

# DISCOVERIES



## Eyes on the Prize

Like many undergraduate students, **Jessica Fernandez** had no idea about the variety of career paths available for someone with a PhD in biology. She expected to go into nursing, but changed her mind when she took a microbiology class.

“The professor was so engaging and excited about microbiology that I scheduled a meeting with them to discuss potential career options in microbiology,” says Fernandez, who continued taking biology classes when she transferred to California State University in Los Angeles. While there, she joined a research team that collaborated with the Jet Propulsion Lab characterizing microbes isolated from space crafts and clean rooms.

Fernandez joined the PhD program in biochemistry and cellular and molecular biology at UT in fall 2014. Her decision to come to UT was in large part due to the wide variety of research projects to choose from within the department. She was admitted as a scholar in the NIH-funded Program for Excellence and Equity in Research (PEER). After rotating in several labs, Fernandez joined the Burch-Smith lab where she studies the role of cell-to-cell communication in plants through pore-like structures called plasmodesmata.

“These structures have diverse roles, including being involved in pathogen responses,” Fernandez says. “My project focuses specifically on the roles of secondary metabolites produced by plants in regulating intercellular trafficking through the plasmodesmata.”

In 2019, she was awarded an F31 Ruth L. Kirschstein Individual National Research Service Award from the National Institutes of Health to support her research.

“Writing my own grant was a real eye opener on organizing what I need to complete experimentally,” Fernandez says. “It truly allowed me to focus and keep my eye on the prize. Since submitting the very first proposal, which was rejected, I was able to think of the project clearer. The resubmission was definitely an easier process and the proposal was much stronger.”

In 2020, she won the Dr. Ray Holton Plant Sciences Award and Dissertation Improvement Award for her research. She currently has 10 publications. Research, however, is not always an easy or linear path. There are often obstacles that must be worked through.

“One of my most memorable moments was trying to get a northern blot to work for a paper we were re-submitting,” Fernandez says. “The protocol was about 13 hours long and I couldn’t get the image. Turns out, a buffer was bad. Finally, at around 11 p.m. on the night before the paper was due, I got the image. I called my advisor and we both screamed with joy! The next morning we got the figure and submitted the paper.”

Fernandez appreciates the collaborative and supportive environment in BCMB and looks for the same in any post-doctoral program she enters. She also has support at home that helps as she balances work and personal time, which is difficult at any career stage.

“I always feel like I never give either research or my family the time they deserve. I don’t have any given times that I try to meet, but if the week is light for work, I’ll try and spend more time at home,” Fernandez says. “I have a very supportive husband though, so I never have to really worry about dinner or taking charge of night routines for our child if I’m running late.”

In the small amount of spare time outside of lab and family, Fernandez likes to garden.

“The past two summers we’ve grown all kinds of vegetables,” she says. “It’s very meditative to go out and look at the fruits of my labors.”



**GLADYS  
ALEXANDRE**  
Professor and  
Department Head

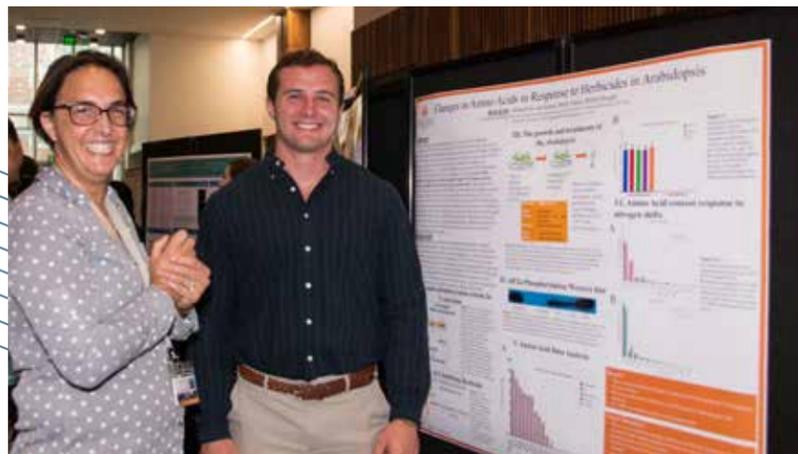
## We are ready

Oh yes we are! We are ready to meet challenges and unknown circumstances. This is what a training as a PhD prepares you for—troubleshooting, contingency planning, accounting for unknown variables, and most importantly, persevering in the face of challenges. As everyone else, we were not ready for the disruption brought about by a global pandemic, but we were prepared to shift what we were doing to meet the new circumstances. Within a week, during the spring break, we turned our in-person classes to online courses and strived to provide quality and meaningful instruction to our students while managing chaos in our research laboratories. We had to shut down research for a while, but have been getting back with new rules, like the rest of the country. Our graduate students were impacted by the research slow down more than most as they depend on access to research facilities to make progress. We have been creative and compassionate in ensuring all got as much as we could from the disruption. We were ready.

Our research was also ready to inform the public of the challenges of COVID-19. We hosted a symposium on the cellular and molecular biology underlying what we knew at the time about COVID-19 in March 2020, just before the university shut down. Professors Guo and McCord, faculty in BCMB, and Micholas Smith, research assistant professor in BCMB, delivered compelling messages regarding the molecular biology and genomics contexts of the virus and what realistic hopes we should have toward vaccines and therapies. Jeremy Smith, a governor's chair in BCMB, has been at the forefront of the effort to discover vaccine targets to fight COVID-19.

This year, we welcome Jianbin Wang as an assistant professor in BCMB, working on programmed DNA elimination and are proud to celebrate the promotion and tenure of Maitreyi Das to the rank of associate professor. We have also celebrated the accomplishments of our top undergraduate and graduate students, faculty, and staff by honoring them with our annual awards. We were not able to meet in person, but we have strived to recognize their contribution to advancing the department's mission. We also were fortunate to be able to recruit Amit Joshi as an assistant professor in cell biology who will start in January 2021.

This year, I look forward to exploring curricular innovations to meet the demands and interests of students. We need to innovate constantly and be ready to address our students' needs. I will lead a casual and informational "meet and greet" meeting with undergraduate students majoring in BCMB to understand what their needs and concerns are throughout the fall semester. I hope this will create a sense of community and belonging in BCMB and I believe, will be critical in guiding future curricular revisions. In this effort, I am thankful to be assisted by our external advisory board members who are always willing and ready to lend a helping hand. I hope that those reading these lines would feel motivated to join these ranks. While I feel I am prepared and ready, I can use the help of our community in achieving these ambitious goals.



## Expanding Technical Experience



**Matthew Everett** is a senior in BCMB starting his fourth year of research in the lab of Keerthi Krishnan where he investigates synaptic plasticity in a mouse model of CDKL5 disorder, which is a rare neurodevelopmental disorder. In humans, this disorder is characterized by early-onset seizures. For this, he specifically examines the role of perineuronal nets and synaptic plasticity in the brain of mice and their relationship to the onset of CDKL5 disorder.

Everett won the Silver Award and the Division of Natural Sciences Award for Excellence for his poster presentation at the 2020 Exhibition of Undergraduate Research and Creative Achievement (EURēCA) event hosted by the UT Office of Research and Engagement. He also won the 2020 Carolyn Fite award from the BCMB department and an Award of Excellence at EURēCA in 2019. His research in the Krishnan lab is leading to a publication where he will be co-first author.

"I hope more students get involved in research to expand their technical experience outside of the classroom, especially at the beginning of their undergraduate career," Everett says. "Professors in the BCMB department want to mentor undergraduates, which can include anything from weekly literature discussions to daily work in the lab. This also helps in class. For instance, learning PCR by performing it in the lab made me an expert as I entered the genetics classroom. I would not have done so well in my undergraduate coursework without the Krishnan Lab. Being able to apply what you learn in the classroom to research has helped me become a better undergraduate researcher, and it will help me in my career."



## Mastering Laboratory Skills



**Katarina Micin** ('20) spent three years as an undergraduate student in the lab of Barry Bruce investigating ways to cryopreserve diverse cyanobacteria. In the lab, researchers use various photosynthetic cyanobacteria to conduct experiments. Micin was responsible for maintaining and harvesting the bacterial cultures and investigating the impact diverse cryoprotectant solutions and other variables had on long- and short-term cryopreservation of these cyanobacteria.

Cyanobacteria are photosynthetic bacteria that account for much of the oxygen we breathe and carbon dioxide fixed from the atmosphere. In ancient earth, they were the organisms that provided enough oxygen in the atmosphere for life as we know it to evolve. The Bruce lab has a long-term interest in understanding photosynthesis in diverse cyanobacteria and an important part of this is to be able to preserve bacterial samples.

Micin won the Division of Natural Sciences Award for Excellence for her poster presentation at EURēCA in May and the 2020 Western Photosynthesis Conference Undergraduate Poster Award. She is likely to be an author on several papers. She graduated in May and began her graduate work in anatomical and translational sciences at George Washington University. When she graduates, she plans to enter medical school for an MD or MD/PhD.

"As a member of Dr. Barry Bruce's lab, I conducted research centered on the establishment of a universal cryopreservation protocol for diverse cyanobacterial species, which was extremely beneficial for me as a scientist," Micin says. "I am now starting a master's program involving research work and plan on continuing work in research once I enter the medical field. Working as an undergraduate research assistant provided me with the exposure needed to better master laboratory skills and a learning environment with graduate mentors (and an extremely helpful and involved faculty mentor) who offered essential guidance and support. I would encourage all undergraduates to find a lab and participate in research, as it provides access to knowledge and hands-on experience that is otherwise not attainable. My most memorable experience in the Bruce lab was attending the Western Photosynthesis Conference in Bodega Bay, California. Being able to travel with the research team and not only present my own research, but also be able to listen to other accomplished scientists' work, was both an enlightening and very fun experience."



# Single-Molecule Biophysics

**Rajan Lamichhane** first learned about state-of-the-art single-molecule biophysics while working on his PhD in biochemistry and biophysics at Wayne State University. He uses the technique to study protein-nucleic acid interactions, RNA folding, protein dynamics, and protein functions.

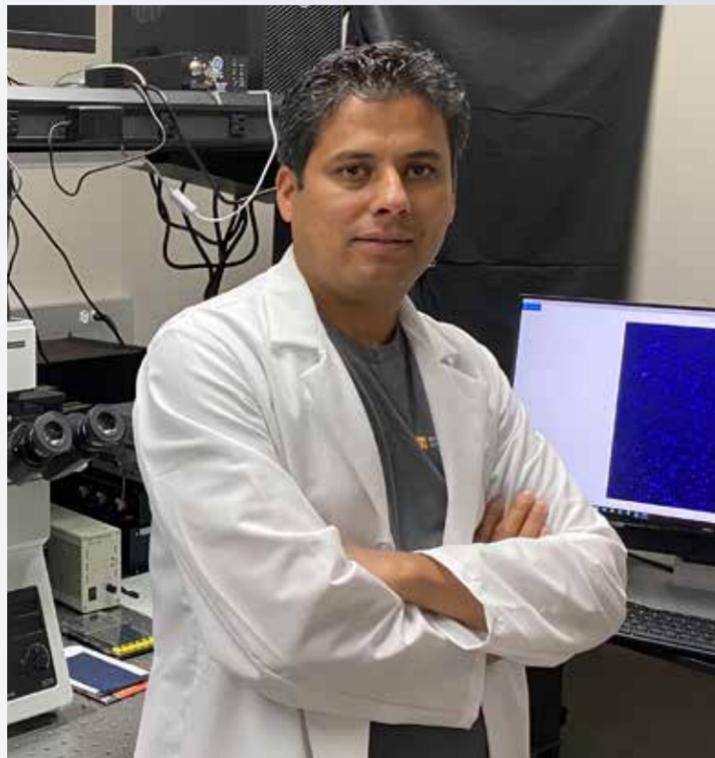
"I like single-molecule methods because they are powerful techniques to explore complex and diverse biological processes at the molecular level," says Lamichhane, an assistant professor in the UT Department of Biochemistry and Cellular and Molecular Biology (BCMB). "Biomolecule interactions and assembly control all aspects of biological activities in the cell and are directly linked with human health. Understanding these processes will help us predict potential defects that cause diseases and will ultimately guide us towards designing therapeutics to cure these diseases."

Lamichhane joined BCMB in 2018 and brought a welcome addition to the department in the areas of biophysics and membrane biology with a focus on understanding receptor function and molecular dynamics using single-molecule techniques. He teaches BCMB 401: Biochemistry I and BCMB 511: Advanced Protein Chemistry and Cellular Biology and enjoys interacting with his students and learning about their experiences.

"The most exciting part of teaching is seeing the students' faces when they understand something new," Lamichhane says. "One thing that always makes me proud of being a teacher is watching my students grow academically and move forward with their career goals."

In his lab, Lamichhane and his students are working on the application and advancement of single-molecule fluorescence to study integral membrane proteins called G protein-coupled receptors (GPCRs), which are involved in many physiological processes.

"There are more than 800 GPCRs encoded in the human genome, which makes them good targets for treating many diseases," Lamichhane says. "More than 35% of marketed drugs target these receptors. GPCRs bind many types of ligands on their extracellular face and undergo conformational changes of the seven-transmembrane domain to activate signal transduction pathways inside the cell to produce a physiological response."



Students in his lab have a basic knowledge of physics, biology, and chemistry, but also must have an understanding of molecular biology and biochemistry since they deal with biological samples.

"This method requires extensive sample modifications, such as putting probes, or fluorophores, at a particular position in biomolecules, which requires an understanding of structural biology and chemistry," says Lamichhane, who studied chemistry and biology during his undergraduate and graduate studies at Tribhuvan University in Nepal.

Lamichhane uses single-molecule microscopy to characterize the conformational dynamics of a GPCR when it interacts with distinct ligands. Despite their importance in signaling, scientists do not fully understand ligand-based conformational changes of transmembrane domains.

"It is crucial to understand this mechanism to enhance our ability toward GPCR-based drug discovery," Lamichhane says. "These studies will allow us to visualize receptor-ligand interactions and receptor dynamics while they interact. I hope my research will help in advancing single-molecule techniques to address fundamental questions and needs in basic biomedical science."

## Support for LGBTQ+ Vols

Studies show having diversity in the sciences leads to stronger research, but studies also show that lesbian, gay, bisexual, transgender, and queer (LGBTQ+) undergraduate students are less likely than peers to remain in college. Then once in a career, 30% of LGBTQ+ STEM professionals are not 'out' to their colleagues. There are many reasons why LGBTQ+ students, faculty, and staff may have difficulties on college campuses. At UT, we have witnessed examples, including the defunding of the Pride Center and the Office of Diversity and Inclusion and the rise of hate crimes on campus. Sadly, according to The Advocate, our campus continues to remain in the top five worst universities for LGBTQ+ students in the United States.

However, there is hope. Vols are stepping up to foster positive change as the UT community has rallied around the LGBTQ+ community. These signs of hope include the Pride Center finding new support, faculty and graduate teaching assistants receiving Safe Zone training to help them to better serve and reach LGBTQ+ students, and OUTgrads, an LGBTQ+ graduate student group advocating for additional LGBTQ+ student support and connecting students to the local LGBTQ+ community.

But there is room for more and you can help support the Volunteer LGBTQ+ community! Become Safe Zone trained through the Pride Center, advocate for more all-gender bathrooms on campus, and familiarize yourself with local LGBTQ+ resources. You can also consider helping attract and retain LGBTQ+ students in STEM fields through organizations such as 500 Queer Scientists, the LGBTQ+ Plant Scientist Network, Out in STEM (oSTEM), and the National Organization of Gay and Lesbian Scientist and Technical Professionals (NOGLSTP).



*- By Sterling Field, a graduate student in the lab of Dan Roberts and recipient of the 2020 LGBTQ Leadership Award from the Chancellor*

All of these groups help to raise the visibility of LGBTQ+ scientists and provide resource for recruitment and retention. Your opportunities to help do not stop there, as several local LGBTQ+ organizations, like the Tennessee Equality Project, need volunteers.

Our roles as educators, scientists, and Volunteers should encourage us to continue to work towards making classrooms, laboratories, and the campus a place to work and think without the fear of discrimination. Let's get to work!



To read more student and faculty news and updates, visit us online at [bcmb.utk.edu](http://bcmb.utk.edu).

## Staying Connected

In 2015, a group of BCMB graduate students identified that more programming was needed to enrich the graduate student community in BCMB and beyond. Although the scientific training they were getting in their mentor's lab was strong, there were gaps they thought could be filled by additional programming so they expanded the activities of the BCMB Graduate Student Organization (GSO). Kate Halter (formerly Abrahamsson) was elected as the GSO president to guide these efforts initially. Since then, the BCMB GSO has hosted various workshops and seminars and has acted as a means of communication between the graduate students and BCMB leadership. Additionally, members of the GSO have been important in advocating to the upper administration for graduate student fee waivers and increased stipends.

The GSO kicked off their efforts by hosting Dave Jensen, who writes the "Tooling Up" column for *Science Careers*, hosted by the American Association for the Advancement of Science. He provided insights on scientific careers outside of traditional, academic careers. The GSO received two grants from the Student Programming Allocation Committee (SPAC) to fund an Art for STEM lecture and an informational workshop on the cutting edge gene editing CRISPR technology. The Art for STEM lecture, hosted by Yvonne Blanco, managing senior scientific illustrator and designer at Cell Press, allowed students from across STEM departments at UT to show and get feedback about their in-progress figures in front of a live audience.

Justin Westerfield took over as the GSO president from 2017 to 2019. The organization continued creating opportunities and connections within our department and across campus. During a weeklong 75 years of ORNL event, Nathan Brady coordinated a tour for graduate students and faculty to the High Flux Isotope Reactor and Spallation Neutron Sources at ORNL. The week culminated with a presentation by Ruth Huddleston, a local Calutron Girl and Oak Ridge historian D. Ray Smith. The Calutron Girls were part of a local workforce that unknowingly maintained mass spectrometers (calutrons) at ORNL for the enrichment of uranium for the Manhattan Project. This event provided a unique opportunity to build connections with ORNL and for the public to learn about this interesting story from East Tennessee.

The following year, the GSO upped the ante by bringing Nobel Laureate Martin Chalfie to UT for a day of meetings with graduate students and professors. This provided an excellent opportunity for researchers here to interact with a top-notch scientist. Chalfie finished the day with a talk to the public about the process of scientific discovery and the discovery of the use of green fluorescent protein as a scientific tool, which led to the Nobel Prize for him and two colleagues. Broadening the focus to a wider scientific audience, Westerfield ended his term on a high



note by hosting Joe Palca, science correspondent for NPR and creator of "Joe's Big Idea" (a radio series on NPR), to speak with students from diverse STEM departments about his path into science journalism.

At the end of 2019, SPAC funding ended so the GSO needed to get crafty, literally. They started raising money with bake sales and even designed and printed a department T-shirt to fund department get-togethers and BBQs. Nathan Brady took over leadership of the GSO and he had a UT branded BCMB T-shirt made to raise funds for programming activities. With money raised from sales of these shirts, the GSO planned field trips to the CDC in Atlanta and St. Jude's research hospital in Memphis, but these have been delayed due to COVID-19. The funds will be used for future events under the leadership of Dana Layo, who just started her term this fall.

In the midst of the pandemic, the topics being discussed by the GSO have taken a much more serious tone. The goal of fostering and maintaining cohesiveness in our work environment has new challenges and for this reason, the GSO is more important now than ever. Staying connected is the key and that is exactly what the GSO is all about.

## Kolape Named Microscopy Center Manager

In July 2020, we welcomed the new manager of the Advanced Microscopy and Imaging Center, **Jaydeep Kolape**. He joined us from his previous position at the microscopy center of the University of Nebraska, Lincoln.

Kolape is taking over from John Dunlap who had helped many generations of students with their microscopy needs. Kolape will follow in this tradition and train users from all over campus on the efficient use of the different instruments in the microscopy core facility.

For more information about the instruments available in the Advanced Microscopy and Imaging Center, visit [microscopy.utk.edu](http://microscopy.utk.edu).



## A Lasting Legacy

As reported in the last newsletter we lost our longtime friend and colleague, Professor **Liz Howell**, in April 2019. She joined the department (then known as the biochemistry department) in 1988 and was the first woman faculty member recruited to the department. She served as a strong role model for women graduate students and saw it as an obligation and opportunity to mentor and train the next generation of women scientists.

Throughout her career in BCMB, Professor Howell continued to work at the bench and remained passionate about mentoring. She set a high standard for both herself and those she mentored. Unknown to many, she also took time away from science and was an accomplished painter and potter. Anyone who visited her office would have seen examples of both. She believed that good scientific research required both precision and creative imagination.

Her family is honoring her memory and commitment to teaching, mentoring, and research with an endowment for graduate students. This award honors her and her work and will be given annually to a graduate student in BCMB beginning in 2021. Because she felt it was important to usher in the next generation of women scientists, this award will be given with a preference for women. Funds from the award can be used towards expenses such as travel and registration expenses to attend conferences and other purposes related to the professional development of graduate students in the department.

Read more news and updates online at [bcmb.utk.edu](http://bcmb.utk.edu).



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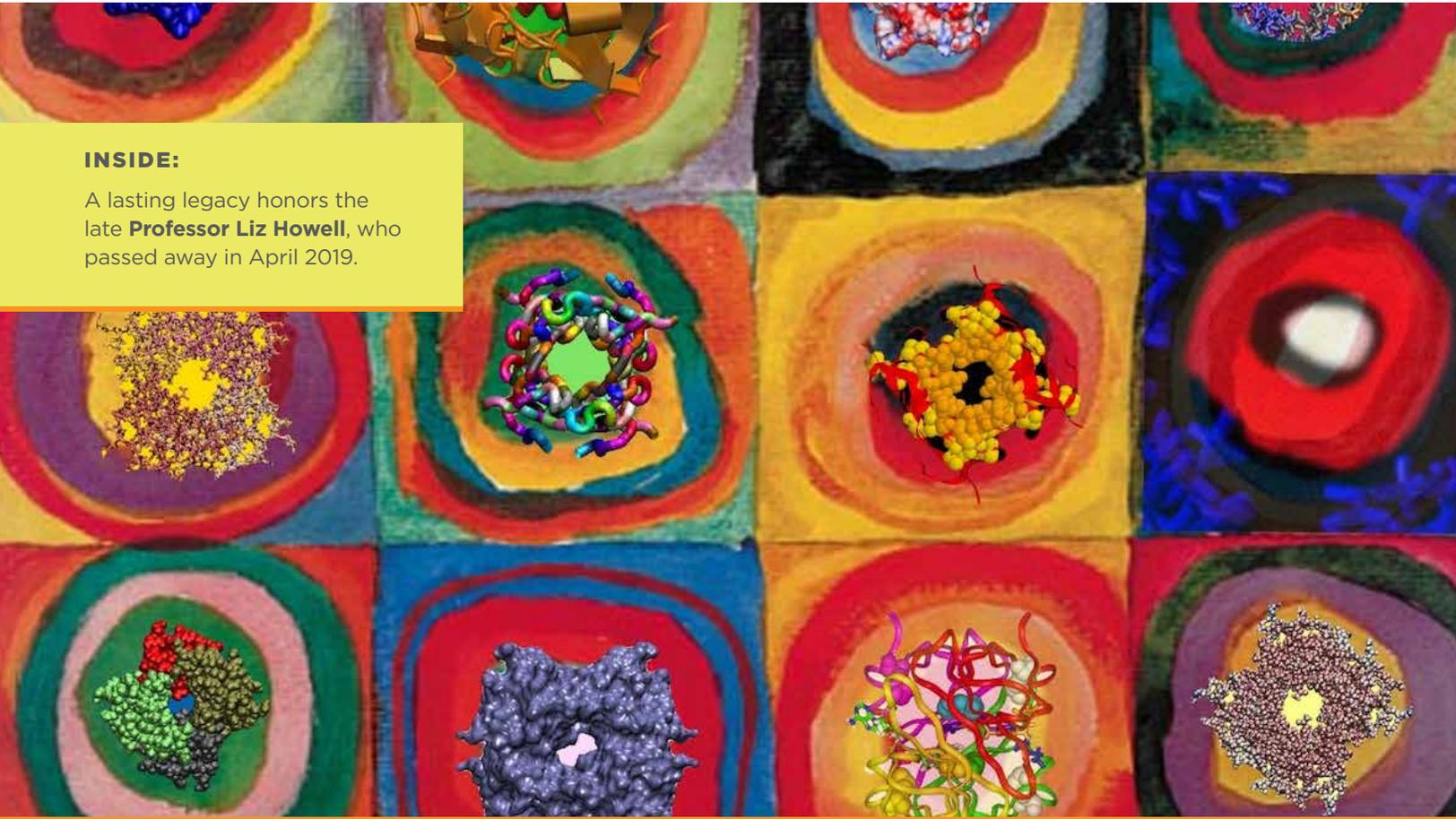
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**INSIDE:**

A lasting legacy honors the late **Professor Liz Howell**, who passed away in April 2019.



# DISCOVERIES

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