Virginia Academy of Science
Fall Undergraduate Research Meeting

Saturday, October 28, 2017

Hampden-Sydney College
Hampden-Sydney, VA

9:00 am - 4:30 pm

The VAS Fall Undergraduate Research Meeting is a research grant proposal competition, which has been held annually since the Fall of 2001. Undergraduate students conducting research projects under the mentorship of VAS members at Virginia colleges and universities are invited to participate.

Interested students (along with their mentors must submit their grant applications/ research proposals by the stated deadline (October 1) and then present posters outlining their research projects at the Fall Undergraduate Research Meeting. Both the research proposals and the poster presentations are evaluated to determine the recipients of the grants.

Nine research grant awards of $750 each will be given to the top student research proposals-poster presentations selected by the Fall Meeting Judges. The recipients of these grant awards will be announced at the conclusion of the meeting. The grant award recipients will also be awarded Student Membership in the VAS for 2018 and will be expected to present the results of their funded research at the 2018 VAS Annual Meeting in May at Longwood University.

VAS President-Elect Woodward Bousquet, Professor of Environmental Studies and Biology at Shenandoah University, serves as the Program Chair for the 2017 Fall Undergraduate Research Meeting.

Corporate sponsorship of the 2017 Fall Undergraduate Research meeting has been provided by Michael Rolband, President, Wetland Studies and Solutions, Inc. (WSSI), a Davey Tree Company. The Academy wishes to thank Mr. Rolband and WSSI for supporting today's conference, and for promoting scientific research, science education, and environmental sustainability.

The Academy extends special thanks to the administration, faculty and staff of Hampden-Sydney-College for hosting the VAS 2017 Fall Undergraduate Research Meeting. The support of both President Larry Stimpert and Dean of the Faculty Walter McDermott are especially appreciated. Food service for this event has been provided by Thompson Hospitality at Hampden-Sydney College.

Special thanks are extended to the following individuals who are serving as Judges at this the meeting:

Robert Atkinson, Christopher Newport University
Jessica Campo, Wetland Studies & Solutions, Inc.
Michael Hammond, Meadowview Biological Research Station
David Knight, Christopher Newport University
Deborah Neely-Fisher, Reynolds Community College
Christopher Osgood, Old Dominion University
Parrish Waters, University of Mary Washington
Michael Zimmerman, Shenandoah University

Special thanks are also extended to the following individuals who are serving as panelists for the Science Careers Discussion:

David Byrd, US Fish & Wildlife Service
Carolyn Conway, VA Academy of Science and VCU (retired)
Thomas Irungu, Optima Health
Josh Walker, Wetland Studies & Solutions, Inc.
Michael Wolyniak, Hampden-Sydney College

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Hampden-Sydney College
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SCHEDULE OF EVENTS

9:00 - 9:50 **Check-In/Registration** (Crawley Forum)
Poster Set-up and Meet and Greet (Crawley Forum)

All meeting attendees should check in at the Check-In Table in the Registration Area.

Following Check-In student applicants for the Undergraduate Research Grants should set up their posters on their assigned poster boards.

Coffee, tea and other beverages will be available for all meeting registrants in the Check-In area.

9:15 - 9:45 **Judges Meeting** (Crawley Forum Viar Room)

All judges will meet with the VAS President-Elect and review the criteria for evaluating the proposals and posters as well as the procedure for selecting the grant recipients.

9:50 - 10:00 **Welcome, Opening Remarks and Instructions**
(Crawley Forum)

Woodward Bousquet, Environmental Studies Program, Shenandoah University, VAS President-Elect and Fall Undergraduate Research Meeting Coordinator

10:00 - 12:30 **Evaluation of Posters** (Crawley Forum)

Each poster will be evaluated by a team of judges. The judges will meet with the grant applicants and the applicants should be prepared to give a brief summary (≤5 minutes) of the proposed research and then respond to questions from the judges.

12:00 - 1:45 **Lunch Break and Panel Discussion** (Settle Hall – South Dining Room)

Lunch and beverages will be available for all meeting registrants in Hampden-Sydney's dining facility.

A panel discussion - *Advice from Science Professionals about Careers and Graduate School* - will take place from 12:45 - 1:45.

12:30 - 3:00 **Judges Lunch and Meeting** (Settle Hall – Main Dining Room)

During this lunch meeting the judges will select the recipients of the 2017-2018 VAS Undergraduate Research Grant Awards.

2:00 - 2:15 **Welcome to Hampden-Sydney College** (Gilmer Hall Room 019)

J. Larry Stimpert, President, Hampden-Sydney College

Michael Wolyniak, Elliott Associate Professor of Biology**,** Hampden-Sydney College

2:15 - 3:15 **Invited Keynote Speaker** (Gilmer Hall Room 019)

Kristian M. Hargadon, Elliott Associate Professor of Biology, Hampden-Sydney College

Tipping the Balance in the War on Cancer: How Insights into the Basic Biology of Tumor Progression are Revolutionizing Cancer Therapy

Recent years have been witness to an explosion in therapeutic strategies for the treatment of cancer. In particular, immunotherapy and targeted therapies have been met with unprecedented success in the clinic and have emerged as powerful weapons to combat this dreaded disease. In his keynote address, Dr. Hargadon will discuss how these advances in cancer therapy have been made possible only by advances in our understanding of the basic biology of tumor progression. Using work from his laboratory on melanoma-associated immunosuppression and the role of the FOXC2 transcription factor in melanoma growth and metastasis, he will emphasize the ongoing need to gain new insights into cancer progression and highlight how undergraduate student researchers in his lab are making contributions that may ultimately inform the design of novel cancer therapies in the future.

3:15 - 3:45 **Announcement of Grant Recipients** (Gilmer Hall Room 019)
Robert Atkinson, Christopher Newport University, VAS President

3:45 - 4:00 **2017-2018 Undergraduate Grant Recipients Assemble for Photographs** (Gilmer Hall Room 019)

3:45 - 4:30 **Poster Removal** (Crawley Forum)
Check-Out and Departure (Crawley Forum)

Student applicants/poster presenters for the Undergraduate Research Grants should remove their posters from their assigned poster boards and leave the poster board and push pins with the easel for subsequent pickup.

POSTER PRESENTATIONS

1 **The Genetic Diversity of Apple (*Malus pumila*) Varieties**
John Christman
Mentor: Janet Steven, Dept. of Organismal & Environmental Biology, Christopher Newport University

My research will estimate the genetic diversity, or lack thereof, in locally grown apples of Virginia. This project uses microsatellites in conjunction with techniques of statistical analysis in order to quantify levels of diversity across apple varieties and also within them.

2 **Synthesis and Characterization of Polyether Ether Ketone (PEEK) Polymer**
Eric Bowen
Mentor: Rupak Dua, Chemistry Dept., Hampden-Sydney College

Polyether Ether Ketone (PEEK) polymers are a class of thermoplastics that have growing applications to the world of medicine mainly in spinal fusion cages and dental implants. However, lack of osteogenic properties and biological inertness limits its application. This research project is the first step to address those issues by understanding the synthesis of PEEK polymer through a nucleophilic aromatic substitution and enhancing its properties by reinforcing with other biomaterials into PEEK polymer.

3 **Effects of Diosmetin on Apoptosis and Protective Pathways in HEPG2 Cells**
Caleb Abel, Jessie Rogers and Nicholas Lehning
Mentor: Gregory Raner, Dept. of Biology & Chemistry, Liberty University

This research will address health benefits that have been ascribed to the Brazilian Acai berry by exploring effects of certain components of the berry on specific genetic and biochemical pathways. Specifically, the flavonoid compound diosmetin, isolated from the acai, will be tested in cell culture to evaluate its influence on antioxidant and other protective pathways, along with apoptosis.

4 **The Effects of BRD3 Bromodomain Cancer Mutations on Gene Expression**

Maurice B. Manchester
Mentor: Erin K. Shanle, Dept. of Biological & Environmental Sciences, Longwood University

BRD3 is a bromodomain-containing protein that has been found to be required for expression of some genes such as cyclin-D1. Previous research has shown that cancer mutations can affect the binding of the BRD3 bromodomain. The aim of this project is to test the effects of these BRD3 cancer mutations on gene expression in human cells.

5 **Phenotypic Characterization and Spatial and Temporal Analysis of Gene Expression in Aintegumenta (ANT) Early Responsive to Dehydration 10 (ERD10) Double Mutants in *Arabidopsis***

Rachel Evans
Mentor: April Wynn, Dept. of Biological Sciences, University of Mary Washington

Spatial and temporal gene expression patterns of two genes, AINTEGUMENTA (ANT) and EARLY RESPONSIVE TO DEHYDRATION 10 (ERD10), will be examined using *in situ* hybridization techniques to identify the location of these two genes. Overlapping expression locations between ANT and ERD10 will help support that they jointly function in floral patterning and ovule development.

6 **Analyzing Litterfall and Plant Community Morphology as an Estimation of Primary Production in Restored Peatlands**

J. Mitchell Doyle
Mentor: Robert B. Atkinson, Dept. of Organismal & Environmental Biology, Christopher Newport University

Peatlands sequester carbon in their living biomass and contribute to soil organic material. These inputs may be affected by depth to water table which is expected to change as restoration efforts continue. We seek to estimate the carbon contribution from primary production at two sites with differing hydrology.

7 **Assessment of Zebra Mussel (*Dreisenna polymorpha*) Colonization Potential Using Atomic Absorption Spectroscopy**

Nick Blankenship and Kyle Haley
Mentor: Tim Durham, Maria Puccio and Delia Heck, Biology, Chemistry & Environmental Science Depts., Ferrum College

By collecting water samples via Van Dorn sampler, analyzing calcium and magnesium concentrations via atomic absorption spectroscopy (AAS), and comparing data from lakes infested with zebra mussles (*Dreissena polymorpha*), it can be determined if Smith Mountain Lake is a suitable habitat for zebra mussels

8 **Identification of FOXC2 Target Genes in Melanoma through Chromatin Immunoprecipitation**

David Bushhouse
Mentor: Kristian M. Hargadon, Biology Dept., Hampden-Sydney College

To determine the gene targets of the FOXC2 transcription factor in B16-F1 melanoma, we are developing a chromatin immunoprecipitation/quantitative PCR assay. We are currently optimizing a protocol to produce consistent enrichment readouts with low background and propose to generate a novel CRISPR-Cas9-engineered FOXC2 knockout variant of wildtype B16-F1 melanoma for use as a negative control in these ChIP-qPCR studies.

9 **Low Level Atrazine Exposure Effects on Crayfish Development**

Nathan Chandler, Mackenzie Lecher, Austin Minuto, Samuel Owens, Abbie Suttle and Caroline Williams
Mentor: Kyle Harris, Dept. of Biology & Chemistry, Liberty University

Atrazine is a commonly used herbicide that acts as an endocrine disruptor in animal physiology. Its effects on invertebrates, primarily crayfish, is not well understood. This study will examine environmentally relevant concentrations, focused around the EPA limit of 3 µg/L. Morphological and histological data will be examined for signs of feminization and tissue degradation.

10 **The Role of Parasitism in the Maintenance of a Mutant Reproductive Strategy in Bluegill Sunfish (*Lepomis macrochirus*): A Histological Study**

Candace Ashworth
Mentor: Michael R. Zimmermann, Biology Dept., Shenandoah University

Bluegill sunfish (*Lepomis macrochirus*) have two male morphotypes that differ in their reproductive strategy and success, but persist in natural populations in equal frequencies. This project is investigating the role of parasitism into the maintenance of the mutant phenotype in natural populations through field collections, necropsy, and histological sectioning.

11 **Molecular Insights into Circadian Regulation of p53 Tumor Suppressor Function**

Sarah Jachim and Kelsey O'Hern
Mentor: Carla V. Finkielstein, Dept. of Biological Sciences & Biocomplexity Institute, Virginia Tech

The overall goal of this project is to understand how cells synchronize their division cycle to specific times of the day. To accomplish this, we propose to use a combination of biochemical, cell, and molecular techniques to better define key molecular players and evaluate the impact of cancer-related mutations for the function of the time-sensing signaling process.

12 **Spider Ballooning: The Effect of Physical Parameters on Take-off, Flight, and Settling**

Jessica Masterson
Mentor: Iordanka Panayotova, Dept. of Mathematics, Christopher Newport University

Spider “ballooning” is one of the most fascinating mechanisms for dispersal. Through ballooning, spiders can travel as far as 3000 km and as high as 5 km. The goal of this project is to study the effect of physical parameters, as mass, length of the dragline, bending modulus, etc. on the spider’s velocity and distance traveled. Data from a 3-D numerical simulation model will be used and mathematical software tools as VisIt and MATLAB will be utilized to analyze the dependence between parameters.

13 **Metalobomics of Chronic Disease**
Ali Jaber
Mentor: Ancha Baranova, School of Systems Biology, George Mason University

HPLC technology will be used to determine differentially expressed metabolites involved in the pathogenesis and etiology of fibrotic tissue formation in the context of NASH (non-alcoholic steatohepatitis) in the sera of a cohort of morbidly obese subjects. These metabolites will be used to assess the metabolomic changes that occurs in the progression and staging of NASH.

14 **Developing Titanium Smart Implants for Orthopedic Applications Based on Biomimetic Design**
Drew Elliott
Mentor: Rupak Dua, Chemistry Dept., Hampden-Sydney College

The development of effective arthroplasty implants must consider antibiotic resistance of local bacteria as well as osseointegration. This project addresses these concerns by engineering titanium surface nanowire arrays inspired by arrays found on cicada wings, offering the possibility of implants displaying bactericidal properties and at the same time promoting the proliferation of mammalian cells.

15 **A Stream Continuum Analysis of Bacteria Community Assembly in Association with Crayfish and their Symbionts**
Matthew Cooke, Luke Fischer, Kaleb Bohrnstedt and Thomas Kepler
Mentor: Kyle Harris, Dept. of Biology & Chemistry, Liberty University

Our experiment will explore several key ideas that are central to the River Continuum concept as well as the crayfish microbiome. Our studies will include analyzing the makeup of *Carambus bartonii*'s microbial flora, as well as studying the effects that symbiotic worms have on this microbial makeup. This data will then be related to stream site location and environmental conditions within the selected watershed.

16 **The Effect of Cognitive Stimulation on Senescent Cognitive Decline**
Alexandra Piercy
Mentor: R. Parrish Waters, Dept. of Biological Sciences, University of Mary Washington

The percent of elderly people in the US is increasing, making it important to understandsenescent cognitive decline. This study aims to understand the effects of daily cognitive exercise on general cognition, by using a senescent mouse model to compare behavioral and physiological differences between a cognitively stimulated group and control group of mice.

17 **Studies of Drug Interactions with Mammalian Serum Albumins**

Ethan Steen and Barat Venkataramany
Mentor: Wladek Minor, Dept. of Molecular Physiology & Biological Physics, University of Virginia

Studies have shown that the modes of circulatory drug transport between model animals and humans may be different. This may stem from dissimilar interactions with serum albumins, posing an important question during clinical studies. We are looking to better understand how different drugs and antimicrobial agents bind to mammalian serum albumins and compare them to previously determined interactions with human serum albumin.

18 **The Effect of Herbicide on Soil Carbon Respiration in Peatland Soils with Different Hydrology Treatments**

Katrina Napora
Mentor: Robert Atkinson, Dept. of Organismal & Environmental Biology, Christopher Newport University

Peatlands sequester carbon and mitigate climate change, but have been drained affecting water table levels. These water levels affect soil aeration and microbial respiration. In addition, selected forest stands were herbicided and replanted. This study seeks to simulate field conditions in soil core microcosms in order to predict the effect of natural resource management on respiration rates.

19 **Characerizations of Terpene Extractions of *Abies fraseri* via GC Mass Spectroscopy**

Taylor Darnell
Mentor: Tim Durham and Laura Grochowski, Biology & Chemistry Depts., Ferrum College

By analyzing terpenes that were extracted from Fraser Fir trees in North Carolina and Virginia, via gas chromatography-mass spectroscopy, elevational differences and soil composition do influence terpene production. All samples were analyzed to determine structural differences in the terpene production levels between North Carolina and Virginia populations.

20 **Effects of Ethanol Exposure in the Striatum during Development in Mice**

James Ingersoll
Mentor: Erin Clabough, Biology Dept., Hampden-Sydney College

Prelimary results show that a single ethanol intoxication episode during brain development in mice can dramatically alter striatal medium spiny neuronal morphology immediately after the insult. This project investigates the impact of ethanol on the number and type of medium spiny neuron dendritic spines, as well as changes in the expression of synaptic markers 24 hours after ethanol exposure.

21 **Characterization of pH Regulation in *Cryptococcus neoformans***

Kristen I. John
Mentor: Michael Price, Dept. of Biology & Chemistry, Liberty University

Cryptococcus neoformans is an emerging fungal pathogen that is particularly skilled at adapting to its human host in order to avoid being killed by the immune system. One way it does this is by its pH regulation system of the Rim pathway. Four specific genes in this pathway will be characterized through gene deletion constructs and biolistic transformation.

22 **Determining the Effects of Mutations in P300 on Gene Expression in Cancer Cells**

Katlyn Myers
Mentor: Erin K. Shanle, Dept. of Biological & Environmental Sciences, Longwood University

Previous research has demonstrated that mutations to the P300 protein in the bromodomain region disrupts binding to acetylated histones. The purpose of this study is to examine the functional effects of P300 bromodomain mutations on gene expression in cancer cells by expressing wild-type and mutant P300 protein in cancer cells and measuring RNA levels of genes.

23 **3D Structure Determination and Refinement of Aldo-keto Reductase Proteins from *Klebsiella pneumoniae* 342, *Sinorhizobium meliloti* 1021, and *Polaromonas sp.* JS666**

Evan Leung
Mentor: Wladek Minor, Dept. of Molecular Physiology & Biological Physics, University of Virginia

This project incorporates methods of protein crystallography to build 3D structures of four aldo-keto reductase proteins in complex with different substrates. These proteins originate from bacteria *Klebsiella pneumoniae* 342, *Sinorhizobium meliloti* 1021, and *Polaromonas sp.* JS666, which have pertinent implications in pathology, agronomy, and biodegradation. Solving 3D structures ultimately allows us to study and target essential mechanisms within each organism.

24 **DNA Detection by Thiazole Orange: A Safe, Non-damaging Replacement for Ethidium**

Casey O'Neil
Mentor: Todd Gruber, Dept. of Molecular Biology & Chemistry, Christopher Newport University

This project investigates thiazole orange as a sensitive DNA detection reagent to replace common dyes such as ethidium bromide and SYBR Safe. It is a promising alternative to other dyes due its high fluorescence intensity, sensitive detection limits, lack of carcinogenic status, low cost, and visibility under blue light as opposed to UV light.

25 **Sandcastle Worm Inspired Bioadhesive for Musculoskeletal Tissue Repair**

Philip James Mollica III
Mentor: Rupak Dua, Chemistry Dept., Hampden-Sydney College

Bone and tissue adhesives are beneficial and are mostly used as supplement to standards methods of musculoskeletal tissue repair. However, the adhesive that can do the repair all by itself is still a huge challenge. My research project aims to develop a synthetic glue inspired by Sandcastle worm's glue which is strong, quick setting, and functional in an aqueous environment.

26 **Encapsulation and Release of Enzymes and Florescently-labeled Dextrans in pH-Sensitive Microspheres**

Carson Smith
Mentor: Michael Korn, Dept. of Biology & Chemistry, Liberty University

The effects, release characteristics and efficiency of encapsulation of enzymes and fluorescently labled dextrans in pH-sensitive microspheres will be determined using alkaline phosphatase and FITC dextrans.

27 **Quantitative Evaluation of *Clinostomum marginatum* Encystment in the Fish Host (*Perca flavescens*) and its Impact on Host Locomotor Performance**

Erica Morris
Mentor: Takashi Maie and Desi Justis, Biology & Chemsitry Depts., Lynchburg College

Our project examines the distribution of a trematode *Clinostomum marginatum* in an intermediate host fish, and estimates the impact of infestation on locomotor performance of the fish. Our goal is to test the hypothesis that C. marginatum reduces force production of the axial muscles during swimming behavior in the fish and thus facilitates its transmission to the definitive avian host.

28 **Effect of Benzo[a]pyrene on Expression of Alzheimer's Disease Marker Genes in Zebrafish (*Danio rerio*)**

Laura Mangano
Mentor: Dianne Baker, Dept. of Biological Sciences, University of Mary Washington

Benzo[a]pyrene, a carcinogenic polycyclic aromatic hydrocarbon found ubiquitously in the environment, is associated with impaired cognitive functioning and neurodegeneration in model organisms following exposure. Alzheimer's disease is a neurodegenerative disease that is influenced by genetic and environmental factors. The purpose of this study is to investigate the expression of Alzheimer's disease marker genes in zebrafish following embryonic exposure to benzo[a]pyrene.

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The Virginia Academy of Science

The **Virginia Academy of Science** (VAS) is the fifth largest state, region, or city academy of science in the US; it was founded in 1923 to promote the civic, academic, agricultural, industrial, and commercial welfare of the people of Virginia. Exemplary programs have included *Flora of Richmond and Vicinity* (published, 1930), the first comprehensive multidisciplinary studies of the James River Basin and the Great Dismal Swamp, volunteer research assistance to Virginia in the instance of the kepone pollution disaster, and leadership in establishing the Science Museum of Virginia.

The **2018 VAS Annual Meeting** will be held on May 23-25 at Longwood University in Farmville. All participants in the Fall Undergraduate Research Meeting are encouraged to participate in this meeting. Detailed information will be provided on the VAS website (www.vacadsci.org) as it becomes available.

VAS and VJAS Scientific Research Grants, Awards, Scholarships, Assistantships, etc. are made possible by hundreds of corporate and individual donors who believe in our work to benefit the people of Virginia. Many have found this a meaningful way to memorialize a loved one, support a student's education, or recognize the work of a colleague.

To Create an Endowment or Make a Donation, please contact Philip M. Sheridan, Executive Officer, Virginia Academy of Science at psheridan@vacadsci.org or 804-864-1451.

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Founded the Science Museum of Virginia … With the Garden Clubs of Virginia, established the Virginia State Parks System … … Established, with the early support of the DuPont family, the first Scientific Research Fund in Virginia ... Founded the Virginia Institute for Scientific Research (erected at the University of Richmond), the forerunner of Virginia Centers for Innovative Technology, funded by the Virginia General Assembly … Founded The Virginia Junior Academy of Science to foster original research in Virginia middle and high schools … Published the Flora of Richmond and Its Vicinity … Leaders' testimony at the Scopes Trial and later resolutions on evolution and its teaching in science curricula of Virginia schools … Advocated inclusion of women and African-American scientists and science educators in professional meetings … Founded the Virginia Journal of Science … Hundreds of teacher education and training programs in the sciences, mathematics, medicine, and technology … Established the Kiser Fund for Science Teacher Education … Published The James River Basin: Past, Present, and Future, funded by the Virginia General Assembly, the first comprehensive, multidisciplinary account of the James and its resources, landforms, flora, fauna, industries and businesses … Established the VJAS Research Fund to support scientific investigations by Virginia's secondary school students … Annually sponsors "The VJAS Experience" bringing hundreds of secondary students to Virginia colleges and universities to stay on campus and visit research facilities … Founded the Virginia Science Resource Network to mentor Virginia's teachers and students … Established the Annual Undergraduate Research Conference to financially support original research in four-year and two-year curricula … Established scientific advisory service to Virginia Governors and state agencies beginning with the state's kepone disaster … Supported the founding of the Virginia Institute of Marine Science (College of William and Mary) … Decades of leadership for the publication of the first *Flora of Virginia* since 1739 (to be published 2012)… … Annually awards over $80,000 in sponsored/endowed scholarships and prizes to Virginia middle and high school students for original research …

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