

News from the Hampden-Sydney Sciences 2015-16

Biology—by Erin D. Clabough

The 2015-2016 year has found the H-SC Biology department engaged in a number of interesting endeavors. In 2016, **Dr. Alison Burke** has joined the department as a visiting professor following completion of her dissertation work at Virginia Tech. **Dr. Rachel Goodman** started a new project in Oahu, Hawaii surveying introduced cane toads, poison dart frogs, and Japanese wrinkled frogs to determine if they carry two emerging wildlife diseases of global concern-- ranavirus and the chytrid fungus *Batrachochytrium dendrobatidis*. She collected tissues in July of 2015 and will be returning during her sabbatical to collect from new populations and species in March of 2016. **Dakota Reinartz '18** is starting lab work during the spring semester to extract DNA from these samples and conduct PCR tests to determine presence/absence and prevalence of the two pathogens.



Dr. Alison Burke worked with the H-SC Biology Department in the spring of 2016, teaching Principles of Biology lecture and laboratory sections

In 2015-2016, **Dr. Kristian Hargadon's** research on melanoma-associated immune suppression and factors that regulate melanoma metastasis has continued to be supported in the second year of a 2-year, \$125,000 grant funded by the Commonwealth Health Research Board. During this past year, he has published a major research article on melanoma-altered dendritic cell function in *Immunology and Cell Biology* (this article includes 5 H-SC student co-authors), an invited Author's View article summarizing the highlights and implications of this work in *Oncolmmunology*, and a Data Report of a whole genome expression microarray analysis of highly versus poorly tumorigenic melanomas in *Frontiers in Immunology*. Several students contributing to aspects of this project have also presented research at conferences across the country. Of note, **Stephen Woodall '15** received the Best Thematic Poster Award for the "Molecular Mechanisms of Infection and Immunity" Theme at the Annual Meeting of the American Society of

Biochemistry and Molecular Biology in Boston, MA for his work on developing a model system to study CD8+ T cell immune responses to melanoma. **Travis Goodloe '16** received the 1st Place Award at the Virginia Branch Meeting of the American Society for Microbiology (where he was judged against both undergraduate and graduate students) for his work on an assay to measure melanoma metastasis to tumor-draining lymph nodes. In addition to these projects, Dr. Hargadon has developed a laboratory module based on this cancer research that he has incorporated into the laboratory component of his Biology 201 - Genetics and Cell Biology course along with recently publishing an article in *Biochemistry and Molecular Biology Education* describing the benefits of this module for improving student understanding of gene expression. He was also the recipient of the Virginia Association of Science Teachers Recognition in Science Education (RISE) Award in the University/College Faculty category for 2015 (only one award is presented annually to a university/college faculty member in Virginia).

Dr. Ed Lowry has been busy in the greenhouse tending to ongoing experiments on invasive plants that he started over the past summer with student **Mason Luck '16**. They are looking for environmental factors that might help explain patterns of invasion seen on the High Bridge Trail of the noxious European species *Centaurea stoebe*. The laboratory work on *Humulus lupulus* (hops) plants and disease resistance has also been progressing as **Chris Hawk '16** works towards finishing his Honors thesis, patiently preparing many DNA samples of plant and fungus tissues. Chris has also been collaborating with the Chemistry Department to try to isolate and identify some of the aroma and flavor compounds in hop varieties we have cultivated locally.

Dr. Alex Werth recently published an article in *Journal of Morphology*, the leading international journal on animal anatomy and physiology, based on his sabbatical work in 2013-14. Professor Werth is first author on the article, with colleagues from Alaska and British Columbia, entitled "Baleen wear reveals intraoral water flow patterns of mysticete filter feeding." The article, based on years of research spent looking at whale anatomy in museum collections and in the field (particularly Alaska and Iceland), reports a novel finding of wear patterns in the filtering material, called baleen, that hangs like curtains from the roof of each whale's mouth, enabling whales to filter tiny plankton or fish from seawater. Werth and his colleagues discovered from gross and microscopic examination of many species (including blue, humpback, and other whales) that the baleen tissue provides clues as to how water flows through the mouth as it enters, is filtered, and exits. This is the first time anyone has shown that



Chris Hawk '16 tends to hops plants in the greenhouse as part of his summer 2015 research project

been active in Dr. Clabough's lab over the past year. Dr. Clabough's Neurobiology class wrote and published a review article in February 2016 entitled "Modifier genes in Huntington disease" in the *Encyclopedia of Life Sciences- eLS* - published by Wiley-Blackwell, the international scientific, technical, medical, and scholarly publishing business. Student authors are **Jefferson Thompson '16, James Lau '17, Mel Savarese '16, Evan Harris '16, Sean Manos '16, Charlie Kyle '16, Taylor Meinhardt '16, John Sheffield '16, Michael Bouldin '16, Myshake Abdi '16, Gus Mohay '16, Robert Harriss '16, Mason Luck '16, Mitch Owens '16, and John Britt '17**. Dr. Clabough was awarded a 2015 Faculty for Undergraduate Neuroscience 2-year loan of a Roto-Rod Motor Skill Measurement System from San Diego Instruments for her collaborative proposals "Detection of Motor Abnormalities in a Chronic, Mild Fetal Alcohol Spectrum Disorder (FASD) Model in Swiss Webster Mice," and "Behavioral Characterization of GRP56 Knockout Mice." Dr. Clabough is incorporating the Roto-Rod system into courses she is teaching at H-SC. Dr. Clabough also presented a poster entitled "Cell Phones for Sea Turtles" at the Southeast Regional Sea Turtle Network meeting in Mobile, Alabama in February 2016.

Dr. Mike Wolyniak worked to bring a course-based research experience into the BIOL151 labs this fall, exploring the hops microbiome. In December 2015, he took **Taylor Meinhardt '16** and **Will Echols '17** to the Annual Meeting of the American Society for Cell Biology in San Diego. Taylor presented a poster on his work on actin cable nucleation completed this summer at the National Institutes of Health under the guidance of Dr. Sricharan Murugesan, a colleague who has worked with several classes at Hampden-Sydney. Conducting Honors research this year are **Christopher Hawk '16, Mason Luck '16, Jacob Rockenbach '16, and Charlie Kyle '16**. Chris and Mason will present their work at the National Conference for Undergraduate Research in Asheville, NC in April, while Jake and Charlie will present their work along with **Travis Goodloe '16 and Jefferson Thompson '16** at the Experimental Biology Annual Meeting in San Diego in April.



Dr. Ed Devlin, seen here working with Developmental Biology students, is retiring in 2016 after 26 years of service

baleen becomes worn, and also helps scientists to understand the physical and biological processes of whale feeding--the major focus of Werth's ongoing collaborative research projects. Dr. Werth also recently had a paper accepted by PLOS One entitled "Baleen Hydrodynamics and Morphology of Cross-Flow Filtration in Balaenid Whale Suspension Feeding." Dr Werth co-authored several papers (presented at different conferences) with colleagues from Woods Hole, Alaska, and other places, and he presented a paper with **Robert Harriss '16** at the Society for Marine Mammalogy meeting in San Francisco in December entitled "How do whales stow their baleen? A comparative biomechanical analysis." In August 2015, Dr. Werth's article, "Inertia vs. Freedom in Faculty Life: Surviving a clash between the most powerful force in the universe and the most perilous perk in academe," was published in *The Chronicle of Higher Education*.

Newest biology faculty member **Dr. Erin Clabough** explores questions of neurodevelopment using molecular, cellular, and behavioral techniques. Students **Tyler Reekes '17, Myshake Abdi '16, Jamie Ingersoll '18, and Josh Chamberlin '17** have

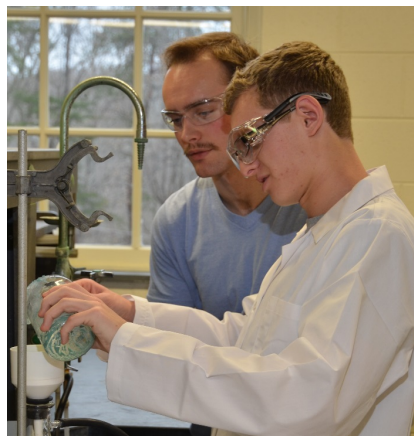
In 2015, **Dr. Ed Devlin** biked from HSC towards Santa Fe using Highway 66—a whopping 1,720 miles (2,768 km) over 62 days! Professionally, Dr. Devlin has shifted his focus and professional energy to pedagogy in recent years. His interest in teaching in the classroom has taken the form of staying quite current in the literature, using case studies and journal articles as a supplement the traditional course material in the classroom. Dr. Devlin is winding down a long and rewarding career in higher education, even though he still really enjoys working with students.

What's next for Dr. Devlin? He's sold his Porsche Boxster and bought a new Honda Odyssey minivan, which he converted into a "camper-van" of sorts. He and his wife, Cyndi, will be spending a couple of weeks in the high desert of New Mexico camping out and doing yoga and meditation this June. Starting shortly after graduation this May, they will be traveling for a year or

so, mostly in the southwest, Taos, Santa Fe, Tucson, but also Florida, Asheville, NC and elsewhere. Dr. Devlin's cheerful presence, quiet optimism, and pointedly challenging questions (delivered without fail at the conclusion of every student seminar) will be sorely missed in the department.

Chemistry—by Nicholas P. Deifel

The department worked with eleven students during a productive summer research session. **Dr. Herbert**



Brant Boucher '17 works with Colton Sheehan of PECHS to filter his coordination compound.

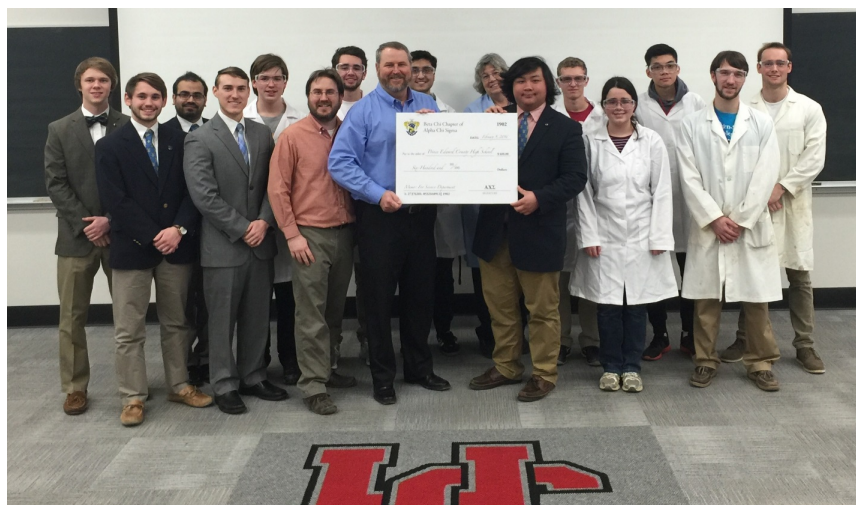
Sipe, Spalding professor of Chemistry, worked with Andres Garcia and **Myshake Abdi '18** over the summer to perform ESR characterization of biologically relevant molecules. **Dr. Nicholas Deifel** worked with **James Lau '17**, **Brant Boucher '17**, **Josh Chamberlin '17**, and **Conrad Brown '17** in synthesizing and characterizing Schiff-base transition metal complexes with an NN'OS coordination sphere. Conrad spent the remainder of his summer studying abroad with the Virginia Program at Oxford. For similar reasons, **Dr. Paul Mueller** worked with **Dane Asuigui '16** on a computational project involving molecular orbital calculations that allowed him to spend part of the summer studying abroad in Germany.

Dr. Mueller also mentored two other projects with **Ben Lam '17**, **Mitch Owens '16**, **John Sheffield '16**, and **Jason Halmo '17**. The main project involved traditional synthesis and characterization of a tridentate imine metal-ligand complex for use as a catalyst in the Baylis-Hilman reaction. Jason Halmo's project extended analytical work done by previous H-SC students leaching Barium ions from ceramic glazes. He presented this work at the Virginia Academy of Science's "Research Showcase at the Statehouse" with Josh Chamberlin who took on the project in the Fall semester.

Dr. Nicholas Deifel and six Hampden-Sydney chemistry students have partnered with Prince Edward County High School teacher Dr. Gary Lutz to

provide a six-week laboratory experience for an AP Chemistry class. The six teaching assistants are **Brant Boucher '17**, **Jason Halmo '17**, **Mark Mason '18**, **Persus Akowuah '18**, **Reed Mingione '19**, and **Brandon Knouse '19**. These H-SC students are providing a great service to their community and are gaining a mentoring experience that should provide useful when the move beyond the hill.

The chemistry department is happy to announce that nearly a quarter of its instrument endowment program has been funded. This program is being spearheaded by Dr. Herb Sipe and Venable Professor of Chemistry Emeritus, **Bill Porterfield**. This fund is designed to periodically replace important instrumentation.



Dr. Lutz of PECHS receives a check from AXΣ for equipment. His AP Chemistry class is also pictured.

Mathematics and Computer Science—by Heidi N. Hulsizer

For computer science, during the summer of 2015 students **JD Chaudhry '16** and **Zach Carter '17** worked on the Energy Research Laboratory (ERL) project by monitoring eight different temperatures and 32 different electrical power measurements. They worked with a Python program configured as a server to respond to the Wi-Fi client burst of values every 30 seconds and sent the values into a MySQL database. Also, **Travis Newcomb '18** created a new web interface and began development of an Android application for visualizing the data that has been monitored at ERL. This enormous task involved learning and writing programs in PHP, MySQL, html, css, JavaScript, JQuery, Android and Java. The web sites address is: <http://ergs.hsc.edu/ERG>. To see real-time power and temperature measurements at ERL, click on the Lab Data/Live Data button. Also, during the summer two students worked on Honors Research projects. **Sam Sheffield '17** and **Linh Nguyen '16** purchased

eight small parallel computer boards to bring High Performance Computing also known as parallel computing to the Hampden-Sydney campus. In their research, they built a parallel computer cluster by combining the eight parallel computer boards with a standard computer to communicate with the parallel cluster. They programmed the parallel cluster to perform matrix and vector mathematics. This new machine will be part of a parallel programming course **Professor Paul Hemler** is teaching this year. These students also presented their findings at Consortium for Computing Sciences in Colleges conference last fall. **Linh Nguyen '16** proposed and was awarded (1 of only 19) a \$5,000.00 National Computational Science Institute grant to develop a parallel computer version of two common SQL Database queries, SELECT and JOIN. This award included a two-week workshop at the National Center for



Carlo Aneslmo '18, Thomas Stauffer '19, Reuben Retnam '17, and Caleb Bowyer '16 representing Hampden-Sydney at the Mathematical Association of America section meeting at St. Mary's College of Maryland

Supercomputing Applications at the University of Illinois at Urbana-Champaign at the beginning of the summer. During this workshop he met and learned from top computational science professionals about writing parallel programs and how to execute them on the Blue Waters Supercomputer. On the mathematics side of things, **Professor Heidi Hulsizer** organized a paper session at the national MathFest in Washington D.C. in August, 2015, on Mathematics and Video Games.

During the fall, **Professor Hemler** and **Professor Tom Valente** took students **Sam Sheffield '17, Linh Nguyen '16, Greg Brownson '16, and David Foulke '16** to a regional

programming contest at Roanoke College. They placed 12 out of 30 teams from small colleges in the southeast. This is very encouraging as this was the first time the college has participated in this contest. Sam and Greg worked on developing programming contest skills over the spring semester and attended another programming contest at Mercer University in February 2016. **Carlo Anselmo '18, Thomas Stauffer '19, Reuben Retnam '17, and Caleb Bowyer '16** attended the Mathematical Association of America Section Meeting at St. Mary's College of Maryland in November 2015. **Professor Hulsizer** presented at the conference, her talk was entitled, "A 'Modern Mathematical Adventure in Call of Duty: Black Ops."

Physics and Astronomy—by Cecil M. Tiblin '18

Every year, the Physics Department brings something new and exciting to the table—this year has been no exception. Between exciting renovations to the floor and research from faculty and students, the department has been very busy.

The renovations to the physics floor were ground-breaking and widely anticipated. New tiles were installed on the floor, giving a more inviting look to the hallway. The lecture hall 019 was gutted and refinished with carpet and drywall, as well as new tables and chairs, making it a very popular and desired location for events and study halls.

Despite the hectic renovations, the department has been as busy as ever. Research has been continual and noteworthy, by both the students and the faculty. **Professor Steven Bloom** has recently submitted his book *Physics of Astronomy and Science Fiction*, which will be published this summer. Along with his book, he is continuing his research here at HSC to study gamma radiation emitted from Quasars. One of his students, **Caleb Boyer '16**, worked with him to study the life sequence of binary stars. **Professor Jonathan Koehane** has been working with his colleague Dr. Foy (a once visiting professor at H-SC) to publish their book *An Introduction to Classical Electro Dynamics*. This is an undergraduate textbook that is designed to teach Classical Electrodynamics to upper level physics students with an historical approach. He hopes to use this curriculum to help better convey the concepts of the course. This book is being published through the Yale University Press, and is to be released in the spring of 2017.

Professor Stan Cheyne has been busy with some personal research that he has been conducting with **Professor Mike McDermott** and Dr. Kinzer, a professor at Longwood University. They have been studying the nature of sound projected from a saxophone. They hope to be able to critique a player's technique by analyzing sound spectra of the music played, and determining the optimal pitch. Professor Cheyne is also working with **Professor Trey Thurman** and **Professor Koehane** with editing the general physics text book that they started using this year. The plan is to finalize the edition and implement it into the curriculum by next year.

A lot of work with the Departmental Honors students has been taking place, as well. **Professor Trey Thurman**, aside from his own personal research, is working with students by helping them carry out individual research projects that they are conducting. **Shaquann Seadrow '16** is currently working on pedagogical research. He is studying the psychological effects that specific learning styles have on the brain, depending on one's gender. He wants to find the most beneficial learning style and classroom structure for students. **Branch Vincent '16** is working on his green energy research that he has spent the last few years working on. He is currently focusing his work on the use of wind turbines for the collection of clean energy. He hopes to follow this route in his grad school career. **Linh Nguyen '16** spent time this last year researching the capabilities and limits of quantum computers by writing programs that would mimic the computers' processes. Although **Professor Mike McDermott** has assumed the position as the Dean of Faculty, he has been working with students as well. **JD Choudhry '16** has been continuing his work on Mossbauer Spectroscopy. They are currently attempting to perform Mossbauer Spectroscopy with a piezoelectric device. Clearly, the Physics and Astronomy Department has been quite active and busy!

Psychology—by Jennifer E. Vitale

This year, faculty in the department of psychology continued to pursue their ongoing research projects in the areas of cognition, development, psychopathology, and attention. This spring, **Dr. Daniel Mossler** will be presenting two posters at the annual meeting of the Eastern Psychological Association. The first, entitled "The use of the Internet and social media by elementary school children" and co-authored with Kelly Colgate of the Chase City School system and H-SC students **Charles "Paul" Ross '16**, **Samuel Slough '16**, and **Lee Carneal '16** addresses developmental changes in children's engagement with technology and media. The second, entitled "How teachers are teaching digital literacy in their classrooms" and also co-authored with Colgate, Ross, Slough, and Carneal, examines how elementary and high-school teachers are addressing the growing use of Internet and social media with their students. Both posters are reflective of Dr. Mossler's continuing work in the area of development and social media use. Future work in this area includes two current senior thesis projects under Dr. Mossler's supervision, both examining differences in social media use across school populations. The first, which is being conducted by Paul Ross, is examining differences in how social media is used by students and how technology is addressed by teachers in private versus public schools. The second project, conducted by Sam Slough, is testing the hypothesis that there are important generational differences in the acceptability of technology and social media. Taken together, these studies are a continuation of Dr. Mossler's sabbatical research, started in 2013, and focused on how technology and social media use are impacting children's cognitive and emotional development.

Dr. Jennifer Vitale continues her work on causal factors associated with the syndrome of psychopathy. In collaboration with Dr. David Kosson and Mr. Zachary Resch of Rosalind Franklin University and Dr. Joseph Newman of the University of Wisconsin-Madison, she presented last year at the bi-annual meeting of the Society for the Scientific Study of Psychopathy. The talk, entitled "Speed-Accuracy Trade-Offs: Testing the Affect Dysregulation Theory of Psychopathy Using a Lexical Decision Task" focused on predictions generated by a relatively new model of psychopathy known as the Affect Dysregulation Theory. In a departure from theories of psychopathy emphasizing innate emotion deficit, this theory proposes that the emotion-based symptoms of psychopathy (e.g., shallow affect, callousness, lack of empathy or guilt) are the result of a developmental history wherein the psychopathic individual has learned to blunt negative emotion experiences. According to the theory, what begins as an effortful strategy to deal with negative experiences and heightened negative emotionality, over time becomes a relatively automatic process that results in dysfunction in the individual's ability to process

emotional information. Data from a sample of incarcerated male psychopaths supporting predictions of the theory were presented at the conference and are currently in preparation for submission for publication.

Dr. Daniel Weese will spend the summer examining the thalamic reticular nucleus (TRN). The TRN has been demonstrated to act as a filter of traffic between the thalamus and cortex in sensory systems. The function of this filter is to employ inhibition to limit the flow of sensory signals that will be processed by the cortex. This is commonly known as attention. Attention is crucial in the selection of situationally-appropriate behavior. The process of behavior selection is performed by a circuit known as the cortico-basal ganglia-cortical loop. The cortex performs the analysis of stimuli present in the environment which it communicates to the basal ganglia. The basal ganglia in turn generates a number of possible responses that would produce favorable outcomes. Next, there is an analysis of the importance or salience of the stimuli. On this basis, basal ganglia selects the action. The motor thalamus receives the output of the basal ganglia and communicates with motor cortex which executes the behavioral command. The thalamic reticular nucleus lies between the thalamus and cortex. Dr. Weese hypothesizes that the thalamic reticular nucleus plays the same filter role in the motor system as in the sensory system and is involved in the selection of behaviors through this filtering process. Furthermore, Humphries and Gurney (2002) hypothesize that the thalamic reticular nucleus 1) enhances the contrast between selected and non-selected behaviors, and 2) prevents behavioral switching during transient changes in salience or when a closely matched salient action exists. Importantly, although these hypotheses have been tested in simulations, there have not been studies with organisms. This summer, Dr. Weese will test the role of the thalamic reticular nucleus in determining the behavioral responses of rats, which will significantly advance this research area.