ENGEL HALL NEWS

BIOCHEMISTRY @ VIRGINIA TECH

WINTER 2017

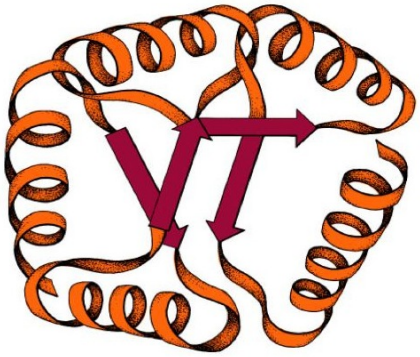
IN THIS ISSUE

Wrapping up 2017!

Dear Alumni and Friends of Biochemistry,

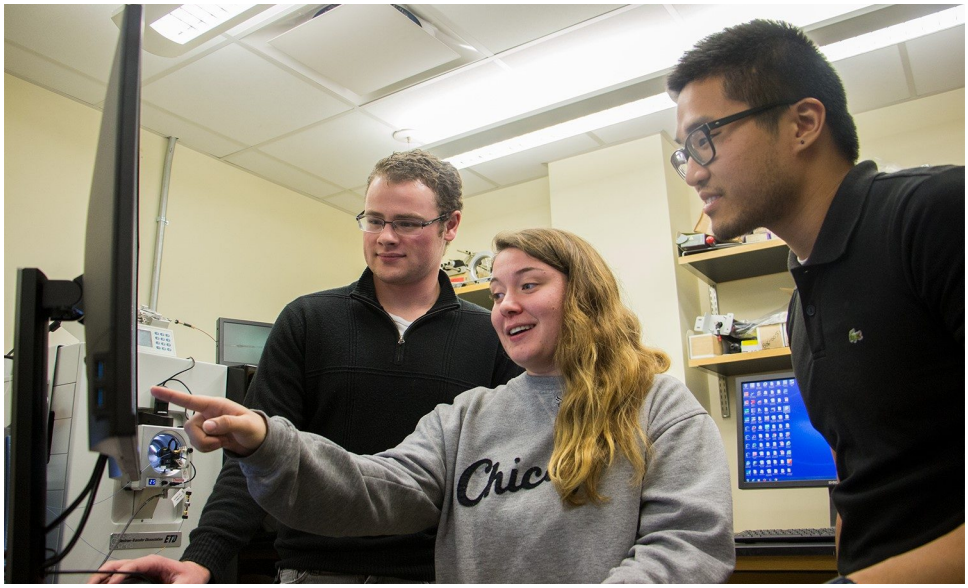
Happy Holidays from Engel Hall. We are grateful for your support of our academic and research programs. We continue to educate eager students who benefit from a strong legacy of outstanding Biochemistry alumni. This year saw a greater investment in our department from the College of Agriculture and Life Sciences as we hired three new Assistant Professors (Justin Lemkul, Brandon Jutras, and Clement Vinauger), a research Assistant Professor (Chloe Lahondere), a Collegiate Assistant Professor (Sasha Marine) and a second Academic Advisor (Molly Wilson). These talented and energetic young scientists are helping us to update and transform our programs, and we hope to tell you more about their achievements in future newsletters. The biggest news in our undergraduate program is that our two Academic Advisors are running a successful Peer Mentoring program. Every first-year Biochemistry student was matched with a Peer mentor this Fall. Peer mentors earn money that helps defray their college costs, and provide us with unique expertise in helping first year students transition to college life. We also have developed Chemistry study sessions that are helping our first-year students develop critical thinking and quantitative problem-solving skills. Our advanced undergraduates continue to benefit from the our 6-credit laboratory course. 77% of our 500+ undergraduate majors perform undergraduate research at some point in their career, solidifying their Biochemistry experience. Our graduate students are also breaking new ground by forming the Biochemistry Graduate Student Association (BcGSA), which organizes social and professional development events throughout the year, and gives our graduate students the chance to make decisions on travel support and seminar speaker invitations. Both the Peer-Mentoring and BcGSA programs benefit from your generous donations to our Biochemistry excellence fund, which gives us flexibility to impact our students in ways not allowed by state budgets.

Glenda Gillaspy
Department Head



White meat or dark meat? Serving up big data to decipher a holiday dinner

BY **AMY PAINTER**



For Virginia Tech biochemistry majors Cat Hayes, Duke Nguyen, and Will Stone, turkey has taken on a whole new meaning. The three, along with their General Biochemistry classmates, were challenged by Richard Helm, an associate professor in the Department of Biochemistry to consider the science behind Thanksgiving.

The professor gave his students the opportunity to dig into the experiment by analyzing large data sets and spending time in the lab with state-of-the-art instruments. Taking the HokieBird as inspiration, the students conducted a protein analysis of turkey, looking at leg, thigh, and breast meat. They were asked to investigate the difference between white and dark meat by analyzing the proteins that give turkey its color.

“You can sink a lot of time into data sets,” said Helm. “You can get more questions than answers. But this is something many students are not challenged to do. I wanted them to examine real data from a real experiment where they had the first shot at the analysis.”

The students looked at the most essential proteins, exploring high-quality protein identifications. They also learned how to pinpoint contaminants in the turkey samples to see how clean the tissue was. In order to understand the numerical difference between breast, thigh, and leg tissue proteins, the students analyzed spreadsheets with thousands of fields – a daunting task. They then developed their own formulas, color coding, filters, and other methods to allow them to see differences and evaluate statistical significance.

“I was both scared and excited,” said Stone, a junior from Springfield, Virginia. “After staring at the data on my computer for at least an hour, I just jumped in the water to figure out how to sort it all." Nguyen also used a whiteboard to plot out information, along with Venn diagrams.

The turkey testers were also able to get some high-tech help courtesy of a mass spectrometer coupled to a liquid chromatography unit. This newly acquired instrumentation is able to conduct highly sophisticated assays, showing the young investigators the relative abundance of various turkey proteins. Although the Helm Laboratory members operated the machine, the students were able to learn how to read data provided by the instrument. The machine also helped them validate their results.

The researchers discovered that enzymes involved in glycolysis, the metabolic pathway that converts glucose into energy, were similar in the turkey thigh and leg, and different in the breast. The concentrations of glycolysis proteins in breast were higher because this muscle is used for flight in birds, a process that relies heavily on glycolysis.

The thigh and leg meat contained relatively less glycolysis protein and more proteins associated with mitochondria because these tissues receive greater levels of oxygen, and these muscles are used more frequently when the turkey is standing or moving.

Although their focus was on proteins, the students also analyzed lipids in the three turkey tissues and found that thigh meat lipids oxidized faster than breast or leg meat. This, according to Helm, could drive further turkey research comparing frozen versus fresh, wild versus domestic, organic versus traditional, and so forth.

“It was a lot of fun,” said Hayes, a junior from Plainfield, Illinois. All three of the students learned that they can conquer intimidating data sets as well as apply their biochemical knowledge to real data. They are also eager to see what other research may be inspired by their work. Just in time for Thanksgiving, a subset of the students’ findings will be published in BioRxiv (pronounced bio-archive), a free online archive and distribution service for unpublished preprints in the life sciences.

@BcGSA: The New Biochemistry Graduate Student Association

BY **ALEXA SALSBURY** AND **DIANE EILERTS**

This fall, the biochemistry graduate students took initiative and formed an official student organization, the Biochemistry Graduate Student Association (BcGSA). The motivation for establishing the BcGSA was to foster collaboration within the department, emphasize community outreach, and increase the department's presence and impact at Virginia Tech. To accomplish this, committees for graduate program recruitment, outreach, professional development, and a journal club were formed. These committees work to enhance recruitment practices, manage social media presence, coordinate community service, invite high-impact speakers to seminar series, and review or celebrate published articles.

Thanks to efforts from BcGSA members, support of staff, and funding from the department, a tailgate for the Virginia Tech vs. Duke football game was arranged on campus on October 28, 2017. This served as an excellent opportunity to relax, socialize, and exhibit Hokie spirit! The tailgate had high attendance and friendly competition between staff and students alike. Building from this success, the first journal club meeting was held to celebrate members of Dr. Slade's lab and their recent publication in Journal of Biological Chemistry *. Here, the researchers led a discussion on their project while encouraging and fielding questions about experimental techniques, methods, and future directions. Members of the BcGSA have also participated in undergraduate sessions about graduate school and the Virginia Tech program, visited biotechnology companies, and established a process for awarding travel grants.

The BcGSA looks forward to continuing professional development, community outreach activities, awarding travel grants, and building networks and relationships with alumni. If you would like to follow BcGSA happenings, please do so at Instagram: @BcGSAVT Twitter: @BcGSAVT

BcGSA students edged out staff in corn-hole, Jenga, and sign design at the tailgate.

Slade Lab members also used the tailgate as an opportunity to relax and celebrate their recent publication.

*** The recent publication by Dr. Slade's lab can be accessed here: http://www.jbc.org/content/early/2017/10/11/jbc.M117.819144**

Dr. Bruce Anderson, former Biochemistry department head, passed away in October 2017. The Bruce Anderson Scholarship recognizes outstanding graduate students in the department. We are grateful for the Anderson family's request for donations to this fund to honor Bruce.

Making a gift to the Biochemistry Department is quick and easy using our secure giving site associated with the Virginia Tech Foundation.

Simply visit the online gift form at http://givingto.vt.edu/donate. Once you enter the amount you would like to contribute, select "College of Agriculture and Life Sciences" and then "Biochemistry Department Annual Fund".

March 20-21, 2018 are VT Biochemistry Giving Days. For more information on matching gifts, novel scholarship opportunities, or if you would like your donation to be directed to a specific cause or student organization, please contact Dr. Glenda Gillaspy by email gillaspy@vt.edu.

Students take roles as campus innovators through global design program

BY **JENNY KINCAID BOONE**

A chance meeting changed Sunny Murthy's idea of his perfect career.

In the summer of 2015, the Virginia Tech senior spent six weeks at the Yale School of Medicine, where he shadowed physicians and medical school students while taking physics and organic chemistry courses.

While walking through the Yale New Haven Hospital, Murthy struck up a conversation with the hospital's vice president of cardiovascular services. The administrator became Murthy's mentor and helped him see that he could combine business and health care into a career path.

This and other out-of-class experiences, coupled with his Virginia Tech work, defined Murthy's direction. Now he is applying to medical school. He eventually wants to work as a physician and then progress to a career in politics and health care policy.

Murthy and a team of three other Virginia Tech students want to create a campus hub for students to learn about these same kinds of out-of-the classroom opportunities, from internships and study abroad to research and service-learning projects. Students, they said, often don't know about the options available to help them embark on these important ventures.

The four students – Murthy, Najla Mouchrek, Danielle Jeffers, and Jarrodd Davis – comprise Virginia Tech's first team of University Innovation Fellows. Stanford University's Hasso Plattner Institute of Design runs this fellows program, and it advocates for college students across the globe to devise new ideas and projects for their institutions

Sunny Murthy, a senior Biochemistry student is one of four students on Virginia Tech's first team of University Innovation Fellows.

related to innovation, entrepreneurship, and design.

The Virginia Tech student team, who represent different majors and academic interests, presented their ideas to university administrators on Nov. 9 during a ceremony in Burruss Hall.

"We all love the university, and we want to see it prosper," said Murthy, who is majoring in biochemistry.

For the team, faculty chose students with an innovation mindset and whose interests cross many disciplines.

"They are movers and shakers at the student level," said Leigh Lally, the team's faculty mentor who proposed the fellows program for Virginia Tech. She is the university's space manager.

"I really like the idea of participating in change at Virginia Tech," said Mouchrek, a doctoral candidate pursuing Virginia Tech's first interdisciplinary Ph.D. in human-centered design.

On Nov. 16, the student team headed to Stanford for several days to meet fellows from at least 62 institutions around the world, participate in workshops, and visit Google's headquarters.

Their work started in September when they began an intense six-week online training for the program. They mapped Virginia Tech's campus to highlight spaces that encourage entrepreneurship and interviewed students and faculty about challenges and opportunities for innovation and learning outside of the classroom.

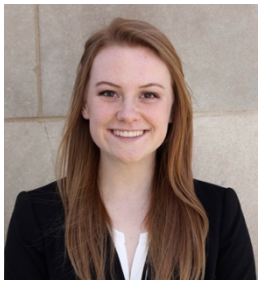
After working for several hours each week, the students created a series of short- and long-term plans that they hope will lead to the launch of a proposed virtual and physical campus hub.

"Students need that," said Jeffers, a junior who is majoring in journalism and already has had five internships and externships as a college student. "The world is bigger than the textbook."

The proposed hub also would offer tips for funding out-of-the-classroom experiences, and peer mentoring from students who have had similar opportunities.

The fellows' plans remain in the preliminary stages. Their next step includes more campus research, and the team also will help with a new student experiential learning conference planned at Virginia Tech for April 13.

Virginia Tech Innovation Fellows team at Google Headquarters in Mountain View, California. Left to right: Sunny Murthy, Leigh Lally, Danielle Jeffers, Majala Mouchrek, and Jarrodd Davis.



Biochemistry Peer Mentors: Modeling Success

BY **EMMA WILKINSON**

The biochemistry peer mentors are a group of 18 driven students who help to strengthen the biochemistry community at Virginia Tech. We help facilitate discussion and foster an atmosphere of inclusion during the Introduction to Biochemistry First Year Experience class each week. The peer mentors also hold study sessions for biochemistry students of all levels. A general chemistry study session for freshmen and a general biochemistry study session for upper level students are held weekly. Students come together to work on homework, additional practice problems, or just help to improve their study skills.

Personally, I enjoy helping people, and being a peer mentor allows me to help incoming freshmen and transfer students become oriented at Virginia Tech throughout the First Year Experience class. This course brings in different speakers each weak, helping to enlighten students about various subjects within biochemistry. Additionally, it allows the younger students to seek advice from their peers that have been in their same shoes before. In fact, I have found that many of the students are more comfortable talking with their peer mentor than to an adult faculty member about certain issues.

My favorite part of being a peer mentor is helping out at Virginia Tech open house events for prospective students. I love interacting with potential Hokies, answering their questions about the biochemistry major requirements, or just about Virginia Tech in general. As I am currently only a sophomore, I look forward to years to come as a peer mentor and I am excited to see how the program grows.

For more information about the peer mentoring program, please contact David Lally, Academic Advisor by email at dlally@vt.edu or call 540-231-9524.

Undergraduate Organization: The Biochemistry Club

BY **MORGEN VANDERGIESSEN**

The Biochemistry club at Virginia Tech is a small student run organization which strives to engage students passionate about biochemistry in volunteering events, social bonding, and education about career paths available beyond their college careers. I have been a member of the club for about two years and was first attracted to it because it was a small club with attainable membership requirements. Now as the president, I have come to greatly appreciate the inviting nature of the club which provided a great way for me to get involved as a young timid student.

In addition to the large event involvement as Relay for life, The Big Event, and Gobblerfest, the Biochemistry club also does weekly after school science clubs with Prices Fork Elementary and Kipps Elementary. During science club, we provide demonstrations and individual experiments with the students and educate them about the science behind the results. Witnessing children from a wide age range come together in awe with questions and excitement over experiments such as slime, juice density columns, and ocean zones brings has created a tighten friendships within the club.

This semester, I have enjoyed engaging with the new members during our bi-weekly meetings and club study rooms as well as encouraging them to engage with each other. Overall this club has not only provided me with fun volunteering opportunities and friendships, but has encouraged me to strive for more outreach and helping fellow science majors in doing so also.

Biochemistry Club members volunteer together for Virginia Tech's Big Event, a university-wide community service event.

Although the biochemistry club is particularly designed for science majors, is an amazing opportunity students from any major to get more involved with volunteering and learn more about science related career fields.

We are interested in meeting and networking with alumni. If you would like to contact the Biochemistry Club at VT please contact Morgen VanderGiessen, Club President by email at morgenvg@vt.edu.

¡Química Orgánica! A Semester Abroad

BY **CAT HAYES**

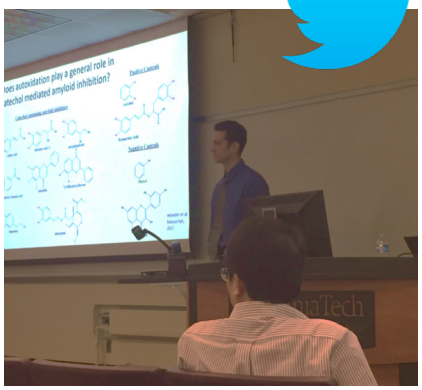
Cat Hayes and her organic chemistry classmates enjoying their class dinner.

Cat and her organic chemistry professor, Paz Cabal Naves, at La Universidad de Oviedo.

This past semester (Spring 2017), I studied abroad at La Universidad de Oviedo (the University of Oviedo) in Oviedo, Spain, which is located in the northern province of Asturias. I wanted to study abroad to improve my language skills, gain cultural knowledge, and earn more credits for my second major (Spanish). While I was there, I had the opportunity to take the second semester of organic chemistry - in English, luckily. The class was challenging in a way that I hadn't really experienced before. While most classes at Virginia Tech are graded based on tests, quizzes, homework, and a final exam spread out throughout the semester, this class's only grade was the final exam. It was daunting, and I had to change my studying habits in order to succeed. In addition, the class material did not line up exactly with where I had left off, so I also had to play catch-up with the rest of the class. That being said, taking this course was an incredibly positive addition to my study abroad experience.

One of my favorite memories was being included in a "class dinner" that the students in the second-year of the chemistry program had. They introduced me to traditional Asturian food, apple-cider sangria, and new slang that was specific to Asturias. Coming back to Virginia Tech after such an amazing semester has been a little difficult, but the experiences I had have given me many skills to succeed in my biochemistry studies in the future. Studying abroad while pursuing a major in a STEM field is extremely possible, and I encourage everyone to do it if they can. Oviedo has stolen a piece of my heart, and I am already eager to return.

December Tweets



Glenda Gillaspy @BiochemVT

Paul Velander (from Bin Xu's group) did a terrific job defending his dissertation research!

Justin Lemkul @JustinLemkulVT

The lab is growing! Today I officially welcome my first two Ph.D. students, Alexa Salsbury and Darcy Davidson!

Daniel Slade @TheSladeLab

As elusive as the Yeti, here is a picture of my ENTIRE amazing group in one location, running their own journal club! #proudpi #fridaynightscience

Researchers discover compounds that could decrease fungal infections in lungs

BY **LINDSAY KEY**

A Virginia Tech research team found a way to alter the growth of a fungus that causes deadly lung infections in immune-compromised individuals, such as leukemia patients and recipients of stem cell or organ transplants.

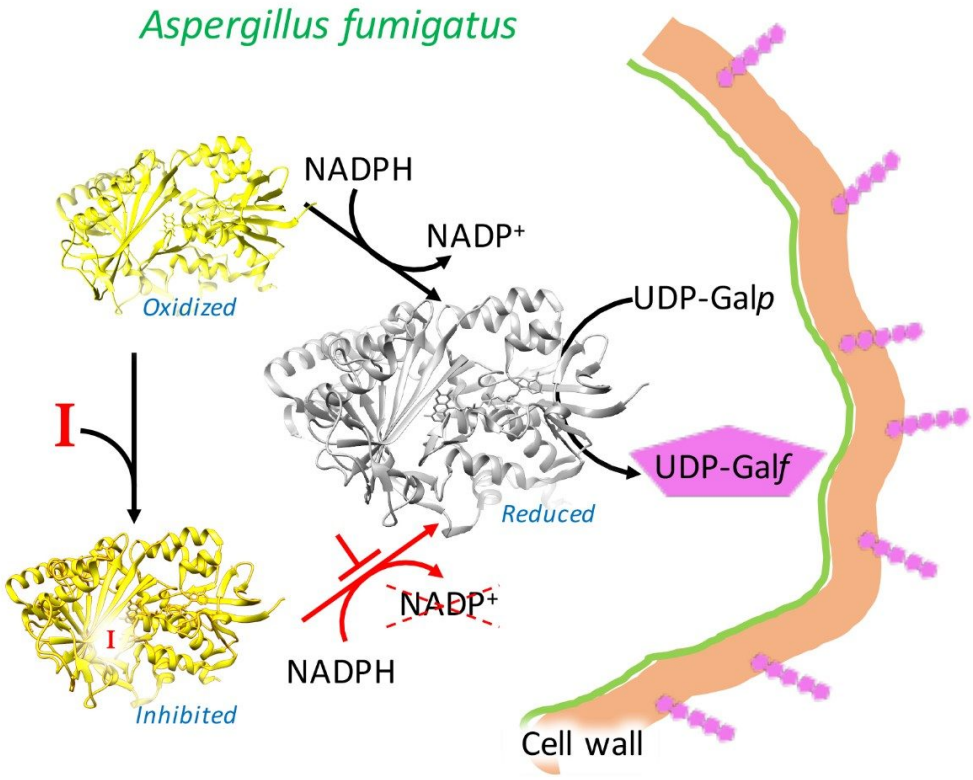
Two naturally occurring compounds– identified in the small molecule library available at the Virginia Tech Center for Drug Discovery Screening Laboratory supported by the Fralin Life Science Institute – work against an enzyme important in cell wall production in the deadly fungus, called *Aspergillus fumigatus*.

The findings were published in the journal Scientific Reports on Sept. 7.

"This work validates the use of an assay designed to target a specific region of UGMs. The compounds that were identified are the first-generation inhibitors of UGM from eukaryotic human pathogens," said Pablo Sobrado, lead author, professor of biochemistry in the College of Agriculture and Life Sciences, and a Fralin Life Science Institute affiliate.

The compounds, naringenin and hesperetin, are flavonones found in citrus fruits. Naringerin has been shown to have antibacterial activity and hesperetin is known to be an anti-inflammatory and to help with regulatory adjustment of the immune system.

The enzyme, called UDP-galactopyranose mutase, produces a rare sugar that is a major component of the cell wall in several dangerous organisms besides *Aspergillus fumigatus*, such as other fungi, parasitic worms, and protozoan parasites. It is also known to help the bacteria that causes tuberculosis to infect its human hosts.



The scheme shows the effect of inhibitors identified using the assay developed in the Sobrado laboratory. Inhibitors bind to UDP-galactopyranose mutase (UGM) and prevent the binding of NADPH. NADPH is required for activation of UGM. Therefore, inhibitors found using this assay block activation of UGM by NADPH, turning off the production of galactofuranose required for optimal fungal call wall biosynthesis. Image courtesy of Pablo Sobrado.

In 2010, Sobrado received funding from the National Institutes of Health to study UDP-galactopyranose mutases. The overall goal in studying enzyme structure and function is to develop improved treatments for human disease.

The next step will be to fully describe the structure of the enzyme with the inhibitor bound, which will help determine how it works. These structures will provide a blueprint for the development of more effective derivatives. The team will also search for more potent compounds that can be developed into potential drugs to treat fungal-related infections and other diseases.

Co-authors on the paper include Julia S. Martin del Campo, a postdoctoral research scientist in Sobrado's lab; Meital Eckshtain-Levin, a postdoctoral research scientist in Sobrado's lab; and Nancy Vogelaar, manager of the Virginia Tech Center for Drug Discovery.

IN THE CLASSROOM: SNAP SHOT

Just before the Thanksgiving break in November, students in the first-year experience class were introduced to design-inspired thinking and had some fun coming up with inventions to solve problems and meet unique user needs by playing the game “Mock-ups” from Design For America. Here, course instructor David Lally models the wearable prototype designed to increase positive vibes. Looks like it works!

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