ENGEL HALL NEWS

BIOCHEMISTRY @ VIRGINIA TECH

FALL 2017

IN THIS ISSUE

New Year & New Update

The Department of Biochemistry has been busy getting ready for the fall semester. With everything from new faculty members and research updates, to the Biochemistry undergraduate class of 2021, stick around and get acquainted with what we've been up to!

Welcome Class of 2021!

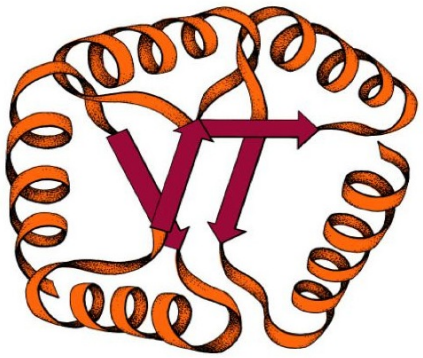
The class of 2021 consists of over 7,000 students from 49 states as well as 545 international students. Among these students are 120 Biochemistry undergraduates, all ready to embark on their new journeys.

Undergraduate Orientation – Summer 2017

Throughout the course of the summer, the Biochemistry boardroom hosted over 100 Biochemistry first-year students. With the help of multiple undergraduate peer mentors, Academic Advisor David Lally successfully introduced this fall's first year students to the department and was able to get them all registered for their first semester here at Virginia Tech – hello, General Chemistry!

Fall Seminar Series

Biochemistry Seminars are back this semester with many great speakers lined up. Virginia Tech Biochemistry professors Drs. Bin Xu and Jinsong Zhu will present this semester, along with representatives from East Carolina University, Penn State, and Lehigh University, as well as colleagues from other departments here at Virginia Tech. Seminars will take place each Monday from 4:00-5:00 PM in Engel Hall, Room 223. Please contact Zerita Montgomery (zerita@vt.edu) for more information.



New Faculty Spotlights

The Biochemistry Department is pleased to welcome several new faculty members this semester. Pages 2,5

Recent Research

Virginia Tech biochemists dip into the health benefits of olives and olive oil. Page 3

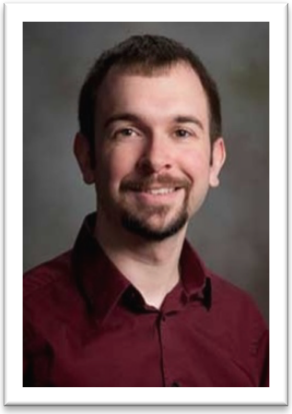
Awards

Virginia Tech biochemistry researchers win Alzheimer's research awards from Virginia General Assembly. Page 4

Faculty Research Retreat

Before the semester officially began, the department came together to enjoy a day of research and fellowship at Mountain Lake Lodge in Pembroke, VA. Page 6

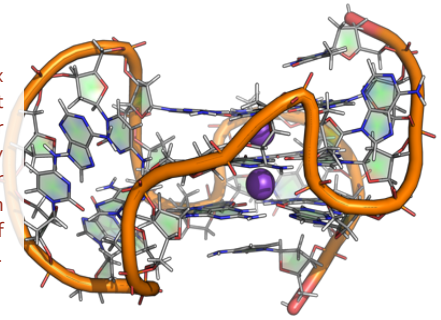
New Faculty Spotlight:
Dr. Justin Lemkul



Assistant Professor Dr. Justin Lemkul uses computational/theoretical methods, particularly molecular dynamics (MD) simulations, to dissect the atomistic details of biomolecular phenomena on time and length scales that are inaccessible even to the highest resolution experimental techniques. His specific interests are in understanding pathological protein unfolding and aggregation and utilizing unusual states of nucleic acids for pharmaceutical design. Underlying these efforts is a cutting-edge simulation model that more accurately represents electrostatic interactions that are crucial to defining the folded and unfolded conformational ensembles of these systems and the thermodynamic factors that govern them. By leveraging the exceptional computational facilities at Virginia Tech, Dr. Lemkul is eager to break new ground in complex biological pathways.

Conformational ensembles of intrinsically disordered and amyloid-forming proteins are important to biological function and many human diseases.

Dr. Lemkul's interest in understanding the unfolding of amyloidogenic proteins is an outgrowth of his Ph.D. work, which was conducted here at Virginia Tech. Amyloid aggregate formation is central to the pathology of nearly two dozen human diseases, yet the details of how they form remain largely unknown. His research seeks to determine the thermodynamic driving forces for protein conformational change, particularly with respect to helix-coil equilibrium that are important in the earliest stages of amyloid diseases. Gaining insights into these systems is important for designing anti-amyloid therapeutics for Alzheimer's, Parkinson's, type II diabetes, and many more chronic human diseases.



The G-quadruplex formed in the c-kit gene promoter region, which may serve as a target for drug design in several forms of cancer.

Dr. Lemkul's research also aims to study non-canonical nucleic acid structures called G-quadruplexes. These structures form in guanine-rich DNA and RNA sequences and are involved in regulating gene expression. Little is known about the driving forces for their stability and folding, and previous simulation efforts have been stifled by unsuitable physical models. With his cutting-edge polarizable electrostatic model, Dr. Lemkul is uniquely positioned to break new ground in understanding the dynamics of these structures and how they can be exploited for drug design. Despite common sequence motifs, G-quadruplexes have considerable structural differences among them. Thus, it should be possible for his team to design new classes of effective, selective modulators of gene expression to treat a wide range of conditions, especially those with "undruggable" protein targets like those found in several types of cancer. Dr. Lemkul plans to leverage recent developments that incorporate dynamics in computer-aided drug design to advance this effort.

New Faculty Spotlight:
Dr. Sasha Marine

Dr. Sasha Marine joined the Department of Biochemistry in August 2017 as a Collegiate Assistant Professor. Dr. Marine received her B.S. degrees in biochemistry and biotechnology from St. Cloud State University, MN. She completed her Ph.D. at Virginia Tech in plant pathology with a focus on fungicide resistance in tree fruit. After her graduate training, she accepted a post-doctoral position with the University of Maryland, where she conducted research on organic vegetable production and food safety. During that time, she also worked as an adjunct at the University of Maryland Eastern Shore. She then accepted a post-doctoral position with Virginia Tech, where she conducted research on emergent diseases of woody ornamentals and served as a co-instructor for a graduate writing course.

Currently, Dr. Marine is the instructor for BCHM 2024: Concepts of Biochemistry, a large non-majors undergraduate course. She also serves as the Program Coordinator for a Research and Extension Experiential Learning program in translational plant sciences, funded through USDA NIFA. In her new position in the Department of Biochemistry, Dr. Marine is excited to help undergraduates develop a broad appreciation of the discipline.

Virginia Tech Biochemists dip into the health benefits of olives and olive oil

BY Lindsay Key

The health benefits of olives— and associated natural products such as olive oil—have long been recognized and touted by proponents of the Mediterranean diet.

However, little was previously known about what specific compounds and biochemical interactions in the fruit contribute to its medical and nutritional benefits such as weight loss and prevention of type 2 diabetes.

A Virginia Tech research team discovered that the olive-derived compound oleuropein helps the body secrete more insulin, a central signaling molecule in the body that controls metabolism. The same compound also detoxifies another signaling molecule called amylin that over-produces and forms harmful aggregates in type 2 diabetes. In these two distinct ways, oleuropein helps prevent the onset of disease.

The findings were recently published in the journal *Biochemistry* as a Rapid Report, which is reserved for timely topics of unusual interest, according to the journal.

"Our work provides new mechanistic insights into the long-standing question of why olive products can be anti- diabetic," said Bin Xu, lead author, assistant professor of biochemistry in the College of Agriculture and Life Sciences, and a Fralin Life Science Institute affiliate. "We believe it will not only contribute to the biochemistry of the functions of the olive component oleuropein, but also have an impact on the general public to pay more attention to olive products in light of the current diabetes epidemic."

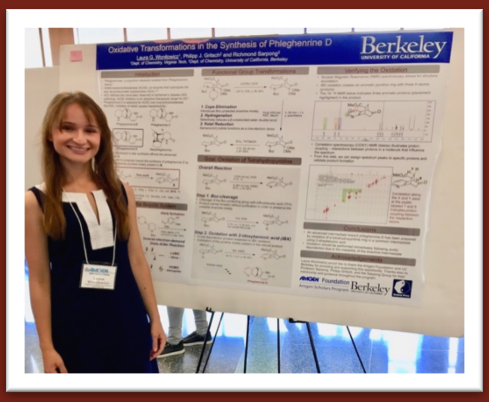
The discovery could help improve understanding of the scientific basis of health benefits of olive products and develop new, low-cost nutraceutical strategies to fight type 2 diabetes and related obesity.

Next steps include testing the compound in a diabetic animal model and investigation of additional new functions of this compound, or its components, in metabolism and aging.

Xu is also affiliated with the Virginia Tech Center for Drug Discovery.

Co-authors on the paper include Dongmin Liu, a professor of human nutrition, foods, and exercise in the College of Agriculture and Life Sciences; Ling Wu, a research scientist in the Department of Biochemistry; and Paul Velander, a doctoral student in the Department of Biochemistry.

CHECK OUT THESE SUPER BIOCHEMISTRY STUDENTS:



"This summer, as an Amgen Scholar at the University of California Berkley, I conducted research in natural products chemistry. I tied in by biochemistry background to organic synthesis as I worked toward building a structurally complex bioactive plant product."

LAURA WONILOWICZ, Senior

Junior, **ASTRID MEENAN**, spent the summer shadowing, learning, and serving with the Atlantis Project in Montevideo, Uruguay. Astrid stated that the biggest help she had while in Uruguay, was her sharpened sense of diverse community that she developed throughout her time in Biochemistry. "It was an amazing month, and anyone who wants to explore medicine should venture into doing this program. It gives you a new perspective, and an idea of how medicine works outside of America."

Virginia Tech Biochemistry researchers win Alzheimer's research awards from Virginia General Assembly

BY Amy Painter, Zeke Barlow & Steven Mackay

Two Virginia Tech Biochemistry researchers have received money from the Commonwealth of Virginia's Alzheimer's and Related Diseases Research Award Fund, established in 1982 to spur innovative investigations into Alzheimer's disease and related disorders.

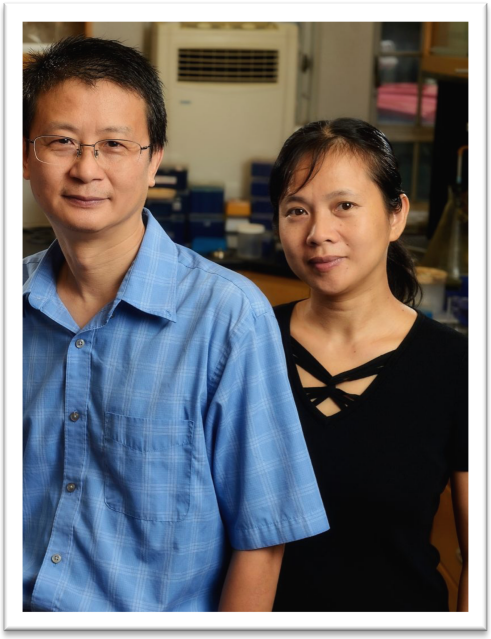
Among those receiving the 2017-18 funds are Ling Wu, a research scientist, and Bin Xu, an assistant professor, both with the Department of Biochemistry, which is part of the College of Agriculture and Life Sciences and the College of Science.

The funding was established by the Virginia General Assembly to fund research into the causes, epidemiology, diagnosis, and treatment of the disorder; public policy and the financing of care; and the social and psychological impacts of Alzheimer's and other related neurological diseases in the elderly.

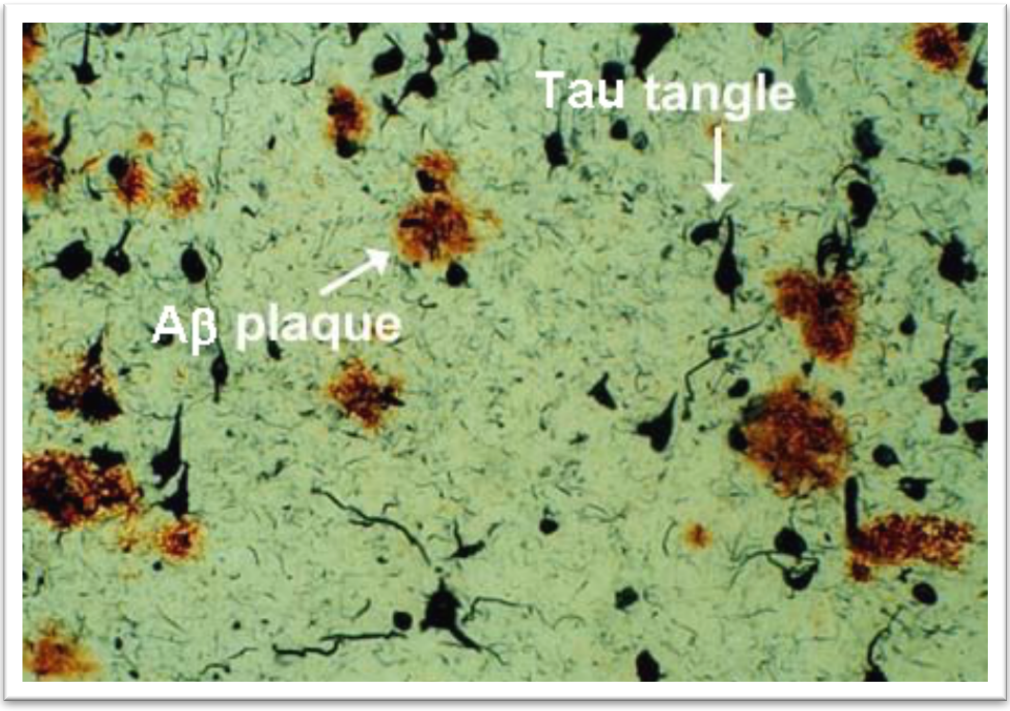
Alzheimer's is characterized by the accumulation of two types of abnormal structures in the brain, amyloid plaques, made of a small protein called amyloid beta peptide, and neurofibrillary tangles, made of a protein called tau. To date, the majority of clinical efforts have focused on the development of drugs to target amyloid beta, efforts that have been largely unsuccessful. Wu and Xu believe that tau may be a better target for drugs designed to combat Alzheimer's. They hope to learn more about the mechanisms behind the toxicity of this protein to the neurons and to explore how this toxicity may be inhibited.

The team will screen repurposed drugs from the National Institutes of Health's Clinical and Pharmaceutical Collection libraries of small molecules in order to identify compounds that can block the formation of tau aggregation and protect neurons from tau-induced cytotoxicity. Further tests will establish whether compounds that emerge from the screenings can protect cultured neurons from the adverse effects of extracellular tau aggregates.

Due to a rapidly aging population and the modern sedentary lifestyle, Alzheimer's is reaching epidemic proportions, according Wu and Xu. It is now the most expensive disease in the United States, exceeding even cancer and cardiovascular disease for the total annual cost to American society.

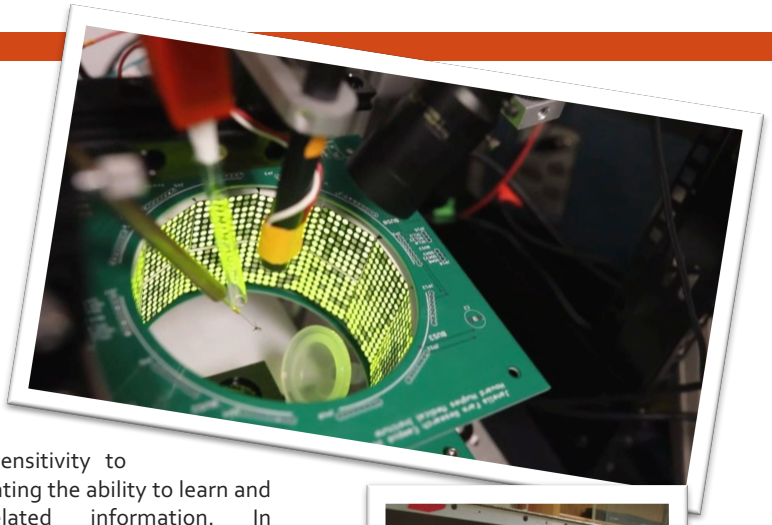


Awards for Wu and Xu were enhanced by a donation from Mrs. Russell Sullivan, of Fredericksburg, VA, in memory of her husband, who died of dementia. The award competition is administered by the Virginia Center on Aging in the School of Allied Health Professions at Virginia Commonwealth University.



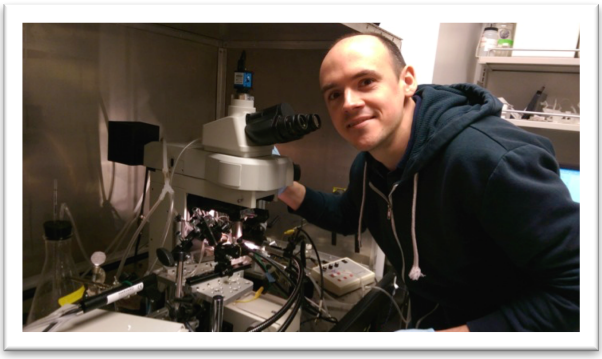
Postmortem tissue sample from an Alzheimer's disease (AD) patient brain reveals AD pathology including amyloid-beta plaques and tau neurofibrillary tangles.

(Image courtesy of the Buck institute for Research on Aging)



New Faculty Spotlight:
Dr. Clément Vinauger & Dr. Chloé Lahondere

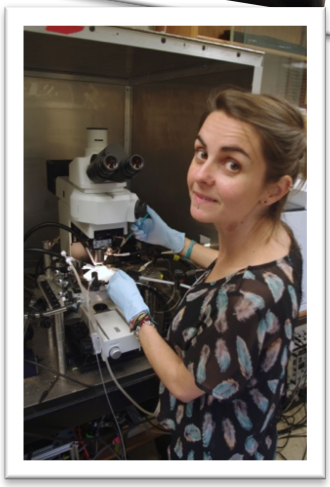
Disease vector insects, and among them mosquitoes, are making headlines and they are claiming lives. The global strategy for management of vector-borne diseases involves controlling vector populations, to a large extent through insecticide application. However, vector-borne diseases are now resurgent, largely because of rising insecticide resistance in vector populations and the drug resistance of pathogens. In this context, Dr. Clément Vinauger's research is aimed at closing key knowledge gaps in our understanding of the mechanisms that allow mosquitoes to be such efficient disease vectors and, more specifically, to identify and characterize factors modulating their host-seeking behavior.



A remarkable feature of blood-feeding insects is their rhythmic activity and biting patterns. In a large number of disease vector species, different activities are modulated throughout the day and diverse vector-host interaction patterns have been described. Previous work has shown that biological clocks mediate host-vector interactions through diverse processes, such as regulating the sensitivity to host odors or modulating the ability to learn and memorize host-related information. In particular, Dr. Vinauger and his collaborators have shown that triatomine bugs only learn at times when it is biologically relevant (Vinauger and Lazzari, 2015). However, despite clear epidemiological relevance, we know very little about the underlying mechanisms modulating vector-host interactions throughout the day. In addition, there are many examples in the literature of pathogen infection affecting the behavior of insect vectors. But again, despite obvious epidemiological consequences, the mechanisms underlying the modulation of vectors' behavior and activity rhythms by parasites remain to be unraveled.

In this context, the focus of Dr. Vinauger's laboratory is to investigate circadian and pathogen induced modulations of vector-host interactions, while leveraging interdisciplinary tools to go from the gene, to the neuron, to the insect behavior, and combining methods from Biochemistry, Neuroscience, Engineering, and Chemical Ecology.

The Biochemistry Department is not only very lucky to welcome Dr. Vinauger as an Assistant Professor, but also to welcome his wife, Dr. Chloé Lahondere as a Research Assistant Professor. Dr. Lahondere's research focuses on how disease vectors such as kissing bugs, tsetse flies, and mosquitoes overcome the heat stress caused by the rapid intake of a large volume of warm blood. Her future research plans are centered on how environmental temperature impacts mosquitoes' olfactory system and physiology. In the context of recent outbreaks of vector-borne diseases (e.g. Zika) and of rapid climate change, Dr. Lahondere's research aims to identify potential targets for disease vector control. Both Drs. Vinauger and Lahondere come to Virginia Tech from the University of Washington in Seattle, WA.



New Faculty Spotlight: Molly Wilson

Molly Wilson joined the Biochemistry Department this semester as an Academic and Student Support Advisor. Mrs. Wilson completed a BS in Biochemistry and an MS in Entomology here at Virginia Tech. Previously, she was the Director of the Virginia Tech Bed Bug and Urban Pest Information Center and a Research Associate in the Department of Entomology. Mrs. Wilson is thrilled to join the Academic Advising team in the department and looks forward to helping students find their own path through the Biochemistry curriculum, so that they can meet their future career goals, whether they be academic, personal, or professional.

Faculty Research Retreat

August 24, 2017

Just before the semester began, on August 24, 2017, the department gathered for a day of research and fellowship at Mountain Lake Lodge in Pembroke, VA. Research faculty, collegiate faculty, post-docs, and graduate students spent the day listening to research updates and engaging in discussions. An extended lunch break combined with beautiful weather afforded everyone the opportunity to stretch their legs and enjoy the outdoors by playing lawn games or taking on a short hike. The day culminated with a poster session which facilitated individual discussions among attendees.

The department's cohort of new graduate students enjoyed the day's presentations and discussions as it gave them the opportunity to interact with members of different research groups prior to submitting their rotation selections.

The retreat at Mountain Lake Lodge gave me the opportunity to meet everyone in the department and learn about current research. After listening to individual presentations, I had a more comprehensive understanding of the research occurring in each lab and felt more confident in my rotation selections. The poster presentations also allowed me to ask the questions that I had following each presentation and gain more insight into the specific projects and the environment in each lab. – Diane Eilerts

The Fall 2017 Biochemistry retreat was my first formal introduction to the research activity in the department. The scenic beauty of the Mountain Lake Resort made those sessions very easygoing and was very beneficial for me to decide which lab I would love to work in towards my rotations. – Nazneen Sultana

I really enjoyed the retreat at Mountain Lake Lodge this year because I had a few professors in mind that I was torn between regarding rotation and major professor selection. Getting to have that many faculty available at once was very helpful in my decision process. The poster session was my favorite portion of the retreat for the ability to have candid conversations and to get to know the faculty as better people, not just by the work their lab produces. – Megan Richardson

ENGEL HALL NEWS

BIOCHEMISTRY @ VIRGINIA TECH

111 Engel Hall (0308)
340 West Campus Dr.
Blacksburg, VA 24061

www.biochem.vt.edu