11th Annual Virginia-North Carolina Alliance for Minority Participation Symposium

"Fostering Innovation and Excellence in STEM"

Virginia Polytechnic Institute and State University

Blacksburg, VA

October 14-15, 2018

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October 14, 2018

Dear Symposium Participants,

Greetings and welcome to Blacksburg. Virginia Tech is proud to host the Virginia-North Carolina Alliance for Minority Participation's 11th Annual Research Symposium. At Virginia Tech, we understand the value of STEM education in the VA/NC region, and the importance of increased diversity in STEM programs. We produce about 25% of Virginia's undergraduate STEM-H degrees each year, and along with our sister institutions, are responsible for meeting the workforce demands of a rapidly expanding regional technology economy.

Our students and their future employers expect a learning environment that is diverse in every dimension, from life experience to disciplinary expertise to diversity of thought. Virginia Tech's living motto, *Ut Prosim* (That I May Serve) requires empathy and cultural competence that can be developed only by interacting with those one is aiming to serve, addressing every opportunity and challenge through the lens of improving the human condition. Our history as a land-grant institution is rooted in providing opportunities to those who have been traditionally disadvantaged and underserved. We have the obligation and the demographic imperative to expand the pools of talent from which we recruit as broadly as possible.

Through an ongoing initiative called *InclusiveVT,* Virginia Tech aims to create an inclusive environment that supports diversity as part of every student experience. Inclusion and diversity are core to our role as an engine for social and economic mobility, for attracting talent from the broadest pools possible, and for ensuring that all of our students have on-campus experiences that prepare them for the world they are about to enter. We have committed to doubling the underrepresented minority percentage of the entering undergraduate class to 25 percent and increasing the underserved and underrepresented percentage from 25 percent to 40 percent by 2022. This transformation will include comparable efforts to diversify staff and faculty.

Though I have only been at Virginia Tech since 2014, I have long understood the important role of the Louis Stokes Alliance for Minority Participation in improving the graduation rate of underrepresented students in STEM fields. In 2011, while serving as provost of Purdue University, I was the lead Principal Investigator of Phase II LSAMP program, with the goal to triple the number of degrees awarded to LSAMP participants.

I want to express my appreciation to the symposium organizers, the Alliance partners, and all the participating students. And thank you to all Alliance members for your efforts to improve inclusion and diversity in STEM education. I hope you enjoy your time on campus, and we look forward to engaging with you in future endeavors.

Sincerely,

Timothy D. Sands
President

UNIVERSITY of VIRGINIA
Office of the Vice President and
Chief Officer for Diversity and Equity

October 14, 2018

Greetings Symposium Participants:

On behalf of the Virginia-North Carolina Alliance for Minority Participation, I welcome you to the 11th Annual Undergraduate Research Symposium, hosted by Virginia Tech (VT) in Blacksburg, Virginia. The primary purpose of the VA-NC Alliance is providing opportunities for underrepresented minority undergraduates seeking STEM degrees. These include research experiences, presentation opportunities, travel to national research conferences, mentoring, tutoring, professional development workshops, and financial support, among others. I'm glad to see each of our students here today, seizing the opportunity to develop their presentation skills and knowledge about research in the science, technology, engineering, and mathematics (STEM) fields. Thank you to our twelve partner institutions for strong support of their students and this symposium.

I am pleased to report that since our inception in 2007, enrollment of URM students in STEM fields has increased by 90%. During the same time period, we have seen a 174% increase in the number of STEM degrees conferred to URM graduates, for a total of more than eight thousand six hundred bachelor degrees earned over ten years across all Alliance schools! This significant progress has been achieved through the commitment of students, faculty, and staff at our partner institutions.

I especially acknowledge President Timothy Sands of Virginia Tech for his strong commitment to helping our students pursue degrees and careers in the STEM fields. Alliance partners at VT including the Director of the Multicultural Academic Opportunities Program, Dr. Jody Thompson Marshall, along with Program Coordinator, Ms. Monica Hunter, have done a terrific job organizing this symposium. In addition, I appreciate the work of the faculty, judges, guest speakers, and administrators who support our undergraduates as they pursue their research experiences. These experiences will prepare them well for graduate school and future career opportunities.

The theme of this year's symposium speaks to the Alliance's purpose: "Fostering Innovation and Excellence in STEM." Each one of our students is a potential innovator in STEM. I look forward to learning about their research projects this weekend and I encourage them to network during the symposium as they may cross paths with students from Alliance partner institutions during graduate school or the workplace. I am always pleased to hear from former students who presented their undergraduate research at our Alliance symposia and subsequently update me on their STEM graduate school and workforce experiences. I look forward to hearing about our current students' accomplishments in their future endeavors.

Best wishes,

Marcus L. Martin, MD

Marcus L. Martin, MD
Vice President and Chief Officer for Diversity and Equity
Principal Investigator, Virginia-North Carolina Alliance

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October 14, 2018

Dear Symposium Participants:

The Multicultural Academic Opportunities Program (MAOP) welcomes all of our partner institutions to Virginia Tech! For over 25 years, MAOP has provided academic, financial and emotional support to thousands of undergraduate and graduate students. We have always championed the importance of diversity in higher education and our goal has always been to support the success of students. We have also had the good fortune to host a number of students from our partner institutions during the summer.

For our scholars who have participated in LSAMP, the experience has been invaluable! Alumni of the program at Virginia Tech have attended graduate and professional institutions around the world. Having an opportunity to participate in research and present at regional and national conferences has made a difference for our students. The experiences have helped in strengthening their credentials for future employment or education. However, we still have much work to do to increase the numbers of diverse students in STEM and have them engaged in experiential experiences.

With this symposium, I have asked graduate students from Virginia Tech to assist in judging the posters and oral presentations. Hopefully, students will be able to network with current students to learn more about their research programs. We are open to questions that you might have about Virginia Tech or graduate education. I do hope that you have a great visit at Virginia Tech.
Sincerely,

Jody Thompson Marshall

Jody Thompson Marshall
Director

About Virginia Tech

Virginia Polytechnic Institute and State University (Virginia Tech), founded in 1872, is a comprehensive, innovative, land grant university. It has the largest full-time student population in Virginia. Virginia Tech has 135 campus buildings, a 2,600-acre main campus, and an 1,800-acre agricultural research farm. The institution also maintains a number of facilities across Virginia and in Europe, including: the Marion DuPont Scott Equine Medical Center in Leesburg, the National Capital Region in Northern Virginia, the Hampton Roads Center in Virginia Beach, the Roanoke Center, the Richmond Center, and the Southwest Center in Abingdon. Virginia Tech offers more than 90 undergraduate majors and minors through its seven undergraduate academic colleges: Agriculture and Life Sciences, Architecture and Urban Studies, Engineering, Liberal Arts and Human Sciences, Natural Resources and the Environment, Pamplin College of Business, and Science. On the postgraduate level, the university offers 150 master's and doctoral degree programs and two professional degrees through the Graduate School, the Virginia-Maryland Regional College of Veterinary Medicine, and the Virginia Tech Carilion School of Medicine.

Sunday, October 14, 2018
Virginia Tech Inn

2:00-4:00 pm	**Conference Check-in** at the Residence Inn, Blacksburg
4:00-4:30 pm	**Transition to Virginia Tech Inn**
4:30-5:30 pm	**Virginia Tech Inn** **HBCU/MSI Alumni Panel** (Solitude Meeting Room)
4:30-6:00 pm	**VA-NC Alliance for Minority Participation Partner Meeting** (Smithfield Meeting Room)
4:30-5:30 pm	**Panel for Faculty-Agreements/Collaborations** (Cascades)
6:00-8:00 pm	**Dinner and Welcome** Keynote Speaker: Dr. Karen Eley Sanders, Associate Vice Provost for College Access and Chief Diversity Officer, Virginia Tech/Carilion School of Medicine

Monday, October 15, 2018
Squires Student Center, Virginia Tech

8:00-8:45 am	**Welcome (Old Dominion Ballroom)** Dr. Marcus Martin, Principal Investigator, Virginia-North Carolina Alliance for Minority Participation and Chief Diversity Officer, University of Virginia Dr. Claire Oliveros, Assistant Provost for Student Success Initiatives, Virginia Tech
8:45-9:30 am	**Graduate School Funding** Dr. Keisha John, Director of Diversity Programs, University of Virginia
9:45-10:30 am	**Poster Presentations** (Odd Numbered Posters)
10:45 -11:30 am	**Oral Presentations**
11:30 am-12:15 pm	**Poster Presentations** (Even Numbered Posters)
	Transition to Owens Dining Hall
12:45-2:30 pm	**Lunch and Keynote Presentation** Speaker: C. Alicia Traughber **Awards Presentation**

Keynote Speaker

Cynthia “Alicia” Traughber is a PhD candidate in the Molecular Medicine Program at the Cleveland Clinic/Case Western Reserve University. Alicia earned her B.S. in Biology at Oakwood University in Huntsville, Alabama in 2012. She knew that she wanted to be involved in research, so she applied to and was accepted as a summer research intern in the Multicultural Academic Opportunities Program (MAOP) at Virginia Tech in 2011.

Alicia worked on a project in Dr. Daniel Capelluto’s lab investigating how protein-protein interactions disrupt membrane trafficking and docking. This inspired Alicia to want to learn more about science and how research can be used to study diseases. After completing her undergraduate degree, Alicia was welcomed back to Virginia Tech into the VT-PREP program. When she arrived, she was able to help finish the project she worked on during her 2011 summer internship that eventually led to a co-authored 2013 JBC publication. After wrapping up her work with Dr. Capelluto, Alicia joined Dr. Isis Kanevsky’s lab in Dairy Science, where she studied immune responses to *Staphylococcus aureus*-induced mastitis in dairy cows. The work and training that Alicia completed in the VT-PREP program endowed her with the research skills, knowledge, and competitive edge to gain acceptance into the Cleveland Clinic/Case Western Reserve University.

She is currently working on her thesis in the lab of Dr. Jonathan Smith in the Cellular and Molecular Medicine Department. The focus of Alicia’s research is to investigate how HDL metabolism, through receptors SR-B1 and ABCA1, leads to pro- or anti-proliferative effects on prostate cancer cells. She is using cutting edge technology, such as CRISRP/Cas9 gene editing, to assist with her ongoing research. Since beginning her work, Alicia has been a recipient of the Carl Storm Underrepresented Minority Fellowship for the 2015 Hormone Dependent Cancers Gordon Conference, acquired an NIH NRSA F-31 Diversity Fellowship (2016), and submitted data that was used to secure a Cleveland Clinic Velosano Cancer Research Grant (2017) to support her thesis research.

Once she completes her dissertation, Alicia plans to pursue a Master’s of Education. She acknowledges that her success, thus far, would not be possible without the support of all the mentors that she has had. As an underrepresented minority, who has been given several opportunities and much support throughout her academics and training, Alicia wishes to be a mentor and educator in efforts to inspire other youths and minorities to pursue college and a future in science.

Oral Presentations (10:45-11:45 am)

Brush Mountain A (3rd Floor), Squires Student Center

Time	Name of Presenter(s)	Title
10:45-11:00 am	Teagen Baiotto	The Effects of Urbanization on Streams
11:00-11:15 am	Narendra Banerjee	Web Crawling to Match miRNA ID to Expression
11:15-11:30 am	Matthew Hill	A Multivariate Regression Analysis of Hospital Stays in a Nosocomial Infection Control Data
11:30-11:45 am	Sophia Upshaw	Capturing Abilities of Hydrogel Nanoparticles through Quantitative Electrochemical and Spectrometric Analysis

Room 300 Squires Student Center

Time	Name of Presenter(s)	Title
10:45-11:00 am	Amber Abbott	Amyloid-beta and p-Tau Anti-Threat Response to HSV-1 Infection in a Murine Model of Primary Adult Hippocampal Neurons
11:00-11:15 am	Taneva Busch	Genetic identification of putative muscle nociceptors
11:15-11:30 am	Sarai Alvarez	Dissecting kinase networks with targeted single-cell genomics and proteomics

Oral Presentation Abstracts

Presenter: Sarai Alvarez
Major: Bioengineering
Home Institution: George Mason University
Host Research Institution: University of Washington
Research Mentor: Dr. Cole Trapnell
Title: Dissecting kinase networks with targeted single-cell genomics and proteomics

Receptor tyrosine kinase network (RTK) signaling cascade is important for growth and development. Its response is mediated by downstream phosphorylation and activity of different transcription factors. However, the specific contribution of each pathway component remains a challenge to study due to the network's complexity.

For this project, we focus on studying the epidermal growth factor by measuring the effect of EGF receptor (EGFR), MEK, and AKT kinase inhibition on EGF-induced phosphorylation (as assessed by oligo conjugate anti-pERK ½ and IgG control). We hypothesized that chemical inhibition of EGFR and MEK will result in low EGF-induced phosphorylation, chemical inhibition of AKT will result in medium phosphorylation, and the control will result in high EGF-induced phosphorylation. Secondly, we hypothesize incorporating a protease treatment before the anti-pERK antibody stain and IgG control will increase the antibody accessibility. To measure phosphorylation, we used single-cell combinatorial indexing followed by sequencing to measure levels of oligo-tagged antibodies.

Overall, we found that incorporating the protease treatment resulted in a higher number of pERK and IgG counts per cell. At the highest protease treatment condition, pERK phosphorylation is significantly reduced by chemical inhibition. This same experimental design was conducted on dCas9-KRAB cells expressing guides to EGFR, MEK, AKT, and control guides. We expect to observe similar results to the chemical inhibition when using a transcription repressor. Finally, this workflow will also be expanded to determine the effect of loss of 64 components of the RTK pathway on the phosphorylation and transcriptional output of the EGFR pathway.

Presenter: Amber Abbott
Major: Microbiology
Home Institution: Virginia Tech
Host Research Institution: Virginia-Maryland College of Veterinary Medicine
Research Mentor: Dr. Andrea Bertke
Title: Amyloid-beta and p-Tau Anti-Threat Response to HSV-1 Infection in a Murine Model of Primary Adult Hippocampal Neurons

Alzheimer's Disease (AD) is the sixth leading cause of death in the U.S. Recent studies have established a potential link between herpes simplex virus 1 (HSV-1) infection and the development of AD. HSV-1 DNA has been detected in AD amyloid plaques, and treatment with the antiviral acyclovir (ACV) was reported to block the accumulation of AD-associated proteins amyloid-beta (AB42) and hyper-phosphorylated-tau (p-tau) in Vero and glioblastoma cells. Our goal was to determine whether the accumulation of AD-related proteins is attributable to acute and/or latent HSV-1 infection in mature hippocampal neurons, a region of the brain severely impacted by AD. Primary adult murine hippocampal neuronal cultures infected with HSV-1 (strain 17+), with or without ACV, were analyzed via FISH and immunofluorescent staining for LAT and amyloid-beta and p-tau expression over five days post-infection. HSV-1 infected neurons treated with ACV had a 3.5-fold greater expression of AB42, while uninfected cultures exhibited no signs of AB42 over- expression. Furthermore, AB42 co-localized with HSV-1 latency associated transcript (LAT) expression. Alternatively, p-tau expression was transiently elevated in the presence of ACV alone, as well as in infected (with or without ACV) neurons. These studies suggest

that amyloid-B plaque accumulation is an antiviral response to viral LAT expression in lieu of apoptosis in adult neurons, while p-tau potentially acts as a danger associated molecular pattern (DAMP) in response to any perceived threat. In hippocampal neurons, either mechanism may ultimately progress to disease pathology with persistent infection.

Presenter: Teagan Baiotto
Major: Systems Engineering
Home Institution: University of Virginia
Host Research Institution: Stuart Hall High School
Research Mentor: Nathaniel Adkins
Title: The Effects of Urbanization on Streams

Recent shifts in population density has resulted in unprecedented levels of urbanization. The purpose of this study is to predict the effects urbanization has on temperature of nearby streams. Ten strategic locations in streams within the South River watershed, the site of the research, were chosen for HOBO Pendant temperature sensor deployment. Locations were primarily chosen based on distance apart from each other and diversity in the amount of urban area within their respective watersheds. The sensors simultaneously recorded water temperature values in 30-minute intervals for approximately 36 days. Three sensors were lost or critically damaged and one was moderately damaged, leaving only 250 data values at the conclusion of data collection. Thus, the time-frame of the study was confined to when seven sensors(n=7) were fully operational (March 25, 2018 to March 30, 2018) to maximize sample size/useable data. The multivariable linear correlation computed between the dependent variable, temperature, and the independent variables, amount of urban area and elevation, predicted that in the South River watershed an increase in 1 Km^2 correlates to a 0.039-degree Fahrenheit increase in temperature (P=.329). This shows a presumably positive correlation between increase in urban area and stream temperature, but with a very low level of certainty. The effects of urban area on stream temperature were not quantified with significance, but the model predicted a positive linear correlation.

Presenter: Narendra Banerjee
Major: Engineering Technology
Home Institution: Elizabeth City State University
Host Research Institution: Elizabeth City State University
Research Mentor: Dr. Lin Chen
Title: Web Crawling to Match miRNA ID to Expression

A web crawler was developed to match miRNA IDs to corresponding expressions. A miRNA ID corresponds to multiple expressions and an expression is from multiple miRNAs. The complexity of building a connection between miRNA IDs and expression is an O(n^3). A web crawler was designed to conduct matching between miRNA IDs and their expressions by automatically search databases hosted on internet.

Presenter: Taneva Busch
Major(s): Biology and Chemistry
Home Institution: Johnson C. Smith University
Host Research Institution: Cincinnati Children's Hospital
Research Mentor: Dr. Michael Jankowski
Title: Genetic identification of putative muscle nociceptors

Neuropathic myalgia occurs when the peripheral nerves carrying input from skeletal muscle tissue that sustains damage. This is common after traumatic injuries and is a major cause of chronic muscle pain. However, there is limited information on the mechanisms of neuropathic myalgia development. To begin to fill this gap in knowledge, we performed RNA-Seq analysis on isolated proprioceptive and non-proprioceptive muscle afferents. One molecule of interest was solute carrier family 10, member 6 (Slc10a6) as it was highly expressed in the non-proprioceptive population and was distinctly induced in the dorsal root ganglia (DRG) by injury to muscle innervating nerves. Since Slc10a6 has been linked to global gene expression regulation in other cells, and can facilitate immune responses, it may play a crucial role in the development of neuropathic myalgia. We hypothesized that Slc10a6 is specifically expressed by muscle nociceptors and may play a role in the development of neuropathic myalgia. We concluded that many genes are differentially expressed in proprioceptors and non-proprioceptors. Slc10a6 is induced by muscle nerve injury and is preferentially expressed in muscle over cutaneous sensory neurons. Slc10a6 may be an important molecule in neuropathic myalgia development. For future directions, we want to quantify additional Slc10a6 containing muscle vs. cutaneous afferents and assess afferent function and animal behavior in mice with afferent specific Slc10a6 knockout.

Presenter: Matthew Hill
Major: Mathematics
Home Institution: Elizabeth City State University
Host Research Institution: Elizabeth City State University
Research Mentor: Dr. Apelete Allagan
Title: A Multivariate Regression Analysis of Hospital Stays in a Nosocomial Infection Control Data

We explored several variables that might explain the length of stay of patients in this Nosocomial (hospital acquired) infection control data, the SENIC project from CDC-Atlanta. We found a pool of potential exploratory variables which we used to build several (multivariate) linear models. After some analysis, we determined that at least one predictive model which includes variables such as Age and Region helped explain the most the length of stay of patients.

Presenter: Sophia Upshaw
Major: Electrical Engineering
Home Institution: George Mason University
Host Research Institution: George Mason University
Research Mentor (s): Drs. Lance Liotta and Alessandra Luchini
Title: Capturing Abilities of Hydrogel Nanoparticles Through Quantitative Electrochemical and Spectrometric Analysis

In the past, solution-based immunoassays have demonstrated qualitative results with low analytical sensitivities. We have developed a novel, in-solution immunoassay capable of achieving sensitivities of less than 100 pg/mL and being measured using standard electrochemical and spectrometric methods. The hydrogel nanoparticles (NPs) are made up of a network of polymers resembling an open-mesh and are dyed with chemical affinity baits, enabling these particles to segregate all undesirable proteins, capture the target biomarker in a solution, prevent degradation of that biomarker, and greatly increase the sensitivity of an immunoassay. The NPs have been applied for the detection of disease biomarkers that are often found in low concentrations in the blood or bodily fluids. These NPs were covalently coupled with the enzyme horseradish peroxidase (HRP) and, through a simple redox reaction, are able to produce an amplified amperometric response. This allowed for quantitative electrochemical as well as spectrometric measurements to prove the effectiveness of the enzymatically coupled NP. It was found that NP cage protects the enzyme from reacting to saturation quickly when exposed to the reactive solution, therefore improving the dynamic range and elevating the dose response results in under 5 minutes. The electrochemical data demonstrated similar results to the spectrometric data. Overall, the results observed proved the consistent function and high performance of the immunoassay developed. This methodology can be further applied to sensing low abundance biomarkers such as ESAT-6, found in tuberculosis patients, and would be a feasible diagnostic tool in both clinical and field settings.

Posters
Old Dominion Ballroom, Squires Student Center

Poster Number	Presenter (s)	Title
1	Daniel Cordero-Laske, Terionna Cuthrell, Crystal Boateng, and Breanna Crawley	Aptamer-based Nano Biosensors
2	Tien Tran, Saytendra Banerjee, and Jamod Johnson	Exposure to Programming an Autonomous Robot to Stimulate Engineering Technology
3	Alton Turner, Tyler McCoy, Daniel Ashley	A Comprehensive Wind Energy Resource Assessment at Elizabeth City, North Carolina
4	Janna Ridley, Cecile Eke, Miles Marshall, and Samuel Musore	Magnetic Medicated-Hyperthermia
5	Chelsey Aurelus and Kayla Johnston	MicroRNA let7C in Epithelial Mesenchymal Transition of Cancer Cells
6	Rita Anae-Wae	Attitudes and Allusions Regarding the Use of Complementary Medication for Heart Failure among Patients, Caregivers, and Healthcare Providers in Southwestern Uganda
7	Elizabeth Ankrah	Multi–population clustering: Comparison of scVMDC algorithm to K-means
8	William Boyd	Comparison of Farrowing Induction Protocols
9	Virginia Boulos	Soil Temperature Antibiotic Resistance Study
10	Taneva Busch	Relationship between Depression and Experimental Pain in Males and Females
11	Angela Caraballo	Determining the cause of cell lysis in E.coli from the production of Gfp
12	Xiomara Cuno-Lavilla	Potentiated Opioid Analgesia by a Serotonin-5HT Receptor Antagonist Suggests New Therapeutic Target for Pain Management
13	Mischa Ellison	Room-Temperature Electrochemical Reduction of Nitrogen to Ammonia

14	Naudia Gay	Glyphosate Resistance in Plantago lanceolate
15	David Gonzalez	Synthesis of Multicomponent Transition Metal Oxalates and Oxides: Probing Phase Homogeneity of Energy Storage Precursors
16	Monica Gurung	Variability in time in the concentrations and composition of vapors from a subsurface heating oil spill
17	Rodney Hawkins	Environmental Justice in Coastal Cities with Sea Level Rise and Flooding
18	Bianca Igwe	Understanding the Cellular Response to Chloroplast Import Stress
19	Te'Nel Kearney	Heavy Metals in Commercial Tea Prepared Typically for Human Consumption
20	Eddiesha Lang	Stereotype Threat in Virtual Reality
21	Tynasia Milfort	Cloning and Expression of the Chicken LRRFIP1 Homolog and Its Role in Innate Sensing of Marek's Disease Virus (MDV) Infection
22	Tyra Onley	The Composition of Protective Cuticular Lipids Differs between Juvenile and Adult Leaves across 13 Diverse Maize Inbreds and Hybrids
23	La'Tricha Parks	The Structure Characterization of Damaged-DNA using Molecular Dynamics
24	Jose Pineda Reyes	Using Geographic Information System to build Land Water Conservation Fund Database
25	Mahinaokalani Robbins	Determining the chemical and physical properties of late Cretaceous shale formations in in the El Paso, TX area for correlation with Eocene intrusions
26	Ka'Shawn Robertson	Screening for optimal activity of a key enzyme in the plastidial isoprenoid biosynthesis pathway
27	Kaitlin Santos	Let's Under-STRAND Double-Stranded Breaks and Repair
28	Constance Staley	Synthesis of an Eu-Bearing Peptide for the Versatile Tagging of Ligands

29	Isis Thomas	The identification of cutting agents using paper-based analytical devices with colorimetric detection.
30	Nana Afia Twumasi-Ankrah	Using bioinformatics to characterize the genomic attributes of Neisseria gonorrhoeae Strain FA1090 and its Genetically Modified Antibiotic Derivatives

Poster Abstracts

Presenter: Rita Anae-Wae
Major: Chemical Engineering
Home Institution: University of Virginia
Host Research Institution: Mbarara University of Science and Technology
Research Mentor: Dr. Samson Okello
Title: Attitudes and Allusions Regarding the Use of Complementary Medication for Heart Failure among Patients, Caregivers, and Healthcare Providers in Southwestern Uganda

Non-communicable diseases such as Heart Failure are on the rise subsequent to the general rise of noncommunicable diseases in the Global South. Unfortunately, conventional medical therapies are expensive and inaccessible to the majority of patients in low-income countries. The role of Complementary Medicine (CM), use of herbalists or traditional healers, in heart failure management has not been explored. We aimed to identify the attitudes towards CM and the role that it is already playing in the lives of heart failure patients in Southwestern Uganda.

We conducted a cross-sectional sub-analysis using responses from interview transcripts from EPOCH (Experiences and perspectives of patients, caregivers, and healthcare providers with Heart failure in Southwestern Uganda) study as the main source of qualitative data. Qualitative data was analyzed using Grounded Theory methodology.

We found that while the general community expresses positive attitudes towards CM, the heart failure community expresses negative attitudes due to discovered ineffectiveness. Stigma in discussing CM use in healthcare settings is present. Additionally, health professionals are unaware of some patients' devotion to the prescribed medicine. Interventions to educate both patients on CM, and health professionals to engage in transparent conversations concerning CM to maximize therapeutic benefits and reduce risks.

Presenter: Elizabeth Ankrah
Major: Bioengineering
Home Institution: George Mason University
Host Research Institution: University of Minnesota
Research Mentor: Dr. Rui Kuang
Title: Multi–population clustering: Comparison of scVMDC algorithm to K-means

Single cell RNA sequencing (scRNA-seq) is a growing methodology that allows for new understanding and the characterization of many cells through the analysis of gene expressions. There has been an increase in the availability in scRNA-seq data, and as a result, new methods for the analysis of such data has become an integral part of computational biology and bioinformatics. Currently, there are many algorithms for the analysis of scRNA-seq data, yet these methodologies are limited as they are derived from algorithms meant to analyze bulk RNA-seq. As a result, these algorithms cannot always account for scRNA-seq specific properties especially, when analyzing multi-population datasets. Variance Driven multi-task Clustering (scVDMC) is one of the only algorithms built specifically for the analysis of scRNA–seq containing multi-populations. The goal of this experiment is to demonstrate the accuracy, and efficiency of the scVDMC algorithm, against the k means algorithm, from which it was derived.

Presenter: Chelsey Aurelus and Kayla Johnston
Major(s): Biology
Home Institution: Elizabeth City State University
Host Research Institution: Elizabeth City State University
Research Mentor: Dr. Hirendra Banerjee
Title: MicroRNA let7C in Epithelial Mesenchymal Transition of Cancer Cells

Let-7C is a tumor suppressor miRNA responsible for downregulation of polycomb repressor proteins such as EZH2 and SUZ12. The downregulation of those polycomb prevents epithelial-mesenchymal transition (EMT), proliferation, spheroid formation and metastasis in cancer cells. We transfected miRNA Let-7C in a full-length construct in HTB112 Uterine cancer cell lines and validated their effects by downregulation of their target 3'UTR target mRNAs. Our results showed decrease in EMT markers ALDH, increase in EMT marker E-cadherin, decrease in cell proliferation and spheroid formation; fluorescence microscopy studies showed a decrease in CD44-positive cells in the spheroids, signifying a possible hindrance in the growth of cancer stem cells. Thus, miRNA Let-7C could be ideal target for diagnosis, prognosis and therapeutic intervention for cancer.

Presenter: William Boyd
Major: Animal and Poultry Science
Home Institution: Virginia Tech
Host Research Institution: Smithfield Foods Hog Production - North Region
Research Mentor: Dr. Mark Estienne
Title: Comparison of Farrowing Induction Protocols

Induction of parturition is of great interest for the ability to terminate and coordinate farrowings. This project compared 5 different induction protocols that are of common practice and their effects on stillborn rates and farrowing timeframe. PGF2a and oxytocin have been used independently or in conjunction in several studies in an attempt to more closely synchronize farrowings. Ideally, animals that farrow during normal, working farm hours will have a higher chance of receiving any assistance they require which in theory decreases the stillborn rate. Animals blocked by due date and parity; blocked animals were randomly assigned to 1 of 5 treatments and a minimum of 5 animals per parity must have been due to farrow in order to form one treatment block. Use of induction protocol and attending of farrowing can increase sow farm performance and reduce cost /increase profitability. Standardization of induction protocol is important in managing cost/benefit ratio. Use of a perivulvar shot can be a practical way to administer reproductive treatments through decreased dosages and increased effectivity. Older parity sows and those that have not farrowed by the end of D115, require additional assistance to reduce excessively high stillborn rates.

Presenter: Virginia Boulos
Major: Biological Sciences
Home Institution: Virginia Tech
Host Research Institution: Virginia Tech
Research Mentor: Dr. Brian Badgley
Title: Soil Temperature Antibiotic Resistance Study

The study is conducted based on two major hypotheses. The first is that an increase in temperature will lead to an increase in antibiotic resistance; this effect could be magnified with the addition of antibiotics or antibiotic laden manure. The second hypothesis is that addition of manure and antibiotics will cause disproportionate change as opposed to only changing temperature. some samples combine the pure antibiotic with soil, some combine soil and manure treated with each antibiotic and some are just the antibiotic treated manure. The three controls are soil alone, manure alone, and a combination of soil and manure. There are five repetitions of each sample and each rack of 45 tubes are placed in one of four incubators. The four temperatures are 15, 20, 25, and 30 degrees Celsius. During the experiment, carbon mineralization measurements are made to track the respiration of the different samples.

Presenter: Taneva Busch
Major: Biology and Chemistry
Home Institution: Johnson C. Smith University
Host Research Institution: Cincinnati Children's Hospital
Research Mentor: Robert Coghill, PhD
Title: Relationship between Depression and Experimental Pain in Males and Females

Depression has a significant influence on experimental and clinical pain such that those with higher levels of depression commonly exhibit a lower tolerance to experimental pain. The aim of this study was to examine gender differences in depression and cold pain tolerance. We hypothesized that females exhibit greater depressive symptoms and shorter cold tolerance times compared to males controlling for age also, females will exhibit greater depressive symptoms and shorter cold pain tolerance times compared to males controlling for age.
Healthy individuals from a sample size of male and female N=42 were recruited for this study. Each participant went through an amount of stimulus testing. Male and female participant's analysis was determined through graph and p values. The PROMIS depression adult scale was used to assess raw scores and T scores. In the future, a sample size of clinically depressed individuals could be chosen to rate their pain tolerance with correlation to their depression and age, age ranges should be the same for male and female, and sample size could be much larger. In a different analysis, to see a dramatic change in tolerance times and raw scores with the sample presented in this study there would have to be a total of 200 participants or more. Unfortunately, the study individual difference in pain study does not present to have that many participants yet.

Presenter: Angela Caraballo
Major: Biology
Home Institution: Saint Augustine's University
Host Research Institution: North Carolina State University
Research Mentor: Dr. Catherine Zhang
Title: Determining the cause of cell lysis in E.coli from the production of Gfp

The purpose of the project is to determine the parameters that cause cell lysis during the production of Green Fluorescence Protein (GFP). Recombinant strain E. coli BL21(DE3)- pET17b-gfpuv was fermented in 2-L bioreactors (working volume 1-L) with Isopropyl β-D-1-thiogalactopyranoside (IPTG) as the inducer. Different conditions such as temperature (30 °C and. 37 °C), glucose concentration (8 g/L, 20 g/L, and 30 g/L), fermentation mode (batch and. fed-batch) was investigated by monitoring the microbial growth, glucose concentration, and GFP concentration in both the supernatant and pellets. Higher GFP in the supernatant indicates cell lysis in the bioreactor. The fed-batch condition was triplicated to determine the accuracy of the operation. The fermentation with high glucose concentration (30 g/L) and high temperature (37 °C) encountered severe cell lysis with 24 hours of the fermentation. The fermentation with 30 g/L glucose concentration at 30 °C encountered cell lysis after holding the fermentation broth for a week. Therefore, high nutrient (e.g. 30 g/L glucose) in the medium may result in excessive expression of GFP and cause cell lysis. Compared to 30 °C condition, cell growth and glucose consumption were faster while the cell lysis was more severe at 37 °C, indicating that more aggressive fermentation may cause more cell lysis. The future plan of this project includes to investigate whether cell lysis occurs at conditions with lower glucose concentration (8 g/L and 20 g/L) at higher temperature (37 °C).

Presenter: Daniel Cordero-Laske, Terionna Cuthrell, Crystal Boateng, and Breanna Crawley
Major: Bioinformatics
Home Institution: Virginia Commonwealth University
Host Research Institution: Virginia Commonwealth University
Research Mentor: Dr. Rosalyn Hargraves
Title: Aptamer-based Nano Biosensors

An accumulation of Thyroxine in the human body will often attribute to metabolic hyperactivity, and, while often unrecognized by patients or health professionals, such accumulations can lead to threatening health complications. Our research focuses on the engineering of nano-biosensors to effectively monitor and report a subject's thyroxine levels to gauge the risk of hyperthyroidism; to successfully engineer nanotechnology with the capability to recognize and follow thyroxine in the body would establish further opportunities for diagnostic testing that would render immunoassay, a commonly-used yet highly sensitive procedure, obsolete for conventional clinical lab tests. With the intent to lower the cost and improve the accuracy of current diagnostic tests for hyperthyroidism, aptamers are being applied to carbon-based nanotubes. The aptamers, initially labeled with fluorescein, are essentially quenched by binding to graphite. Consequently, departing from graphite to bind to the iodine moieties of thyroxine, fluorescein is released, allowing an optical analysis of the fluorescence to measure the analyte. In theory, the specific binding of aptamers to iodine moieties would produce measurements of thyroxine that are otherwise more indicative of thyroid activity than immunoassay. This whole process of connecting the nanosensor to the body, and measuring its fluorescence, should take minutes; Results, which would occur in real time, can be measured through devices that are already built to detect cellular fluorescence. Because aptamer manufacturing is more cost-effective than antibody manufacturing, and better-encompassing of thyroxine levels, it is in theory that to develop these technologies against immunoassays would benefit hospitals and patients alike.

Presenter: Xiomara Cuno-Lavilla
Major: Biology
Home Institution: Thomas Nelson Community College
Host Research Institution: Virginia Commonwealth University
Research Mentor(s): Drs. Salvador Sierra and Javier Gonzales-Maeso
Title: Potentiated Opioid Analgesia by a Serotonin-5HT Receptor Antagonist Suggests New Therapeutic Target for Pain Management

More than 30% of Americans have some form of acute or chronic pain. Although opioid analgesics rapidly relieve many types of acute pain, the benefits of opioids when prescribed for chronic pain are much more questionable due to alarming cases of opioid overdose and addiction. Serotonin receptor 5-HT2A has been involved in a number of processes related to nociception. However, the nociceptive effects of 5-HT2Areceptor agonists and neural circuits related to 5-HT2Areceptor-dependent pain management remains largely controversial. We tested neuroanatomical location of 5-HT2Areceptor immunoreactivity in the tail-flick reflex circuit, and determined the effect of the 5-HT2Areceptor antagonist volinanserin on analgesic effect induced by the opioid drug oxycodone. We first dissected the dorsal root ganglion and lumbar spinal cord from C57BL/6 male mice, and performed immunohistofluorescence assays with anti-5-HT2Areceptor antibody in the soma of bipolar and ventral horn neurons. Behavior assays were carried out in adult C57BL/6 male wild-type mice and 5-HT2A knock-out 129S6/Sv mice. Animals were pretreated with the 5-HT2Areceptor antagonist volinanserin or vehicle, after which animals received p.o. of the μ-opioid receptor agonist oxycodone or vehicle. Acute thermal nociceptive activity was assessed following standard hot thermal immersion test. Our data showed that 5-HT2Areceptor immunoreactivity is present in the dorsal root ganglion and ventral horn neurons of the spinal cord. Behavior assays suggested that volinanserin increases the analgesic effect of oxycodone in wild-type mice. Additionally, this pain management behavioral effect induced by oxycodone was significantly augmented in 5-HT2A knock-out mice, as compared to wild-type controls. These results suggest that 5-HT2A receptor antagonism represents a novel pharmacological tool to reduce pain.

Presenter: Terrionna Cuthrell
Major: Biology
Home Institution: Virginia Commonwealth University
Host Research Institution: Virginia Commonwealth University
Research Mentor: Dr. Rosalyn Hargraves
Title: Aptamer-based nano biosensors

An accumulation of Thyroxine in the human body will often attribute to metabolic hyperactivity, and, while often unrecognized by patients or health professionals, such accumulations can lead to threatening health complications. Our research focuses on the engineering of nano-biosensors to effectively monitor and report a subject's thyroxine levels to gauge the risk of hyperthyroidism; to successfully engineer nanotechnology with the capability to recognize and follow thyroxine in the body would establish further opportunities for diagnostic testing that would render immunoassay, a commonly-used yet highly sensitive procedure, obsolete for conventional clinical lab tests. With the intent to lower the cost and improve the accuracy of current diagnostic tests for hyperthyroidism, aptamers are being applied to carbon-based nanotubes. The aptamers, initially labeled with fluorescein, are essentially quenched by binding to graphite. Consequently, departing from graphite to bind to the iodine moieties of thyroxine, fluorescein is released, allowing an optical analysis of the fluorescence to measure the analyte. In theory, the specific binding of aptamers to iodine moieties would produce measurements of thyroxine that are otherwise more indicative of thyroid activity than immunoassay. This whole process of connecting the nanosensor to the body, and measuring its fluorescence, should take minutes; Results, which would occur in real time, can be measured through devices that are already built to detect cellular fluorescence. Because aptamer manufacturing is more cost-effective than antibody manufacturing, and better-encompassing of thyroxine levels, it is in theory that to develop these technologies against immunoassays would benefit hospitals and patients alike.

Presenter: Mischa Ellison
Major: Chemistry
Home Institution: Virginia Commonwealth University
Host Research Institution: University of Virginia
Research Mentor: Dr. Zhiyong Zhang
Title: Room-Temperature Electrochemical Reduction of Nitrogen to Ammonia

Ammonia is important to many industries: agriculture, fertilizer, metal treating, petroleum, water and waste water treatment, stack emission control, photochemical, refrigeration systems, rubber, pulp and paper, etc. The main method of synthesizing ammonia relies on the Haber-Bosch (HB) process, which operates at a high temperature and pressure (400o-450oC and 200 atm). These conditions are expensive to maintain, and produce excessive carbon dioxide. In this project, we propose that a more efficient NH3 production will be achieved via an electrochemical approach. To demonstrate this concept, we will explore the synthesis of well-defined transition metal nanoparticles and employ them as catalysts, electrochemically activating N2 at room temperature. Compared with the industrial HB process, the present electrochemical approach is safer, more energy efficient, and environmentally friendly. The electrochemical reduction of dinitrogen is performed in a self-designed air-tight H-type cell. The concentration of produced ammonium is determined by the Nessler reagent, using the UV-spectrometer. Acetylene Black coated carbon paper has been identified as an ideal electrode material, which gives a minimum background in the Nitrogen Reduction Reaction (NRR). At 60°C, we observed the highest Faradaic efficiency of ~ 1.6% at -0.9 V vs. Ag/AgCl, and the highest yield of 0.8 µg cm-2 hr-1 at -1.2 V. The dinitrogen is electrochemically reduced into ammonia on a Pd/C catalyst. However, the Faradaic Efficiency (FE) is still low due to the overwhelming Hydrogen Evolution Reaction (HER). To increase the NRR efficiency, we are looking for other well-defined transition metal catalysts that are more nitrogen active.

Presenter: Naudia Gay
Major: Biology
Home Institution: St. Augustine's University
Host Research Institution: Auburn University
Research Mentor: Dr. Scott McElroy
Title: Glyphosate Resistance in Plantago lanceolate

The 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) is one of the crucial enzymes in the shikimate pathway for the biosynthesis of essential aromatic amino acids in plants and bacteria. It is the specific target of the non-selective herbicide glyphosate, commonly known as RoundUp. Increased and constant use of glyphosate caused a selection of biotypes to develop a resistance to the herbicide. To determine the mechanism of evolved resistance to glyphosate the Pro-106-Leu and Gly-101-Thr amino acid sites were studied in susceptible (S) and resistance (R) species of Plantago lanceolate. RNA from the susceptible and resistant biotypes was extracted and sequenced for analyzation of the targeted amino acid sites. A mutation was not found at the Gly-101 and Pro-106 amino acid positions in the EPSP synthase gene. Therefore, the resistant biotype of Plantago lanceolata's resistance to glyphosate is not associated with a mutation at the Pro-106-Leu or Gly-101-Thr amino acid sites. The mechanism for glyphosate resistance could be a mutation in another conserved region of the EPSP gene or gene amplification and increased expression in EPSPS genes.

Presenter: David Gonzalez
Major: Electrical Engineering
Home Institution: Old Dominion University
Host Research Institution: University of Virginia
Research Mentor: Dr. Gary Koening
Title: Synthesis of Multicomponent Transition Metal Oxalates and Oxides: Probing Phase Homogeneity of Energy Storage Precursors

We examined the synthesis of various precursor materials through precipitation reaction involving different relative ratios of Nickel, Manganese, and Cobalt. By utilizing a precipitation method to synthesize the precursors, we had explicit control over the morphology, phase, and composition of the particles, and subsequently the battery active materials. For battery active materials, very good mixing of transition metals allows us to reduce the temperature we have to fire the active material, saving resources and energy and improving the electrochemical performance of the final material. The synthesized precursors were examined using powder X-ray diffraction to determine the phase of the crystalline material. The final battery material was then synthesized via calcination with the precursor particles and a lithium salt. The battery material was then turned into an electrode and a coin cell battery was fabricated where we can test the results of the various precursor chemistries.

Presenter: Monica Gurung
Major: Civil Engineering
Home Institution: Thomas Nelson Community College
Host Research Institution: Virginia Tech
Research Mentor: Dr. Mark Widdowson
Title: Variability in time in the concentrations and composition of vapors from a subsurface heating oil spill

Vapor intrusion, sub-soil gases entering buildings through gaps in foundations and basements, has in recent decades been a major field of study for scientists and researchers. Intrusion of harmful vapors can lead to health problems like headaches, respiratory problems, eye irritation and sometimes even cancer. One possible exposure route is vapor intrusion of petroleum-derived compounds due to spills from leaking underground storage tanks used for heating houses. In this research, we extensively sampled the site of a known oil tank discharge in southwest Virginia. Soil gas samples were taken from 12 different soil probes over a period of seven weeks and analysed by thermal desorption gas chromatography/mass spectrometry (TD-GC/MS). The chemical composition of the soil gas was measured throughout the contaminated area to study spatial and temporal trends in the concentrations of compounds found and to determine the driving factors influencing these trends (e.g. temperature, atmospheric pressure, humidity). Although compounds found in heating oil such as benzene and naphthalene were commonly observed in all the samples, the concentrations of these compounds varied significantly as a function of distance from the tank. Concentrations of the compounds in each hole were observed to vary over time, but this variability could not be strongly connected to the temperature or the atmospheric pressure of the site except for benzene. The concentration of benzene was found to be inversely proportional to the atmospheric pressure ($r2 = 0.54$).

Presenter: Rodney Hawkins
Major: Engineering Mathematics
Home Institution: Saint Augustine's University
Host Research Institution: Saint Augustine's University
Research Mentor: Dr. Jon Goodall
Title: Environmental Justice in Coastal Cities with Sea Level Rise and Flooding

Coastal cities like Norfolk, Virginia and Atlantic City, New Jersey are at a high risk of environmental justice problems due to sea level rise. Environmental Justice is defined as fair treatment among different race, age, and community income level. Sea level rise has been occurring because of climate change and global warming and it causes increasing amounts of flooding. To explore how sea level rise might be an environmental justice problem in these two cities, census and elevation data was analyzed to indicate where flooding may disproportionately affect vulnerable low income and minority groups. This research is important because the low-income communities need and are entitled to the same support as the high-income communities regarding solutions to sea level rise.

Presenter: Bianca Igwe
Major: Biology
Home Institution: Saint Augustine's University
Host Research Institution: Michigan State University
Research Mentor(s): Drs. Lynn Richardson and Danny Schnell
Title: Understanding the Cellular Response to Chloroplast Import Stress

The chloroplast is an organelle in the plant cell that is the site of photosynthesis. The organelle imports about 3000 different proteins from the cytosol. With the amount of protein being imported, the chloroplast has developed a system to handle the proteins that are being imported. TOC and TIC are membrane channels that allow the preproteins to enter the organelle. Our goal is to understand how the cell responds to the stress when there is stress on the import system. We will look at a TOC75 mutant that expresses a truncated version of TOC75 in a heterozygous TOC75 mutant background to study cellular response to import stress. The mutant shows degrees of paleness when grown on MS media. We want to determine the reason why there are different phenotypes in the mutant. In the end, we will use this mutant for RNA sequencing to understand the import stress response. We hypothesize that the reason that there are degrees of paleness in the phenotypes is because of their genetic background. To determine which plants were the heterozygous mutant TOC75 allele we extracted DNA and then tested for the mutant allele of TOC75 by PCR. Our results show that pale plants had the mutant allele present, while the greener plants did not have the mutant allele. This confirms our hypothesis, that the reason why the plants are so pale is because they carry the mutant background. Also, we extracted protein and conducted a Western Blot to test for TOC75 protein levels. The results from the test was that the pale plants had more of the truncated TOC75 compared to the green plants. Moving forward, these TOC75 mutants with different genetic backgrounds will be used for RNA-SEQ to understand the cellular response to import stress.

Presenter: Te'Nel Kearney
Major: Biology
Home Institution: Elizabeth City State University
Host Research Institution: Elizabeth City State University
Research Mentor: Dr. Jeffrey Rousch
Title: Heavy Metals in Commercial Tea Prepared Typically for Human Consumption

Heavy metals are common in the environment. Depending on specific conditions, heavy metals are transported into plants at varying levels and rates. Tea, a drink which is typically derived from the Camellia plant by extracting flavors, caffeine and other botanical molecules using hot water is one of the most consumed beverages in the United States and worldwide. It is estimated that nearly 150 million Americans are drinking tea on any particular day and nearly 3.8 billion gallons of tea were consumed by Americans alone in 2017. Heavy metals enter the environment from natural sources, but also from commercial and industrial processes. Lead deposition was a problem in many countries and in the United States in the 1970s due to the combustion of leaded gasoline in automobiles. Copper, arsenic and other metals were left in the environment as a result of treated building materials for pest and rot resistance. This is significant since metals present various health issues in humans, like acting as carcinogens, lowering immunity to pathogens and causing developmental problems. Since plants take up and concentrate metals, and since humans consume tea from plants, this study was performed to test the potential availability of select metals in tea of various commercial varieties prepared as typical for human consumption. Metal concentrations were analyzed in extracts using furnace atomic absorption spectrophotometry. The amounts of metals found in tea preparations were compared within and across various brands of commercially available tea and the implications on human health of amounts of potentially consumed heavy metals is discussed.

Presenter: Eddiesha Lang
Major: Engineering Mathematics
Home Institution: Saint Augustine's University
Host Research Institution: Davidson College
Research Mentor: Dr. Tabitha Peck
Title: Stereotype Threat in Virtual Reality

It is a cliché generalization that women perform worse than men in math and science. Stereotype Threat research done by social psychologists shows that persons of a positively affected stereotype group show improved performance when that stereotype threat was made salient. Using virtual reality has proved that participants tend to take on the characteristics of the avatar they are embodying.

Currently, we are using identity manipulation through full body embodiment to determine whether male participants would show working memory impairment when in a female avatar under a stereotype threat. Also, to determine if the working memory would improve when in a male avatar when the stereotype is made known.

While there have been broad investigations about stereotype threat, there is little writing on whether the impact holds an advantageous affect through a virtual reality body swap. After completing an eligibility checklist, 64 undergraduate males were placed in a virtual classroom then assigned randomly either to a male or female avatar with the same race. After completing the cognitive test, results showed that men embodied in male avatars under a stereotype threat performed better on test compared to no threat. Whereas, men in female avatars performed more poorly when the stereotype threat was made salient compared to no threat at all.

Presenter: Tynasia Milfort
Major: Biology
Home Institution: St. Augustine's University
Host Research Institution: University of Delaware
Research Mentor: Dr. Mark Parcells
Title: Cloning and Expression of the Chicken LRRFIP1 Homolog and Its Role in Innate Sensing of Marek's Disease Virus (MDV) Infection

Marek's disease is a highly contagious viral neoplastic disease of chickens. Marek's disease is caused by an alphaherpesvirus known as Marek's disease virus (MDV). The disease is characterized by the rapid onset of T cell lymphoma, as well as infiltration of nerves and visceral organs by transformed lymphocytes. The virus matures into a fully infective, enveloped form in the epithelium of the feather follicle. How MDV infection is sensed by the innate immune system is currently unknown. In mammals, double stranded DNA viruses are sensed in the cytoplasm by a number of sensors including DNA virus-dependent activator of interferon (DAI), Dead-box protein 41 (DDX41), and Interferon gamma-induced gene 16 (IFI16). All of these sensors mediate interferon activation through cyclic guanosine-adenine synthetase (cGAS) and the stimulator of interferon genes (STING). Chickens lack a number of these sensors (DAI and IFI16), but encode DDX41 and STING. The goal of my research was to clone the chicken LRRFIP1 gene of chickens in a two-step RT-PCR strategy. Our hypothesis was that by cloning and over-expressing the chicken LRRFIP1 homolog, it would trigger a measurable type I IFN response. Furthermore, we seek to understand its role in the innate sensing of Marek's Disease Virus (MDV) infection. Currently we are in the process of cloning the LRRFIP1 gene using RNA purified from mock-infected spleen cells from an MDV vaccine trial and from the chicken microphage cell line, HTC. Once we have cloned this gene, our plan is to subclone an epitope-tagged LRRFIP1 gene into expression vectors peCFP-NI, peYFP-NI and pBKCMV for expression and localization studies.

Presenter: Tyra Onley
Major: Biology
Home Institution: St. Augustine's University
Host Research Institution: Iowa State University
Research Mentor: Drs. Travis J. Hattery and Marna Yandeau-Nelson
Title: The Composition of Protective Cuticular Lipids Differs between Juvenile and Adult Leaves across 13 Diverse Maize Inbreds and Hybrids

The cuticle is the outermost layer that lays atop the epidermis and protects aerial portions of plants against both abiotic and biotic stresses such as drought, heat, salt stress, pests, and pathogens. Plants are stationary, so they must adapt to the stresses within their environment. One potential adaptation is to build and customize the cuticular wax layer for protection, which is comprised of different combinations of hydrocarbons, fatty acids, aldehydes, alcohols, and wax esters, depending on the plant or plant tissue being examined. The overall goal of this work is to catalog the diversity in surface lipid compositions on juvenile and adult leaves from a variety of maize inbreds. During summer 2018, we grew and collected leaf tissue from juvenile and adult leaves of 13 genomically diverse inbreds and 11 hybrids that were grown in two different environments. Analysis of maize inbreds shows a 1.5-fold difference in total surface lipids (2.07 to 3.10 μmol/g dry tissue) in juvenile leaves and a 1.8-fold difference in total surface lipids (1.14 to 2.13 μmol/g dry tissue) in adult leaves. In addition, the same inbred genotypes were grown in summer 2017, with 5 genotypes displaying significant differences of accumulation between the two years. This research will contribute to our understanding of how plants react to different types of stress throughout development. By deepening our understanding of when and how the plant responds to specific stresses, it may be possible in the future to use breeding approaches to increase a plant's ability to protect against specific types of stress.

Presenter: La'Tricha Parks
Major: Engineering Mathematics
Home Institution: Saint Augustine's University
Host Research Institution: NIEHS
Research Mentor: Dr. Lalitha Perera
Title: The Structure Characterization of Damaged-DNA using Molecular Dynamics

The effects of DNA damage can come from environmental factors or naturally. The structure of double-stranded-DNA is found to be sensitive to solvent conditions. For example, in the presence of a smaller number of solvent molecules, DNA prefers to adapt to the A-form. Recent FRET experiment implied a nicked duplex can be highly flexible but it maintains the canonical B-form. The objective is to characterize potential structural changes associated with using micro-second DNA simulations of the damaged DNA. We used molecular dynamics simulations of A-, B-, and damaged B-DNA to study potential structural changes. 16-mers of A-, B-, and single- and double-nicked B-DNA were used as test systems and trajectory calculations were performed using the Amber software package. A total of 9 systems was simulated. DNA structures extracted from half microsecond simulations were analyzed using the program, X3DNA. The structure of A-DNA started transiting to the form of B-DNA immediately after releasing constraints and within 3 nanoseconds it was fully converted to the B-form and remained in the B-form for the rest of the simulation period. The single nicks of double-stranded-DNA still showed the traits/properties of B-DNA compared to the double nicks which had greater changes within the properties during trajectory calculations. In one case, when the nicks were in opposite helix, the nicked-DNA was separated into two segments during the simulation period. Several trajectories with single- and double-nicked DNA will be subjected to extended simulations to further the study of potential structural changes. Following the same procedure, the study of single- and double-gaped B-DNA will also be performed.

Presenter: Jose Pineda Reyes
Major: Engineering Mathematics
Home Institution: Saint Augustine's University
Host Research Institution: Saint Augustine's University
Research Mentor: Dr. Mark Melton
Title: Using Geographic Information System to build Land Water Conservation Fund Database

Geographic Information System (GIS) is a software program for gathering, managing, and analyzing spatial data. GIS uses many types of data to organize layers of information to reveal insights into data and to do spatial analysis. Such as patterns, relationships, and situations using maps and 3d scenes. GIS is used in multiple fields, research institutions, environmental scientists, health organizations, land use planners, businesses, government agencies and individual people. Our aim is to use this software to develop a database to store and extract information from structured sets of geographic data. The immediate goal is to create a data layer that will assist monitoring compliance with the requirements of the LWCF Program by grant recipients. Other reasons are to create maps and establish spatial relationships between the topography and land use of the area. Metadata was developed to document the procedure process. Data layers that where need to build the data base where added. The following layers where used in developing and updating the LWCF database; LWCF, land survey data (Parcels), Land Protection Program Transactions (LPP Transactions), Towns and Cities (Municipality), State Parks (Park Boundaries), World Street Map, Arial photography (Imagery\ Orthoimagery). The LWCF Park paper files where used to locate the boundary location and size of the boundary. The benefits for building a GIS were not fully explored as the project is still ongoing.

Presenter(s): Janna Ridley, Cecile Eke, Miles Marshall, and Samuel Musore
Majors(s): Physics, Pre-Nursing, Pre-Engineering, and Chemistry
Home Institution: Virginia Commonwealth University
Host Research Institution: Virginia Commonwealth University
Research Mentor: Mr. Hilton
Title: Magnetic Medicated-Hyperthermia

The progressions in magnetic nanoparticle technology has allowed for the emergence of a more effective approach to tumor removal, an advancement that acts as a gateway for other types of cancers to be treated. The application of magnetic nanoparticles as a form of cancer therapy, relies on the factors of magnetism, movement, MRI imaging and the binding with a cancer treating agent, in order to facilitate the process of removing a tumor. The safe removal of brain tumors is a procedure that becomes conceivable through the continuous experimentation of this method. From the amount of research that was found, on this application for this specific kind of tumor, the investigations on this procedure is confined. The exploration into this particular topic was conducted through research articles, informative pieces and a video. The material from the research conducted provides a basis that, through more exploration and attention to this technology and procedure, the utilization of this technology could serve as a viable replacement from standard chemotherapeutic practices.

Presenter: Mahinaokalani Robbins
Major: Geology
Home Institution: Thomas Nelson Community College
Host Research Institution: University of Texas at El Paso
Research Mentor: Dr. Diane Doser
Title: Determining the chemical and physical properties of late Cretaceous shale formations in in the El Paso, TX area for correlation with Eocene intrusions

Deformed Cretaceous shale units are present within the margins of Mt. Cristo Rey, an Eocene andesitic laccolith located in southern Doña Ana County, New Mexico. In the El Paso, Texas area, there are multiple Eocene andesite intrusions in contact with Cretaceous sandstone, shale, and limestone. All of these intrusions contact various shale formation deposits that were deformed by thrusting and folding prior to intrusion. Index fossils within interbedded limestones of these shale deposits are currently the only means to identify the shales with their corresponding formation. Multiple contact locations lack fossil exposure for adequate formation correlation. I am investigating the physical and geochemical properties of these shales in situ and in hand samples in an attempt to determine if the shales are related to the Boquillas, Muleros or Mesilla Valley formations of Early to Late Cretaceous ages. I used an Elemental Analyzer and an Isotope Ratio Mass Spectrometer (IRMS) to calculate the carbon, nitrogen, and sulfur content and isotopic ratios of the samples in order to geochemically distinguish one formation from another. Preliminary results indicate that there are variations in carbonate content within each of the shale samples within the different units, some identifiable with index fossils and some presently not identifiable, varying from 1.89% to 77.68%. Carbonate content is not likely to serve as a marker between units because of the wide variances in carbonates within a single unit. It is possible that sulfur content and sulfur isotope ratios could be a marker, but due to processing error by the poor combustion in an Elemental Analyzer, we obtained unreliable calculations for sulfur, thus we were unable to make a thorough comparison. Preliminary conclusions indicate that the use of an IRMS gives reliable data, however a larger sampling pool, combined with a smaller sample to aid combustion in the Elemental Analyzer, may give more substantial results.

Presenter: Ka'Shawn Robertson
Major: Chemistry
Home Institution: St. Augustine's University
Host Research Institution: Michigan State University
Research Mentor: Bjoern Hamberger
Title: Screening for optimal activity of a key enzyme in the plastidial isoprenoid biosynthesis pathway

Terpenoids are the largest group of specialized metabolites in plants and play many key roles in various biological processes. In addition, various terpenoids have important commercial applications as biofuels, pigments, flavors and fragrance molecules, and pharmaceuticals. The building blocks for all terpenoids are the two 5-carbon units, isopentenyl diphosphate (IPP) and dimethylallyl diphosphate (DMAPP). In chloroplast, IPP and DMAPP are made by themethylerythritol 4-phosphate pathway (MEP) pathway. The first enzyme of this pathway, deoxy-D-xylulose-5-phosphate synthase (DXS), plays a significant role in the regulation of this pathway. It has been shown earlier that DXS is feedback inhibited by IPP and DMAPP. Thus, it controls the carbon flux of the MEP pathway. Our aim is to increase the carbon flux into the MEP pathway by installing an improved DXS into this pathway. This work demonstrates the screening of different DXS from diverse organisms to identify a better candidate DXS. Various DXS candidates would be tested in the transient expression system Nicotiana benthamiana, where the activity of DXS would be measured by the production of casbene, a plastidial diterpene. In order to do that, DXS genes would be coexpressed with geranyl geranyl diphosphate synthase (GGPPS) and casbene synthase, the other genes required for the biosynthesis of casebene. Quantification of casbene would be done using gas chromatography - flame ionization dectector (GCFID). The best DXS candidate obtained from this work will be used in the future for bioengineering purposes to increase the production of terpenoids.

Presenter: Kaitlin Santos
Major: Biology
Home Institution: John C. Smith University
Host Research Institution: University of North Carolina at Charlotte
Research Mentor: Dr. Christine Richardson
Title: Let's Under-STRAND Double-Stranded Breaks and Repair

Maintaining genome integrity is necessary for cellular and organism survival. In humans, lack of genome maintenance is associated with cancer, abnormal immune response, and genetic disease. Double-Stranded Breaks (DSBs) are the most detrimental form of DNA damage, resulting in two DNA fragments. Homologous recombination (HR) is a DNA repair pathway that provides a template-dependent nucleotide sequence which aids in repair of DNA damages. However, chromosomal translocations, in which a chromosomal segment is transferred to a nonhomologous chromosome, can be the result of response to DNA damage and incorrect repair. Preliminary work observed that cells treated with the DNA damaging agent, etoposide, result in more DSBs and an increase in pif-1 expression. Although pif-1 is known to act as a DNA helicase, its role in DSB repair is not known. Our hypothesis predicts that if pif-1 is involved in repair of DSBs, then pif-1 -/- cells will show fewer DSB repair events than wild type (WT) cells. To test this an I-Sce1 model cell system will be used to analyze repair of DSBs by recognizing and cutting a specific 18-bp restriction site in 2 neomycin genes. If HR occurs the neomycin gene will be functional resulting to cells being G418 resistant. To create pif-1 -/- cells, this study involves the CRISPR/CAS system which involves selecting a guide RNA (gRNA) to direct the Cas9 protein to degrade the target DNA, pif-1. This project provides important information to better understand DSBs, DSB repair and proteins involved to maintain genome integrity.

Presenter: Constance Staley
Major: Chemistry
Home Institution: Bennett College
Host Research Institution: Virginia Tech
Research Mentor: Dr. Jatinder Josan
Title: Synthesis of an Eu-Bearing Peptide for the Versatile Tagging of Ligands

Before the FDA approves a new drug for human consumption, a target has to be identified (e.g. human cancer cell receptors), and a molecule must be designed and tested to demonstrate its binding affinity to the target. Radio-labeled ligands are staples of ligand-receptor research, due to their high sensitivity. However, these ligands are extremely dangerous and difficult to work with. Herein, the use of lanthanide-based ligands eliminates concerns posed by radioactive materials (e.g. safety, waste disposal, etc.). Therefore, an alternative technique used is a solid support method called Solid Phase Peptide Synthesis (SPPS).

SPPS has been successfully used to synthesize modified peptides that are able to chelate lanthanides (e.g. Europium). This chelation allows for Europium to be released and highly sensitized for fluorescence. Because of its infinite fluorescence lifetime, a lanthanide like Europium makes an attractive label that can enhance the determination of Eu-ligand binding affinity in competitive binding assays bound to melanoma and prostate cancer receptors in living cells. We are currently exploring synthetic strategies to obtain a versatile tag, bearing a chelated Eu moiety, for selective labeling on ligands in-solution post-cleavage. Therefore, our focus is on performing SPPS using various peptides and coordinating Europium to form efficiently binding chelates. DTPA-Trp-PEG3-NH2, herein DTPA-amine was synthesized by SPPS and tested after each amino acid addition. Upon completion, the molecule underwent HPLC analysis and purification. The target structure, chemical list, and experiment protocol will be presented and discussed.

Presenter: Isis Thomas
Major: Chemistry
Home Institution: St. Augustine's University
Host Research Institution: University of Sao Paulo Brazil
Research Mentor: Dr. Thiago Paixao
Title: The identification of cutting agents using paper-based analytical devices with colorimetric detection

The overall scheme of this research is to gain the ability to detect cutting agents in mixtures such as cocaine which can be cut to build profit. This idea stems to detect a pattern of what is being used in certain samples of cocaine which can lead to the tracking and detection of the purchase and monitoring of such chemicals to find the main source of where this product comes from and find the individual cutting and distributing the product. This would be an effective, easy and affordable way to monitor the production and selling of drugs. The experiment is designed to develop a method of chemical identification through a type of paper chromatography. Further research done my mentors showed success in proving that this device can detect procaine in seized cocaine samples. The process of developing the device and concluding from data is a key ability in learning the chemical feature and identifications of procaine. Research has shown that the interference of most common adulterants found in seized cocaine samples was verified, and a novel electrochemical approach was used for sample pre-treatment in order to increase the selectivity. The device has demonstrated excellent analytical parameters and, for this reason, it is expected to be a promising device for field analysis in forensic police intelligence.

Presenter: Tien Tran, Saytendra Banerjee, and Jamod Johnson
Major(s): Engineering Technology, Computer Science, and Engineering Technology
Home Institution: Elizabeth City State University
Host Research Institution: Elizabeth City State University
Research Mentor: Dr. Akbar Eslami
Title: Exposure to Programming an Autonomous Robot to Stimulate Engineering Technology

The objective of this project is to introduce and expose research students to Arduino microcontroller and write simple programs to control an autonomous robot. Arduino programming language is based on C/C++ which will be used in this project to program the robot to perform desired tasks. In this project, the Arduino-BOT which is a robot with a Board of Education (BOE) Shield mounted on it and the Arduino UNO microcontroller under the shield will be used. Most engineering and technology students have a fairly broad exposure to computers, but few have used computers to communicate with external devices. A robot is little more than a specialized computer used to read input devices (sensors) and to control output devices (motors, relays, servos, lights, sirens, etc.). It is challenging and fun to use computers to accomplish tasks and the applications are unlimited. The project starts with writing and testing a program to run the Arduino-BOT in a straight line and recording the time to navigate the specific distance. The measured values (distance and time) will be used to calculate the speed of the robot. The next step of the project is to program servos. A servo is a single device that contains motors and gearbox that gears down the motor to provide slower speeds (than most motors) and generate higher torque power to turn the robot. Finally, sensors will be used for more reliable navigation methods. The sensor navigation program helps the robot to detect the obstacles and navigate faster on the track.

Presenter: Alton Turner, Tyler McCoy, and Daniel Ashley
Major: Engineering Technology
Home Institution: Elizabeth City State University
Host Research Institution: Elizabeth City State University
Research Mentor: Dr. Mehran Elahi
Title: A Comprehensive Wind Energy Resource Assessment at Elizabeth City, North Carolina

Wind energy industry is one of the fastest growing industries by marketing, mainly commercial, wind energy conversion systems. The success of any wind energy system installation—success measured in the quantity of energy captured from the wind over time—is foremost dependent on the wind resources available at a particular site. This study presents a comprehensive assessment of available wind power at Elizabeth City, North Carolina by analyzing metrological data collected up to 200 meter high for more than a year, using remote sensing equipment. Various data filtering procedures such as wind speed quality, wind turbulence quality, and vertical wind speed are employed to remove invalid data. In addition, the results and the methodology are utilized to develop and to implement laboratory modules for the renewable energy curriculum offered by the Department of Technology. The experience will enable students to perform professional quality wind resource assessments as well as turbine performance estimates. These competencies and skills will make the graduates more marketable in today's economy.

Presenter: Nana Afia Twumasi-Ankrah
Major: Bioinformatics
Home Institution: Virginia Commonwealth University
Host Research Institution: University of Virginia
Research Mentor: Dr. Alison Criss
Title: Using Bioinformatics to Characterize the Genomic Attributes of Neisseria Gonorrhoeae Strain FA1090 and its Genetically Modified Antibiotic Derivatives

Neisseria gonorrhoeae (Gc) is the human-specific pathogen of the STI gonorrhea. Gonorrhea affects over 100 million individuals around the world annually. While current antibiotic treatments have proven effective in clearing infection, the growing prevalence of drug-resistant N. gonorrhoeae strains has renewed public interest regarding the future of Gc treatment. This emerging resistance has led researchers to investigate the defensive mechanisms Gc employs to evade immunoregulatory cells and antimicrobials. Previous studies have attempted to delineate the role phase-variable opacity associated (Opa) proteins play in facilitating Gc recognition and binding to human cells. To further investigate the extent Opa proteins play in infection, four strains of genetically modified Opa-negative bacteria with antibiotic resistant alleles were genetically engineered (Criss lab, University of Virginia) and sequenced (Tettelin Lab, University of Maryland). Using gene analysis and alignment tools, the genome of each strain was analyzed to verify the accurate removal and insertion of target genes, illustrate the genomic attributes of each strain, annotate open reading frames for putative functions and identify the presence of novel mutations. The genomic characterization of these strains provided new insights that will be used to direct further research regarding Neisserial pathogenesis and antibiotic resistance.

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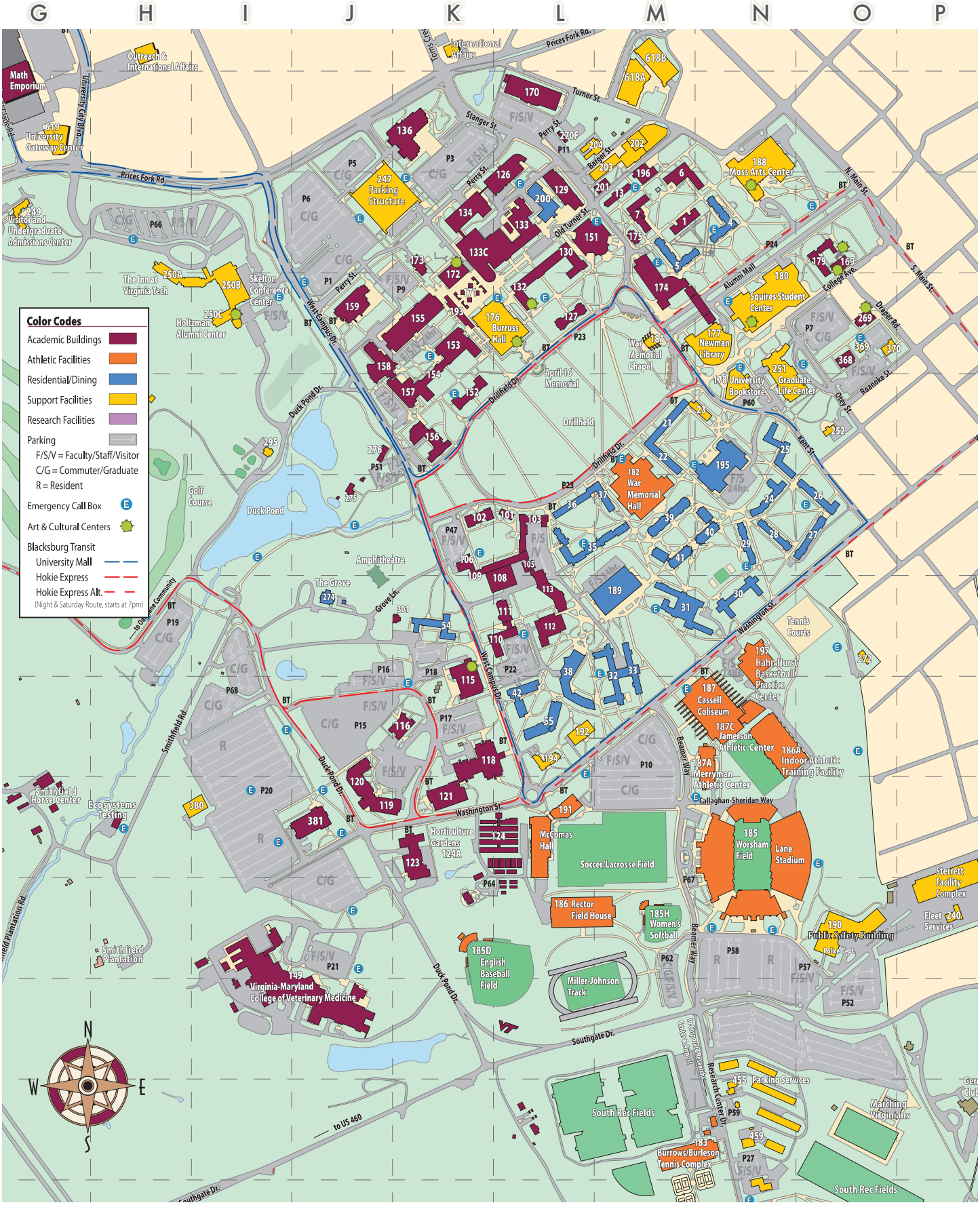
Mrs. Monica Hunter
Ms. Jennifer Turner
Ms. Emily Weeks
Ms. Amy Ingram

VirginiaTech

MAIN CAMPUS MAP



Building keys and select university phone numbers and addresses on the back

Virginia Tech is an equal opportunity, affirmative action institution.

Alphabetical Key

K-7 ..... 109 ..... Agnew Hall
M-2 ..... 204 ..... Air Conditioning Plant
M-8 ..... 33 ..... Ambler Johnston Hall - East Wing
M-8 ..... 32 ..... Ambler Johnston Hall - West Wing
O-4 ..... 368 ..... Architecture Annex
O-4 ..... 269 ..... Armory
M-2 ..... 196 ..... Art and Design Learning Center
O-6 ..... 26 ..... Barringer Hall
K-3 ..... 173 ..... Bishop-Favrao Hall
L-2 ..... 270F ..... Building 270F [VPAS-IT]
J-4 ..... 159 ..... Classroom Building
M-3 ..... 270G ..... College of Science
..... Administration Building
K-4 ..... 171 ..... Burchard Hall
L-4 ..... 176 ..... Burruss Hall
L-6 ..... 37 ..... Campbell Hall - East Wing
L-6 ..... 36 ..... Campbell Hall - Main Wing
N-8 ..... 187 ..... Cassell Coliseum
L-7 ..... 112 ..... Cheatham Hall
L-8 ..... 38 ..... Cochrane Hall
K-3 ..... 172 ..... Cowgill Hall
K-5 ..... 156 ..... Davidson Hall
K-4 ..... 155 ..... Derring Hall
M-7 ..... 189 ..... Dietrick Hall
L-2 ..... 126 ..... Durham Hall
M-5 ..... 23 ..... Eggleston Hall - East Wing
M-5 ..... 21 ..... Eggleston Hall - Main Wing
M-5 ..... 22 ..... Eggleston Hall - West Wing
L-7 ..... 110 ..... Engel Hall
K-10 ..... 185D ..... English Baseball Field
J-12 ..... 475 ..... Etgen Dairy Pavilion
M-3 ..... 13 ..... Femoyer Hall
P-10 ..... 240 ..... Fleet Services
J-9 ..... 123 ..... Food Science and Technology
L-7 ..... 111 ..... Fralin Biotechnology Center
K-4 ..... 193 ..... G. Burke Johnston Student Center
I-5 ..... 295 ..... Golf Course Club House
O-5 ..... 251 ..... Graduate Life Center at
..... Donaldson Brown
L-9 ..... 124 ..... Greenhouse
Q-10 ..... 241 ..... Grounds Building (Central Stores)
K-2 ..... 136 ..... Goodwin Hall
J-4 ..... 158 ..... Hahn Hall - North Wing
K-5 ..... 157 ..... Hahn Hall - South Wing
N-7 ..... 197 ..... Hahn Hurst Basketball Practice
..... Facility
K-3 ..... 133C ..... Hancock Hall
L-8 ..... 42 ..... Harper Hall
I-10 ..... 149C ..... Harry T. Peters Animal Clinic
N-12 ..... 459 ..... Health & Safety Building
O-3 ..... 179 ..... Henderson Hall
K-7 ..... 54 ..... Hillcrest Hall
L-3 ..... 130 ..... Holden Hall
H-4 ..... 250A ..... Holtzman Alumni Center
J-9 ..... 381 ..... Human and Agricultural
..... Biosciences Building I
L-6 ..... 103 ..... Hutcheson Hall
K-8 ..... 116 ..... Institute for Critical Technology
..... and Applied Science II (ICTAS II)
K-7 ..... 301 ..... Institute for Society, Culture and
..... Environment
N-12 ..... 183 ..... Indoor Tennis Courts
N-8 ..... 187C ..... Jamerson Athletic Center
N-6 ..... 28 ..... Johnson Hall
L-3 ..... 129 ..... Kelly Hall
M-3 ..... 1 ..... Lane Hall
N-9 ..... 185 ..... Lane Stadium
L-7 ..... 113 ..... Latham Hall
L-3 ..... 200 ..... Lavery Hall
N-7 ..... 30 ..... Lee Hall
M-3 ..... 175 ..... Liberal Arts Building
K-9 ..... 121 ..... Life Sciences I Facility
K-8 ..... 118 ..... Litton-Reaves Hall
M-3 ..... 7 ..... Major Williams Hall
M-3 ..... 151 ..... McBryde Hall
L-9 ..... 191 ..... McComas Hall
O-4 ..... 369 ..... Media Annex
P-4 ..... 370 ..... Media Building
N-8 ..... 187A ..... Merryman Athletic Facility
O-6 ..... 27 ..... Miles Hall
M-2 ..... 203 ..... Military Building / Laundry
N-2 ..... 188 ..... Moss Arts Center
M-3 ..... 5 ..... New Cadet Hall
L-8 ..... 55 ..... New Hall West
N-6 ..... 40 ..... New Residence Hall East
N-6 ..... 24 ..... Newman Hall
N-4 ..... 177 ..... Newman Library
L-4 ..... 132 ..... Norris Hall
M-2 ..... 618A ..... North End Center
M-1 ..... 618B ..... North End Center Garage
N-6 ..... 29 ..... O'Shaughnessy Hall
M-3 ..... 201 ..... Old Security Building
N-5 ..... 195 ..... Owens Hall
K-4 ..... 153 ..... Pamplin Hall
N-12 ..... 455 ..... Parking Services
L-4 ..... 127 ..... Patton Hall
M-6 ..... 39 ..... Payne Hall
N-3 ..... 4 ..... Pearson Hall
M-6 ..... 41 ..... Peddrew-Yates Residence Hall
M-2 ..... 202 ..... Power House
K-6 ..... 102 ..... Price Hall
M-7 ..... 31 ..... Pritchard Hall
O-10 ..... 190 ..... Public Safety Building
L-3 ..... 133 ..... Randolph Hall
L-10 ..... 186 ..... Rector Field House
I-11 ..... 149B ..... Richard B. Talbot Educational
..... Resources Center
K-5 ..... 154 ..... Robeson Hall
L-6 ..... 101 ..... Sandy Hall
K-6 ..... 106 ..... Saunders Hall
L-7 ..... 108 ..... Seitz Hall
N-2 ..... 6 ..... Shanks Hall
M-6 ..... 35 ..... Slusher Hall
L-8 ..... 194 ..... Smith Career Center
L-6 ..... 105 ..... Smyth Hall
J-6 ..... 275 ..... Solitude
I-9 ..... 380 ..... Southwest Chiller Plant
N-4 ..... 180 ..... Squires Student Center
J-9 ..... 119/120 ..... Steger Hall
P-10 ..... 242 ..... Sterrett Facility Complex
L-8 ..... 192 ..... Student Services Building
L-2 ..... 170 ..... Surge Space Building
J-7 ..... 274 ..... The Grove [President's House]
O-3 ..... 169 ..... Theater 101
M-4 ..... 174 ..... Torgersen Hall
N-5 ..... 178 ..... University Bookstore
O-5 ..... 252 ..... University Club
N-5 ..... 25 ..... Vawter Hall
J-11 ..... 149 ..... Virginia-Maryland Regional
..... College of Veterinary Medicine
G-3 ..... 249 ..... Visitors & Undergraduate
..... Admissions Center
K-8 ..... 115 ..... Wallace Hall
M-4 ..... 181 ..... War Memorial Chapel
M-6 ..... 182 ..... War Memorial Gymnasium
K-3 ..... 134 ..... Whittemore Hall
J-11 ..... 149A ..... William E. Lavery Health
..... Research Center
K-5 ..... 152 ..... Williams Hall
M-10 ..... 185H ..... Women's Softball Field
J-5 ..... 276 ..... Wright House
O-7 ..... 272 ..... 417 Clay Street

Numerical Key

M-3 ..... 1 ..... Lane Hall
N-3 ..... 4 ..... Pearson Hall
M-3 ..... 5 ..... New Cadet Hall
N-2 ..... 6 ..... Shanks Hall
M-3 ..... 7 ..... Major Williams Hall
M-3 ..... 13 ..... Femoyer Hall
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N-6 ..... 24 ..... Newman Hall
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L-6 ..... 103 ..... Hutcheson Hall
L-6 ..... 105 ..... Smyth Hall
K-6 ..... 106 ..... Saunders Hall
L-7 ..... 108 ..... Seitz Hall
K-7 ..... 109 ..... Agnew Hall
L-7 ..... 110 ..... Engel Hall
L-7 ..... 111 ..... Fralin Life Science Institute
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J-9 ..... 123 ..... Food Science and Technology
L-9 ..... 124 ..... Greenhouses
K-9 ..... 124A ..... Hahn Horticulture Gardens
L-2 ..... 126 ..... Durham Hall
L-4 ..... 127 ..... Patton Hall
L-3 ..... 129 ..... Kelly Hall
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K-3 ..... 172 ..... Cowgill Hall
K-3 ..... 173 ..... Bishop-Favrao Hall
M-4 ..... 174 ..... Torgersen Hall
M-3 ..... 175 ..... Performing Arts Building
L-4 ..... 176 ..... Burruss Hall
N-4 ..... 177 ..... Newman Library
N-5 ..... 178 ..... University Bookstore
O-3 ..... 179 ..... Henderson Hall
N-4 ..... 180 ..... Squires Student Center
M-4 ..... 181 ..... War Memorial Chapel
M-6 ..... 182 ..... War Memorial Hall
N-12 ..... 183 ..... Burrows/Burleson Tennis Center
N-9 ..... 185 ..... Lane Stadium/Worsham Field
K-10 ..... 185D ..... English Field
M-10 ..... 185H ..... Women's Softball Field
L-10 ..... 186 ..... Rector Field House
N-8 ..... 187 ..... Cassell Coliseum
N-8 ..... 187A ..... Merryman Athletic Center
N-8 ..... 187B ..... Jamerson Athletic Center
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Q-10 ..... 241 ..... Central Stores
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I-4 ..... 250B ..... Skelton Conference Center
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J-9 ..... 381 ..... Human and Agricultural
..... Biosciences Building I
N-12 ..... 455 ..... Parking Services
N-12 ..... 459 ..... Health and Safety Building
J-12 ..... 475 ..... Dairy Science Complex
M-2 ..... 618A ..... North End
M-1 ..... 618B ..... North End Center Garage

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Architecture and Urban Studies 202 Cowgill Hall 231-6416
Engineering 3046 Torgerson Hall 231-6641
Liberal Arts and Human Sciences 260 Wallace Hall 231-6779
Natural Resources and Environment 138 Cheatham Hall 231-5482
Pamplin Business 1046 Pamplin Hall 231-6602
Science North End Center 231-5422
Veterinary Medicine Phase II Bldg. 231-4699

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St. Augustine's University
Thomas Nelson Community College
University of Virginia
Virginia Commonwealth University
Virginia Tech

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