3rd Annual
USM LSAMP Fall Research Symposium

Program Book

December 7, 2019
University of Maryland, College Park

Keynotes • Presentation Sessions • Abstracts
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About the Symposium

The University System of Maryland (USM) Louis Stokes Alliance for Minority Participation (LSAMP) Fall Research Symposium invites undergraduate, community college, and graduate students in science, technology, engineering, and mathematics (STEM), within the USM, to submit abstracts for the USM LSAMP Fall Research Symposium. Students from the University of Maryland - College Park, Baltimore County, and Eastern Shore Campuses, Towson University, Frostburg University, Community College of Baltimore County, Flowers High School, Oxon Hill High School and Montgomery Blair High School are presenting at this 3rd Annual USM Fall Research Symposium.

The USM LSAMP Fall Research Symposium provides students with the opportunity to both view and present research through poster, traditional oral, and TED-style presentations, while also enhancing their scientific development. Symposium attendees participate in the Symposium’s Graduate School & Resource Fair, where they are provided with information about graduate schools, summer research opportunities, sources for funding research and graduate school, and more!

The USM LSAMP Fall Research Symposium is supported by LSAMP and funded by the National Science Foundation (NSF).
Program Agenda

8:00 am - 9:00 am  Registration & Breakfast
A. James Clark Hall Forum 1101

9:00 am - 9:50 am  Opening Ceremonies
A. James Clark Hall Forum 1101

Welcome Remarks
Rosemary Parker
Director of CMSE, UMDCP P.I. for LSAMP Grant

Distinguished Speakers Presentation
Osvaldo Gutierrez, Ph.D.
Assistant Professor, UMDCP

Kendall Williams, Ph.D.
Senior Lecturer, UMDCP

Symposium Program Breakdown & Announcements

9:50 am – 10:00 am  Transition

10:00 am - 11:00 am  Oral Presentation Session 1
Session 1A – KEB 1105    Session 1B – KEB 1200    Session 1C – KEB1110

11:00 am – 11:10 am  Transition

11:10 am – 12:10 pm  Oral Presentation Session 2
Session 2A – KEB 1105    Session 2B – KEB 1200    Session 2C – KEB1110

12:10 pm – 12:50 pm  Power Lunch
A. James Clark Hall Forum 1101

12:50 pm – 1:00 pm  Transition

1:00 pm – 2:30 pm  Exhibitor Fair
KEB Rotunda

2:30 pm – 4:00 pm  Poster Presentations
A. James Clark Hall
4:00 pm – 4:10 pm  
Transition

4:10 pm – 5:00 pm  
Closing Ceremonies

Closing Remarks  
Sunji Jangha  
Director, Upward Bound, LSAMP BD Program, and USM LSAMP

Presentation of Awards  
Peter DeCrescenzo  
Project Coordinator, McNair Scholars Program and USM LSAMP

Acknowledgments
Distinguished Speakers

Osvaldo Gutierrez, Ph.D.
Assistant Professor
University of Maryland, College Park

Osvaldo was born in Salamanca, GTO (Mexico) and raised in Sacramento, CA. He attended Sacramento City College and transferred to UCLA in 2006 to pursue a career in medicine. However, working as an undergraduate at the laboratories of Prof. Kendall N. Houk inspired him to change career path to organic chemistry. He graduated in 2009 with B.S. and M.S. degrees in chemistry from UCLA and moved back to northern California to enroll in graduate studies at UC Davis. He completed his Ph.D. in 2012 under the guidance of Prof. Dean J. Tantillo; his thesis was focused on the use of computational electronic structure methods to reveal mechanisms of catalytic processes. He then moved across the country to work with Prof. Marisa C. Kozlowski at the University of Pennsylvania where he used computational and experimental tools to study transition-metal catalyzed processes.

In 2016, he started his independent career at the University of Maryland where his research focus on combining computational and experimental approaches to
advance our understanding of organic/organometallic reaction mechanisms and biological systems. Specifically, we are interested in (1) role of open-shell intermediates in small-molecule and enzymatic catalysis, (2) development of predictive models of reactivity and selectivity of iron-catalyzed carbon-carbon and carbon-heteroatom bond transformations, and (3) rational design of selective supramolecular catalysts.

In addition, Osvaldo is very passionate about increasing the number of underrepresented students in STEM. In this vein, he started a new Alliance for Diversity of Science and Engineering chapter at UMD, serves as board member for the ADSE national organization, organizes the annual Young Researcher Conference at UMD, and started a new community college research partnership between the UMD chemistry department and Prince George’s Community College. In his free time, he likes to listen to 90s rap and watch college football and basketball.
Kendall Williams, Ph.D.
Senior Lecturer
University of Maryland, College Park

Kendall Williams has been teaching mathematics on the collegiate level for 10 years. After graduate school, he began his career as a Lecturer at Howard University, the number 2 ranked Historically Black College and University (HBCU) in the country. From there, he became an Assistant Professor at West Point - the United States Military Academy where he spent the largest portion of his career thus far. West Point has continually been ranked as one of the top 10 undergraduate institutions in the country. Kendall joined University of Maryland as a Lecturer of mathematics in 2016 and has since been promoted to Senior Lecturer. University of Maryland is one of the top 25 public universities in the country, where over the past 6 semesters, Kendall has taught 11 different courses – six of which he has taught on multiple occasions. During his career, Kendall has successfully taught developmental courses for students having trouble with mathematics; general service courses; advanced math program courses for students whose skills exceeded their general math course requirements; as well as upper-level courses for math majors. He has taught over 20 different mathematics courses to approximately 2000 college students and received multiple awards and nominations for excellence in teaching throughout his career.
Kendall received his bachelors degree, masters degree, and PhD, all in mathematics, from Howard University. As an undergraduate, he was a part of the Louis Stokes Alliance for Minority Participation. From there, he entered the PhD program at Howard as a Bridge to Doctorate Fellow. The institutions at which Kendall has been a faculty member are in stark contrast to the predominantly black University where he was educated. Yet, he quickly came to embrace the moniker of not being the stereotypical mathematician in the eyes of students, faculty, administrators, and parents alike. He feels as though this allows him the opportunity to enlighten individuals to the possibilities that exist. Kendall swiftly realized he could use the fact he doesn’t “fit the bill” to others’ advantage, especially college and pre-college students who had never encountered a Black mathematics professor. Thus he takes full advantage of the numerous opportunities, both formal and informal, to provide mentorship to minority students. He especially embraced this when during his second year as a faculty member at West Point, he was appointed the Associate Director of West Point’s Center for Leadership and Diversity in STEM. The main component of this Center was teaching middle school children from underserved and underrepresented STEM populations how to build and program robots. Kendall planned and led over 35 STEM workshops in nearly 25 U.S. cities reaching over 1000 middle school students in just three years. Kendall has a goal to continually increase his service role here at University of Maryland as well. He currently organizes the mathematics department’s Teaching Forum in which panelists discuss teaching topics with math department graduate student TAs.

Even with all his own years of schooling, Kendall feels as though his realization of the true importance of education would have been impossible without having himself taught. He truly loves to learn and in turn loves to teach. He feels there is nothing like having to learn a topic so deeply that you can relay it to others, answer their dynamic set of questions, and ensure they can properly use their new-found knowledge in realms outside of the classroom. On the surface, some may think school is over for Kendall. He begs to differ. He doesn’t go to work each day; rather he packs his backpack, puts on his bicycle helmet, and pedals to school each morning where his students keep him abreast of their ever-changing learning styles and teach him to adapt accordingly. Kendall strives to impart knowledge along with lifelong learning skills to be utilized in his courses as well as a broader sense throughout students’ schooling, careers, and personal lives.

Kendall has one 14-month old daughter of whom he is exceedingly proud and loves more than anything.
Hayat Abdurahman  
Community College of Baltimore County  
- Mechanical Engineering

Afuh Adeck  
Towson University  
- Biology  
- Senior  
- LSAMP

Ashley Afueh  
University of Maryland, College Park  
- Electrical Engineering  
- Senior  
- LSAMP

Marvellous Aina  
Flowers High School  
- Senior  
- Esteem Ser-Quest

Olorunjuwon Ajayi  
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- Computer Engineering  
- Junior  
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- LSAMP | Meyerhoff

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• LSAMP

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• LSAMP

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Halle Welch
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Sophomore
• LSAMP
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- LSAMP

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- LSAMP | Meyerhoff

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- Senior
- McNair

Jasper Scelsi
Towson University
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- Senior
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**PRESENTERS**

Reneece Skeen
University of Maryland, Eastern Shore
- Biology
  - Junior
- LSAMP
**ORAL PRESENTATIONS**

Oral Presentations Schedule

**Session I: 10:00 am - 11:00 am**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 1A</th>
<th>Session 1B</th>
<th>Session 1C</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 – 10:10 am</td>
<td>--</td>
<td>Rohan Shah</td>
<td>Ahsley Afueh</td>
</tr>
<tr>
<td>10:15 – 10:25 am</td>
<td>Yasmine Pierre</td>
<td>Mawuyon Okesola</td>
<td>Olorunjuwon Ajayi</td>
</tr>
<tr>
<td>10:30 – 10:40 am</td>
<td>Shakuria Davis</td>
<td>Wilkins Njigna Njinguet</td>
<td>I'shea Boyd</td>
</tr>
<tr>
<td>10:45 – 10:55 am</td>
<td>Tyla Holoman</td>
<td>Yasmin Roye</td>
<td>Tre Barr</td>
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**Session II: 11:10 am – 12:10 pm**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 2A</th>
<th>Session 2B</th>
<th>Session 2C</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:10 – 11:20 pm</td>
<td>Suha Ansari</td>
<td>Keyona Curry</td>
<td>Rachel Harvey</td>
</tr>
<tr>
<td>11:25 – 11:35 pm</td>
<td>Jada-Mercy Ayebae</td>
<td>Somtochi Ojaku</td>
<td>Jude Thaddeus Persia</td>
</tr>
<tr>
<td>11:40 – 11:50 pm</td>
<td>Katrina Kelly</td>
<td>Funke Okunrinboye</td>
<td>Arjun Trivedi</td>
</tr>
<tr>
<td>11:55 – 12:05 pm</td>
<td>Jonathan Bolanos</td>
<td>--</td>
<td>Jasper Scelsi</td>
</tr>
</tbody>
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Understanding Field Probe Characteristics to Improve Transcranial Magnetic Stimulator Used for Treatment of Neuropsychiatric Diseases

Shytaya Jackson*, Hedyeh Bagherzadeh, Dr. Fow-Sen Choa

Developed by Anthony Barker and his associates in 1985, transcranial magnetic stimulation (TMS) tools have been approved by the Food and Drug Administration to treat several neuropsychiatric diseases such as depression, migraine, and obsessive-compulsive disorder. Due to field divergence and technological limitations, current TMS tools cannot effectively activate nerve tissue greater than 2 cm away from the stimulator tool. Since most neuropsychiatric diseases are initiated from deep brain regions, new TMS tools are needed to achieve deep and focused stimulation with sufficient field strength. In this work, we will develop a new type of brain phantom that can be used to characterize newly developed TMS tools. The desired phantom would consist of multiple layers of 3-D vector electric field sensor arrays and would be able to measure induced electrical field vector distribution in the 3-D space. Each sensor will contain 3 small modified Rogowski coils to measure the stimulator tool induced electrical field along the x, y, and z directions at the sensor location. A multichannel A-to-D will be used to record sensor signals from all of the sensor locations and reconstruct the 3-D field distribution plot. In the particular project, we hypothesize that we can demonstrate a proof-of-concept phantom containing only two 3-D vector sensors. Since there is currently no commercial TMS calibration tool on the market, we expect a completed brain phantom will not only be used for characterizing newly developed TMS tools but also for calibrating existing TMS tools.

Comparison of Riboswitch Reporter Systems for Live Cell Imaging of Cyclic-Di-GMP Dynamics in Bacillus Subtilis Populations

Yasmine Pierre*, Silvana Fragano1, Keren Snehi, Kian Sun1, Darren Chea1, Susan Kang1, Dr. Catherine Spirito1, Dr. Cordelia Weiss2, Dr. Wade Winkler2

Fluorescent riboswitch reporters can be used in vivo to monitor metabolite dynamics. Previous work used a fluorescent yfp reporter based on a cyclic di-GMP responsive riboswitch from *Bacillus licheniformis* to monitor cyclic di-GMP levels in individual *Bacillus subtilis* cells. The previous study found that cell fates in *Bacillus subtilis* are not uniform in the presence of varying cyclic di-GMP levels. It is important to further develop tools that enable single-cell imaging in Gram-positive bacteria. Fluorogenic aptamers are single-stranded RNA molecules that have been evolved via in vitro selection to bind strongly and specifically to fluorophore molecules and emit a fluorescent signal. These fluorogenic aptamers can be used instead of fluorescent proteins in riboswitch reporter systems to provide a more dynamic read-out of metabolite dynamics in cells. However, relatively little work has been done to evaluate the use of these fluorogenic aptamers
in Gram-positive bacteria. The objective of this project is to evaluate the use of four different fluorogenic aptamers (Mango-III, Broccoli, dimeric Broccoli, and SpinachII) instead of yfp in the cyclic di-GMP responsive riboswitch reporter system in *Bacillus subtilis*. Currently, all plasmids containing the riboswitch reporter have been constructed and successfully transformed into *E. coli* cells and their sequences have been confirmed. The fluorogenic aptamer Mango-III riboswitch reporter system has successfully been transformed into *B. subtilis* WT PY79. Future work involves transforming the remaining riboswitch reporter plasmids into *B. subtilis* WT PY79 and evaluating their performance in vivo.

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**Establishing a Zebrafish Model for Behavioral Assessment Following Pentylenetetrazol (PTZ) Induced Epileptic Seizures**

Shakuria Davis*, William Harrod, Ethan Childs, Bethany Ngerei, Ngoy Yamitshi, Sherene Black, Isis Amaye, Dr. Patrice Jackson-Ayotunde, Dr. Tracy Bell

Epilepsy is a chronic neurological disorder characterized by sudden recurring seizures and affects humans of all ages. Adult zebrafish are a common *in vivo* model used to study epileptic seizures; therefore, the aim of this study was to establish a pentylenetetrazol (PTZ) induced epilepsy model that can be used to assess the efficacy of potential anticonvulsant agents. To develop our methodology, the experimental zebrafish were exposed to 5mM PTZ in aquatic system water (1 ppt) at 26°C and observed for 20 minutes. The behavior of PTZ-induced epileptic fish were tracked using the Ethovision XT behavioral tracking software. Seizures are typically characterized as unexplained sudden, erratic and uncontrollable movement. In our model, fish exhibiting these movements were characterized as seizure induced. Initial behavioral analysis revealed that fish in the control group exhibited a higher mean swim velocity and were less prone to shift between different speeds and directions randomly. Alternatively, the behavior of the treatment fish were much more erratic, indicative of actual seizures where patients experience uncontrollable movement. Consistent with other reports, our findings indicated that we were able to establish a zebrafish epilepsy model. The development of this model has several implications. In addition to providing undergraduates continuous experiential learning opportunities, it broadens the institutions research capacity by providing a feasible model to study the efficacy of potential anticonvulsant agents on treatment of seizures identified by onsite researchers. Thus, the model can facilitate and enhance multidisciplinary research at the institution.

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**Investigating Magainin Through Computational Molecular Modelling**

Tyla Holoman*, Dr. Jeffery Klauda

Magainin is a 23-residue, helical, antimicrobial peptide found in the skin of the *Xenopus laevis*, also known as the African Clawed Frog. Magainin is important because it can disrupt electrochemical gradients in the cell membranes of many bacteria, tumors, and fungi, which is extremely useful in pharmaceuticals for killing these organisms. Understanding how Magainin
interacts with cell membranes is an important part of understanding how it could work medicinally, and one of the best ways to understand these reactions is through computational protein modeling. Ten membrane protein systems containing Magainin and a membrane bilayer were constructed to analyze Magainin’s behavior and interactions with a model for the outer skin membrane. These systems were simulated by a supercomputer for about 300 ns each to allow the peptide to fully interact with the membrane bilayer. Now that the simulations have been completed, they are being analyzed to determine exactly what patterns of behavior were exhibited by Magainin when placed near a model skin membrane.

Session 1B Abstracts

Recognition of Aminated Guests by Acyclic Cucurbituril Motor2

Rohan Shah*, Sandra Zebaze, Dr. Lyle Isaacs

The acyclic cucurbituril Motor2 has already been well documented in its binding to several types of molecular guests in phosphate buffer. However, while these tests provide a rough idea of motor2 affinity to different types of guests, they are incomplete in that they do not reflect how motor2 actually binds in body conditions. The human body contains many proteins and macromolecules that can affect the host-guest interactions of motor2, so it is important for new binding constants to be measured for motor2 in body conditions. In order to do this, Isothermal Titration Calorimetry (ITC) was used to measure motor2 binding constants to several different guest types in several different solutions, including albumin and fetal bovine serum. It was found that when tested with cyclic, monoaminated guests, motor2 binding affinity did not decrease significantly from phosphate to protein serum solvents. This retained affinity held across several different ring sizes and shapes. Motor2 binding affinity did suffer greatly in protein serum for guests that were linear, regardless of how many amines they had. The results also indicated that more hydrophobic guests do not bind as well to motor2 once albumin and other proteins are introduced to solution, while hydrophilic, polar guests have better affinity retention. The ITC testing results indicated that motor2 binding in body conditions is heavily dependent on the shape of the guests it is binding to, and that motor2 would be most effective at its purpose in the human body if it was used to target cyclic amines and similar types.
Modification of Surface Charge of Hemostatic Nanoparticles

Mawuyon Okesola*, Nidhi Naik1, Tobias Coombs1, Nuzhat Maisha1, Dr. Erin Lavik1

To combat trauma, the leading cause of death of humans from ages 1 through 44, hemostatic nanoparticles have been created and modified to resolve the trauma of bleeding. Hemostatic nanoparticles are made from poly (l-lactic acid)-b-poly (ethylene glycol) block copolymer and (poly-d-lactic acid). These nanoparticles work via the intravenous route, traveling to the site of injury, and binding with activated platelets to assist in faster blood clotting. Within the rodent model, specifically the femoral artery and liver injury model, these nanoparticles improved the survival rates as well as reduced the clot formation time by 50%. When tested on the porcine model, it resulted in hypersensitivity reactions as a result of complement activation. Complement activation-related pseudoallergy or CARPA is when complement protein fragments are generated, some of which are anaphylatoxins that cause hypersensitivity reactions which clear the nanoparticles from the system. Based on the naïve injury model, highly negative and highly positive zeta potential lead to complement activation whereas neutral nanoparticle within range of -3 to 3 mV did not. The nanoparticles are inherently negatively charged due to deprotonation of the carboxyl group of the polymer. To combat this, we are working on surface modification utilizing cationic surfactants, ligands, and positive coatings. The goal is to modify the surface charge of the nanoparticles by utilizing these methods to alter its ionic core to lead to a neutral zeta potential, the parameter related to surface charge. The focus of our research has been determining optimum conditions to reproducibly produce neutral nanoparticles. As well as to assessing complement protein levels by analyzing in-vitro ELISA assays. Future direction would be towards utilizing these nanoparticles for in vitro complement assays to determine whether the neutral charge can overcome CARPA and eventually apply and optimize it in a large animal trauma model.

Stabilization and silica coating of iron-oxide nanoparticles for structural color optimization

W.M. Njigna Njinguet*, R. Fedderwitz, P. Kofinas

Iron oxide nanoparticles (IONPs) are stabilized and coated with silica using tetraethyl orthosilicate (TEOS). The IONPs are stabilized with polyvinylpyrrolidone (PVP) MW: 50,000, which results into a lowering of particle surface charge. Herein, IONPs of a varying size distribution are coated with TEOS of different concentrations to identify how silica shell size is influenced by a range of TEOS concentrations. Additionally, other reagents such as ammonium hydroxide (NH₄OH) is studied via varying ammonium concentrations. It is understood that there is a range at which a change in concentration no longer affects the formation of the silica outer shell. These procedures can be applied on particles of uniform sizes to tune structural color.
Investigation of Neutrophil Sequestration Through a Lung Capillary Constriction Device

Yasmin Roye*, Brittany Neumann, Craig Lefort

The lung has a unique role in immunology for being a site of sequestration of neutrophils. This is in part due to the structure of the pulmonary capillary bed. It is composed of short, narrow segments arranged in an interconnected network. It is thought that these dimensions, which are smaller than the diameter of the neutrophil, result in sequestration. While having neutrophils is necessary for fighting pathogens, having activated neutrophils constantly retained in the lung capillary system can lead to host-tissue damage. This neutrophil activation due to pathogen/damage sensing includes cell stiffening. The combination of the dimensions of the pulmonary capillary bed, the mean diameter of neutrophils, in addition to stiffening during activation results in high levels of neutrophil sequestration and a higher potential for pulmonary vascular damage. The aim of this study is to characterize how N-formylmethionine-leucyl-phenylalanine (f-MLP), and atrial natriuretic peptide (ANP) impact neutrophil stiffening and link it to the cytoskeletal biochemistry underlying it. To investigate these stimuli on neutrophil biomechanics, we followed single cell transit times through a microfluidic device that models the dimensions of the pulmonary capillary network. Currently, we have found that f-MLP-stimulated neutrophils pass through the constriction device slower than the unactivated cells or with cells treated with cytochalasin D, an inhibitor of actin polymerization. Additionally, we have found that vinculin, a structural protein linking the actin cortex to the plasma membrane, affects transits times also. These preliminary data support that the stiffening response is due to the engagement of the cytoskeleton.

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Heat Transfer through Nanoporous Membranes

Ashley Afueh a, Kijjiketchme Southern-Fox a, Ibrahim Elkholy b, Hadi Ghasemi c and Kausik S Das b,*

Electronic devices nowadays are not only becoming more powerful computationally but also shrinking in size rapidly. Due to high level of computational power these devices generate enormous heat in small area, but the industry has not found a way to dissipate this heat from small surface area and prevent the devices from burning. We are working on solving this industry bottleneck by using nanoporous membranes to transfer orders of magnitude more heat using evaporative cooling. In a micro/nano channel Laplace pressure difference between the pressure of
air just above the meniscus (pA) that forms when a capillary tube is dipped into water and the pressure of the liquid just below the meniscus (pL) is given by \( \Delta p = p_A - p_L = 2\gamma/R = 2\gamma/r \cos \theta \), \( \ldots \) (1) where \( \gamma \) is the surface tension of water, \( \theta \) is the contact angle of water with the tube wall, \( R \) is the radius of curvature of the meniscus and \( r \) is the radius of the capillary tube. It is clear from Eq.(1) that if we use the surface tension of water \( \gamma = 0.072 \) N/m, assuming perfect wetting and atmospheric pressure \( p_A = 101325 \) Pa, we get \( r \approx 1.42 \times 10^{-6} \) m, meaning that if the radius of the capillary is less than 1.42\( \mu \)m, the pressure just below the meniscus will be negative. As the pressure at the bottom of the capillary at the level of the water reservoir is \( p_A \), implying that there will be capillary pressure difference of \( \Delta p \) between the bottom and the top surface of the liquid column which can drive a flow. In this project we are exploiting this extraordinary capillary actuation process by using submicron/nano porous membranes and evaporating the liquid from the top.

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**Model Developments in Ocean Current Turbine: Image processing (cross correlation) and machine learning tools to predict velocity vector fields using Tomo-PIV data**

Olorunjuwon Ajayi*, Dr. Navid Goudarzi

The purpose of this research is to develop a MATLAB code that will analyze the images taken from a Particle image velocimetry (PIV) set up. The images will be analyzed using crosscorrelation to generate the velocity vector field. After completing this first process then develop a Machine learning (ML) algorithm that will be able to predict the flow of the particle from images taken from Particle image velocimetry set up. I am interested in implementing ML with PIV to analyze how accurate ML model determines the flow of the fluid when relying on the input images from either computational or experimental results. Two research questions guide my research: First, how accurate the developed MATLAB code obtains the velocity vector fields compared to those from PIV results? Second, how accurate the develop ML model predict the flow field velocity values using the experimental/computational input data? For MATLAB, online courses and available resources in the research group will enable developing a simple, yet robust code. For ML, several courses are taken, and regression models on some sample data are being developed. The results of this research will be beneficiary to other researchers in the team to (1) educate them on how the cross-correlation in a commercial software (i.e. Dantec Dynamics for PIV) works and (2) how a data-based approach (i.e. ML) can use the physics-based data to obtain a faster and accurate prediction of flow fields.
Design for Additive Manufacturing: Effectiveness of Unit Cell Design Guidelines as Ideation Tools

I'Shea Boyd*, Dr. Mohammad Fazelpour

The periodic cellular materials are comprised of repeatable unit cells. Due to outstanding effective properties of the periodic cellular materials such as high flexibility or high stiffness at low relative density, they have a wide range of applications in light-weight structures, crushing energy absorption, compliant structures, among others. Advancement in additive manufacturing has led to opportunities for making complex unit cells. A recent approach introduced four unit cell design guidelines and verified them through numerical simulation and user studies. The unit cell design guidelines aim to guide designers to re-design the shape or topology of a unit cell for a desired structural behavior. While the guidelines were identified as ideation tools, the effectiveness of the guidelines as ideation tools has not been fully investigated. To evaluate the effectiveness of the guidelines as ideation tools, four objective metrics have been considered: novelty, variety, quality, and quantity. The results of this study show the unit cell design guidelines can be considered as ideation tools and are effective to help engineers creating novel unit cells to improve shear flexibility while maintaining the effective shear modulus.

Piano Mattress: Accessible IoT Control of a Smart Robotic Mattress

Tre Barr*, Kavita Krishnaswamy, Dr. Tim Oates

A comfortable mattress usually makes the difference between a good night’s sleep and a restless night. The importance of mattresses is typically overlooked, even though we spend most of our time on them. This is even more true for those who have significant motor disabilities as they are forced to spend more time in bed than the average person due to their physical conditions. The goal of our project is to design a specialized mattress with accessible controls for those who are physically disabled. Real-time force sensors, oxygen saturation, heart rate, and body temperature provide information that can identify any potential health and safety risks to the patient. We then use this data to control the settings of the mattress. Our current prototype consists of three air chambers, three air pressure sensors, three force sensors, a temperature sensor, a pulse oximeter, a Raspberry Pi, and a structure to contain the circuitry under the air chambers. The sensors and oximeter provide data which is collected by the Raspberry Pi and then it communicates with a web server. This collection of data allows for new methods of human-computer interaction. There will be a website interface that greets the user with a login, the user can be either the doctor or the patient. When the patient logs in they are able to adjust pressure inflation percentage in an individual air chamber using a dial on the website. The patient can also view their biomedical data in a chart below the adjustment dial. The doctor is able to monitor the patient's vital signs, adjust air pressure, and monitor the status of the patient via a webcam. We are also developing a mobile interface that is nearly identical to the web interface,
the major differences are that the adjustment of the air chambers would be done by a horizontal slider as opposed to a dial. Swiping left and right will allow the user to go to different sections in the order of: chamber selection interface, heart rate data, oxygen saturation data, body temperature data, and settings. The web interface was designed with a combination of HTML5, CSS3, JavaScript, jQuery, and Bootstrap. Our future plans are to implement machine learning to alleviate discomfort automatically, and further develop the interface.

Session 2A Abstracts

Depression and Contraception

Suha Ansari*, Dr. Julia Steinberg

Amongst the numerous amount of detrimental effects regarding poor mental health in humans, there exists the negative effects of mental health and decision making processes. More specifically, there exists substantial reasoning to believe that mental health disorders such as depression, contribute to contraceptive behaviors. In order to alleviate the burden of poor mental health and risky sexual behaviors, such as neglecting contraceptive use, more research needs to be conducted on the issue in order to develop successful interventions that work towards alleviating these issues. This research team intends to conduct qualitative research that seeks to analyze the extent to which depression influences contraceptive behaviors and investigate these mechanisms by which changes in depression contraceptive behaviors. Data collection will take place over the course of a year and will occur at three different locations; including a counseling clinic and a family planning clinic in Prince George’s County, and a family planning clinic in DC. After the subjects complete a recruitment and consent form, research staff conducted a brief screening interview with the participants, to which a 30-60 final in-depth interview will be conducted when research staff found that the potential participants met all of the criteria. This data will be used to evaluate potential links between depression/other mental disorders and contraceptive use; with hopes to advocate for further interventions for women who are disproportionately affected by mental illness’s ability to impact important decisions that can impact their health.

Reforestation in Peru: Mercury Contamination

Jada-Mercy Ayebae*, Maria Rodriguez, Dr. Natasha Andrade

In the Amazon Rainforest, illegal gold mining leaves water, soil and vegetation contaminated with mercury. This affects the environment and the populations that depend on the
land for survival. Experiments to assess the toxicity of mercury on indigenous plant will be performed by UMD researchers next year in the Amazon. Bean, lettuce, radish, and pumpkin seeds were used to design an experiment with the purpose of understanding the effects of mercury on vegetation. It was hypothesized that the control seeds (non-exposed to mercury) would grow longer and healthier than the others. Seeds were treated with different concentrations of mercury (2ppm, 1ppm, 0.5ppm, 0ppm). The results show that the seeds from the control group and those exposed to 0.5 ppm of mercury had a higher weight after germination than all others, followed by the seeds exposed to 1 ppm of mercury. The seeds exposed to 2 ppm of mercury had the lowest weight. The shoot length of the seeds was measured after germination. The results of the experiment showed no differences in the shoot length of the seeds from the control group and those exposed to mercury. The beans and lettuce were eventually eliminated from the experiment due to issues with mold and fungus. These results support some of the hypothesis and the worries about mercury deposits in the Amazon rainforest. The difficulties with mold, fungi, and other variables were unexpected and may have greatly affected the results of the experiment.

Mapping Black-led Foodways in Baltimore City, Maryland

Katrina Kelly1*, Dr. Ashante M. Reese1

Baltimore City is home to about 619,493 people (US Census Bureau, 2011) and, of this number, one in four residents reside in neighborhoods where the nearest major grocery store is more than one mile from their home. These low food access neighborhoods are popularly referred to as “food deserts” and are disproportionately located in communities of color that are already facing other complications like racialized disinvestment, depopulation, unemployment, decaying structures, and housing insecurity due to gentrification. This project explores the network of African American urban farms, food hubs, church food banks, restaurants and other community-based initiatives established to respond to the nutritional, vocational, political, and economic needs of Baltimore residents in these areas. This research focuses on the Baltimore City neighborhood of Cherry Hill as its primary study area and seeks to accomplish three primary objectives: (1) to examine what specific challenges and limitations the case study area faces, (2) to identify existing resources available to address these issues, including the Cherry Hill-based organization, Black Yield Institute, and (3) to provide a visual reference of categorized foodshed assets throughout the Baltimore City area. Given the limited research period, this scholarship is intended only to provide a visual overview of the existing components of local Black-led food justice movements and identify any additional resources necessary to construct a self-sustaining integrated food system and advance a self-determined food economy in local African American communities.
Correlation of Ground Based Aerosol Optical Depth to Particulate Pollution over the Baltimore

Jonathan Bolanos*

Particulate Matter (PM), widely known as particle air pollution within the atmosphere, these particles have contributed to the causes of worldwide ranges of toxicological problems that threatens mankind and environmental sustainability. The University of Maryland, Baltimore County (UMBC) is looking into components within the local air quality of fine airborne particles (PM$_{2.5}$, aerodynamics diameter < 2.5µm). Atmospheric particles in which are constantly interacting with solar radiation through the process of scattering and absorption of light. The degree of understanding their size, shape, and composition will transition in investigating the amount of PM$_{2.5}$ concentrations and the scatteration of light wavelengths. To correlate to NASA’s Aerosol Robotic Network (AERONET) sun photometer ground-based remote sensing measurements, provides aerosol optical depth (AOD) observations which can contribute to long-range pollution to local air quality in Baltimore. By combining ground air quality measurements, lidar profiles measurements and column observations will potentially provide a three-dimensional (3D) overview of aerosol pollution within Baltimore, Maryland.

Bacteria-mucus interactions & their role in chronic lung infections

Keyona Curry*, Katherine Joyner, Gregg A. Duncan

Obstructive lung diseases such as cystic fibrosis (CF), chronic obstructive pulmonary disease (COPD) and asthma are characterized by impaired mucus clearance. For 60-70% of adults with CF *Pseudomonas aeruginosa* is the primary pathogen responsible for mortality in these patients. Understanding the interplay between this pathogen and mucus could lead to superior methods of drug design and delivery for the treatment of CF. In this work, we explored how *P. aeruginosa* affects mucus hydrogel assembly and the influence of the mucus gel on bacterial growth. Using multiple particle tracking micro-rheology and monitoring bacterial growth in a mucin-based we systematically examined each part of the system. We have observed that *P. aeruginosa* affect mucus gel assembly by prolonging the gelation process of mucin-based hydrogels. Also, we found that *P. aeruginosa* growth in hydrogels was two times slower than *P. aeruginosa* grown in media. The results of this work provided a deeper understanding of how *P. aeruginosa* affects airway mucus in patients with cystic fibrosis.
Water-Containing Gel Polymer Electrolytes for Lithium Ion Batteries

Somtochi Ojiaku1*, Margeret Akande1*, Chukubwuike Peterson1*, Marvellous Aina1*, Jesse Matthews2, Dr. Peter Kofinas2

Since pioneer exertion began for the creation of lithium ion batteries, society has begun to make great use of them, as they lasted longer and were rechargeable, unlike all the other batteries that were previously created. However, lithium ion batteries were and are currently reported to result in dangerous explosions when in high temperatures. To combat this issue, the primary objective of this research was to synthesize and enhance the properties of a water-containing gel electrolyte in order for lithium ion batteries to be able to perform comparably to normal liquid electrolytes without combusting at high temperatures. Electrolytes are components of a battery that contain conductive molecules so lithium ions can travel throughout its interior. The greatest problem to solve for the electrolyte was to find how much water was optimal not only for good conductivity but also for acceptable electrochemical stability. The team hypothesized that a higher concentration of water would boost the conductivity of the gel but also cause the stability to worsen; water is a very conductive material so the more water added, the higher the conductivity would be. The water in the electrolyte reduces the electrolyte’s stability because water is only electrochemically stable to 1.23V vs Li. To synthesize the gel electrolyte, two different homofunctional macromers were mixed together and cured in an oven, which resulted in a chemically bonded network polymer. The experimental results indicated that adding more water, in fact, did increase the conductivity of the gel electrolyte, but while doing so, it reduced its stability. The gel electrolyte in which were dried for 2 minutes was optimal because in that time period, enough water was extracted to achieve stability down to 2.25V while still maintaining adequate conductivity. In the future, the group plans to further dry the electrolytes to achieve improved stability and construct a full battery cell with lithium titanate oxide and lithium manganese oxide as electrodes. This project is beneficial to society because by making gel electrolytes that perform on the same level or better than liquid electrolytes, it increases the safety of batteries all over the world.

Encapsulation of Candida albicans in Alginate Polymer

Funke Okunrinboye (Senior)1*, Dr. Amy Karlsson1

Candida albicans is a commensal opportunistic fungal pathogen. It is a polymorphic organism that exists in pseudo-hyphal, hyphal and yeast forms in human hosts, and is known to cause superficial and systemic infections including oral thrush, vaginal yeast infections and systemic bloodstream infections. Systemic candidiasis can be deadly in immunocompromised patients such as transplant recipients and patients that have HIV, cancer, and diabetes mellitus. C. albicans infections are associated with high morbidity and mortality rates yearly. The characteristics of C. albicans associated with an ability to cause infections involve cell adhesion, dimorphism, phenotypic switching, thigmotropism and biofilm formation. These characteristics
aid in yeast dispersal, virulence and resistance to current antifungal therapies. Due to the toxicity of antifungal therapies to human host cells, the resistance of *C. albicans* to antifungal therapies, and *Candida*’s ability to escape the white blood cells, newer approaches to better study *C. albicans* are needed. Encapsulation of yeast cells will allow observation of cell signaling, growth patterns, and ultimately enable the development of better alternatives to prevent biofilm formation and *C. albicans* hyphal growth, thereby limiting virulence. Anionic alginate polymers were used to mimic human host cells for *Candida* encapsulation observation. and *C. albicans* strain SC5134 was embedded in the capsules. The cells grew predominantly in the yeast form at 35°C but showed significant hyphal growth at 37 °C, in both liquid growth medium, and in the alginate capsules. The results also show that *C. albicans* can successfully be encapsulated and that growth can be observed in the capsules. Next, cell signaling studies (quorum sensing) in *Candida albicans* will be studied.

**Effect of Epidermal Growth Factor Pathway Inhibition on Re-epithelialization and Regeneration Rate in Salamanders**

Afuah Adeck1*, Renee Dickie2

Salamanders have one of the most extensive regenerative abilities among most adult vertebrates. The Epidermal Growth Factor Receptor (EGFR) gene in salamanders is crucial for the maintenance of successful cell growth, cell proliferation and survival. EGFR signaling is vital for the development of several tissues including the skin, the lungs and most organs. The objective of this study is to investigate the effects of the inhibition of EGFR pathways by AG-1478 on re-epithelialization and regeneration of amputated salamander tails. We hypothesize that the inhibition of EGFR pathways in cells will lead to low levels of re-epithelialization, thereby causing low levels of regeneration and regrowth. It was observed that the salamanders in treatment on average had less re-epithelialization compared to those in the control group, since they displayed a lengthier average timeframe of ~1 h before the loss of MB dye, compared to the salamanders in the control solution which took on average ~40 minutes. Our results indicate that EGF pathways play a significant role in wound healing. This suggests that a better understanding of EGF pathways could potentially lead to the development of better enhanced wound healing therapies.

**Honeycomb Structures for Energy Absorption Applications**

Rachel Harvey*, Dr. Min Mao, Dr. Norman Wereley

Honeycomb structures have been studied thoroughly to understand their in and out-of-plane mechanical properties. The ability of honeycombs to effectively absorb energy makes them...
ideal for usage in crash mitigation, particularly for helicopters and automobiles. Currently, when crushed by a dynamic load, there is an impulse in force prior to a steady absorption – which could be detrimental in such crash mitigation applications. In this study, 3D printed honeycombs are investigated for subsequent crush efficiency with quasi-static and dynamic crush tests. 3D printing, rather than conventional manufacturing, allows for structural modifications within the honeycomb that influence its force-displacement profile. Buckling initiators on the face and/or vertex of honeycombs should reduce the initial peak stress and increase the strain at which densification, the point at which the stress once again increases, begins. The experiment is not complete, but thus far, buckling initiators have proven to decrease the initial peak stress of tested honeycombs. Future directions for the project include testing honeycombs of other materials with buckling initiators, and the implementation of variations of current buckling initiator designs.

Post-Processing of Topology Design

Jude Thaddeus Persia, Myung Kyun Sung, Dr. Soobum Lee

Wind tunnel force balances are utilized in the aerodynamics industry to predict the applied loads on an aircraft during wind tunnel testing. A major challenge in designing the force balances is the section responsible for measuring the axial forces, as these forces are often an order of magnitude less than the other applied loads. An optimization code, written in MATLAB, is utilized to generate a mathematical model of this component that satisfies the design requirements for measuring the axial forces. This 2D topological model is an idealized theoretical model, and is then interpreted as a more practical geometric model through the use of commercially available FEM software. ANSYS workbench was used in this study to post-process the topological result into a CAD model that achieves compatible results. Our proposed post-processing method parameterizes and optimizes the geometric model through the use of existing functions within ANSYS. The optimization function modifies key components of the geometry until the design requirements are satisfied. This post-processing method of the original topology is projected to include manufacturability as a factor in obtaining a feasible result.

Thermoelectric analysis of composite p-type and n-type films

Arjun Trivedi, Kendall Jackson, Dr. Deepa Madan, Priyanshu Banerjee

Thermoelectric materials have the capability to generate electrical energy from temperature gradients. Since practically all energy conversion processes lose some energy to heat, thermoelectric generators (TEGs) would offer a way to reintroduce waste heat into the system as electrical power, therefore improving electrical efficiency. Applications of TEGs range from recharging batteries in wireless sensor networks located in remote areas, to using human body heat to power internal electronic devices. Thermoelectric materials must have high power factor,
meaning the material has a high Seebeck coefficient and electrical conductivity, and a low thermal conductivity in order to generate sufficient power. Bismuth Antimony Telluride (BST) with added Tellurium and Magnesium Silicide (Mg$_2$Si) with added Tin composite films of varying weight ratios and particle sizes were synthesized using plant-based chitosan in order to optimize the power factor. Increasing the percentage of added Tellurium and Tin increased the Seebeck coefficients of the BST and Mg$_2$Si films respectively. However, electrical conductivity of both BST and Mg$_2$Si decreased with increasing amounts of added material, therefore lowering the power factor. The highest power factor for BST was achieved with 60 mesh particles, a weight ratio of 1:7000, a pressure of 200 MPa, and no added Tellurium. Likewise, the highest power factor for Mg$_2$Si was observed with 325 mesh particles, a weight ratio of 1:5000, a pressure of 200 MPa, and no added Tin. Further studies should focus on optimizing the thermal conductivities of these materials and creating TEGs using Mg$_2$Si and BST films.

Using MATLAB to Run a Split-Step Fourier Analysis on Oscillators

Jasper Scelsii+, Curtis Menyuk, Chaoran Tu, Zhen Qi

Oscillators are devices that produce a signal that varies sinusoidally as a function of time. The characteristic equation of this, shown with $s$ being the signal and $t$ being time, is $s(t) = s_0 \cos(\omega t + \phi_0)$. Current and voltage can be graphed independently against time, or together to make a phase plot. Resistors can cause current and voltage to spiral into the origin of a phase plot due to damping, and can even cause them to dampen away completely. This “death spiral” is unacceptable in real oscillators, and it must be compensated by a source of energy that makes up for the loss. Equations given in the text showing the relationship between current, voltage, and resistance were verified through substitution into the governing equations. MATLAB was learned and used to modify a given piece of code to plot the driven oscillation for five different driving frequencies. This required the use of the split-step Fourier method. The equation being solved had two parts, a linear part and a nonlinear part. To solve it, two different Fourier transforms must be used. The equation must be separated and the correct Fourier transform must be used on each part.
## Poster Presenter Assignments

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<td>Katrina Kelly</td>
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<td>Hana Tekle</td>
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<td>Reneece Skeen</td>
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** Psychology, Atmospheric Science, Public Health, Environmental Science, Geography and Environmental Studies, Physiology
The Graduate School-Newark supports scholarly inquiry and intellectual growth across 25 disciplines ranging from the arts, humanities, sciences, business, urban and global studies. We offer programs in several STEM fields including Masters and PhD programs in Biological Sciences, Chemistry, Environmental Sciences, Physics (Applied), and PhD programs in Behavioral and Neural Sciences, Mathematical Sciences, and Psychology. The majority of PhD students are offered competitive funding packages which may include a stipend, tuition remission, and health care. The Graduate School-Newark has been awarded an NSF Bridge to the Doctorate grant and NSF Minorities in Biomedical Research Support grant to help support students in STEM programs.

Established in 1981 as a unit within the School of Engineering, the Center for Minorities in Science and Engineering provides academic support services and outreach programs designed to recruit, retain, and graduate African American, Hispanic American, and Native American engineering students.

The Graduate Program in Life Sciences (GPILS) offers cutting edge research training in basic, biomedical, clinical and population sciences. We offer seven Ph.D. granting graduate programs and three M.S. level programs. Our graduate programs cover the entire range of biomedical research, from the basics of protein structure and molecular biology, through integrative systems physiology, microbial pathogenesis and vaccine development up to behavior, cognition, population-based genetics, and the impact of the environment on human health. Our programs place a special emphasis on the importance of translational research.

The College of Science at George Mason University blends traditional science education with sought-after programs in molecular medicine, climate dynamics, planetary science, forensic science, environmental studies, and geoinformation science to prepare students for exciting careers at the cutting edge of interdisciplinary scientific domains.
UMBC is the second largest public research University in the state of Maryland, with an overall enrollment of roughly 11,000 undergraduate students and 3,000 graduate students. The UMBC Physics Department has two different graduate programs:

**PhD program in Physics:** This program includes a standard physics core curriculum, with research opportunities in the areas of astrophysics, condensed-matter physics, as well as quantum optics and quantum information science.

**PhD program in Atmospheric Physics:** This program includes a specialized curriculum with a focus in atmospheric physics, and research opportunities in the areas of remote sensing, atmospheric modeling, and climate dynamics.

The UMB Graduate School offers graduate education and training in biomedical, health, and human service sciences. We offer 17 Master of Science (MS), 13 Doctor of Philosophy (PhD) degree programs, and 12 post-baccalaureate certificate programs in these areas of study.

As a comprehensive, Top 100, R-1 research university, Drexel University provides graduate-level education with a focus on innovation, research, and practical application of learning. The University's programs are designed to furnish the concrete knowledge that will aid students in career advancement. Located in Philadelphia, Pennsylvania, our Graduate College includes:

- 90+ master's programs
- 35+ doctoral programs
- 70+ certificate programs
- Offered across 14 Colleges in Full-time, Part-time, and Online Options

Graduate level offerings include MS and Ph.D. Information Systems, MS and Ph.D. Human Centered Computing, MS Information Systems (online), MPS Health IT.
The Organization for Tropical Studies is a nonprofit consortium of more than fifty universities, colleges, and research institutions from around the world with the objective of providing leadership in education, research and the responsible use of natural resources in the tropics. To this end, OTS offers intensive field courses for undergraduates, graduate students, and natural resource professionals in tropical biology and related disciplines in Costa Rica and South Africa. OTS maintains research stations in three ecologically diverse ecosystems in Costa Rica and one in South Africa.

UMBC reflects the future of research universities. Young and dynamic, the university is small enough to provide personal attention, yet large enough to provide a rich and diverse experience. With over 80 master's, doctoral, and certificate programs, UMBC seeks to provide you with an enriched experience drawing upon leading scholars attracted to a campus that prides itself on diversity and multiculturalism.
The School of Agricultural and Natural Sciences
has three academic departments:
Agriculture, Food and Resource Sciences
Human Ecology
Natural Sciences

Graduate programs, at both the masters and doctoral levels, are offered in marine estuarine and environmental sciences (MEES) (M.S., Ph.D.) food and agricultural sciences (M.S., Ph.D.), and toxicology (M.S., Ph.D.).

Strong RESEARCH and EXTENSION programs are integrated with the school’s academic programming.

Our Sponsor:

Partner Agencies:
NSF Bridge to the Doctorate Fellowship
Boise State University

Eligibility:
- Must be admitted to a Boise State STEM M.S. or Ph.D. program for fall 2020
- Must be a U.S. Citizen, U.S. National, or permanent resident
- Provide evidence of participation in LSAMP programs from the LSAMP Director/Coordinator at undergraduate institution

PNW Graduate Fellows Program

Fellowship Benefits
- Stipend of $32,000 annually, plus tuition and fee supplement, up to $12,000 annually, for first two years.
- Continued funding support at unit level through to graduation.
- Community building among fellows.
- Individual faculty mentors provided to Fellows.
- Enriched academic and research opportunities
- Participation in annual PNW LSAMP Alliance Conference and Graduate Showcase.

Questions? Contact stem@boisestate.edu

Find more information on our website:
https://www.boisestate.edu/stem/lsamp/bridge-to-doctorate-fellowship/
EXHIBITORS

VIRGINIA - NORTH CAROLINA LOUIS STOKES ALLIANCE FOR MINORITY PARTICIPATION

BRIDGE TO THE DOCTORATE
AT THE UNIVERSITY OF VIRGINIA

ABOUT
• $32,000 stipend
• Cost of education allowance including:
  - tuition and university fees
  - health insurance
• Funding guaranteed for up to six years for students in good academic standing
• Three-week residential transition program
• Mentoring institute
• Support for writing fellowship applications

PH.D. PROGRAMS
• Astronomy
• Biology
• Biomedical Engineering
• Biomedical Sciences
• Chemical Engineering
• Chemistry
• Civil and Environmental Engineering
• Computer Engineering
• Computer Science
• Electrical Engineering
• Environmental Sciences
• Mathematics
• Materials Science and Engineering
• Mechanical and Aerospace Engineering
• Physics
• Statistics
• Systems Engineering

ELIGIBILITY
• Must have been a Level 1 LSAMP student as an undergraduate

FOR MORE INFORMATION, VISIT:
LSAMP.VIRGINIA.EDU

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Office of the Vice President and Chief Officer for Diversity and Equity, Office of Graduate Postdoctoral Affairs, National Radio Astronomy Observatory, College and Graduate School of Arts & Sciences, School of Engineering and Applied Science, School of Medicine