focus on the integration of additional modules in the hopes of creating a nationwide resource that utilizes natural curiosity to encourage independent learning. This work was supported in part by the following grant: NSF #MCB - 1330180 /

Dr. Kristy Collins (kdivitto@vbi.vt.edu)

## Mutagenesis of genes responsible for the exopolysaccharide that forms the biofilm of *Histophilus somni*

Yuchen Gao, Biological Science

*Histophilus somni* is a gram-negative coccobacillus, host-specific, opportunistic pathogen contributes to bovine respiratory disease complex in cattle. *H. somni* makes an excellent biofilm in vitro and in the bovine host, which may contribute to chronic respiratory and myocardial disease. The biofilm matrix is largely composed of an exopolysaccharide (EPS), which may also contribute to *H. somni* virulence. An *H. somni* gene cluster with homology to polysaccharide gene clusters of other bacteria has been identified by comparative genomics. Our objective is to determine if this gene cluster is responsible for EPS biosynthesis, biofilm formation, or *H. somni* virulence by mutating one or more of the genes in this region to generate a defined, EPS-deficient mutant. The *dctP* gene encoding for a putative TRAP C4-dicarboxylase (periplasmic component), which also contains a signal sequence uptake motif, is selected for mutagenesis. Regions of about 1.5-kb upstream and downstream of *dctP* will be amplified by PCR and cloned into pBluescript with kanamycin-resistance gene (*kanR*) is cloned between. The resulting plasmid will be purified, concentrated by ethanol precipitation, and methylated using a *HhaI* methylase. At least 1  $\mu\text{g}$  of methylated plasmid DNA is introduced into multiple *H. somni* strains by electroporation. The mutant will be isolated on 145  $\mu\text{g}/\text{ml}$  kanamycin CBA plate, then evaluated for EPS synthesis, biofilm formation, and virulence in a mouse model.

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## Comparison of Maternal Report and Observed Attention Focusing

Elizabeth M. Gardiner, Human Development

Children's temperament involves genetic predispositions often linked to how children express and control their emotions (Rothbart & Bates, 2006). Both maternal report and laboratory observations have frequently been used to measure temperament, although each addresses different aspects of temperament. Maternal reports incorporate holistic views of temperament from a variety of naturally occurring experiences in children's lives over a long period of time, whereas observations of temperament often take place in controlled laboratory procedures and thus focus on narrow aspects of temperament elicited in specific contexts. Given these potential differences in measures of temperament, I will examine the relation between maternal-report and observed temperament, specifically children's focused attention. Preschool-aged children (n=116, 54 girls) were observed in a laboratory frustration task, where they were told to get a toy from a locked, clear box, but the correct key was not provided. Focused attention was coded as present during 5-second coding periods if children's eyes were fixated on the stimulus for two or more seconds. Mothers reported on children's attention focusing using a 7-point scale from extremely untrue to extremely true. I hypothesize that the two measures of attention focusing will not be highly correlated because they measure temperament in very different contexts. /

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## Sedimentary Charcoal as Evidence of Pre- and Post-European Fire Patterns on Barbuda, Eastern Caribbean

Mary Anna Garifo, Geography- Geospatial and Environmental Analysis  
Rylan Linddy, Geography- Geospatial and Environmental Analysis

Analyses of relatively large ( $>125\mu\text{m}$ ) charcoal fragments contained in lake sediment profiles can provide valuable information on watershed fire histories over timescales of centuries to thousands of years. A location's fire history may relate to both climatic and human influences. The Caribbean Islands, particularly the Lesser Antilles, have produced few sedimentary charcoal records, especially those that document long-term fire history before pre-European contact. Thus, such records represent a key area of study to document both human activities and climate dynamics on Caribbean islands. This project examines long-term fire history around Freshwater Pond, Barbuda, Lesser Antilles, through analysis of macroscopic charcoal fragments isolated from an 84cm lake sediment core representing the past  $>2000$  yrs. We removed 1cc sediment samples every 1cm throughout and wet sieved using  $125\mu\text{m}$  screens. Charcoal fragments  $>125\mu\text{m}$  were verified with a microscope and tallied. Preliminary results from this ongoing research indicate dramatically higher charcoal abundance in sediments representing the pre-European period versus post-contact (since 1632). This finding may point to larger indigenous populations than historical ones and a greater influence of fire on the island's ecosystems before European contact. Our final results will be paired with ongoing archaeological work on the island. Key words: Fire history, charcoal, lake sediments

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## Job Offers: Realizing You Are Being Scammed

Leah R. Gillespie, Consumer Studies

In 2013, the Federal Trade Commission conducted a study on fraud. Approximately, 25.6 million people, 11% of adults in the United States, paid for fraudulent products. This information may shock the population; however, scammers know how to coax consumers into scams to steal their money. There are ways that consumers can become educated to protect themselves. This case study describes how education can help a consumer faced with an attempted scam can avoid loss. This student had taken classes on consumer education and consumer protection and was aware of situations that could lead to Internet scams. However, she was nearly scammed by being offered a job through a reputable company. Her education and skepticism kept her from having money stolen directly from her bank account. By investigating the e-mails received and the questioning the instructions given for buying materials for the job, the student concluded it was a scam. Using the Better Business Bureau database, she realized this relatively new scam had been used in another state. This poster will describe the scam and education to prevent these crimes from continuing.

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## City by the Sea: Charleston's Built Character

Carter H. Gresham, Landscape Architecture

Built on the land, grown from the sea; Charleston, South Carolina is the city by the sea. The research investigates the city's morphology and identifies the urban character of Charleston. The city has recently experienced a period of growth and rejuvenation, yet some portions of the city have remained islands within it. The city lacks a built vocabulary for the land/sea edge just north of Market Street. This research creates that built vocabulary for future development. The city was analyzed for its street character, developmental history, economic evolution, green systems, block characteristics, and neighborhoods. In addition, a major focus of the research centered on the treatment of the water's edge and its alterations over time. This coastal edge defines the relationship between Charleston and its rivers. Charleston is an enclosed, intimate city, full of defined public spaces, yet often separated from its maritime environment. This research will be used to create a design for an abandoned site on the eastern edge of Charleston that combines housing for locals as well as a dining and retail district to be enjoyed by residents and visitors alike. Using this research, the design seeks to extend the built narrative of Charleston.

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## Self-assembly of Artificial Actin Filaments

Christopher R. Grosenick, Physics

Actin Filaments are long, double-helical biopolymers that make up the cytoskeleton along with microtubules and intermediate filaments. These filaments self-assemble into complicated structures within cells, allowing them to move, divide, and more. To further understand how this self-assembly process works, a model to recreate actin filament geometry was developed. A monomer in the shape of a bent rod with vertical and lateral binding sites was designed to assemble into single or double helices. With Molecular Dynamics simulations, a variety of phases were observed to form by varying the strength of the binding sites. Focusing on vertical binding only, we have found a narrow range of binding strengths that lead to long single helices via various growth pathways. When lateral binding was introduced, double helices began to form. These double helices self-assemble into much more stable structures than their single helix counterparts. We have found that double helices form long filaments at about half the vertical binding strength of single helices. Surprisingly, we have found that triple helices occasionally form, indicating the importance of structural regulation in the self-assembly of biopolymers.

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## Validation of exercise intensity of a commercial fitness application

Jaeo Han, Statistics

An integrated research-practice partnership identified Fitnet, a free commercially-available mobile exercise application (app) where users follow a pre-recorded trainer through segments of 6, 5-minute cardio, strength, or flexibility videos labeled as beginner, intermediate, and advanced. A camera imbedded in a tablet or a smartphone device provides participant feedback by counting movements. Study objectives are to: 1) to determine if the levels of exercise being promoted by Fitnet can be distinguished as mild, moderate, and vigorous physical activity (MVPA), 2) to determine if the camera count data can be used to track physical activity of different levels accurately, and 3) to determine the degree to which different strength versus cardio FitNet activities facilitate MVPA. Over 3 days, 20 healthy adults completed 6, 30-minute strength and cardiovascular sessions at each level, with a break every 15 minutes. Heart rate (HR), rating of perceived exertion (RPE), and accelerometry (AC) were used to measure intensity. Pairwise correlation and simple linear regression were used between all response variables. A mixed effect linear model was used based on each response variables / / Level and exercise type explained significant variance in exercise intensity in HR, RPE, and AC ( $P < 0.0001$ ). For cardio sessions, exercise intensity significantly increased across beginner, intermediate, and advanced levels. Camera count data was significantly and inversely related to exercise intensity

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## Perspectives of Poverty, Identity, and Faith: Stories from Mothers in Honduras

Isabel M. Hefner, HNFE

The J.M.A. Clinic in Tegucigalpa, Honduras, supports the impoverished with quality medical care and inexpensive pharmaceuticals, and it encourages community development through its Nutrition Program. Their Nutrition Program enrolls poor single mothers in the city and offers each participating family free medical and dental care, supplementary food donations, and vocational training to promote empowerment and boost employability. In an effort to gauge the efficacy and satisfaction with the Nutrition Program, qualitative analysis of current Nutrition Program participants was conducted to define how the Program supported their families, and how it could be improved to better fulfill their self-determined physical, spiritual, and educational needs. / Methods: A one-on-one interview was conducted with each of the 24 Nutrition Program members, asking general questions about family health and nutrition, competency gained through vocational classes, and intent to pursue future employment after the Program term. / Results: Data collected from the mothers' interviews is being used to develop a "Cook Book" that ties together nutrition, the promotion of women's health and equality, and the culture of Honduras. It is my hope that this work will offer a unique perspective of life in a developing country and the challenges faced by mothers, as well as the importance in the continued funding of the J.M.A. Clinic and the Nutrition Program.

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## Sex Differences in Laterality through Motor Function and Concurrent Cerebral Regulation of Autonomic Nervous System Tasks

Grace A. Herrick, Biology  
Michael W. Stafford, Neuroscience  
Kyle Woisard, Psychology  
Andrew Banick, Neuroscience  
Hannah Hawks-Mayer, Neuroscience  
Diane Opeikun, Biology  
Carson Baldwin, Psychology

Recent research into the neural substrates of hostility has failed to include sex differences. Williamson & Harrison found differences in right frontal lobe functioning between high- and low-hostile males in a study assessing blood pressure, heart rate, and perseverative errors corresponding to two neuropsychological tasks mediated by the right and left anterior hemispheres of the brain. In the current study, sex differences in the influence of hostility levels on verbal and nonverbal fluency and concurrent cerebral regulation of autonomic nervous system functioning will be examined in high- and low-hostile males and females. Recent research supports anterior right and left cerebrum roles in regulation of sympathetic and parasympathetic activity, respectively. Fluency and perseverative errors will be analyzed and physiological measures will be taken, including systolic and diastolic blood pressure, respiration, and E.K.G. It is predicted that high-hostile males will show interference in cardiovascular regulation concurrent with the neuropsychological measure of right frontal lobe function in comparison to low-hostile males. Research suggests more interhemispheric connections in female brains and more intrahemispheric connections in male brains leading to the hypothesis that there will be no statistically significant differences in / cardiovascular regulation or perseverative errors between low-hostile females and high-hostile females.

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## Evaluating the Negative Regulation of TLR Signaling Pathways via Intestinal Organoid Cultures

Haleigh M. Hixson, Biology

Recent advances in stem cell biology have led to the ability to culture and maintain three-dimensional intestinal epithelial organoids termed “mini-guts” in vitro that closely parallel their in vivo counterparts. Compared to traditional monolayer culture techniques, organotypic cultures provide more physiologically relevant models of the mammalian adult intestine and are emerging as powerful tools for examining the properties of intestinal epithelial cells (IECs) in vitro (1, 2). Of particular interest to the Allen Lab is the use of these intestinal organoids to elucidate the contributions that the negative regulator Interleukin Receptor Associated Kinase-M (IRAK-M) has in innate Toll-Like Receptor (TLR) signaling pathways. Though characterized in macrophages, the effects of this negative regulation by IRAK-M in TLR signaling pathways in IECs remains largely unknown (3). To test this and other potential outcomes resulting from IRAK-M mediation in IECs, small intestinal organoids were generated in vitro from genetically modified *Irakm*<sup>-/-</sup> mice for future stimulation with pathogenic associated molecular patterns (PAMPs) and live pathogens. We anticipate that the successful maintenance of these intestinal organoid cultures will lead to an enhanced understanding of the IEC contribution to innate immune signaling pathways, paving the way for the development of enhanced therapeutic options for various gastrointestinal ailments in the years to follow.

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## Computational Insights into Binding of a Repeat Unit of an Antiviral Copolymer to Glycoprotein 120 in Four Strains of HIV

Louis Hollingsworth, CHE

HIV currently affects approximately 35 million people worldwide and accounts for the deaths of 1.5 million annually. Poly(4,4'-stilbenedicarboxylate-alt-maleic acid) (DCSti-alt-MA), a polyanion, shows excellent anti-HIV activity against four viral strains (HIV92UG037, HIVIIIb, HIVJR-CSF, and HIVBaL). In order to assess mechanistic details relevant to the anti-HIV properties of DCSti-alt-MA and assess strain specificity, a combination of semi-empirical calculations and molecular docking studies of a repeat unit of the polyanion with glycoprotein 120 (gp120) have been performed. Semi-empirical computations on the repeat unit of the precursor polymer and the polyanion identify the minimum energy configuration and conformation for multiple DCSti-alt-MA species and provide essential details for developing potent, specific anti-HIV polyanions. Molecular docking studies show differences in affinities for certain DCSti-alt-MA species based on net charge. Future studies include docking selected DCSti-alt-MA variants into multiple strains of HIV in order to determine potential polyanion specificity and performing molecular dynamics studies to assess effects of polyanion binding on protein structure-function relationships. Ultimately, mechanistic insight can be gained to (1) improve and optimize DCSti-alt-MA as an anti-HIV agent and (2) provide avenues for future microbicide design.

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## Person & Place in Wuthering Heights

Matthew W. Johnson, English--Literature & Language

In *Wuthering Heights*, Bronte develops the characters and settings together, creating specific ideas of placehood and peoplehood that inform each other. The characters of the Heights and the Grange embody characteristics and identities that reflect and impact the identities of these settings and further inform a reading of mobility between locations. This informs both our understanding of the imprisonment within certain boundaries and the assimilation of other characters as a result of moving between the Heights and the Grange. Ultimately, the two locations begin to converge as light and dark, Grange and Heights, intermingle through the crossing of these boundaries by various characters.

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## Sphingosine Kinase is a Potential Drug Target in *Trypanosoma brucei*

Hyun Kang, Biochemistry

*Trypanosoma brucei* is a kinetoplastid parasite that is the causative agent of Human African Trypanosomiasis (HAT), commonly known as sleeping sickness. HAT is usually lethal when left untreated. However, only four drug therapies are approved for treatment of HAT and each drug has toxic effects associated with their use. The lack of safe and effective drugs for treating *T. brucei* highlights the need for novel therapies that kill the parasite and are less toxic to patients. One approach for finding new drugs is to identify targets in the parasite that can be specifically inhibited by small molecules. The sphingosine kinases (SphK) phosphorylate the amino lipid, sphingosine, to produce sphingosine-1-phosphate (S-1-P). They are involved in a wide variety of cellular functions including cell proliferation and apoptosis which makes them interesting targets to inhibit in *T. brucei*. We have tested a small library of sphingosine kinase inhibitors against *T. brucei* and identified five that have bioactivity against the parasite between 1-5 $\mu$ M concentrations. Here, we show that the lysate of *T. brucei* is able to convert sphingosine into sphingosine-1-phosphate (S-1-P). We have identified a sphingosine kinase A (TbSKA) homolog in *T. brucei* and are developing an assay that will allow us to analyze these compounds for their ability to inhibit TbSKA.

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## Additive Manufacturing of Magnetic Power Electronic Components for Integrated Circuits

Dana A. Kazerooni, Materials Science and Engineering

Power electronics are essential in regulating power usage in integrated circuit (IC) systems. As these components get smaller, manufacturing such components become increasingly difficult. In recent years the emergence of three-dimensional (3D) printing or additive manufacturing technology has allowed faster design and manufacture of smaller, more intricate, and precise objects. Due to this technology's availability and affordability, it has begun to appear in many different industries such as the art, food, automotive, and construction industries. The purpose of this research is to explore the ability of using 3D printing technology to create a functioning power transformer that can be integrated into a circuit. A power transformer was designed and additively manufactured using a commercially available 3D printer. Various types of filaments were used to get both magnetic, electrical, and insulative properties required in creating a functioning transformer. The transformer's magnetic core properties were characterized and modelled using electromagnetics software.

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## Working Memory and Recollection, but not Familiarity, Contribute to Academic Achievement

Kayla Keith, Psychology

Academic achievement requires many cognitive processes. One such process is working memory (e.g. Gathercole et al., 2006). Working memory (WM) is a cognitive construct that maintains awareness of information for manipulation and use (Baddley & Hitch, 1974). Little is known, however, of the relation between episodic memory (EM) and academic achievement. EM refers to memory for specific events (Tulving, 1972). EM may be dichotomized into recollection (re-experience of events) and familiarity (strength of memory trace). Our study examined the contributions of both recollection and familiarity on four measures of academic achievement (reading comprehension, calculation, reading and math fluency), while controlling for both WM and verbal IQ in 102, 6-year old children. Children were given a recognition memory task (EM, both recollection and familiarity), a backwards digit span task (WM), the Woodcock Johnson III Test of Achievement, and the Peabody Picture Vocabulary Test IV (Verbal IQ). Four regression equations were used to examine the contributions of Verbal IQ, WM, recollection, and familiarity on academic achievement. WM and recollection contributed to all four measures of academic achievement. Verbal IQ contributed to reading comprehension, and familiarity did not contribute to any of the measures. Findings suggest that recollection, in addition to WM, should be considered when examining academic achievement.

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## Common and distinct neural pathways support self-controlled and altruistic decision making

Amber M. Koch, Psychology

Humans subjectively devalue distant future outcomes. This is known as delay discounting and is linked to impulsive behavior. Similarly, social discounting is the subjective devaluation of altruism towards distant social acquaintances. Evidence from behavioral studies indicates that social discounting closely resembles delay discounting; however, no studies have directly compared brain regions supporting these processes. In this study, 26 young adults completed a social and delay discounting task while undergoing functional magnetic resonance imaging (fMRI). During delay trials, participants chose between receiving a small amount of hypothetical money now or a larger amount in the future. During social trials, participants chose between receiving a smaller amount for themselves or allocating a larger amount to someone else. We observed overlapping activity in the frontoparietal cognitive control network which supports self-controlled and farsighted decision making. We also observed overlap in subcortical limbic areas known to support subjective value. Social trials, but not delay trials, led to increased neural activity in the default network. The default network plays a role in evaluating one's self and others. These results provide converging neural evidence for similarities between self-controlled and altruistic decision making and also highlight some potential differences. /

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## Intracerebroventricular Oxytocin Effects on mRNA Abundance Differ in Adipose Tissue of Chicks from Low and High Body Weight-Selected Lines

Anna G. Koskinen, Animal and Poultry Sciences

Neuropeptide oxytocin (OXT), an important anorexigenic factor in the central nervous system, has been shown to have effects on adipose tissue lipid metabolism in mammals. The purpose of this study was to determine the effect of intracerebroventricular (ICV) administration of OXT on subcutaneous adipose tissue mRNA abundance in chicks from lines selected for low (LWS) or high (HWS) juvenile body weight. These lines differ in adiposity. At 5 days post-hatch, LWS and HWS chicks were fasted for 3 hours, injected ICV with 0 (vehicle), 0.039, 0.312, or 2.5 nmol OXT ( $n=10$  per group). Their food intake was monitored, and subcutaneous adipose tissue was collected at 3 hours post-injection. Total RNA was isolated, reverse transcribed and real time PCR performed to measure mRNA abundance of the following adipose metabolism-associated factors: acyl-CoA dehydrogenase, long chain, 1-acylglycerol-3-phosphate O-acyltransferase 9, CCAAT/enhancer-binding protein alpha, CCAAT/enhancer-binding protein beta, fatty acid binding protein 4 (FABP4), lipoprotein lipase (LPL), monoglyceride lipase (MGLL), OXT, peroxisome proliferator-activated receptor gamma, and sterol regulatory element-binding transcription factor 1. There were several interactions of genetic line and OXT treatment on gene expression in adipose tissue. Results thus show that central administration of oxytocin to young chicks may have effects on adipose tissue physiology and that they are genetic line-dependent.

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## EPHA4 Negatively Affects Mouse Digit Regeneration Partially Through Regulation of Vascularization

Alexander J. Kwiatkowski, Biological Systems Engineering  
Mark E. Piatkowski, Biological Systems Engineering

Nearly 2 million people are living with limb loss in the U.S., among which about 54% of amputations are due to vascular disease. This study explores the vascular role of Ephrin type-A4 receptor (EphA4) on mouse toe-regeneration. Pups at the age of 2 days (n=11-20) were used to examine toe length, regrowth rate, limb blood flow, and vascular elements following toe amputation. Toes #2-4 of the right limb (test) were amputated so as to be even with toe #5. Before, immediately after surgery, and on day 7, 14, and 28 following toe-amputation, three tiers of analysis were implemented to monitor limb regeneration: (1) the length, (2) growth rates between time intervals and (3) blood flow through both feet at 36.5 °C using the Laser Doppler Imager at 50ms/pixel. Paws of the mice were harvested on day 28 for H&E and Masson's trichrome staining. Using a two-way ANOVA and T-tests, with  $p < 0.05$  as significance, it was found that length regrowth in EphA4-KO mice is significantly larger than those in WT at weeks 2 and 4 ( $p < 0.05$ ). Significance for regrowth rate was found from surgery day to 1 week post-surgery and from weeks 1 to 2 between EphA4-KO vs. WT ( $p < 0.01$ ). Blood flow significance was observed from weeks 3 to 4 ( $p < 0.05$ ). The larger regrowth lengths and faster regrowth rate observed in EphA4-KO mice may indicate negative regulation of EphA4 on toe regeneration. The knockout of EphA4 likely facilitates toe-regeneration through increasing vascularization and/or collateral formation.

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## Brains and Bones: An Investigation of The Endocranium of The Phytosaur Wannia Scurriensis

Emily J. Lessner, Biology

With increased use of virtual methods, large amounts of archosaur endocranial data have been collected focused on body size evolution, nerve pathways, and sensory systems. Archosauria is an extensive group containing dinosaurs, living birds, and crocodylians, but little is known about their common ancestor. However, there are many examples of the current sister taxon, phytosaurs, an extinct group of reptiles that superficially resemble living crocodylians. Until recently, phytosaur endocranial studies have used antiquated methods and focused on derived taxa. We provide a comparative digital examination of the internal skull anatomy of *Wannia scurriensis*, the most basal known phytosaur, using computed tomography (CT) to distinguish the morphology and evolution of the phytosaur brain, inner ear, and soft tissues. *Wannia* shows some similarities with living crocodylians and derived phytosaurs in general endocranial shape and cranial nerve innervation. *Wannia* exhibits a large hypophyseal fossa relative to brain size, which may be indicative of rapid growth. *Wannia* possibly exhibited a unique alert head position as the semicircular canals have lateral canals that are angled more than in derived taxa. Extensive facial innervation from the trigeminal nerve suggests increased facial sensitivity as in *Alligator mississippiensis*. Endocranial similarities among phytosaurs and with *Alligator* could indicate conserved ecological and functional constraints of an aquatic lifestyle on anatomy.

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## A Successful Apparel Design Interview Project

Amanda C. Locke, Fashion Merchandising and Design

As a part of the final interview process for Kohl's Apparel Design Internship, I was asked to complete a design challenge project. The purpose of this project was to showcase my design skills and trend knowledge to Kohl's interviewers, and prove to them that I would be a great fit for their Apparel Design department. For this project, I was to choose one of the many brands Kohl's has and present my own view of what that collection would look like for Fall 2014. I was responsible for delivering a theme, color palette, mood/trend board, key fabrications, technical flats, and collection illustrations of 4 key looks. With my prior knowledge of Kohl's brands, I chose Simply Vera Vera Wang, a brand that fit well with my own design aesthetic, and I analyzed the current in-store assortments for inspiration. I then completed extensive trend research and color forecasting, and chose elements, colors, and fabrication that could be most applicable and successful for the brand and season. Once my project was complete, I sought out one of my professors to obtain feedback and critiques in order to perfect my work and prepare myself for questions that may come from my interviewers. The rigorous hours I put into the project ultimately paid off when I was applauded for my work and received an offer as an Apparel Design Intern.

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## Robust Prediction Of Airdrops

Thomas J. Magelinski, Engineering Science and Mechanics

Airdrops are common in military and humanitarian relief operations where supplies are delivered from a plane. Since wind is a turbulent system that is hard to measure, the landing location of supply packages can be highly uncertain. The purpose of this research is to quantify and visualize that uncertainty with a computational approach. The model used thus far treats the package system as a point, and uses a static wind field with Dryden Turbulence. At each point in a three dimensional grid, an ensemble of airdrops with the same initial conditions is simulated. For each location, a landing distribution is found. The 95-percentile miss distance can then be found at each potential release point, and is used to quantify the uncertainty at that point. To visualize the accuracy, isocountours of 95-percentile miss distance are plotted, providing a way for pilots to quickly ascertain candidate air release points. The general appearance of these isocontours is a series of concentric tubes wherein released packages can be expected with high confidence to land within the specified distance. These tubes can be used to determine package release points that minimize miss distance. Further study will increase the complexity of both the wind model and the package model.

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## Modeling foraging behavior and contact rates for *Helisoma trivolvis*

Philip McElmurray, Mathematics

Epidemiological models are a primary tool for understanding, predicting, and managing the spread of infectious disease. All epidemiological models contain simple assumptions regarding how hosts move around in their environments and interact with other hosts, where the most common assumptions are based on random movement and thus random contacts. But of course, animals do not move randomly through their environments; they forage for food, search for mates, and hide from predators. We have developed an agent-based model for an aquatic snail (*Helisoma trivolvis*) that links individual-level behavior with population-level processes, focusing on how foraging behaviors and resource distribution affect contact rates between individuals in a population. Preliminary results show that, given the ability for the snails to track resources, contacts between individuals increase with concentration of resources.

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## Keratin Microparticle Characterization via Enzyme Degradation and Size Exclusion Chromatography

Allison N. Molen, Biochemistry

Microparticles made from keratin proteins may represent an approach to processing biomaterials with greater utility for applications such as drug and cell delivery, as well as others where the biomaterial needs to be injected into tissue. Keratin microparticles can be made using well-established emulsion polymerization techniques. The goal of this project is to make and characterize keratin microparticles. In order to assess the potential for keratin microparticles to be used as an injectable biomaterial, and to determine the feasibility of using them for drug and cell delivery, several fundamental characteristics must be determined. One such important parameter is degradation rate. The purpose of this study is to eventually investigate the degradation of keratin microparticles under conditions that simulate injection into tissue, namely attack by enzymes. Microparticles will be formed from keratins using standard emulsion polymerization techniques. Microparticles will then be tested using various enzymes at body temperature for their ability to degrade the keratin and destroy the microparticle over time. The degradation itself will be investigated by analyzing the peptides that are cleaved by the enzymes using size exclusion chromatography. Finally, the degraded microparticles will be characterized using microscopy to determine the structure that remains. Both wool and human hair keratins will be used.

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## Accessible Redesign of Maple Ridge Clubhouse, Blacksburg, VA

Joseph L. Mrava, Residential Environmental and Design  
Austin E. Parris, Residential Environmental and Design  
Kendall Hammer, Residential Environmental and Design  
Adam White, Residential Environmental and Design

The purpose of this project is a functional & aesthetic redesign of the Maple Ridge Clubhouse in Blacksburg, VA to increase usability through universal design considerations. Built in 2002, this resort style town home community originally served older residents. Now it serves primarily students. The clubhouse now needs to meet improved accessibility concerns and also serve as a welcoming environment for student residents. Our design process followed 3 phases: analysis of building accessibility, integration of research, and design development. We used the Americans with Disabilities Act Accessibility Guidelines (ADAAG) to analyze building accessibility. 3 main problems were identified: difficulty of finding an accessible entrance; connection to basement; & unsuitable height of reception desk. At the integration of research phase, we conducted resident surveys, identified recent club house design trends, and studied characteristics of millennium generation. After the research phase, the team exchanged various viewpoints in problem finding and problem perception, as well as design concept goals. To create a more welcoming space and to improve accessibility, we proposed improved signage for easy navigation. We also want to maximize natural lighting by moving the front entrance to the side of the building. A larger door will be installed. Ramps to the door will be added as well. Finally, we added new materials & finishes to make the space more inviting for student residents.

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## Food security in Madagascar: Exploring the diets of women and children living around Betampona Nature Reserve

Keely R. O'Keefe, Human Nutrition, Foods, and Exercise

**Objectives:** Exploring diet diversity, nutritional status, and food beliefs of mothers living around Betampona, Madagascar. / **Purpose:** Many households in Madagascar are food insecure (53%) and stunting in children under 5 years is high (6th highest in the world). Baseline nutrition knowledge is needed to identify possible nutritional interventions. / **Methods:** Mothers living in ten villages surrounding Betampona were provided a questionnaire on diet diversity and food beliefs. Weight and height were measured. Descriptive statistics were used to evaluate differences between villages with or without markets. / **Results:** A total of 138 women were surveyed, with 55% of women (n =?) without a market, 45% with a market. For women without markets, 15.8% were underweight; 10.5% overweight, versus with markets, 12.9% were underweight; 16.1% overweight (4.8% obese). The average diet diversity score was 6.9 for mothers and 6.7 for children in villages with markets; 6.2 for mothers and 6.4 for children in villages without markets (max score of 12). The most frequently reported "nutritious foods" were rice (58%), meat (38%), cassava (18%). The most frequently reported "non-nutritious foods" were breadfruit (23%), cassava (23%), green leaves (22%). / The results will be used to develop education materials/interventions to promote diet diversity and nutritious foods in Betampona.

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## The structure of holomorphic Yukawa couplings in compactifications of the heterotic string

Joon Won. Park, Physics

In this project we explore the structure of holomorphic Yukawa couplings in compactifications of the heterotic string. These are essential in determining the structure of particles/masses in Standard Model type particle physics, derived in a string context. In particular, using tools from group theory, we will attempt to classify which discrete and continuous groups can successfully produce the Yukawa textures observed in Standard Model interactions as realized in string theory and how these can be distinguished from vanishing conditions arising from underlying topology.

Dr. Lara Briana Anderson, James Gray (lara.anderson@vt.edu)

## Stereotype Fit Predicting Perceived Credibility: Examining the Influence of Speech Proficiency and Stereotype Activation

Samuel E. Robinson, Psychology  
Gabrial T. Anderson, Psychology  
Alyssa A. Brunal, Psychology  
Bailey E. Carver, Psychology  
Vatia P. Caldwell, Sociology

Stereotypes are often used as a shortcut to determine qualities of unknown individuals. These assumptions can have negative consequences on the perceptions of credibility in the stereotyped individual. Understanding what activates these stereotypes is important for understanding how to combat these negative consequences. The current study examines the effects of stereotype fit and speech proficiency on perceived credibility, with specific focus on the interaction between stereotype fit and the antecedents of perceived credibility (expertise and trustworthiness). Participants included a sample of students at a large university in the Southeastern United States (N=138) who answered an online questionnaire regarding perceptions of credibility of supposed graduate students presenting information. ANOVA analysis demonstrated that the main effects were statistically significant: stereotypical fit individuals had higher rates of perceived credibility than those deemed stereotypically unfit and individuals displaying high levels of speech proficiency were perceived as more credible than those presenting lower levels. Observations revealed that expertise interactions were significant but trustworthiness was not. Implications, future research, and limitations are discussed with specific emphasis on breaking gender role stereotypes.

Dr. Neil Hauenstein (nhauen@vt.edu)

## Mutual Drive: Examining the Influence of Analogous Goal Orientations on Team Cohesion

Samuel E. Robinson, Psychology  
Courtney P. Vogel, Psychology  
Devan M. Baxley, Psychology

Teamwork is a primary component of organizational life. At the individual level, goal orientation has been found to play a critical role in overall performance. However, this important individual difference is rarely discussed within the context of the team. Through looking at the variability of the levels of goal orientation for members of a team, we analyze its influence on team cohesion and how it forms over a short period of time. This study aims to suggest that goal orientation interacts with team cohesion in such a way that when the variance for goal orientation is smaller for members of a team, team cohesion will be higher on average than those teams with higher variability of goal orientation. Participants include a sample of students at a large university in the Southeastern United States randomly assigned to a team of four individuals. This in-lab experiment measures individual differences and team dynamics over time through use of self-report and a highly interdependent task. Primary analysis suggests the expected results will support the hypothesis: those teams with lower variability in goal orientation have higher team cohesion than those teams with higher variability in goal orientation.

Dr. Roseanne Foti (rfoti@vt.edu)

## The Effect of MAX1 Genotype and Nitrogen on Populus Metabolites and Branching

Naomi Rodman, Biochemistry

Axillary bud outgrowth (branching) determines tree structure and has a major impact on biomass production. In Arabidopsis, branching is negatively controlled by the MORE AXILLARY GROWTH (MAX) genes through the synthesis and perception of strigolactones (SLs). MAX1 encodes a cytochrome P450 CYP711 subfamily member and loss-of-function mutants show increased branching compared to wildtype (WT) in annual plants. Using RNAi, we downregulated the expression of the two Populus MAX1 co-orthologs. However, no phenotypic difference emerged between WT and transgenic plants until a nitrogen treatment (NH<sub>3</sub>) was applied. Surprisingly, the MAX1-RNAi transgenics showed less branching than WT trees under elevated NH<sub>3</sub>. To further characterize the response to N, we collected five distinct tissues from WT and transgenic plants at three time points during NH<sub>3</sub> treatment. Samples were processed through liquid chromatography–mass spectrometry (LC-MS) to identify differences among genotypes and response to NH<sub>3</sub>. When comparing the three MAX1-RNAi transgenics to WT, ion data collected from LC-MS was filtered statistically and by examining chromatograph peaks. We found significant differences between WT and transgenic plants and their response to NH<sub>3</sub>. Ongoing work will establish the identity of these compounds to inform on the role of MAX1 in poplar as well as broaden the knowledge base of SL synthesis and function since previous research on this topic has focused on herbaceous annual plants.

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## Reproductive Performance of Sows Fed Diets Supplemented with Copper

Amanda M. Rogers, Animal and Poultry Science

Because of selection for prolificacy and advances in sow nutrition and management, average litter size on commercial swine farms in the U.S. has increased dramatically, as well as lowering birth weights. Poor survival to weaning, and decreased growth performance are characteristics of the low birth weight phenotype. It is well known that dietary supplementation of diets with 250 ppm copper increases growth rate by 5 to 10% and improves feed conversion in nursery pigs (Braude, 1975). Moreover, feeding pregnant sows diets that contained supplemental copper increased pig birth weights (60 ppm, Lillie and Frobish, 1978; 250 ppm, Cromwell et al., 1993). The objective of this experiment was to test the hypothesis that diets supplemented with tribasic copper chloride increases pig birth weights and enhances reproductive performance in sows. Yorkshire x Landrace sows were fed gestation and lactation diets supplemented with copper at levels of 20 ppm, 120 ppm and 220 ppm. For sows consuming 20 (n = 6), 120 (n = 10), or 220 (n = 3) ppm copper, total litter size was 12.2, 14.4, and 11.0, respectively; pigs born live was 11.2, 13.0, and 10.0, respectively; and average pig birth weight was 3.3, 3.0, and 3.3 pounds, respectively. For the variables measured, there were no significant differences ( $P > 0.1$ ) among treatments. The lack of treatment effects could be due to the relatively small sample size used in the first round of the study, but will continue through three parities.

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## Identification and Characterization of a Putative Monoterpene Synthase in Switchgrass Leaves

Meredith R. Ruggiero, Biology  
Andrew Muchlinski, Graduate Student

Switchgrass (*Panicum virgatum* L), a native perennial warm season grass, with two morphologically distinct ecotypes, Alamo and Dacotah, differs in susceptibility to pathogen infection, which provides a platform for the study of chemically mediated defenses. Previous work by Dr. Bingyu Zhao (VT) found that during infection by rust fungus, a putative terpene synthase (PvTPS13) was differentially expressed in the leaves between the ecotypes. We believe that this terpene synthase may play a role in the observed infection resistance. Our findings suggest that PvTPS13 is constitutively expressed in Alamo leaves, but not in Dacotah leaves. It is the goal of this study to functionally characterize PvTPS13, and perform volatile profiling of both ecotypes. This study aims to understand the broader role of PvTPS13 in plant defense. Standard methods will be applied (RT-PCR) to amplify TPS13 cDNA from extracted RNA. The gene sequence will be verified by Sanger sequencing in comparison to the cDNA sequence derived from the switchgrass genomic DNA in the Phytozome database. Cloning will be performed by ligation into the pGEM T-Easy cloning vector and cDNA will be subcloned into a prokaryotic protein expression vector by restriction digest and ligation. Protein expression will be performed in *E. coli*.

Dr. Dorothea Tholl (tholl@vt.edu)



## Identification of a new cystathionine cleavage enzyme

Michelle C. Ruhlin, Biochemistry

The transsulfuration pathway is an important biochemical pathway of sulfur containing compounds such as homocysteine to cysteine via cleavage of cystathionine. Cystathionine is normally cleaved at one of the two CH<sub>2</sub>-S bonds either beta- or gamma-lyases to produce cysteine and homocysteine, respectively. These intermediates are important for the biosynthesis of methionine, as well as amino acid metabolism. In *Methanocaldococcus jannaschii* the canonical enzymes that cleave cystathionine are not present even though cystathionine is known to be produced by these cells. The purpose of this project is to characterize and isolate the enzyme(s) that cleaves cystathionine to either homocysteine or cysteine. *M. jannaschii* is a hypothermophilic autotrophic anaerobe that was first isolated from hydrothermal vents on the ocean floor. Cell extracts of *M. jannaschii* were separated and the collected fractions were tested for their ability to cleave cystathionine to cysteine and/or homocysteine. After it was confirmed that homocysteine or cysteine was produced in the selected fractions, the proteins in these fractions were identified by LC-ESI-MS/MS. This resulted in the identification of five gene candidates that could encode the enzyme that cleaves cystathionine to homocysteine or cysteine.

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## Parasites and microbes: the symbiont communities of spring peepers (*Pseudacris crucifer*) from Blacksburg, VA, USA

Lea V. Sarment, Biological Systems Engineering

Vertebrates host a variety of symbionts, but taxonomically diverse symbiont communities are often studied in isolation. This study investigated two symbiont communities, helminth parasites and skin bacteria, associated with spring peepers (*Pseudacris crucifer*) with the ultimate goal of understanding how different symbiont communities might interact. Spring peepers (N=30) were collected from Virginia Tech's Kentland Farm, and skin bacteria and intestinal helminth parasites were assessed for each individual. Overall, 47% of individuals contained helminth parasites, which were nematodes and trematodes, located in the stomach or intestines, with an infection intensity of 1-5 and 1-40 per host, respectively. Spring peepers harbored a rich bacterial community on their skin, consisting of 275-683 operational taxonomic units (~ bacterial species). Preliminary analyses examining relationships between parasite presence and skin bacterial community diversity revealed interesting trends. First, individuals infected with parasites generally had less rich bacterial communities. Second, the bacterial communities of individuals infected with parasites clustered together, suggesting that shifts in bacterial community composition associated with infection are consistent across individuals. Additional research is needed to better understand the relationship between skin bacterial community composition and infection with helminths.

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## Effect of Moisture Content on the Physical Properties of Corrugated Paper

Robert A. Shock, Packaging System and Design

Over 90% of all goods rely on corrugated paper at some point in the supply chain. The physical properties of corrugated paperboard are inherently affected by moisture content which is related to the relative humidity in the air. Previous studies have measured the effect of moisture content on paper and corrugated boxes but not corrugated paper. The properties tested in this study include: edge crush, machine/cross direction bending, Mullen burst and coefficient of friction. Commonly available B, C, and E flutes of corrugated paper were used in this study. The results indicate that moisture content has a significant effect on all properties tested and the results varied for each of the properties tested. Edge crush test results have a linear relationship while bending test results are sigmoidal or S-curved. Mullen burst test results are relatively unaffected between 20% and 80% moisture content and Coefficient of Friction test results are unaffected until 30% moisture content, or approximately the point of free-water accumulation, after which the coefficient increased linearly. This study is the first comprehensive measure how moisture contents affects the performance of corrugated paper. The findings will be utilized in the future design of corrugated boxes and improvements to existing predictive formulas.

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## Effects of Dietary Calcium and Various Oil Sources on Performance and Energy Digestibility of Commercial Broiler Chicks

Brittany M. Singh, Animal and Poultry Sciences

Past research has shown a difference in energy digestibility in laying hens versus broilers when fed corn oil. It has been suggested that dietary Ca may interact the oil causing the formation of lesser digestible soaps; reducing energy digestibility and ultimately performance. The objective of this experiment was to determine the effects of dietary Ca (0.9% or 4.0% Ca) on performance and energy digestibility when fed to broiler chickens fed either corn or soybean oil. The four treatments were applied to 10 replicate cages of five chicks each, resulting in 200 chicks for the 28 day feeding period. The body weight of the birds fed the 4.0% Ca diets was reduced in comparison to the birds fed the 0.9% Ca diets, but oil source did not have a significant effect on BW. Feed intake was not affected by the oil source; however, increased dietary Ca reduced feed intake. Broiler performance was not significantly different when corn or soybean oil were utilized in the diets, but energy digestibility (determination currently underway) will best indicate the status of dietary Ca concentration on various oil sources in broiler diets.

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## Boredom and the Brain

Michael Wayne Stafford, Psychology

Kyle Woisard, Psychology

Roan Parrish, Neuroscience

Sareena Patel, Neuroscience

Grace A. Herrick, Neuroscience

Previous research has related boredom to negative affect, such as hostility, depression, and anxiety. However, we argue boredom to be a state which is neither positive nor negative but an experience predicted by emotional state. Our goals are to define boredom and factors associated with boredom with negative emotion by using neurophysiological and psychological methods. We plan to do this by inducing boredom through a vigilance task and assessing hemispheric asymmetries between those who score high and low on depression and anxiety scales. We will ascertain hemispheric activity and physiological measures through QEEG and galvanic skin response. Participants will be provided a series of batteries and questionnaires to self-report pre and post emotional status. We anticipate the scores of the anxiety and depression scales to correlate positively with the magnitude of emotional distress indicated by hyperactivation of the right hemisphere and an increase in skin conductance post boredom.

Dr. Kelly Harrison (kellyh07@vt.edu)

## Analyzing Early Earth Metabolism in *Sulfurihydrogenibium azorense*, a Deeply-rooted Bacterium

Cyrus D. Tafti, Biochemistry

Life on Earth evolved about 3.5 billion years ago while oxygen came into the environment 1 billion years after that. Consequently the early inhabitants of Earth were strict anaerobes. Our laboratory is working towards the discovery of molecular tools that allowed these early inhabitants to transition to an aerobic metabolism and the specific focus is on how they dealt with oxidative stress and redox shock. For work with the bacteria we are developing *Sulfurihydrogenibium azorense* as the model. This thermophilic, chemolithoautotrophic, microaerophilic bacterium belongs to Aquificae, the most ancient bacterium phylum. It grows anaerobically as well as in the presence of oxygen, albeit in low concentrations, and these conditions represent the pre-oxygen and early aerobic stages of Earth. To begin our research, we have developed robust microaerophilic growth conditions in liquid and on solid media with H<sub>2</sub> and O<sub>2</sub> (98:2, v/v) as energy source and electron acceptor, respectively, and made advancements towards genetic manipulation of the organism. The next tasks are to fully develop the genetic analysis tools and bioreactor-based methods for cultivation under precisely monitored and controlled conditions. Then we will use these systems and RNA-Seq approach to study the molecular responses of the organism to changes in the hydrogen and oxygen concentration in its environment

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## Lamb Behavior is a Key Driver of Performance in Silvopastures

Lewis, G. Tucker, Agribusiness

Silvopasture is the intentional integration of timber, forages, and livestock on the same unit of land. Some research has shown that sheep grazing in silvopastures have the same weight gains as sheep in conventional open pastures despite reduced forage yield in the silvopastures. To determine some benefits in silvopastures that might compensate for reduced forage growth, we evaluated the nutritive value of forages, vaginal temperatures, weight gain, and the behavior of lambs in black walnut and honeylocust silvopastures, relative to that in open pastures. We used digital recorders to record lambs throughout the day and acoustic analysis software to extract prehension events from the recordings. Forage yield was lowest in the black walnut silvopasture ( $3500 \pm 100$  kg/ha;  $P < 0.0001$ ) while there was no difference ( $P = 0.9916$ ) in forage yield between the open pasture ( $4900 \pm 100$  kg/ha) and the honeylocust silvopasture ( $4900 \pm 100$  kg/ha). Total lamb gains were highest in the honeylocust silvopasture ( $12.6 \pm 1.0$  kg/period;  $P \leq 0.0254$ ); there was no difference ( $P = 0.5173$ ) in lamb gains between the black walnut silvopasture ( $8.5 \pm 1.0$  kg/period) and the open pasture ( $9.4 \pm 1.0$  kg/period). Forages in the honeylocust silvopasture had greater ( $P < 0.0412$ ) protein concentration than forages in the other systems. Lambs in the open pastures spent about five hours longer standing up than lambs in the silvopastures, representing greater energy expenditure for these lambs.

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## A Community Intervention for Mother Earth: An Application of Behavioral Science

Ashley J. Underwood, Psychology

Faith S. Crews, Psychology

Alexandra T. Gwynn, Human Nutrition, Food and Exercise

Shirleen S. Rahmanm, Psychology

Ruth-Anne E. Poli, Psychology

Applied behavioral science intervention work has targeted environmentally responsible behaviors for increase. This field study explored increasing the use of reusable bags that were either branded or non-branded with the VT logo. Another component of the intervention included patrons signing or not signing a commitment poster. Additionally, patrons received reminder stickers to address previous survey results indicating “forgetting” as their main barrier. By observing 200 individually numbered reusable bags, we explored social identity or commitment as mechanisms for this environmentally responsible behavior. Follow-up survey results will indicate whether patrons adopted new behaviors such as recycling paper or conserving water, the effect of the reminder sticker, and their evaluation of the bag, and novel uses of the bag. We will also investigate long-term use of the bags.

Dr. E. Scott Geller (esgeller@vt.edu)



## Sex Differences in Laterality in Emotion Specific Autonomic Nervous System Activity

Caitlin Van Wicklin, Biology  
Haleigh A. Huchenson, Psychology  
Elsye F. Hammond, Psychology  
Matthew T. Reynolds, Psychology  
Emily R. Wills, Psychology

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. The method of grading this semester will be a presentation during a lab meeting where I will present the data collected up to that point and what has been learned so far.

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## Crumpling of an Elastic Ring in Two Dimensions

Carter A. VanHuss, Physics

We use molecular dynamics simulations to study the crumpling of an elastic ring (i.e., a circular elastic line) in two dimensions. The crumpling is triggered by reducing the radius of a circular repulsive wall that is used to confine the ring. The ring is modeled as a bead-spring chain. A harmonic potential describing the bonds between neighboring beads is parameterized to reproduce the Young's modulus of the elastic line in the continuum limit. A modified harmonic angle interaction is used to capture the bending of the elastic line including situations where the line is locally stretched or compressed. We have confirmed that the bead-spring model has the correct continuum limit by comparing results on rings made of different numbers of beads but with parameters derived from the same elastic line. With the computational model, we study the morphological transition of the ring and the local distribution of the bond and bending energies as the ring is compressed at various rates, forced to crumple, and finally confined into a dense-packed structure. We find that the crumpling transition signals a sharp energy transfer from the compression to the bending mode.

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## Trace element mobility from hydrocarbon-rich shales during pyrite oxidation

Maria C. Vargas, Geology

The Bakken Formation and the Marcellus formations consist of black organic-rich shale rocks. These rocks are known to be rich sources for oil and gas. These resources are generally extracted through hydrofracturing and horizontal drilling (aka. fracking), which can lead to a threat to the environment and/or local communities. One potential environmental impact of fracking is the mobilization of trace elements to either surface and/or ground water. The shales in the Bakken and Marcellus formations are locally rich in pyrite. Pyrite can oxidize when exposed to oxygen in-situ or as waste material on the surface. Furthermore, Pyrite ( $\text{FeS}_2$ ) often contains numerous trace elements such as arsenic, copper and selenium. To further understand the potential of shales to generate trace elements during pyrite oxidation, five different samples were taken from the Marcellus and Bakken formations to determine their chemical composition and mineralogy. Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) was used to determine trace element distribution and abundance. LA-ICP-MS was successful in measuring concentrations of V, Cr, Mn, Co, Ni, As and Se. Furthermore, X-ray diffraction was used to determine mineralogy and estimate the abundance of pyrite and carbonate minerals in each sample. X-ray diffraction was successful in identifying Albite, Muscovite, Pyrite and Quartz. These results helped to understand and predict acid rock drainage potential of the shales.

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## Total Energy Cost of Competitive Soccer

Kathryn M. Wingfield, Human Nutrition, Foods and Exercise

Soccer continues to gain popularity in the United State and requires many physical demands. One physical load that was looked at in this study was energy cost. A typical soccer match requires 700-1000 kcal of energy for a 90-minute match with players covering 8-10 kilometers of total distance. This data does not take into account for non-match activities such as the warm-up period. The subjects included 16 female varsity college players during 25 competitive soccer matches. The main objective of the study was to quantify the total energy cost and physical demands of a soccer match including both the warm up and match play. To determine the distances covered, speed and acceleration profiles, a 10Hz GPS and a triaxial accelerometer were worn by each player. These measures were used to calculate energy expenditure. During warm-up and match, players covered  $3.1\pm 0.1$  and  $10.2\pm 0.1$  kilometers of total distance, respectively. The main energy expenditures during warm-up and match were  $15.4\pm 0.7$  and  $51.0\pm 0.6$  kJ/kg, respectively or  $238.3\pm 10.5$  and  $788.3\pm 9.8$  kcal. The results of this study suggest that the warm-up period accounts for 20-30% of the total distance covered and energy expended during a complete soccer match. This energy should be considered when evaluating the physical demands of the match and designing a nutritional recovery program.

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## Just Beat It: Binaural Beats in the Beta Frequency

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Michael Wayne Stafford, Psychology  
bRoan Parrish, Neuroscience  
Sareena Patel, Neuroscience  
Grace A. Herrick, Neuroscience

Binaural beats is a phenomenon that arises when two auditory tones of differing frequencies are presented to each ear. This results in the perception of a third tone with a frequency which is the difference of the two presented tones. Research has suggested that binaural beats can cause brain entrainment when the frequency occurs in a physiologically relevant range to the EEG. The different frequency ranges of the human EEG have been linked to different cognitive functions. The current experiment is assessing binaural beats induced brain entrainment in the beta frequency (14-32 Hz), a frequency range associated with active concentration. Following the presentation of binaural beats in the beta frequency range, participants performed the Controlled Oral Word Association Test (COWAT), a verbal fluency task, before and after receiving binaural beats treatment in the beta frequency range or a placebo tone. This allowed us to assess the practical utility of binaural beats in improving executive cognitive functioning. We expect the beta binaural beats to elicit brain entrainment and improved COWAT scores relative to placebo.

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## Neurophysiological Correlates of Anxiety

Kyle M. Woisard<sup>1</sup>, Psychology

Anxiety is an aversive emotional state marked by hyperarousal and cognitive impairments. Recent research using QEEG has supported the role of asymmetric activation of the right hemisphere in individuals scoring high in trait anxiety as evidenced by greater left than right hemisphere alpha activity, an inverse marker of brain activation. The current experiment will assess alpha asymmetries in response to concurrent emotional and motor stressors in both high and low anxious subjects. Subjects scoring high in trait anxiety are expected to exhibit greater left than right alpha activity in both anterior and posterior electrode sites. Initial results have found greater left than right alpha activity in the posterior C3/C4 electrode pair in subjects scoring high in trait anxiety following the stressors. The aim of this experiment is to contribute to the understanding of how the tendency to become anxious relates to the way stress is processed in the brain.

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## Do Macroinvertebrate and Habitat Bioassessments Reflect Presence of Clinch Dace?

Skylar L. Wolf, Fisheries Conservation

Clinch Dace (*Chrosomus* sp. cf. *saylori*) are an undescribed species of minnow confined to two adjacent counties in Southwest Virginia. Specific threats stem from coal mines within the region that increase siltation, reduce riparian zones, and alter water quality in headwater streams that Clinch Dace inhabit. We examined relationships between Clinch Dace occupancy and stream characteristics in order to determine water quality and habitat preference of the species. We combined Clinch Dace collection records from Virginia Tech with Virginia Stream Condition Index (VSCI) and Rapid Bioassessment Protocol (RBP) data from VA Department of Mines and Mineral Energy, VA Department of Environmental Quality, and U.S. Fish and Wildlife Service in order to make comparisons. Both VSCI and RBP stations were classified as near or absent of Clinch Dace. Comparisons were made using non-metric multidimensional scaling plots (NMDS). Mann-Whitney test were used to quantify significance of correlation of Clinch Dace presence with RBP and VSCI scores. Results suggest that Clinch Dace presence corresponds with higher overall VSCI scores as well as certain individual VSCI metrics including percent Ephemeroptera (%EPT), percent Plecoptera and Trichoptera excluding Hydropsychidae (%P+T-H), and percent scrapers (%scrap). Clinch Dace sites were not distinguishable from other sites using RBP scores.

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## The ViBe Arts District

James P. Woodard, Landscape Architecture

The city of Virginia Beach established the ViBe District last year in hopes to create a vibrant district for creativity, arts, and culture at the oceanfront. The city has developed into a busy tourist destination, which is dominated by big business hotels and related retail. Overtime the area has lost the local culture and charm it once offered, and now the ViBe District is looking to reestablish that culture. Looking for ways to redesign a landscape that has been dominated by the automobile is what the ViBe District is searching for. Through interviews with local business owners and residents, community meetings, and available online history information, there begins to grow a series of opportunities and challenges as well as goals and aspirations for the area. Implications to improve the ViBe District result in creating an identity of place for the area. The new arts district will come alive with improved streetscapes, community gathering places, and artistic elements to give it an identity. The improved planning for the unconnected landscape will bring back a strong sense of culture and arts to the oceanfront of Virginia Beach.

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