



ENGEL HALL NEWS

LETTER FROM THE DEPARTMENT HEAD

November 19, 2021

Dear VT Biochemistry Alumni and Friends,

The department is excited to share our annual fall newsletter with you! During the fall semester, it's been exciting and rewarding for all of us to be back on campus. Teaching and interacting with our students in person once again has helped us regain a sense of normalcy. Students have lived up to the Hokie spirit by getting vaccinated, following a few remaining COVID-19 restrictions, and by embracing the chance to learn in person, attend football games, and create community on campus.

The department is adapting to big changes, as six faculty and staff, with a combined total of more than 120 years of service, have retired over the past one-and-a-half years. Thank you Janet Donahue, Jody Jarvis, Steve Lowe, Zerita Montgomery, David Ruggo, and Robert White for your service. In addition, two senior faculty have announced their retirement plans with Professor Tim Larson entering transitional retirement starting January 2022 and Professor Peter Kennelly planning for a December 2022 retirement. These retirements will have a big impact and are accompanied by new searches for staff and faculty. We have three open positions that we're looking to fill: a tenure-track position in biochemistry, a collegiate faculty position in biochemistry, and a fiscal coordinator.

Another key change to the department is our ability to invest in new lab equipment, due to a major infusion of funds. Our teaching labs are now equipped with state-of-the-art equipment, which allow students to be exposed to the types of instrumentation that they're likely to encounter in industry. While we're on the topic of industry, over the next two years, the department has plans to develop more career resources for our students who wish to enter directly into employment after completing their B.S. degree in biochemistry. We hope to increase internship opportunities and engage companies and other entities in a virtual career fair, which will accompany our EngelPalooza research showcase held each fall. If this is an area of interest for you and you'd like to provide advice or assistance, please call or email me using my contact information at the end of this letter.

We're always striving to provide experiential learning opportunities and enhance our teaching for our students and, if you'd like to contribute towards this objective, we encourage you to save the date for Giving Day 2022, which will occur on February 23-24th, noon to noon.

If you're looking for other ways to give back to the department and get involved, consider joining our LinkedIn page or volunteering on our external Advisory Board, which provides us with excellent input into creating more opportunities for both undergraduate and graduate students. To learn more about other opportunities, visit our new and improved alumni webpage, where you can meet our current advisory board members and read a sample of alumni profiles. If you'd like to submit an alumni profile, please reach out to our Communications Coordinator, Cameron Warren, at cameronrw@vt.edu. These profiles as well as visits (whether via Zoom or in-person) by alumni prove to be incredibly valuable resources for our students, as they're curious about what a career for them could look like after receiving their biochemistry degree.

We sincerely hope you are doing well. If you are ever in Blacksburg, please stop by our main office in Engel Hall, as we welcome visitors, and like to hear about what our alumni are doing. I will end with a statement I made this time last year: I am constantly amazed by and proud of our VT Biochemistry students. Go Hokies!

Sincerely,
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ENGELPALOOZA

STAY CONNECTED

To follow the latest achievements of our students, faculty, staff and view recent departmental news, visit our website.

www.biochem.vt.edu

Follow us on social media for daily content, including announcements, event information, student features, departmental plans, and more!



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Virginia Tech
Department of Biochemistry



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UNDERGRADUATE STUDENT FEATURES

ICYMI: 2021 Biochemistry Hokie Grad Profiles



SENAH STEPHENS HONORED AS ONE OF BIOCHEMISTRY'S OUTSTANDING SENIORS

Senah Stephens, an undergraduate student in the Department of Biochemistry, was recognized as one of the department's outstanding seniors. Stephens is one of two outstanding seniors in the department and shares this honor with one of her classmates, Taylan Tunckanat.

Stephens hails from Wytheville, Virginia, where she grew up milking cows, tending to chickens, gardening, and baking loads of sweets for the local farmer's market every weekend. Working on her family's dairy farm instilled a sense of commitment and dedication early on in Stephens' life.

Stephens says being in a farming family taught her what it meant to truly earn your own money, as milking cows and baking would help her to earn supplemental income to support her dancing career. Stephens remembered always dancing as a child and began dance classes when she was three years old.

"It was a really good outlet for me. It's an art, a form of expression, a way to release," she said.

Dancing would become an important part of her life as Stephens grew older. After auditioning and being selected to join the Virginia Tech dance team, the HighTechs, Stephens couldn't pass up the opportunity to attend Virginia Tech.

FRALIN UNDERGRADUATE RESEARCH FELLOW SEARCHES FOR MECHANISMS BEHIND CELL DETECTION IN ARABIDOPSIS PLANT

According to the USDA, the average American eats some 415 pounds of vegetables a year. To keep up with supply and demand, farmers must rely on one tool to maximize their plant growth and crop yield: nitrogen.

When a plant takes up the nitrogen from the soil, it creates amino acids to distribute nitrogen throughout the plant to be used in the leaves and stored in the seeds or roots. The plant enlists the help of small proteins, called amino acid transporters, which act as valves that open or close, directing the flow of amino acids to where they are needed most.

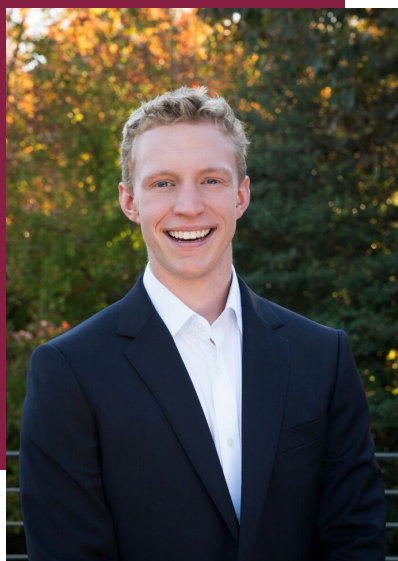
But little is known about the mechanisms that are behind these transporters. Amanda Ramirez, a senior biochemistry major, has been studying a specific amino acid transporter called Amino Acid Permease 1 (AAP1) as part of the Fralin Undergraduate Research Fellowship (FURF).

"We studied AAP1 in *Arabidopsis thaliana*, and expressed it into tobacco and yeast to understand its signaling mechanisms," said Ramirez. "We wanted to determine how the cells detect whether they need more amino acids, if they already have enough, or if they don't need to take in any more."



Both full stories are available to read on our website in our Biochemistry Newsroom.

UNDERGRADUATE STUDENT FEATURES



The 2021 Dennis Dean Undergraduate Research & Creative Scholarship Conference took place virtually on April 30, 2021, and hundreds of students representing every university college participated through Virginia Tech's Office of Undergraduate Research. 120 presentations by 255 students from Virginia Tech and Blacksburg High School were given and, as part of the virtual format, students and faculty were able to engage with presenters, posting more than 1,750 questions and comments. Shortly after the conference, Outstanding Undergraduate Research Award winners were announced and biochemistry student, Austin Murray, was one of three students recognized for their ability to communicate complex research.

"My research at Virginia Tech has been transformative and guided my career choices," said Murray. "I don't think anyone in the life sciences should graduate without the experience of doing research. The professional and communication skills I learned will be invaluable."

Murray's research was done in the laboratory of Xiaofeng Wang in the School of Plant and Environmental Sciences and focused on the brome mosaic virus, which is a leading cause of agricultural crop damage. The work looked at a specific protein that allows the virus to safely attach and replicate within a host cell and could eventually serve as the foundation for a broad-spectrum antiviral drug for similar viruses, like Hepatitis B.

"When I got to Virginia Tech, I wasn't sure what direction to take my education," said Murray. "But the combination of my time in the lab and the direct interaction I got with patients as a volunteer with the Blacksburg rescue squad, helped me decide to pursue a career in medicine."



Ashlynn VanWinkle, Accelerated Master's Student, received a +Policy Destination Area award for her presentation on the Development of an Attractive Toxic Sugar Bait for the Control of *Aedes J. Japonicus*, which she shared at the Dennis Dean Conference.

"I would say my experience with the Dennis Dean conference was of course made more challenging by the virtual delivery of the conference, but was still so eye-opening to see other undergraduate research and get out of my own little research "bubble." It was my first experience presenting my research formally, so learning the format of this type of presentation as well as getting out the first-presentation-jitters was extremely helpful," VanWinkle said.

"If anyone was hesitant to present at an event such as this, I would want them to know that everyone is at different stages in their research, some people had proposals and some people had fully fleshed out and even published work - so go for it, no matter where you're at with your project," VanWinkle continued.

VanWinkle is also the recipient of a Global Change Center Undergraduate Research Grant and will be using the funds to research how climate change can impact disease vectors such as mosquitoes. VanWinkle studied the development of an attractive toxic sugar bait for the control of *Aedes j. japonicus*.

The invasive species *Aedes j. japonicus* is a potential vector of West Nile virus, a disease with no approved treatment or vaccine that impacts millions worldwide, and is competent for several other viruses including dengue. "With warming climates," VanWinkle said, "the active range for mosquitoes is growing, and we hypothesize that drier climates will encourage more mosquito activity."

Biochemistry student, Danielle David (left), along with five other students, presented an Orion LLC project which focused on the Science of Wellbeing.

"The Dennis Dean Conference was a great way to gain experience creating and presenting a research project in a professional setting without a lot of added pressure. It is the perfect opportunity to become comfortable speaking with astute members of the community while honing one's public speaking skills," David said. "Anyone who is interested in scientific research but hesitant to start should take this opportunity, as it is a low-stress way to become comfortable speaking in front of fellow members of the scientific community."

Biochemistry Outstanding Senior and Accelerated Master's Student, Taylan Tunckanat (right), presented on the biochemical characterization of aminomutases involved in salt tolerance in methanogenic archaea!

"The Dennis Dean Conference has been one of the best places to practice communicating my research to a broad and friendly audience," Tunckanat said. "I would highly recommend participating to anyone that has any research experience even if you don't think you have enough to share (you more than likely do!), and sharing your work is the second half of research that you absolutely must partake in for the full experience."



UNDERGRADUATE STUDENT FEATURES

The 2021 Dennis Dean Undergraduate Research & Creative Scholarship Conference had a total of 120 presentations, many of which were done by biochemistry students. Aurora Jensen, Anthony Briganti, and Erin Collins represent the wide array of topics covered during the conference.



AURORA JENSEN

Biochemistry sophomore, Aurora Jensen, presented an Orion LLC project which focused on the Science of Wellbeing at the Dennis Dean Conference.

"Presenting with the Dennis Dean Conference allowed me the ability to gain confidence presenting research to a larger audience," Jensen said.

ANTHONY BRIGANTI

Biochemistry sophomore, Anthony Briganti, presented on Combating Antibacterial Resistance: Characterizing Antibiotic Binding Pockets to Advance Bidentate Design at the Dennis Dean Conference.

"At the end of such a long year, being able to attend and present at the Dennis Dean conference was a great experience. It was rewarding to find that, even with all the changes and hiccups that came with COVID, everyone was still engaged with each other's research and making mind-blowing progress," Briganti said. "This was my first presentation, and it was very validating to feel that sense of support and community that may have been lost for a little bit, [due to the pandemic]."



ERIN COLLINS

Erin Collins presented on Using Virtual Screening to Develop Predictive Models to Discover Novel Partial Agonists of PPAR γ at the Dennis Dean Conference.

"The Dennis Dean conference gave me an excellent opportunity to reflect on all the progress that I made on my research project this semester and over the last three years," Collins said. "Additionally, having only 5 minutes to present my work gave me practice with communicating what I found in a concise way that everyone could understand."



UNDERGRADUATE STUDENT FEATURES

After canceling last year's program because of the COVID-19 pandemic, the Summer Undergraduate Research Fellowship (SURF) program at the Fralin Life Sciences Institute returned as 20 students embarked on a full summer of research. SURF gave undergraduate students hands-on research experiences during a 10-week program that mimicked graduate training. The program gave students the tools to make critical career decisions by providing them not only with research experience but also with professional development and networking opportunities. This year, six biochemistry students were selected for the program: Aymeric Busidan, Maegan Gabby, Ian Hicklin, Shannon Pollock, Bryce Wozniak, and Brynn Yaun. Below four of our students share their experiences participating in this program.



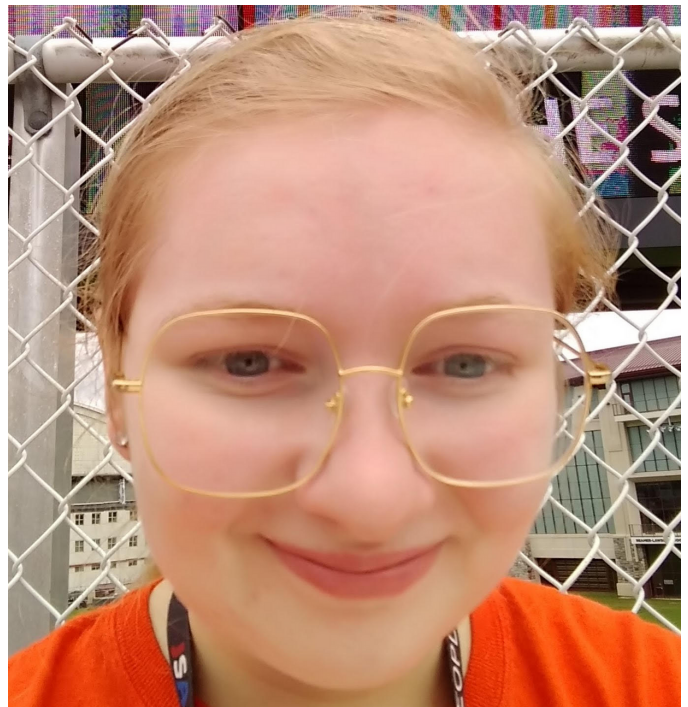
"Last year I was so excited to participate in the SURF program, but unfortunately because of COVID-19, I was no longer able to spend the summer in the research lab full time," said Maegan Gabby. "I wanted to still do it this summer because I really wanted to spend full time in the research lab and make significant strides in my research projects." Gabby worked in Dr. Brandon Jutras's lab over the summer.



Ian Hicklin worked in Dr. Anne Brown's lab over the summer through the Fralin SURF program. "I've already made far more progress than I would have thought; I [faced] exciting new challenges every day," Hicklin said. "I [felt] prepared to accomplish so much last summer!"



In the Fralin SURF program, Brynn Yaun worked with Dr. Joseph Hoyt to study the vegetative growth and spore production of the fungal pathogen *Pseudogymnoascus destructans*. "I [was] honored to participate in this fellowship and [I enjoyed] delving into this research throughout the summer," Yaun said.



Shannon Pollock worked in Dr. Biswarup Mukhopadhyay's lab over the summer through this program. "I [was] so lucky to be given the opportunity to participate in the Fralin SURF program and grow as a scientist," Pollock said. "I [knew] the work [would] be physically and intellectually demanding, but I look[ed] forward to learning and making connections [last] summer."

UNDERGRADUATE STUDENT FEATURES

In-person research returns this summer in the Department of Biochemistry



After the COVID-19 pandemic canceled all in-person undergraduate research programs in Summer 2020, the Department of Biochemistry was more determined than ever to engage students in research and experiential learning opportunities in Summer 2021. A total of thirty-seven students participated in undergraduate research in the Department of Biochemistry this summer. Students from the Virginia Tech Department of Biochemistry, Virginia Tech Department of Biological Sciences, peer universities like NC State University and the University of Texas at Dallas, and high schools around Blacksburg, participated in research opportunities across thirteen labs.

Students were involved in various summer programs including, but not limited to, the Multicultural Academic Opportunities Program (MAOP), Jeffress Trust Interdisciplinary Research Program, Computational Biochemistry of Ancient Proteins Summer Program, GlycoMIP Summer Undergraduate Research Program, and the Fralin Summer Undergraduate Research Fellowship Program. Biochemistry students Sara Pacini (top left), Zachary Hartman (top right), Sara Gallegos (bottom right), and Meghana Kamineni (bottom left) participated in summer undergraduate research programs over the summer and they represent the wide array of research interests and focuses in our department.

Sara Pacini, sophomore, studied three genes in *Fusobacterium nucleatum* in Dr. Daniel Slade's lab. Genes 177, 279, and 1005 encode for proteins that are seen to inhibit lysozyme in our mouth. Lysozyme is an enzyme typically found in our saliva that kills bacteria and, since *F. nucleatum* has these genes, the bacteria can live a lot longer in people's mouths and travel to other parts of the body. *F. nucleatum* is an important bacterium to study because Virginia Tech researchers discovered in July 2020 that this mouth bacterium may cause colon cancer to spread.

The main objective in the Slade Lab is to study the factors of the bacteria's virulence: the degree to which damage is caused to a host. With more knowledge about *F. nucleatum*'s virulence, the goal is to stop this bacterium from potentially escalating the spread of colorectal cancer.

Zachary Hartman, junior, studied the most common cause of Lyme disease in Dr. Richard Helm's lab. Hartman and researchers in Helm's lab are partnering with the National Science Foundation (NSF) GlycoMIP facility to analyze certain structural anomalies found in the cell wall of *Borrelia burgdorferi*. Unique pathogen cell wall molecules have been implicated as a cause of Lyme disease and Hartman's role in this research project was to purify and isolate fragments of this cell wall. Isolating and characterizing the structures of these fragments could potentially lead researchers to further understand the mechanisms of how Lyme disease symptoms originate, and subsequently, what a possible path forward with treatment might look like. After the program, Hartman was able to contribute more knowledge about the structure of the cell wall in this bacterium, and Helm is continuing forward with this work on a larger scale throughout the Fall 2021 semester.

Sara Gallegos, sophomore, studied methylated pterin biosynthesis research in Dr. Kylie Allen's lab. Gallegos participated in the Allen Lab as a Multicultural Academic Opportunities Program (MAOP) Summer Scholar. She researched the functions of enzymes that produce Tetrahydromethanopterin (H4MPT), a compound found in methanogenic microbes that is vital to the production of methane, which is a prominent greenhouse gas. Gallegos and researchers in Allen's lab found that an enzyme denoted MA1486 catalyzes a unique methylation reaction during the production of H4MPT. This discovery could lead to a process that can inhibit the formation of the H4MPT molecule and decrease the production of methane gas and global warming in the future.

Meghana Kamineni, sophomore, studied Brome Mosaic Virus (BMV) in Dr. Anne Brown's lab. Kamineni's curiosity about the drug discovery field alongside her prior experience with molecular modeling was what originally led her to the Brown Lab. She began her research on BMV in January 2021 and had the opportunity to continue in the summer. BMV is a positive-strand RNA virus that drastically reduces the yield of cereal plants, such as wheat, rice, and corn, through cell death. This reduction in cereal plant yield could result in widespread food insecurity and developmental delays in young children due to a lack of proper nutrition.

In Brown's lab, Kamineni was researching the proteins in BMV that play a key role in viral replication. Her research revealed how BMV affects cells and she identified potential mutations that can prevent BMV from affecting cereal plants. This new information can be used to develop preventative methods and treatments for cereal plants. "BMV is responsible for up to 61% yield loss in a crop of wheat," Brown said. "With more knowledge and research about the virus, we can be more proactive in protecting our crops."

Read the full story in our Newsroom on our website.

UNDERGRADUATE STUDENT FEATURES

Thirty-seven students engaged in undergraduate research in our department this past summer. Seven biochemistry students share which research program they participated in and describe their experiences as research fellows below and on the following page.



SHIRIN SAYANI

Shirin Sayani, sophomore, participated in the VT-REEL program this summer, which is ran by Drs. Sasha Marine and Glenda Gillaspy.

"I'll admit that being a VT-REEL participant was not an experience I had expected for this summer, especially considering the limited options due to the pandemic. Being at the VA Beach AREC gave me hands-on exposure to extension work that I don't think I would've gotten otherwise."

BEN LEWIS

Ben Lewis, senior, participated in the Computational Biochemistry of Ancient Proteins Summer Program in Dr. Kylie Allen's lab.

"Having the opportunity to participate in undergraduate research has opened my eyes to what the sciences have to offer. I have learned many things and made some friends along the way. I only wish more people could have had the same experience this year."



EMILY TESTA

Emily Testa, senior, participated in the Jeffress Trust Interdisciplinary Summer Research Program in Dr. Justin Lemkul's lab.

"I am extremely lucky to have had an opportunity to work in the Lemkul lab this summer. COVID-19 has made it difficult to take steps pursuing a future, however, researching this summer helped me grow and discover who I want to be. Thank you to the Jeffress Trust program and to the Lemkul lab!!"

UNDERGRADUATE STUDENT FEATURES



Helen Oker, senior and Accelerated Master's Student, completed mosquito research in Dr. Chloé Lahondère's Lab this summer. "I was incredibly grateful to be in person at the lab this summer. Working in mosquito research with the Lahondère Lab also meant that I got to go outside to do loads of field research and truly enjoy spending a summer in Blacksburg! I have learned so much about what it means to be a researcher since joining the lab."



Nathan Otto, recent biochemistry graduate, and Jeffress Trust Scholar completed research in Dr. Justin Lemkul's lab over the summer. "I found the opportunity to study topics not commonly covered in coursework to be challenging, but also very exciting. It showed me the benefits of collaborating with people in other fields and using a variety of techniques to answer questions."



Maria Dorodnitsyna, sophomore, completed research in Dr. Jinsong Zhu's lab this summer! "Doing research in the Zhu lab this summer was a unique and challenging experience, and I felt especially lucky since many research programs were paused from the pandemic. Learning so many new techniques has made me more confident in myself in a lab setting and has greatly improved my problem-solving skills. For the first time, I felt like I could put what I've learned in my classes to use and like I could have a part in something that is practically needed. I think I've learned more in two months at the lab than in any classes I've taken so far!"



Riley Szumachowski, senior and Accelerated Master's Student, completed research in Dr. Anne Brown's lab this summer! "I am honored to have been selected to be a part of Dr. Brown's lab for Virginia Tech's Accelerated Master's Program in Biochemistry. Being able to work alongside Dr. Brown is a tremendous opportunity and is ultimately the culmination of accomplished educational goals, perseverance, and unequivocal passion. Despite delays and cancellations due to the COVID-19 pandemic, the future is bright and spirits are high- excited to begin the next phase of the journey!"

UNDERGRADUATE STUDENT FEATURES

Cassell McMillian selected as Virginia Tech's inaugural Beckman Scholar



Cassell McMillian is embracing a future that is unique among his family. McMillian, Virginia Tech's inaugural Beckman Scholar and second-year biochemistry major in the College of Agriculture and Life Sciences, says growing up in rural Virginia combined with parents who worked hard, encouraged him to be the best version of himself, and to never settle for less has been a guiding principle.

"This program will give me a leg up to getting into a Ph.D. program and continuing my education to a level that no one else in my family has achieved," said McMillian, who is also minoring in chemistry. "I don't ever want to sell myself short of my true potential and look back on what could have been. This unbelievable opportunity goes beyond the here and now – and my future as a chemist and research scientist."

Earlier this year, the Arnold and Mabel Beckman Foundation announced that Virginia Tech was among 12 universities and colleges selected as the 2021 class of Beckman Scholars Program awardees. The institutions were selected after a rigorous application process, which included a two-part review led by a panel of scientific experts. Members of LINK+LICENSE+LAUNCH's Foundation Relations team worked with Amanda Morris, director of Virginia Tech's Beckman Scholars Program, to submit a competitive application package, securing Virginia Tech's place among recognized colleges and universities.

"The applicant pool for the Beckman Scholars Program was an extremely competitive one and the review process meticulous; we are excited to announce our 2021 Beckman Scholars Program award winners, a range of universities that includes both past awardees and new institutions we are confident will host excellent research programs for their undergraduates," said Anne Hultgren, executive director of the Arnold and Mabel Beckman Foundation.

The Beckman Scholars Program is a 15-month mentored research experience for exceptional undergraduate students in chemistry, biochemistry, and biological sciences. The program leverages funding provided by the Arnold and Mabel Beckman Foundation to form a partnership with the Fralin Life Sciences Institute to provide an undergraduate research experience on Virginia Tech's campus. Through unique programming in communication, leadership, grantsmanship, and diversity and inclusion awareness, the program seeks to cultivate the next generation of scientific leaders.

Starting in summer 2021, McMillian will begin work with professor of biomaterials and bioprocessing Kevin Edgar and assistant professor of physics Rana Ashkar centered on the design, synthesis, and characterization of robust, biocompatible, polymer-augmented liposomes for the delivery of hydrophobic drugs and messenger ribonucleic acid vaccines. McMillian will learn how to synthesize and characterize novel copolymers based upon renewable polysaccharides and be trained in the Ashkar Lab to evaluate the structural and mechanical properties of liposomal nanoparticles augmented by the novel block copolymers synthesized in the Edgar Lab.

"The Beckman Scholars Program places Virginia Tech and the selected scholars among an elite group of research institutions and researchers," said Morris, also professor and associate chair of the Department of Chemistry in the College of Science. "With the support from the Arnold and Mabel Beckman Foundation, Virginia Tech can provide exemplary students with an unparalleled, fully funded research experience that sets them on a path to achieving great things. Our mentors are excited to have the opportunity to shepherd the next generation of innovators through their undergraduate career."

"The Beckman Scholars Program is a once-in-a-lifetime opportunity that will be life changing for me. Not only will I be able to do undergraduate research, but also have a mentor who will help me along the way on projects that will make me a stronger student and researcher," McMillian said.

GRADUATE STUDENT HIGHLIGHTS



Say hello to our new graduate students that joined us this fall! Welcome to our department Thuc-Anh Dinh (top left), Kayla Kester (top right), Lan Lou (bottom left), Spenser Stone (center), and Nick Grilli (bottom right)! We're so glad to have you!



Accelerated Master's student, Rowan Wooldridge, was eager to return this summer to complete research in Dr. Kylie Allen's lab! "Summer of 2020 was the longest break I had from research since I began in 2019 and I was really eager to get back to work as soon as I could," Wooldridge said. "I am really happy that I was able to stay in the lab this summer and be really productive on my research project without having to worry about any classes. This summer was the first time I felt like we were heading towards a somewhat normal environment for me to work in since the pandemic began."

The Biochemistry Graduate Student Association (BcGSA) is excited to introduce the organization's executive board! Read more about each officer below and keep up with BcGSA by following them on Twitter and Instagram @bcgsavt!



Sydney Johnson
President

As a third-year Ph.D. student in Dr. Pablo Sobrado's lab, Sydney focuses on the kinetic and structural characterization of flavin-dependent enzymes involved in xenobiotic detoxification, natural product formation, and pathogenic iron acquisition.

Justin McKinney
Vice President & Event Coordinator

Justin is a third-year Ph.D. student in Dr. Kylie Allen's lab where he studies the metabolism of methanogenic archaea, specifically the mechanism behind the formation of methylated pterins.

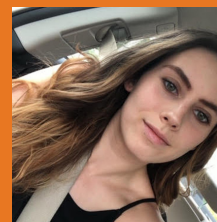


Mecaila McClune
Treasurer & Secretary

As a third-year Ph.D. student in Dr. Brandon Jutras's lab, Mecaila is interested in the effects of peptidoglycan from the Lyme disease bacteria, *Borrelia burgdorferi*, on the host immune response.

Haley Michel
Communication Liaison

Haley studies non-canonical nucleic acid structures known as G-quadruplexes (GQ) in Dr. Justin Lemkul's lab. She uses Molecular Dynamics simulations to better understand GQ folding and its impact on disease states to advance the development of novel therapeutics.



Joanna Reinhold
Outreach Coordinator

Joanna is a fourth-year Ph.D. student in Dr. Chloé Lahondère's lab where she studies the biological, chemical ecology, and pathogen transmission between the mosquito, *Culex territans*, and its amphibian hosts.

Brittany Hart
Journal Club Coordinator

Brittany is a second-year Ph.D. student and is co-advised by Drs. Pablo Sobrado and Brandon Jutras. She investigates the specificity of *Borrelia burgdorferi*'s peptidoglycan machinery to aid in the development of more specific and directed drug treatments for Lyme disease.



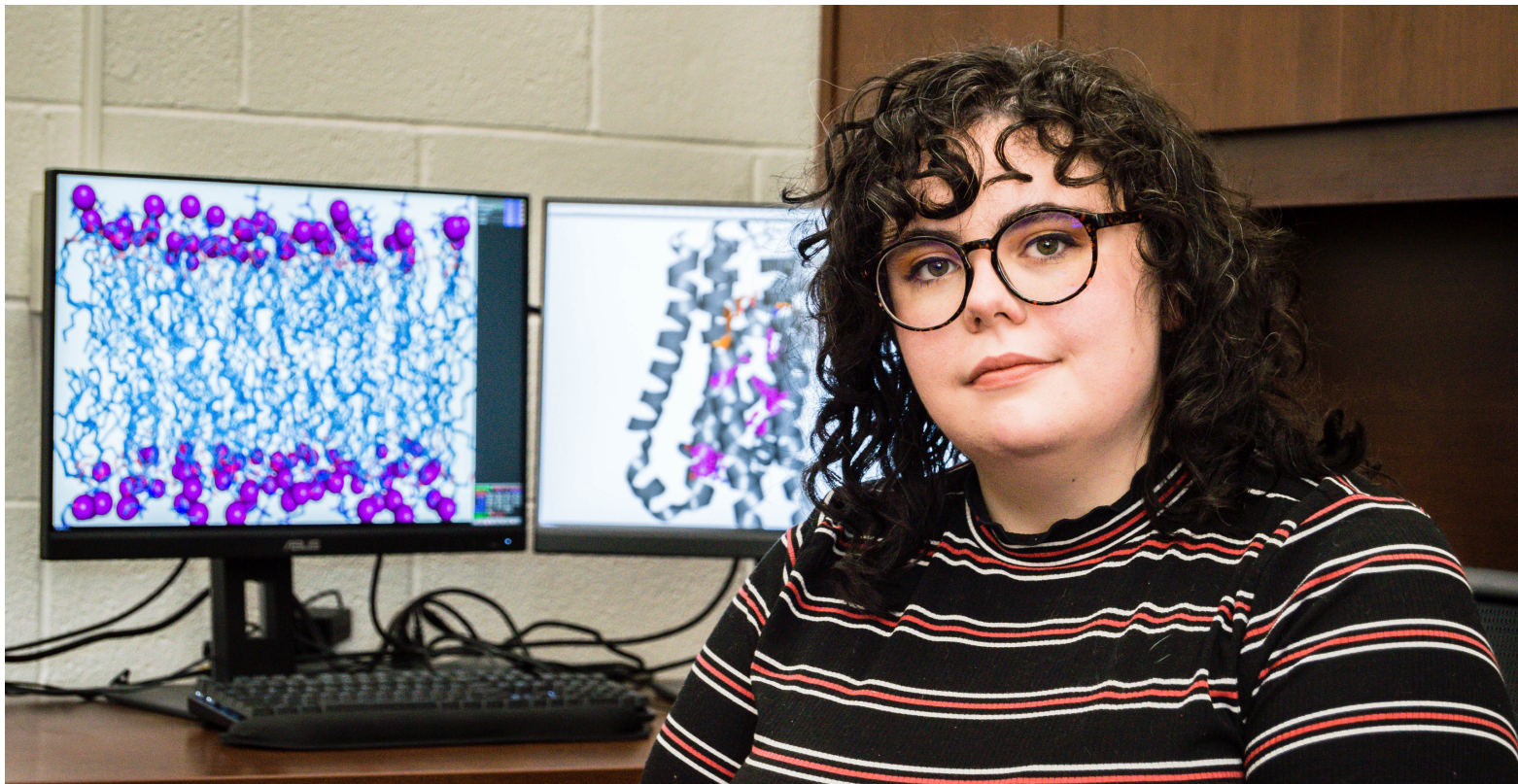
Tam Nguyen
Recruitment Coordinator

Tam is a third-year Ph.D. student in Dr. Daniel Slade's lab interested in the interplay between the host cell and *Fusobacterium* with focuses on bacterial intracellular survival and bacterial invasion.

Do you know someone who is interested in enrolling in one of our graduate programs? The deadline to apply to our M.S. in Life Sciences program and Ph.D. in Philosophy program is January 15, 2022! Learn more by visiting our website.

GRADUATE STUDENT HIGHLIGHTS

Biochemistry graduate student Julia Montgomery named NSF Graduate Research Fellow



Julia Montgomery, a doctoral student in the Department of Biochemistry, has been selected for the National Science Foundation's prestigious Graduate Research Fellowship Program in 2021.

The fellowship program is the country's oldest in support of doctoral and master's students in science, technology, engineering, and mathematics fields, and it aims to recognize and empower the next generation of knowledge experts who can contribute in meaningful ways to research, teaching, and innovations in science and engineering.

"The NSF GRFP is a prestigious fellowship that means a lot to a first-generation college and graduate student like me," Montgomery said. "It is validation that the work that I am doing is important and that my experiences give me a unique and important perspective as a researcher."

Her work will involve research that could lead to the development of drugs that treat asthma and COPD - a subject she knows all too well. Montgomery initially became interested in health and science because of her grandmother, who was diagnosed with COPD before Montgomery was born and whom she cared for during her childhood. She was originally on track to go to veterinary school, but Montgomery found herself becoming interested in the biochemical context behind why her furry patients were sick and sought out research opportunities to further explore this interest.

After applying to the biochemistry graduate program at Virginia Tech, Montgomery was amazed by Justin Lemkul's Lab and the power of molecular simulations. She was fascinated with the idea of using computer-aided drug design to help improve and provide more efficient therapeutics for the people who need them.

Montgomery will focus her fellowship work on studying the dynamics of membranes and the molecules that interact with them. Her project specifically focuses on the beta-2 adrenergic receptor, a membrane receptor that is typically targeted by drugs that treat asthma and COPD. Montgomery hopes to understand this receptor from a new perspective to formulate new rationales in drug development for receptors in the same family.

The beta-2 adrenergic receptor is a part of a family that represents 30% of targets for current FDA-approved drugs. Understanding how the receptor works is important for more effective and targeted drug design and using computational biochemistry to approach scientific questions allows researchers to look at drug targets in a completely new way. Montgomery's research could provide information to potentially streamline the drug design process.

Montgomery is working alongside her advisor, Lemkul, assistant professor of biochemistry, to use computers to simulate this membrane receptor at an atomistic scale to understand how it binds drugs and subsequently changes its shape, altering its activity.

"Julia's proposal was really remarkable, in the sense that she thought of a completely new way to investigate a somewhat 'old' system that scientists have studied for decades," said Lemkul. "Her hypothesis that subtle changes in specific parts of the protein may impact its entire activity is really exciting. It is exactly this type of novel thinking that merited the prestigious award she received."

Read the full story in our Newsroom on our website.

FACULTY AND STAFF SPOTLIGHTS

New Staff



Join us in welcoming Jen Stewart (left) and Austin Compton (right) to the department!

Stewart joined as an Academic & Student Support Advisor and works with our prospective and current biochemistry students.

Compton is our newest postdoctoral associate. He completed his undergraduate and graduate career in the department - we're so excited that he's joined us in this new role.

The Department of Biochemistry is hiring and we want you to join our team! We have three open positions that we're looking to fill: a tenure-track position in biochemistry, a collegiate faculty position in biochemistry, and a fiscal coordinator.

Promotions



Dr. Daniel Slade has been approved by the Board of Visitors for promotion to Associate Professor. In addition to this new promotion, Slade has also been named the new Graduate Program Chair for our department.

In this new role, Slade will supervise and coordinate the administration and governance of graduate studies within the graduate program, serve as a point of contact for graduate students enrolled in the program, and lead the recruiting efforts to find the next talented cohort of biochemists.

Slade joined the department in August 2014 and will be starting his eighth year this semester. Since he began working in the department, he has taught multiple courses including general biochemistry, protein structure and function, and advanced applications of molecular life sciences, and acted as a research mentor for many graduate and undergraduate students working in his lab.

The Slade Lab investigates how bacteria influence the tumor microenvironment and Slade and his team of researchers recently discovered that mouth bacterium may cause colon cancer to spread. This finding was covered by several media outlets and Slade was interviewed by local news station WDBJ7 to explain how poor oral hygiene could cause the bacteria, *Fusobacterium nucleatum*, to migrate to other parts of the body where this bacterium can negatively affect cancer patient outcomes.

Read the full story in our Newsroom on our website.

Awards



The Andy Swiger Land Grant Award recognizes faculty members whose accomplishments help to fulfill the land grant mission of addressing state and national needs through teaching, research, or Virginia Cooperative Extension. This year, the award recipient is Dr. Richard Helm for establishing the Virginia Tech-Mass Spectrometry Incubator in 2007 and his continued work as its director.



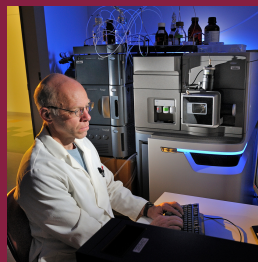
Each year, the College of Agriculture and Life Sciences celebrates and recognizes the accomplishments of its students and faculty in the core area of diversity and inclusion. Dr. Chloé Lahondère was one of three faculty and staff winners of the VT CALS Diversity and Inclusion Service award. In her time in biochemistry, Lahondère established a departmental Diversity and Inclusion Committee in 2018 and her leadership of this group has transformed how the department functions as an academic unit and as a community.



The Virginia Tech Favorite Faculty Awards recognized five recipients who encompass the five Aspirations of Student Learning in their work. The awards, chosen by students, honor faculty at Virginia Tech for their contributions to student education, growth, and development through values of learning, leadership, and service. Dr. Chevon Thorpe was among one of the recipients and she was awarded for the aspiration "Commit to Unwavering Curiosity."

Full stories about our award winners are available to read on our website in our Newsroom.

Grants



The Virginia Tech College of Science Lay Nam Chang Dean's Discovery Fund recently announced research awards supporting such diverse projects as water quality, the discovery of drugs for pain and viruses, mental health treatment, and economic forecasting. Eleven grants were awarded to researchers, Drs. Richard Helm (left) and Anne Brown (right) were among the recipients. Helm is working alongside two biological sciences faculty, Drs. Brenda Winkel and Shihoko Kojima, to work on a project on "Strengthening the Evidence for Crosstalk between Flavonoid Metabolism and the Plant Circadian Clock." Brown is co-investigator alongside Dr. Zhaomin Yang (Biological Sciences) and together they're focusing on "Experimentally and Computationally Establishing *C. diff.* PiIB for Antivirulence Drug Discovery."



The College of Agriculture and Life Sciences recently awarded seed grants to researchers around the college. The seed grant program supports the priorities of the 2020 CALS strategic plan. Twenty-seven grants are for Center for Advanced Innovation in Agriculture affiliated faculty who push the boundaries of innovation in agriculture. Drs. Glenda Gillaspay (left) and Biswarup Mukhopadhyay (right) were among the recipients of these grants. The CALS seed grants will fund Gillaspay's project on "The Phosphorous Crisis" and Mukhopadhyay's project on "Efficient Anaerobic Digestion of Food Waste to Methane."

FACULTY AND STAFF SPOTLIGHTS

Virginia Tech researchers identify a missing piece of the Lyme disease puzzle



Epidemic. Pandemic. These terms have become second nature to us, popping up in everyday conversation, and for good reason – COVID-19 is the latest pandemic to pose a threat to humanity.

But in recent months, far less attention has been paid to another widely spread problem that has been proliferating since the late 1970s: Lyme disease. Lyme disease is the most reported vector-borne disease in the country. Over the past 20 years, the United States has experienced a dramatic increase in both the number of reported cases and the geographic distribution of the disease. In Virginia, the disease is transmitted by blacklegged ticks, which are infected with the Lyme disease-causing bacterium *Borrelia burgdorferi*.

Virginia Tech Assistant Professor Brandon Jutras and his lab have continued to tackle the Lyme disease epidemic over the past year, and they have recently identified another missing piece of the Lyme disease puzzle.

“This discovery furthers our understanding of how *Borrelia burgdorferi* causes inflammation and disease,” said Mari Davis, who is the lead author on the paper, a former master’s graduate of the Jutras lab in the Department of Biochemistry in the College of Agriculture and Life Sciences. “It is a testament to how unique this bacterium is – and how we need to keep working to understand more about what is going on behind the scenes in order to develop future diagnostics and treatments.”

Their findings were recently published in *PLOS Pathogens*, a peer-reviewed open-access medical journal.

Almost all bacteria, including the Lyme disease-causing bacterium, make a mesh-like bag to protect the inside of their cells. This bag is known as peptidoglycan. In 2019, Jutras identified peptidoglycan, a lingering cell wall component of the bacterium *Borrelia burgdorferi*, as a likely culprit of the inflammation and Lyme arthritis, the most common late-stage symptom of Lyme disease.

Jutras’ previous research has shown that peptidoglycan in *Borrelia burgdorferi* lingers in the bodies of Lyme arthritis patients after the bacteria has entered the body. Weeks to months after the initial infection, the peptidoglycan remains, inciting inflammation and pain.

In this newest development, the lab discovered a protein associated with the peptidoglycan of *Borrelia burgdorferi* that plays an amplifying role in causing inflammation in Lyme arthritis patients by acting as a molecular beacon that antagonizes the patients’ immune system.

“We are thrilled about Dr. Jutras’ NapA discovery, publication, and the implications for Lyme disease diagnostics and treatment,” said Matt Hulver, executive director of the Fralin Life Sciences Institute.



The leading not-for-profit sponsor of Lyme disease research in the United States, the Bay Area Lyme Foundation, announced its three recipients of its 2021 Emerging Leader Awards and one of the recipients was Dr. Brandon Jutras! The awards are designed to support established and up-and-coming scientists who have identified new and defined approaches to improve diagnostics or therapeutics for Lyme disease.

Read the full story in our Newsroom on our website.

FACULTY AND STAFF SPOTLIGHTS

Revolutionary mosquito researchers receive \$2.7 million grant



Mosquitoes may be small, but they are a formidable foe. Not only can they smell over 400 chemicals that we emit and detect the carbon dioxide we breathe out, but they can even adapt their daily behavior in response to our own.

With the help of a \$2.7 million grant from the National Institute of Allergy and Infectious Diseases (NIAID), researchers at Virginia Tech are now investigating how mosquitoes adjust their olfactory, or smell, rhythms in response to changes in our daily activity.

“Mosquitoes are sometimes described as the deadliest animal on Earth,” said Clément Vinauger, principal investigator on the project and assistant professor from the Department of Biochemistry in the College of Agriculture and Life Sciences. “What we are seeing is an increase in the rate of mosquitoes that become resistant to insecticides and have some other level of behavioral resistance. We need another tool or other tools to control mosquito populations.”

Vinauger alongside assistant professor Chloé Lahondère and university distinguished professor Zhijian "Jake" Tu, both from the Department of Biochemistry in the College of Agriculture and Life Sciences and affiliated faculty members of the Center for Emerging, Zoonotic, and Arthropod-borne Pathogens, an arm of the Fralin Life Sciences Institute, received the grant to support a five-year project to study mosquito's biological timing, or chronobiology.

The research will look at the molecular and cellular levels of the mosquito brain to find what allows mosquitoes to adapt and finetune their biological rhythms.

“Mosquitoes have rhythms, exactly like us,” said Lahondère, who is also an affiliated faculty member of Fralin's Global Change Center. “We are very active during the day and then we go to sleep. For mosquitoes, we don't know a lot about their biological rhythm, so we are trying to understand how they process information at different times of the day and what is going on in their brain.”

The specific mosquito species being studied is *Aedes aegypti*, a primary vector for Zika, dengue, and yellow fever. These invasive mosquitoes prefer to feed on people and live throughout the Southern United States, including Virginia.

With a more urbanized environment and a changing climate, the ranges of these mosquitoes and other mosquito species could expand over the coming years. Adding to that, large populations of mosquitoes are becoming both physiologically resistant to insecticides and behaviorally resistant to other control methods like bed nets.

“With climate change, there is a potential impact on mosquitoes' geographic distribution,” Lahondère said. “As temperatures are rising, mosquitoes can move north, and that exposes people to the potential diseases that they can transmit.”

Read the full story in our Newsroom on our website.



Dr. Zhijian "Jake" Tu was featured on the podcast Pulse of the Planet with Jim Metzner, where he discussed his lab's discovery of the male determination factor in *Aedes aegypti* mosquitoes! Listen to the 2-minute episode Controlling Zika - Transgenic Mosquitos on Apple Podcasts, Spotify, or wherever you listen to podcasts.

FACULTY AND STAFF SPOTLIGHTS

New NSF-funded research explores origins of blood-feeding in mosquitoes



An interdisciplinary team of Virginia Tech researchers is seeking to understand the physiological and biomechanical characteristics of blood-feeding in mosquitoes and their evolutionary transition from sugar to blood-feeding – knowledge that may help future work to stop disease transmission.

“Mosquitoes are the deadliest animals on the planet due to the pathogens they transmit to humans and other animals,” said Chloé Lahondère, an assistant professor of biochemistry in the College of Agriculture and Life Sciences and an affiliate faculty member of the Center for Emerging, Zoonotic, and Arthropod-borne Pathogens in the Fralin Life Sciences Institute.

“Female mosquitoes transmit pathogens while biting a host,” she continued. “Females can also feed on plants, so food sources include blood, nectar, and plant fluids, which differ widely in viscosity and temperature. One of the key objectives of our project is to understand the specific adaptations that allow certain species of female mosquitoes to feed on such a wide range of fluids.”

Lahondère and Clément Vinauger, also an assistant professor in biochemistry in the College of Agriculture and Life Sciences and an affiliate faculty of the Center for Emerging, Zoonotic, and Arthropod-borne Pathogens, will work with Jake Socha, the Samuel Herrick Professor in biomedical engineering and mechanics, and Mark Stremler, professor in biomedical engineering and mechanics in the College of Engineering, to analyze the biomechanical constraints and trade-offs between sugar and blood-feeding in mosquitoes, thanks to a \$1 million grant from the National Science Foundation.

While much is known about mosquito feeding, such as some species’ ability to feed on a wide range of hosts, from mammals to amphibians, how this ability evolved and the effects thereof remain unknown.

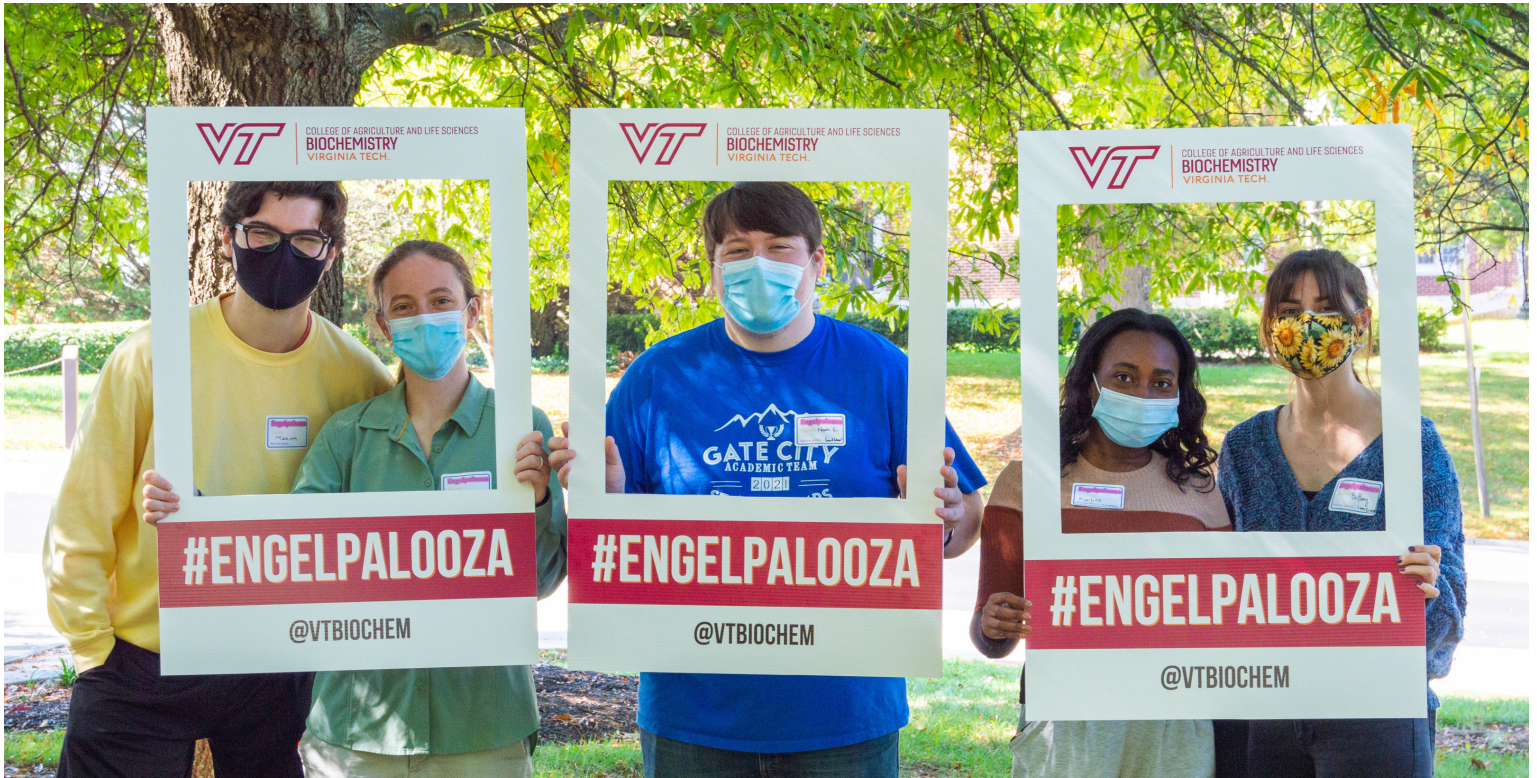
Male and female mosquitoes use sugar to feed their metabolism and sustain life. Males feed solely on nectar throughout their life, while females also feed on vertebrate hosts – such as humans – and use blood nutrients to produce eggs. Only adult females feed on blood, and this is true for only some species. This specialization of blood-feeding depending on sex and species is unique and is the main topic of interest in the team’s research.

All members of the team have studied mosquitoes previously, but these insects form the basis of Lahondère’s and Vinauger’s research programs. In the Lahondère Lab, research is focused on blood-sucking insects’ thermal biology, physiology, and neuro-ethology. Neuro-ethology is the study of the neural basis of natural behavior in animals, looking at how sensory organs and central structures behaviorally process stimuli and how this is integrated by the central nervous system. The Vinauger Lab relies on an integrative, collaborative approach in studying the molecular, physiological, and neural basis of mosquito behavior.

The other half of the research team will bring an engineering element to the physiological basis of the project. Transcending discipline boundaries enables all four researchers to use complementary experimental and computational methods to determine both the physiology and the biomechanics of mosquitoes’ blood versus sugar feeding. They also aim to identify underlying differences in fluid ingestion in mosquitoes, knowing the insects ingest fluids that differ widely in both temperatures – such as those of cold-blooded amphibians and warm-blooded humans – and viscosity.

Read the full story in our Newsroom on our website.

ENGELPALOOZA



On Tuesday, October 12, 2021, the Department of Biochemistry hosted its third annual student research showcase: EngelPalooza! This year, the event was held outside on Fralin Lawn from 11 AM-3 PM and we want to thank everyone who joined and made this such a great event! We had a whopping 179 people in attendance, our largest EngelPalooza turnout since our first one in 2019! We even had a biochemistry alum join us via Zoom.

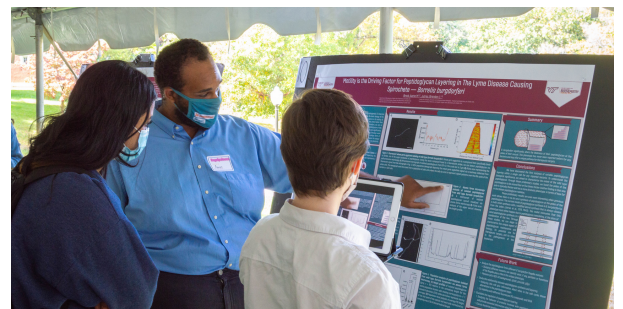
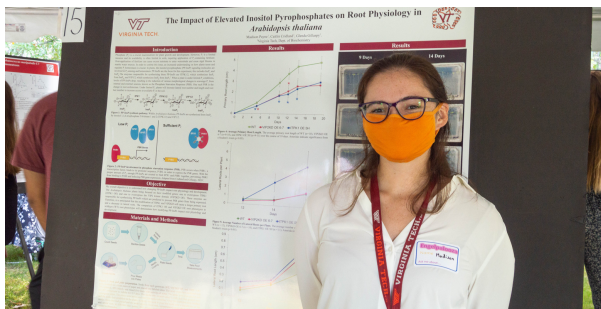
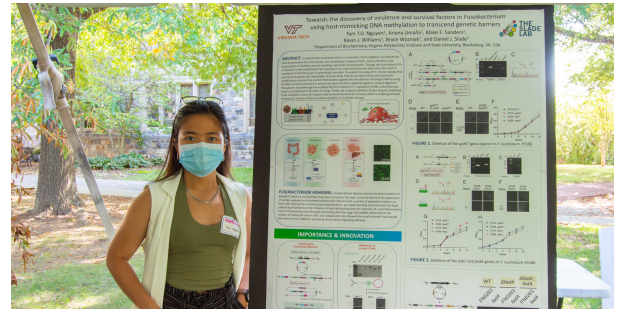
Throughout the late morning and early evening, we had 12 undergraduate presenters and 6 graduate student presenters share their expertise with fellow scientists in our department, people within the Virginia Tech scientific community, and beyond! Research topics throughout the showcase covered computational chemistry and molecular dynamics, pathogenesis and vector-borne disease, drug discovery, redox homeostasis and regulation, and molecular plant physiology.

In addition to the research presentations, we had three information booths: biochemistry study abroad opportunities with Dr. Michael Klemba; ASBMB-degree certification with Dr. Peter Kennelly; and VT Biochemistry Club with Dr. Kristopher Hite.

EngelPalooza is made possible by a grant from the Howard Hughes Medical Institute (HHMI) Inclusive Excellence program. Special thanks to the Biochemistry Department, as well as the department's Diversity, Equity, and Inclusion Committee, for their continued support and involvement.

Undergraduate Presenters

- Anthony Briganti
- Truitt Elliott
- Maegan Gabby
- Benjamin Lewis
- Meghana Kamineni
- Madison Payne
- Andrew Pedraza
- Shannon Pollock
- Zoie Sadler
- Colin Short
- Molly Simek
- Megan Toms



Graduate Presenters

- Aaron Brock
- Mara Kushelman
- Mecaila McClune
- Tam Nguyen
- Joanna Reinhold
- Kevin Williams