CLEMSON
CHEMICAL AND BIOMOLECULAR ENGINEERING

Spring/Summer | June 2020

FOCUS
2020
a year in the making...

Contents

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MESSAGE FROM THE CHAIR

To our fellow Clemson Tigers,

Biology, physics, sociology and history – no, these are not the courses most of our students enrolled in this spring or summer, but they are the topics life has thrust upon them in these troubling times.

Biology – The COVID-19 pandemic meant a normal Clemson spring of frisbees and baseball was replaced with lessons about social distancing, ventilators, vaccines and facemask fashions. Social distancing also meant traditional in-person and hands-on Clemson educational experience had to move online.

Physics – Spring storms in nearby Seneca, S.C. spawned an EF3 tornado with winds of 160 miles per hour that torqued and twisted 40-foot tall pines and uprooted 100-year-old oak trees until few were left standing. Sadly, one life was lost, and the force of the winds left homes and businesses for miles in tatters or littered with debris.

Sociology and History – What started as a simple arrest in Minnesota, quickly turned into murder and a reopening of a generations old rift in the fabric of American society, which led to days of fear, frustration and protests by a multiracial and multigenerational mix of Americans longing for change and true equality for all people.

Whether it be wearing a mask to protect the vulnerable, helping repair a home or marching together for social justice, 2020 has challenged each of us to a renewed sense of empathy for others and demanded we rise above our self-centered tendencies and embrace the golden rule of doing unto others as we would have them do unto us.

This sentiment is well described by the “All In” attitude and the care many of the Clemson Family have shown to those who are suffering and in need. In the coming days, I hope you all continue to stay healthy and safe!

Go Tigers!
David A. Bruce
Professor and Chair, Chemical and Biomolecular Engineering

Larsen selected as recipient for the 2020 Bradley Faculty Award

Earlier this month, Dr. Jessica Larsen was selected as the recipient for the 2020 Bradley Faculty Award for Mentoring in Creative Inquiry. She is the first receipt in the Department of Chemical and Biomolecular Engineering in the 13 years of the award. Creative Inquiry is a unique program that provides undergraduate students with valuable research opportunities led by faculty mentors.

"I am open and honest with my students about my expectations of them and will admit when I fall short of their expectations of me. Because of this, students feel safe to be open and honest with me, calling themselves out when they fall short of expectations and letting me know when I may not be the best version of myself. On day one, I let my students know that I am also capable of making mistakes, and it is our job to work together as a team where members all have equal value. We have created a mutual, safe space for our team."

Larsen understands that mistakes happen and believes that they should be treated as learning opportunities, not as identifying characteristics of the students. As a team, Larsen and her students focus on the value of the mistake in their meetings and take steps to move forward together.

CI Student, Jessica Jager

When asked to describe her mentoring style, Larsen described it as "radical vulnerability".

Larsen believes that her students are driven to make progress because they can see that the work they are doing is extremely important and could have a positive impact on society. There is a clear goal that her team is working towards together.

One of the most important impacts that Larsen has been able to deliver is the strong and constant belief that her researchers are capable of "so much greatness," especially when her team works together and are able to identify the talents of each individual. Larsen ensures to tailor projects towards the individual passion of her students. She believes that this improves the synergy of their lab and the evidence is shown in the confidence that she extends to her students.

"I cannot thank you enough for the positivity you have in our meetings," a student shared with her. "It genuinely makes my day and has really helped me build my confidence when it comes to looking into graduate programs. Having your vote of confidence has given me such a boost of energy and has made me more confident in my ability to do research".

It is obvious that Dr. Jessica Larsen is a well-deserved recipient of 2020 Bradley Faculty Award for Mentoring. We are proud to have her as a member of our department and extend our congratulations!

Larsen Research Team (from left to right): Allison Yaguchi (front), Sara Edgecomb (front), Sarah Smith, Bipin Paruchuri, Jesse Westfall, Austin Evers, Cheyenne Brady, Aon Ali, Nick L'Amoreaux, and Dr. Jessica Larsen (image taken before COVID-19)

Professor David Bruce receives the prestigious University Research, Scholarship, and Artistic Achievement Award

Professor David Bruce received the prestigious University Research, Scholarship, and Artistic Achievement Award (URSAA) from President James Clements this past year.

The award recognizes Clemson University faculty whose work has been acknowledged at the highest levels nationally and internationally. URSAAA winning faculty are lifetime appointees and participate in a yearly celebration of faculty achievements.

Dr. David Bruce, Professor and Chair of the Chemical and Biomolecular Engineering Department, has been a faculty member at Clemson for 25 years.

Prof. Bruce was honored with the Clemson URSAA Award for being an author of a paper that has received over 1,000 citations. The referenced work was a collaborative effort between Dr. Bruce, Dr. Jim Goodwin (former ChBE Chair), Dr. Edgar Lotero (post-doctoral fellow), and graduate students Y. Liu, D.E. Lopez, and K. Suwannakarn. The article titled "Synthesis of Biodiesel via Acid Catalysis" was published in the journal of Industrial & Engineering Chemistry Research in 2005 and has to-date received over 1850 citations. This review article is one of the most highly cited articles on the production of renewable fuels from plant based materials.

While at Clemson, Dr. Bruce has taught 15 different undergraduate and graduate courses, graduated 26 PhD and MS students, and mentored 4 post-doctoral research associates.

Blenner named Junior Researcher of the Year

Article Written by Scott Miller

Mark Blenner, the McQueen-Quattlebaum Associate Professor in the Chemical and Biomolecular Engineering Department, was named Junior Researcher of the Year. Dr. Blenner received his Junior Researcher of the Year award from Clemson University President James P. Clements and was honored again at the College awards ceremony in October.

"The Researcher of the Year awards were created to recognize the efforts of high-achieving faculty whose work is improving society through the generation and dissemination of new knowledge. Drs. Marcus and Blenner offer wonderful examples of the impact university faculty members can have," said Tanju Karanfil, vice president for research.

"I am honored and humbled to receive this award. In addition to all my research students, research mentors and collaborators, I would like to share my award with my colleagues at Clemson," Blenner said.

The Researcher of the Year awards were announced at the university's annual Research Symposium, which brings together faculty from across the Clemson footprint to share ideas and explore the creation of interdisciplinary research teams that can tackle complex societal problems. The awards program was created with input from the Vice President of Research Faculty Advisory Board.

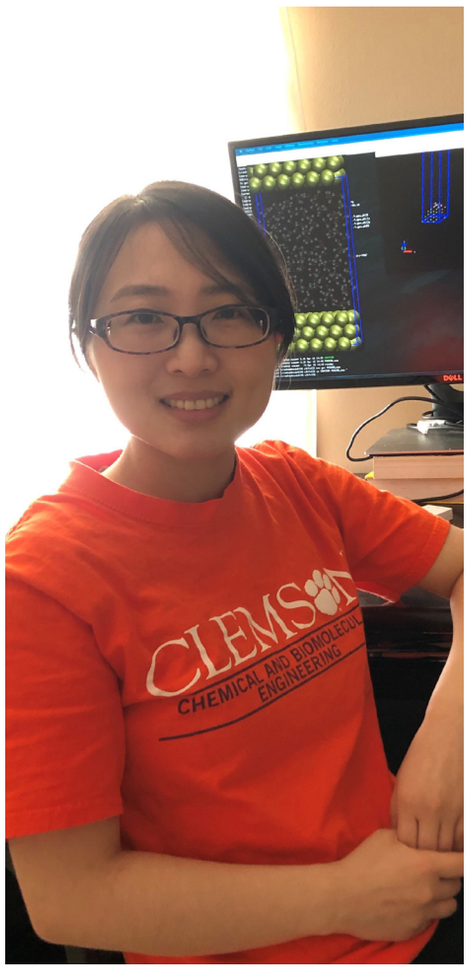
Getman Research Group makes cover of JCTC
New Methods to Measure Adsorption Rates

Graduate student Xiaohong Zhang's research (along with her advisor Dr. Rachel Getman and collaborator Dr. Aditya Savara from the Oak Ridge National Laboratory) recently made the cover of the Journal of Chemical Theory and Computation. Their journal publication titled "A Method for Obtaining Liquid-Solid Adsorption Rates from Molecular Dynamics Simulations: Applied to Methanol on Pt(111) in H2O", explains the new methods they developed to measure adsorption rates.

Industrial-scale chemical reactions routinely employ heterogeneous catalysts to more efficiently produce the desired chemical product(s). In these processes, the reactants adsorb on the catalyst surface and are converted to the desired products, which are later collected and purified.

Thus, adsorption is an important step in heterogeneous catalysis as it predetermines how many reactant molecules can participate in a surface reaction, which directly impacts catalyst performance. While adsorption processes are well studied in both theory and experiment for systems with gaseous reactants (gas-solid adsorption), such processes are much less understood for systems having liquid phase reactants (liquid-solid adsorption). This is partly because of the difficulty in studying the ever-changing environment of the liquid reaction medium.

In this project, Zhang and her fellow researchers developed a method that combines molecular dynamics (MD) simulations and mathematical modeling to calculate adsorption rates for species binding to a solid catalyst surface from liquid solvent.



These MD simulations explicitly model the liquid environment, enabling the trajectories of the reactant molecules to be followed as they adsorb on the catalyst surface.

The mathematical modeling analyzes the essential behavior of the adsorbing process and provides quantitative studies of the adsorption rate. This combined model supplants the prior state-of-the-art, which was derived from ideal gas collision theory.

As the new methods developed by Zhang et al. take into account intermolecular forces from the liquid reaction medium, they are up to 4 orders of magnitude more accurate than the prior state-of-the-art models, providing an example of the importance of atomistic simulations in understanding adsorption and catalysis.

Overall, their approach turned out to be more accurate than the prior methods and can be expanded to arbitrary catalyst surfaces and liquid solvents, providing a useful tool for evaluating and screening catalysts.

The authors also provide methods for accurately estimating rates of adsorption in cases where access to molecular dynamics simulations is unavailable, expanding the impact of the manuscript.

Blenner is one of many researchers responding to urgent call for COVID-19 testing

Article Written by Paul Alongi

Clemson University researchers are volunteering their time and resources as part of a statewide effort to develop serologic tests that could play a key role in reigniting South Carolina's economy and protecting healthcare professionals on the front lines of the COVID-19 pandemic.

A test on track to be ready this week would be aimed at detecting antibodies that form in the bloodstream when someone has been exposed to the novel coronavirus and is therefore thought to have a lowered chance of re-infection.

The test that will be available this week is aimed at checking healthcare professionals for antibodies. The idea is that those who test positive for the antibodies could be cleared to re-enter public life, allowing them to work with minimal concern that they could come down with COVID-19 or infect others.

About 500-1,000 tests could be ready as early as this week, less than a month since the project started, researchers said.

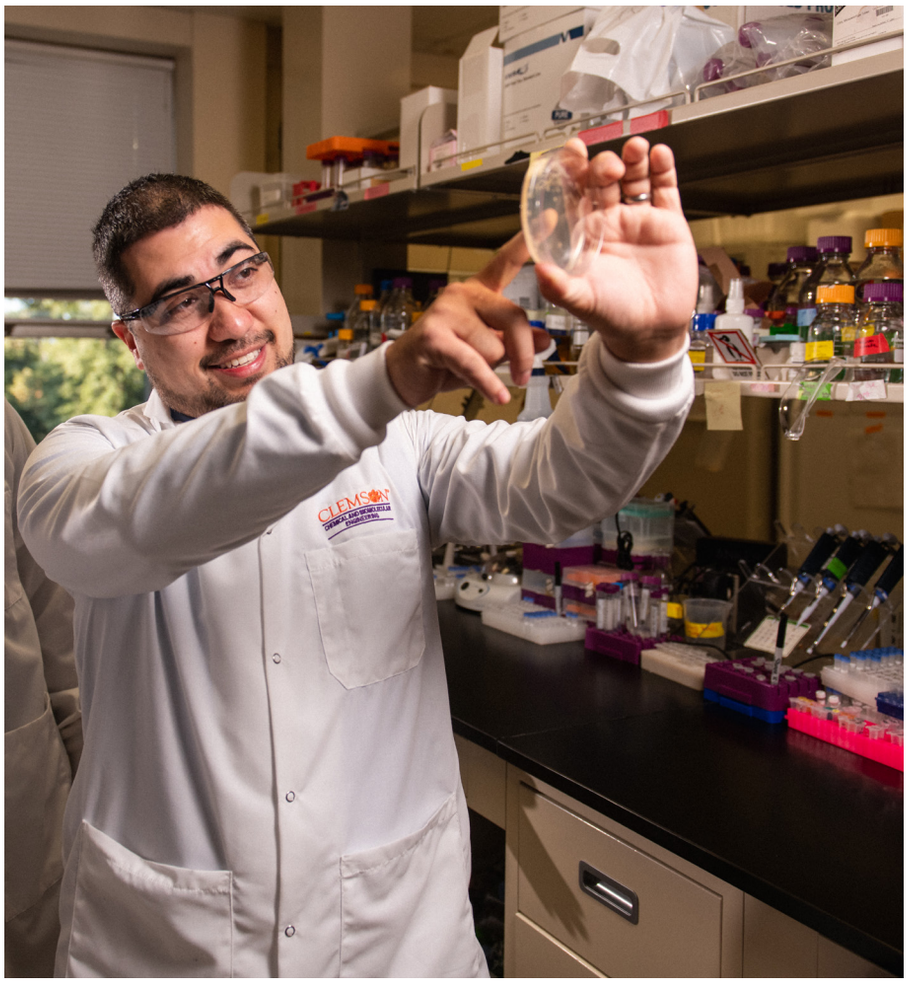
The two Clemson researchers working on the test are Mark Blenner, the McQueen Quattlebaum Associate Professor of Chemical and Biomolecular Engineering, and Sarah Harcum, Professor of Bioengineering.

Currently, blood samples would need to be tested in a lab, which limits how many can be done. Thus, in a parallel effort, Clemson researchers are working to create tests that could take saliva, urine or blood and show results with a color change in as little as 15 minutes, similar to a home pregnancy test.

Researchers involved in developing those tests are: Blenner, Terri Bruce, Research Assistant Professor of Bioengineering and Director of the Clemson Light Imaging Facility; Delphine Dean; Sarah Harcum; and R. Kenneth Marcus, University Professor of Chemistry.

The tests would be a significant improvement on current methods. Antibody tests that check for immunity require a blood draw and are inaccurate and scarce, Blenner said. Testing directly for the virus itself requires an uncomfortable nasal swab and puts healthcare workers at a heightened risk of catching the virus, he said.

Martine LaBerge, the Chair of Clemson's Bioengineering Department, said all the researchers are volunteering their time, efforts and resources to help the state, as it faces the unprecedented challenges posed by the COVID-19 pandemic.



The process to develop the tests starts with Blenner, who is making spike proteins, which give the novel coronavirus its distinguishing feature and is believed to be how the viral infection is mediated.

In his lab, Blenner puts the DNA for the spike proteins inside of human or hamster cells. When the cells grow, they produce the spike proteins, which will ultimately serve as the key reagent in the antibody tests.

"Our group is going to make a stable cell line that we can scale up," Blenner said. "Right now the procedure is not meant to make a lot of protein. It's meant for quick protein production. I'm going to make a productive cell line and work with Sarah Harcum to get that in larger bioreactors."

Harcum said she will put the cells in computer-controlled bioreactors that can sense oxygen and pH levels. Pumps carefully control the nutrients that feed the cells.

Once she has the protein grown, Harcum will then purify it so that it can be used in the diagnostic tests.

Meanwhile, Bruce, Marcus and Dean are starting to lay the groundwork for simple tests that could reach large numbers of people.

Germinating Solutions

Article Written by Paul Alongi

Yeast might be Earth's most under appreciated lifeform. These single-celled members of the fungi kingdom get plenty of credit for turning barley into beer, grapes into wine and wheat into bread. But their range might not be limited to the blue planet for long.

Mark Blenner, the McQueen-Quattlebaum Associate Professor in the Department of Chemical and Bimolecular Engineering at Clemson University, is engineering yeast to do things nature hasn't yet figured out.

The potential is wide-ranging. Blenner is helping yeast produce two very different products —omega-3 supplements and polyester — that astronauts could use on missions to Mars. He is also using yeast to explore new ways of developing drugs, and to create sensors that would help search for radiation from nuclear weapons production.

The scientific community's advances in DNA sequencing and synthesis over the past 10 years have helped break open the field to new possibilities, Blenner says.

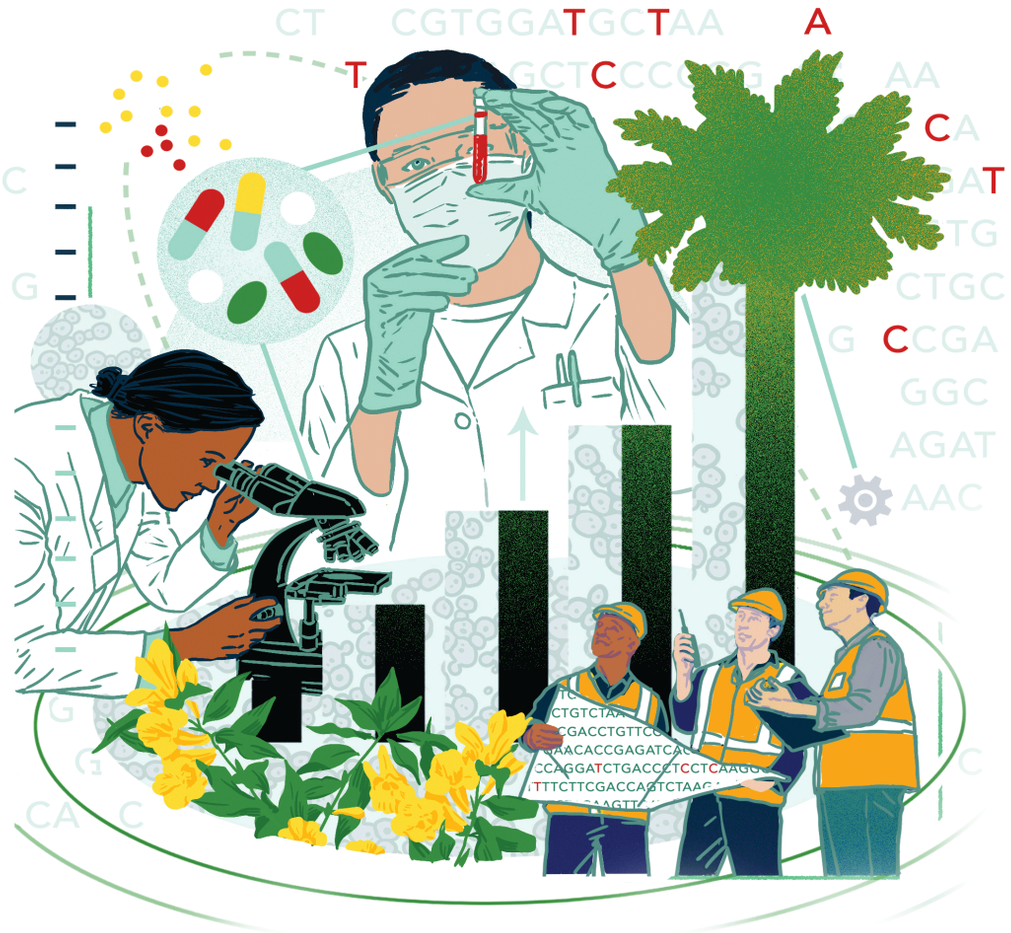


Illustration by Chris Koelle

"I think we're going to see a lot more solutions to problems that are microbial based," Blenner says. "And I think it's going to be part of the solution to helping us survive on Mars and other planets."

The work that has earned Blenner the most headlines focuses on how yeast could help astronauts reach Mars and survive once they land. Yeast would act as a recycling center, allowing astronauts to reuse molecules that are plentiful on Earth but will be precious beyond the atmosphere that sustains life.

Blenner's work with yeast could also help tease new drugs out of plants.

The Blenner team is also collaborating on research aimed at creating devices that sound like they could have come out of the latest James Bond epic. The devices would be disguised, maybe as leaves, and search for evidence of nuclear-weapons production.

Explore the full article at https://www.clemson.edu/cecas/departments/chbe/news-events

Clemson University Ph.D. Student, Allison Domhoff, earns Hitachi Fellowship

Pictured here: Allison Domhoff receives the fellowship during an award ceremony. From left: Douglas Hirt, associate dean for research and graduate studies in the College of Engineering, Computing and Applied Sciences; Phil Bryson, vice president and general manager of the Nanotechnology Systems Division at Hitachi High Technologies America Inc.; Domhoff; and Tanju Karanfil, Clemson University vice president for research.

Article Written by Scott Miller

Clemson University Ph.D. student Allison Domhoff has received a $25,000 Hitachi High Technologies Electron Microscopy Fellowship to support research aimed at making energy grid-scale batteries more efficient and cost-effective.

Domhoff, a Chemical and Biomolecular Engineering student, is working to develop nanocomposite materials for batteries that support energy generation at large wind and solar farms. The technology could reduce the cost of renewable energies, thus making them more prevalent in utility portfolios.

“These are like extremely large car batteries, 15 or 20 feet tall. They would store energy produced by wind and solar farms so during the night or when winds aren’t blowing, you could still harvest energy,” said Eric Davis, Domhoff’s faculty adviser and an Assistant Professor of Chemical and Biomolecular Engineering.

Electron microscopy allows Domhoff to research nanometer-sized particles in the battery’s membrane so she can manipulate its surface chemistries to improve battery life and performance.

Domhoff has presented nationally at meetings of the American Chemistry Society (ACS) and the American Institute of Chemical Engineers (AIChE). She received a prestigious Graduate Research Fellowship from the National Science Foundation and is one of 10 finalists for the national AIChE Excellence in Graduate Polymer Research Award.

Domhoff, who graduated in May, hopes to continue her research in the private sector. She earned her undergraduate degree at Duquesne University in Pittsburgh before attending Clemson for Ph.D. studies.

“Clemson has all of the big-school funding and resources, but it’s a relatively small department so you get the one-on-one mentoring and collaboration,” she said.

Hitachi High Technologies America Inc. established the fellowship in 2014. Domhoff is the sixth recipient.

Hitachi High Technologies helped establish the university’s Electron Microscope Facility in the mid-1990s. It has steadily grown with Hitachi’s support and is housed at the Advanced Materials Research Laboratory (AMRL) in Anderson County about 15 minutes from Clemson’s main campus.

“Ms. Domhoff is clearly performing groundbreaking research and it appears likely that her work will be highly impactful. We at Hitachi are very happy that the electron microscopes at AMRL have been able to play an integral role in enabling Allison’s research,” said Phil Bryson, vice president and general manager of the Nanotechnology Systems Division at Hitachi High Technologies.

Douglas Hirt, associate dean for research and graduate studies in the College of Engineering, Computing and Applied Sciences, thanked Hitachi High Technologies America Inc. for supporting the college’s students.

“These fellowships help enable our students to conduct cutting-edge research with the help of some of the best electron microscopes in the world,” Hirt said. “I congratulate Allison on winning this year’s fellowship. It is a well-deserved honor and a reflection of the quality of work she is doing under the guidance of Dr. Eric Davis.”

Nicholas Gregorich wins 3MT Competition at Clemson – Becomes Finalist at CSGS

Nicholas Gregorich, from the Department of Chemical and Biomolecular Engineering, won first place at Clemson University's Three Minute Thesis (3MT) competition on November 8, 2019.

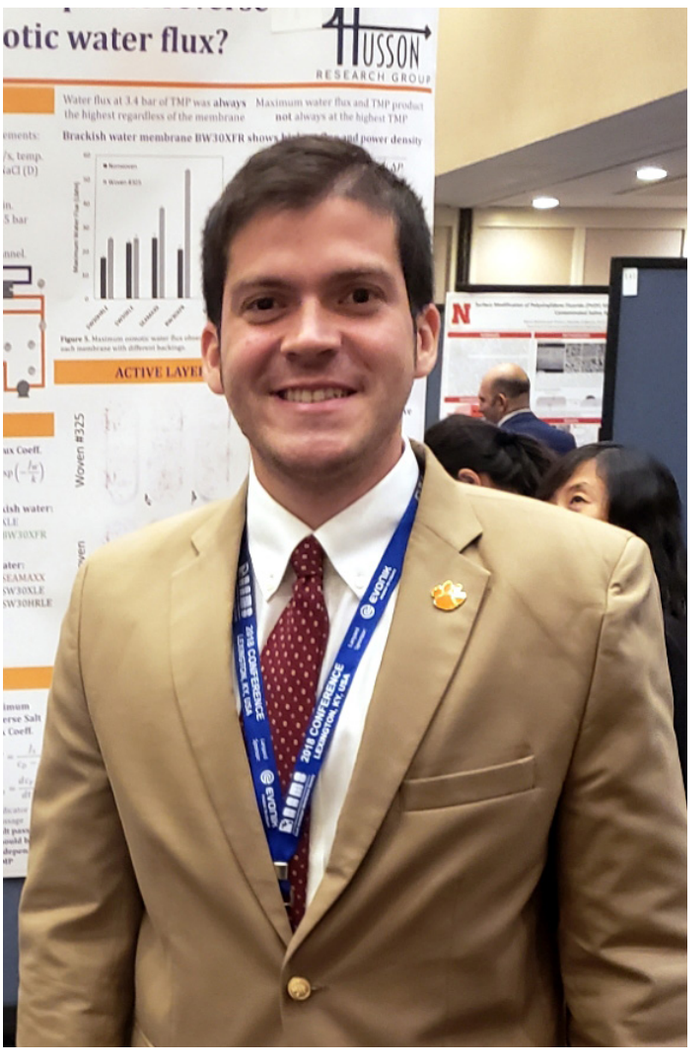
3MT is a research communication competition that challenges research higher degree students to present a compelling oration on their thesis and its significance in just three minutes in language appropriate to a non-specialist audience.

Nicholas won the PhD candidate category for his presentation, "Green Filtration for Cleaner Water." He is advised by Dr. Eric Davis.

Nick went on to represent Clemson at the regional 3 Minute Thesis (3MT) competition in March at the 2020 Conference of Southern Graduate Schools (CSGS), which was held at the University of Alabama in Birmingham.

There were 54 schools in attendance, and Nick was a finalist and placed in the top 8. This is the furthest any Clemson student has achieved in the regional 3MT competition.

Associate Dean Dr. Dominy, Ph.D. student Nick Gregorich, and Assistant Dean Dr. Dumas.



Jaime Idarraga-Mora receives NAMS Society Student Fellowship Award

ChBE Ph.D. student, Jaime Idarraga-Mora won a North American Membrane Society Student Fellowship Award. Presented annually, the NAMS Student Fellowship Awards are given to graduate students in the membrane science and technology area. A total of six fellowships were awarded for 2020.

The award was meant to be given at the NAMS meeting on May 16-20 in Tempe, Arizona. However, due to COVID-19, the meeting was moved online. Jaime was able to give a 15-minute presentation in which he described three mechanical properties of thin-film composite membranes, how he measured them, and what role he believes these properties play in the performance of those membranes in osmotic processes.

Jaime graduated in May and was advised by Dr. Scott Husson.

The NAMS Student Fellowship Award was preivously won by Steven Weinman and Juan Wang, both alumni of the Chemical Engineering Programs at Clemson.

Jaime Idarrago-Mora at the 2018 NAMS Meeting

DEPARTMENTAL AWARDS

1st Place Lab Safety Award - Dr. Ogale's Lab

Clemson University holds its researchers to a high standard regarding lab safety. Our department takes this a step further by rewarding research groups in our department for excellent lab safety techniques that ensure the protection of our students, faculty, and facilities.

Pictured Here: *(From left to right)* Sagar Kanhere, Elijah Taylor, Victor Bermudez, Hailey Baughn, Dr. Amod Ogale *(image taken before COVID-19)*

Pictured Here: Dr. Amod Ogale and Caroline Christopher *(image taken before COVID-19)*

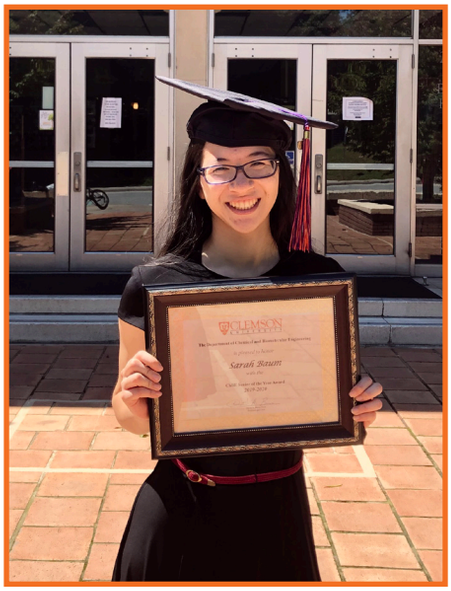
Lab Safety Honorable Mentions:

Dr. Jessica Larsen's Lab *Dr. Marc Birtwistle's Lab* *Dr. Mark Blenner's Lab*

Outstanding Undergraduate Awards

Western SC Section Scholarship Achievement Award

Ross Jenkins



ChBE Senior of the Year Award

Sarah Baum

ChBE Undergraduate Researcher of the Year

Cheyenne Brady

PH.D. GRADUATES

Preparing for graduation can be tricky, especially during a nation-wide crisis. And defending your thesis as a Ph.D. student remotely through Zoom, added another layer of concern. However, Clemson Ph.D. students were well-prepared and successfully presented their dissertations.

Dr. Apoorv Balwani

"Impact of Nanoparticles on the Segmental Dynamics and Transport Properties of Ionomer Nanocomposite Membranes"

Advisor: Dr. Eric Davis

Dr. Allison Domhoff

"Tuning Transport in Ionomer Nanocomposites via Nanoparticle Surface Functionalization"

Advisor: Dr. Eric Davis.

Dr. Jaime Idarraga-Mora

"Mechanical Properties of Thin-Film Composite Membranes and their Role in Osmotic Processes"

Advisor: Dr. Scott Husson

We asked our graduates to reflect on their time in the Ph.D. program and to share advice for future students. As Jaime reflected on his research and studies, he had this to share: "During my Ph.D., I had multiple feelings, from hopelessness to joy. My joy came from constantly trying to learn new things, which led me to propose new, better-informed, hypotheses and experiments to test them. Additional excitement came when some of the hypotheses were proven true.

"Moving forward, I hope to bring the skills and critical thinking that I have gained at Clemson to develop new technologies that enable sustainable chemical processes," said Idarraga-Mora. After graduation, Jaime will be joining the Dow Chemical Company as a Senior Research Specialist at their Innovation Center in Lake Jackson, TX.

As Allison reflected on her journey to receiving her Ph.D., she had this to say; "I am so fortunate to have been a part of the Davis Research Group at Clemson for my PhD studies, through which I have bolstered my technical and writing skills with awesome experiences and feel ready to tackle any scientific problem that presents itself. I look forward to using my expertise on new and different projects as a Research Chemist at PPG." PPG Industries is a global supplier of paints, coatings, and specialty materials and a Fortune 500 company.

As a parting gift, Allison had a wonderful piece of advice to share with Ph.D. students in the Clemson Chemical Engineering program, "I recommend to all current and future students to try all new opportunities and apply to anything extra that you can, whether that be for fellowships you don't think you have a chance in being awarded or for experiments at external facilities, you never know what will happen!"

UNDERGRADUATES

We are often faced with the unexpected in life. But no one could have foreseen the effects of the COVID-19 crisis on our students, faculty, staff, and our university, including the postponement of the May 2020 commencement to this upcoming summer or fall. Due to the social distancing brought on by COVID-19, the class of 2020 is the first senior class since 1969 who did not receive a group photo in front of Earle Hall.

However, we honor them with pictures that they provided and dedicate the next four pages to the Class of 2020. We do hope to coordinate a picture when the commencement is scheduled. Despite the challenges, our department was still able to honor our 2020 Spring Graduates with a Virtual Senior Reception via Zoom that included a video of faculty and staff honoring their achievements.

Once again congratulations to the class of 2020 and their amazing accomplishment of receiving their Clemson degree.


Evan Anderson


Jimmy Bailey


Owen Bailey


Sarah Baum


Adam Benson


George Bilderback

Andrew Bingham


Clara Bono


Samuel Borel


Jackson Bost


Matthew Brabender


Cheyenne Brady


Kristopher Byrne


Caroline Christopher


Alexis Cocolas


Patrick Daggs

CLASS OF 2020


Noah Dammers

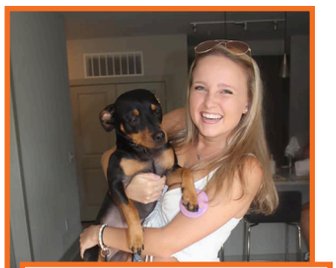

Kyle Dunphy


Theresa Earls


Sara Edgecomb


Austin Evers


Zachary Farell


Samantha Flowers


Ashley Fowler


Parker Friedel


Kevin Gheen


Coleman Gilstrap


Elyse Hanse


Evan Haynes


Cameron Herron


Grant Hummel


Ross Jenkins


Kristen Klein


Mark Klimek

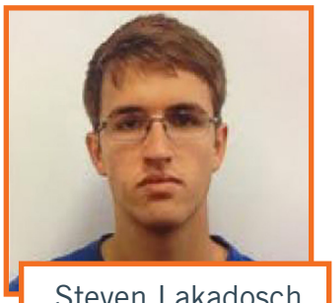

Katharine Komsa


Michelle Koval

UNDERGRADUATES


Kristy Kuoch


Jillian Laird


Steven Lakadosch


Samuel Lampe

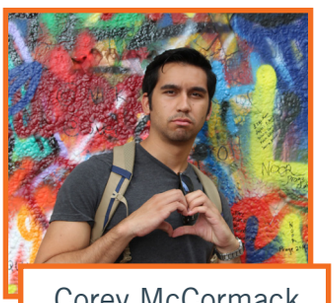

Michael Lemelin

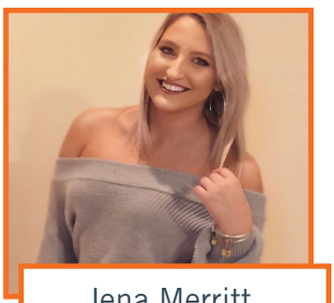

Jacob Martin


Anne Mason


Marc Mason

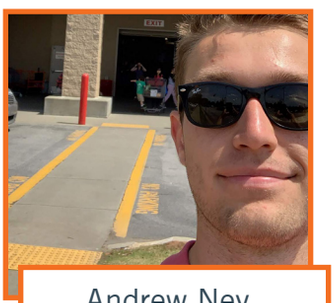

Logan McAbee

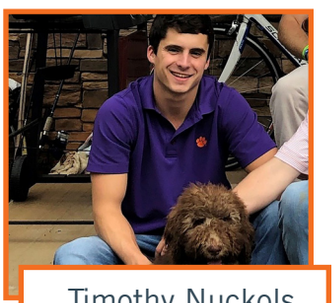

Corey McCormack


Jena Merritt

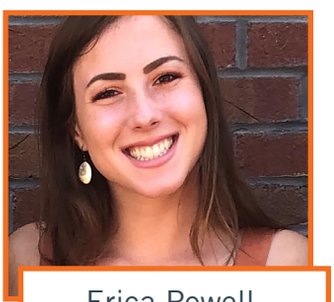

Samuel Miller

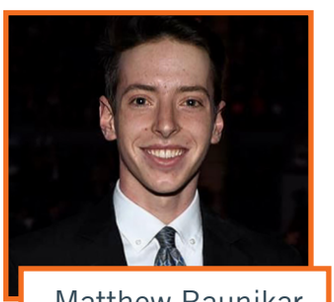

Harold Morrow


Andrew Ney

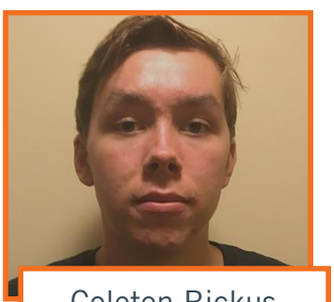

Timothy Nuckols


Frank Paternoster


Erica Powell


Matthew Raunikar


Benjamin Reilley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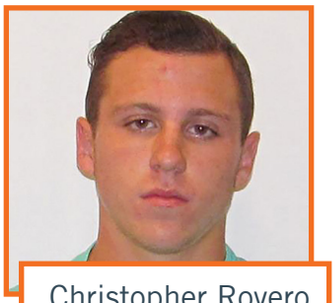
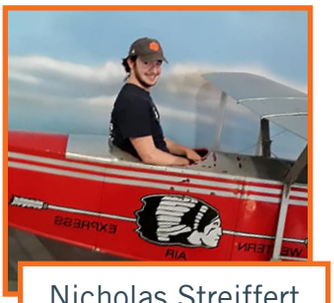
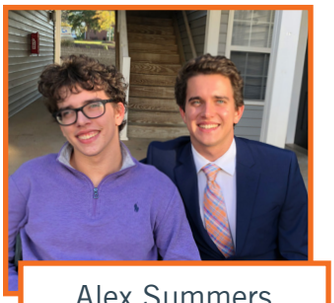
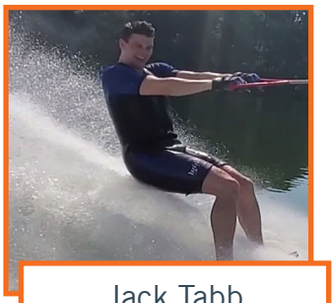

Christopher Rovero


Jessica Schifer

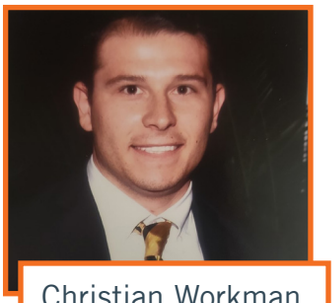

Philip Siegel


Nicholas Streiffert


Alex Summers


Jack Tabb


Nick Theis


Christian Workman


Jacob Wortkoetter


Spencer Youngblood

Words of Wisdom:

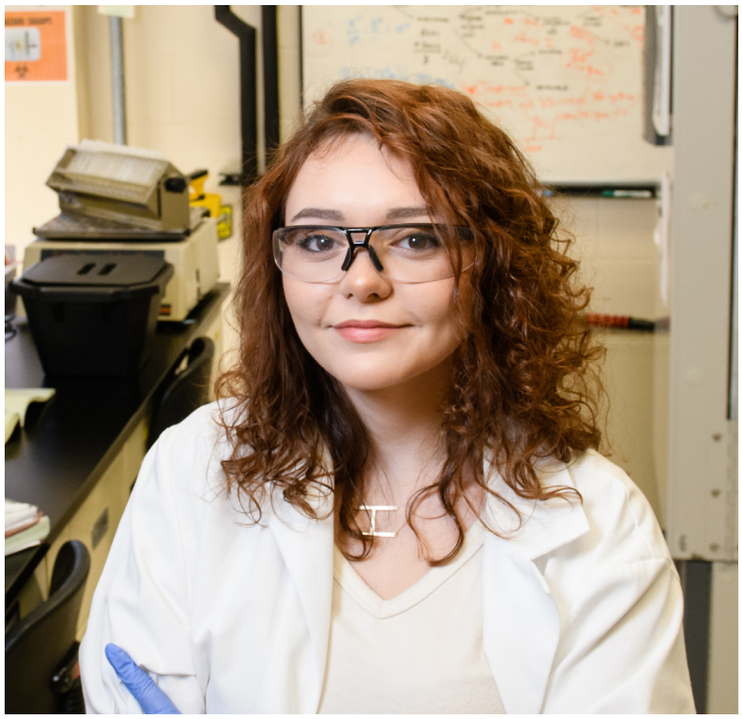
"I survived!!! It's been a wild ride, but we got there in the end. Anyone coming in, if you can make it through Unit Ops 1, you can do anything. Don't worry about That One Exam; by the time you're graduated, you'll have forgotten about it."

- Clara Bono

Undergraduate Research Experience

COVID-19 has had a large impact on our daily lives, both professionally and personally. Even with the influence of COVID-19, our department has been able to adjust and offer important summer research learning opportunities to our undergraduate students. Utilizing proper social distancing techniques and enhancing the sanitation of our building, we continuously strive to create a safe learning environment for our students so that they can make the most out of their summer. Many of our students are also able to work remotely as they work on review papers and continue to pursue their studies online.

Hayden Tharpe



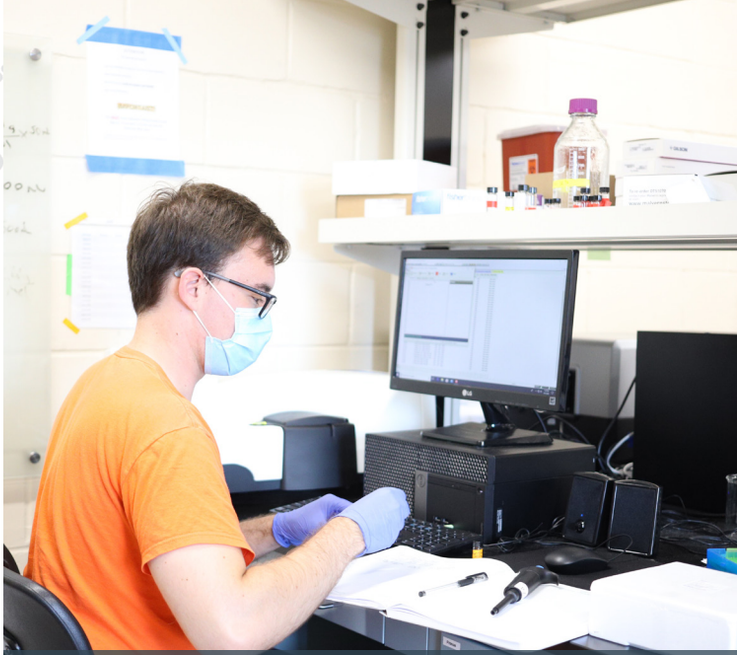
Dr. Mark Blenner's Research Lab

Hayden Tharpe, funded by a prestigious Beckman Scholars fellowship is developing novel antibodies to construct highly specific antigen tests for COVID-19. These antibodies will be used to create conditional activation of a reporter system with extremely high signal to noise.

The Beckman Scholars program offers an intense and prolonged immersion in research to students under the guidance of one of fifteen faculty mentors in the College of Science and the College of Engineering, Computing, and Applied Sciences.

Hayden will receive funding from the Arnold and Mabel Beckman Foundation for 15 months of laboratory research. In addition to this prestigious award, Hayden is also a Department of Defense SMART Scholar Semifinalist and has been an undergraduate research assistant since summer 2019.

Hayden selected as a Clemson University Beckman Scholar this past spring to further her research for "Engineering a Highly Sensitive and Modular Reaction Cascade Biosensor."



Christopher Pierce

Elizabeth Singleton

Valerie Zawrotuk

Dr. Jessica Larsen's Research Lab

Dr. Jessica Larsen's students are working remotely to focus on review papers, while others are completing research in Dr. Larsen's lab (using proper social distancing and safety techniques).

Christopher Pierce is a rising junior in Chemical Engineering. He is working on understanding the thermodynamic driving forces behind shape changes of self-assembled polymeric nanoparticles. The project that he is working on is called "shape modulation". In the lab, they are trying to elongate nano-particles into cylinders so they have more surface area. This will provide more surface contact to the endothelial cells and allow for greater uptake into the blood brain barrier.

Valerie Zawrotuk is a rising junior in Bioengineering. She is working on the encapsulation of nerve regenerative peptides into nanoparticles to treat spinal cord injuries.

Cara Katterman is a rising senior in Microbiology. This summer, she is working from afar on an invited review paper about the potential to bypass the blood-brain barrier using nanoparticles of different shapes. This is also a part of the "shape modulation" project. Cara synthesizes and manipulates polymersomes to better deliver drugs to different targets in the body. Some things that are important to keep in mind for drug delivery efficiency are shape, circulation time, carrying capacity, and targeting mechanisms.

Jessica Jager is a rising senior in Chemical Engineering. This summer, she is working on a Creative Inquiry team focused on the use of nanoparticles to enhance CT imaging of brain tumors. The team is expected to begin an animal study over the summer.

Jessica Tetterton is a rising senior in Biochemistry. She is working on understanding the uptake and delivery behavior of polymeric nanoparticles in neural cells.

Nicole Franaszek is a rising senior in Chemical Engineering. This summer, she is working from afar, writing a review paper focused on theranostic (diagnostic and therapeutic) nanoparticles for neurodegenerative diseases.

Sara Edgecomb is a rising senior in Chemical Engineering. This summer, she is developing solvent free methods of encapsulating Cas9 gene editors into polymeric nanoparticles.

Elizabeth Singleton is a rising senior in Chemical Engineering. This summer, she is working on a Creative Inquiry team focused on the use of nanoparticles to enhance CT imaging of brain tumors. The goal is to produce high quality CT images without exposing patients to the radioactive contrast agents that are used currently. The team is expected to begin an animal study this summer.

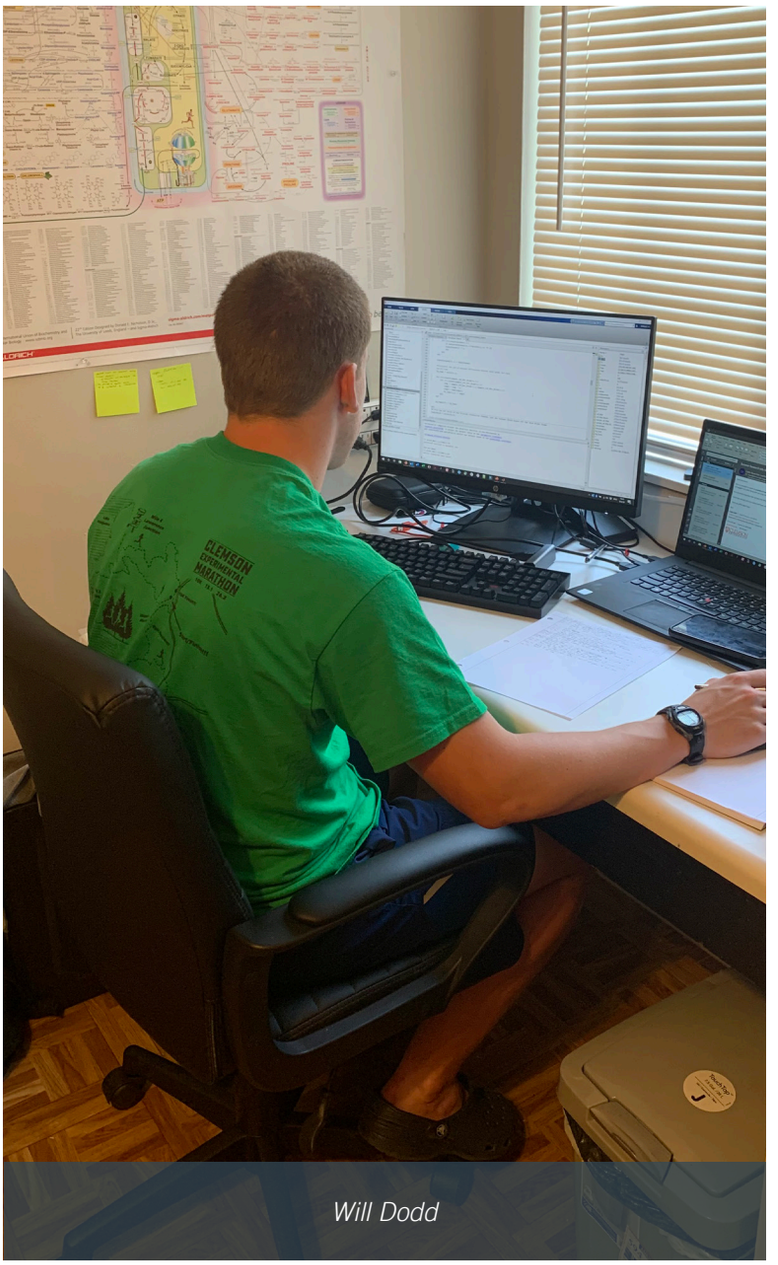
Dr. Marc Bistwistle's Research Lab

Katia Ashy has been working in Dr. Birtwistle's lab on a project involving Mammalian Artificial Chromosomes (MAC). MAC's are useful for their ability to hold large numbers of transgenes in host cells as well as being potentially more stable carriers of such transgenes, which may improve manufacturing of protein-based therapeutics.

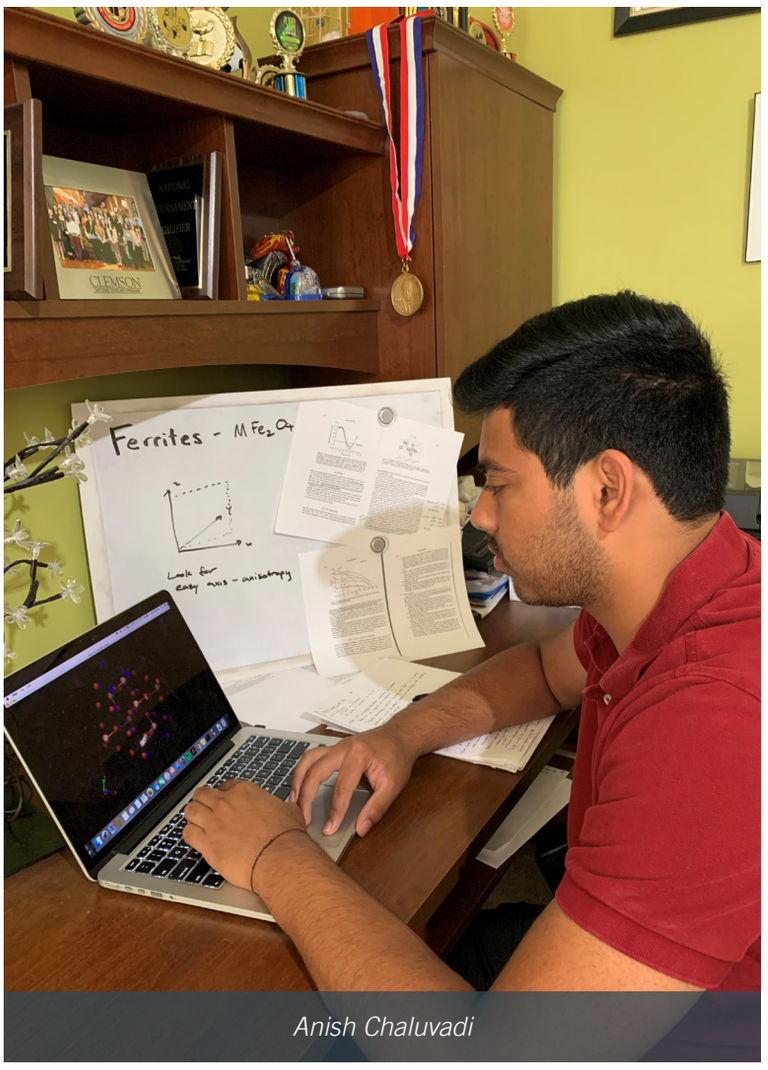
Over the summer, using PCR, Katia has been testing the stability of MAC's in Chinese Hamster Ovary (CHO) cells (a main industrial producer of protein-based therapeutics) over industrially-relevant time scales.

Will Dodd is another student who is a part of Dr. Birtwistle's research lab. He is working on a theoretical validation of a newly developed fluorescence-based approach to genetic interaction screening. Genetic interactions are central to biological function but have been to-date inaccessible due to the large number of possible two-way gene combinations in most organisms genomes.

The goal of his research is to determine to what extent it is possible to use combinatorics & different combinations of fluorescent proteins to track genome wide interactions in cells. This is being done through the simulation of fluorophore 'probes' in a cell and then attempting to unmix the solution and discern which probes are present, which are uniquely mapped to combinations of gene perturbations.



Will Dodd



Anish Chaluvadi

Dr. Rachel Getman's Research Lab

Dr. Getman has assured that her research group is well-equipped to host research interns virtually this summer. The department is hosting 2 students through the Advanced Materials Summer Research Program, an NSF REU project that Dr. Getman is the co-PI for, 7 students from the Governor's School for Science and Mathematics through the Summer Program for Research Interns, and 2 students from Clemson University's EUREKA! program.

Additionally, **Anish Chaluvadi** who is a Clemson undergradate in Materials Science & Engineering is working with Dr. Getmen this summer through the Materials Assembly and Design Excellence in South Carolina (MADE in SC) program. This summer marks the start of Anish's 3rd year working with her group.

The 12 interns working in Dr. Getman's group are exploring a variety of projects in computationally-driven design of materials, from understanding catalytic mechanisms at the molecular level to using machine learning to inform synthesis of magnetic colloids for a variety of applications.

Dr. Mark Thies's Research Lab

Evan Miyasato and Courtney Owens are working with the Thies group this summer to purify and fractionate lignin using renewable solvents.

This Department of Energy funded project has the goal of taking a major waste product from bio-ethanol refineries, lignin, and upgrading it into renewable precursors for advanced materials, such as carbon fibers, activated carbon, and polyurethane foams.

This work combines concepts from separations and polymer thermodynamics to further research in the field of renewability and sustainability.

Courtney Owens

Dr. Amod Ogale, Hailey Baughn, and Elijah Taylor (image taken before COVID-19)

Dr. Amod Ogale's Research Lab

There are currently two undergraduate's working in Dr. Ogale's lab this summer. **Elijah Taylor** is a rising junior who helps conduct fiber spinning for a large, DARPA-funded project. He is trained to help graduate students in conducting specialized research experiments for producing mesophase pitch precursor fibers and then helps in carbonizing them at ultrahigh temperatures, exceeding 2000 Celsius!

Hailey Baughn is also a rising junior. Hailey is trained to conduct tensile testing of ultrafine carbon fibers using customized testing equipment. She utilizes optical microscopes to measure fiber diameters down to 5 micrometers, which is less than one-tenth the size of human hair!

Hailey Baughn and Dr. Amod Ogale (image taken before COVID-19)

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127 Earle Hall, Box 340909
Clemson, SC 29634-0909
www.clemson.edu/chbe
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Thank you to our Professional Advisory Board

We would like to honor them for their continued support of the Department through our current and everchanging challenges.

From left to right - Mark Fisk, Will Medlin, Brandi Brayboy Mobley, Hal Erskine, Ruth Albright, Chris Cavin, Lee Hardin, and Gary J. Wells
Not Pictured - Kavitha Ganesan Arms, Stacey Waldrop Chapman, Silas Wong, Patrick Quarles, Jim Haney