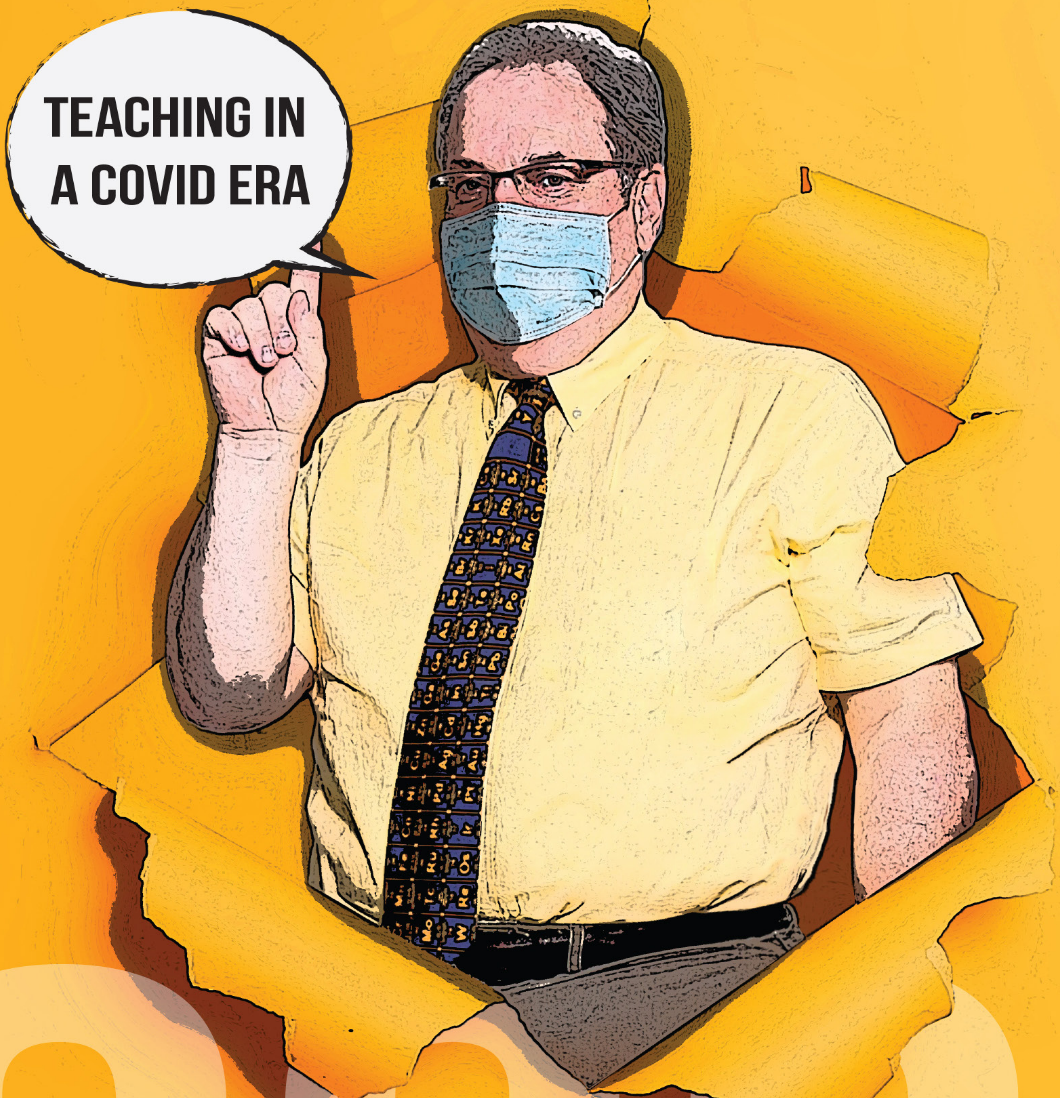
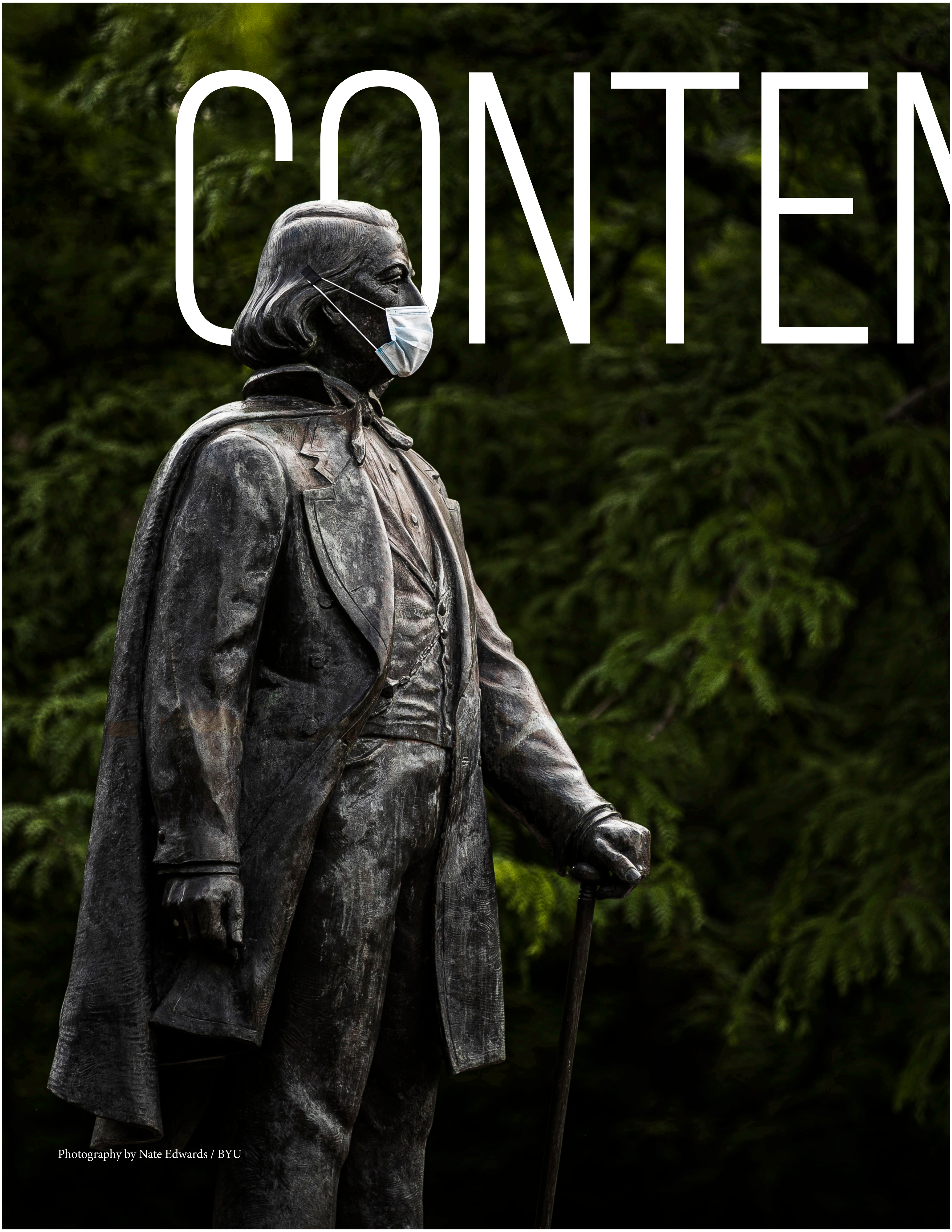
BYU DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

CHEMIGRAM

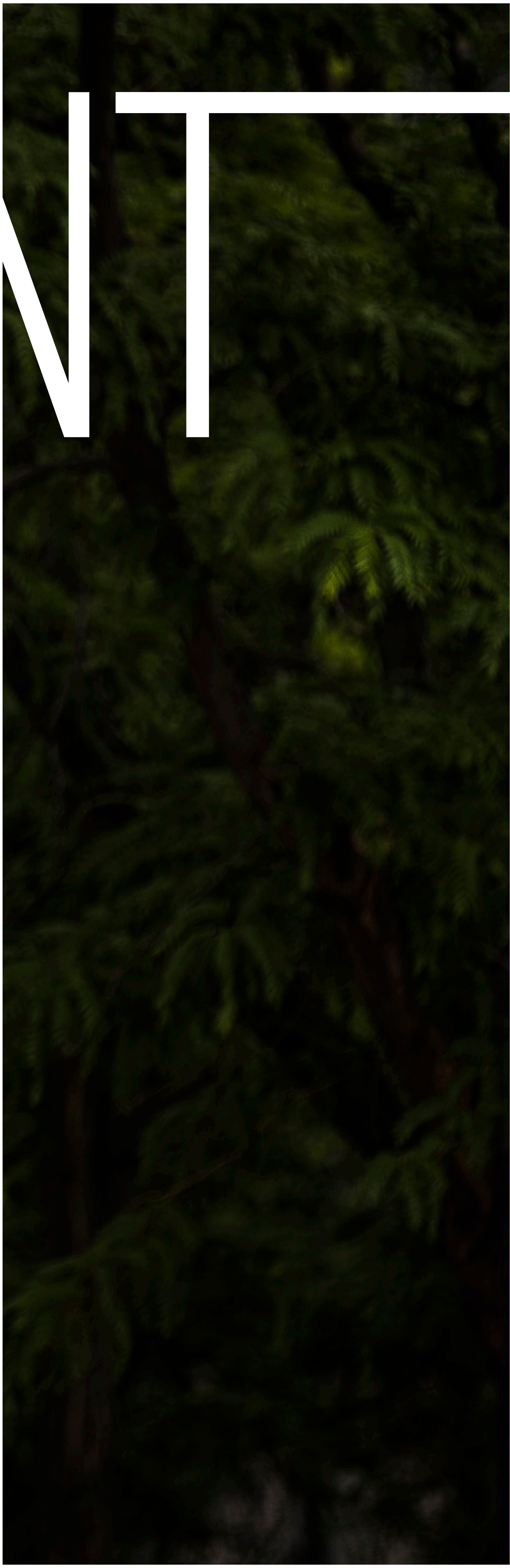


2021

CONTEN



Photography by Nate Edwards / BYU



Publisher: David Dearden
Managing Editor: Anna Kennington
Assistant Editor & Writer: Audrey Davis Ahlstrom
Art Director: Yao Kuang Lee

I am writing with cautious, but very great optimism as it appears that at least in this part of the world the COVID-19 pandemic is abating. This last year has been quite a ride, but you already know that! Despite the chaos, the second century of the BYU Department of Chemistry and Biochemistry has begun with a year of miracles: scientific miracles that produced safe, effective vaccines in record time, and numerous small miracles locally as people have shown care and compassion to help keep each other safe. I am grateful for the sacrifices many have made to continue providing an outstanding educational experience to our students, even under pandemic conditions. Most of our faculty, for example, taught double teaching loads so that our students could continue to have face-to-face instruction under physical distancing requirements. We held a one-of-a-kind virtual graduation in April 2021 where it was fun to focus the celebration on our own students as a department. We were able to keep our labs open so research could go on and students could continue to progress toward their degrees. Although some of our colleagues did get sick, to my knowledge there were no instances of COVID-19 outbreaks or transmission in the Benson Building. This is a testament to the efforts of so many to follow sound practices and care for each other. I am humbled by your superb examples.

The past year saw a number of people moving forward. Professors Kara Stowers and Jeremy Johnson both received continuing faculty status and were promoted to the rank of Associate Professor; we congratulate them on their excellent teaching, scholarship, and citizenship that made this possible. Professors Walter Paxton and Ryan Kelly are on their way to these same milestones, having successfully passed their 3rd-year reviews.

We welcome Professor Grant Jensen as a new member of our department and as the new dean of the College of Physical and Mathematical Sciences, coming to us from the California Institute of Technology where he established himself as a world authority on the use of cryo-electron microscopy in doing structural biochemistry. We are also excited to see Professor Adam Woolley step into a new role as dean of Graduate Studies, where his expertise in leading a world-class group of graduate students can now benefit the whole university. We welcome Neal Hatfield in the Instrument Shop and look forward to working with him.

We are saddened to report that after many years of excellent service designing and repairing electronics and other instruments for the department, due to health issues Bart Whitehead retired from the Instrument Shop and passed away shortly thereafter. We send our deepest condolences to Bart's loved ones; Bart was a superb colleague and we miss him.

The hard work and generosity of past and present faculty, staff, alumni, students, and friends of the Department is crucial to our efforts to continue to provide an environment where faith and science work hand-in-hand to build a better future. I hope you will enjoy reading about some of the great things going on in the Department of Chemistry and Biochemistry, and will accept my thanks for your role in making us what we are today.

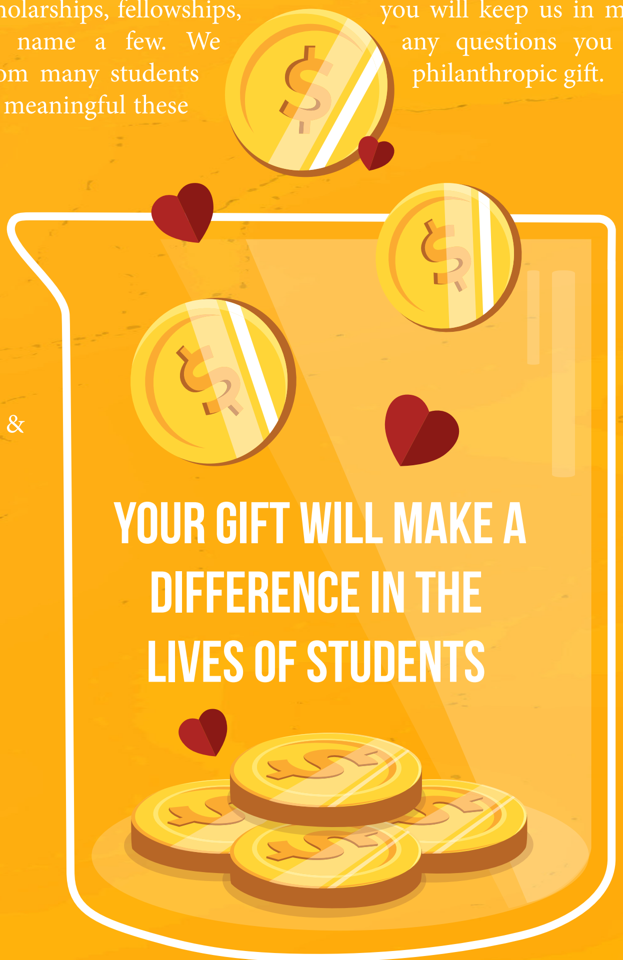
David V. Dearden

TAKE THE OPPORTUNITY TO

GIVE

During this past year many of us have experienced aspects of normal life being put on hold. Yet, we have discovered alternatives and new ways of doing things. We are grateful that while our methods of delivering class instruction changed, the education of our students, both in lab settings and in the classroom remained constant. Many thanks to our donors whose gifts made it possible for students to thrive, even in challenging circumstances. Every dollar of your gift was used for student aid –scholarships, fellowships, undergraduate research, to name a few. We received thank-you notes from many students this year who expressed how meaningful these gifts were. We want to pass along their thanks to you, along with ours. Your expression of confidence in the upcoming generation is represented in the dollars you give . . . and every dollar makes a difference. You have changed lives, boosted a student struggling financially, and celebrated learning. Our heartfelt thanks to each and every one of you.

When you consider giving opportunities, we hope you will keep us in mind. Please contact us with any questions you may have regarding your philanthropic gift.



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2020 AT-A-GLANCE

CHEMISTRY AND BIOCHEMISTRY

FULFILLING THE MISSION OF BYU

DEPARTMENT GOALS & INITIATIVES

- Identify, recruit, and retain the best faculty who will fulfill the mission of the university and achieve the high standards of our discipline.
- Prepare our students by providing engaging, rigorous classroom instruction.
- Provide our students with opportunities to participate in meaningful research projects.
- Create a sustainable structure for maintaining and replacing research and teaching instrumentation.

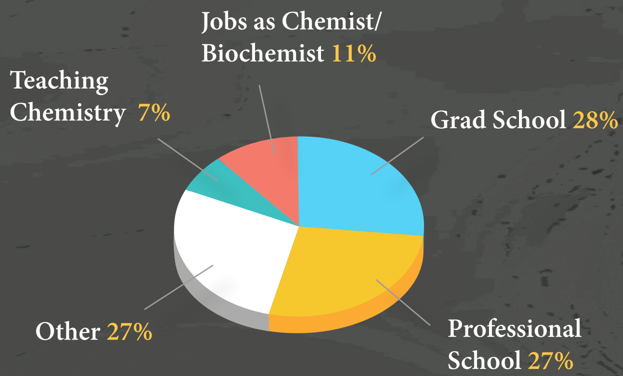
EFFECTIVE TEACHING

Students

Enrollments 12,151
Majors (35% female, 65% male) 434
BA or BS graduates 62

Graduate students 118
PhD Graduates 12
MS Graduates 6

Destination



MEANINGFUL RESEARCH

104,644	Total Hours of Undergraduate Research
375	Total Undergraduates
172	Majors
196	Non-majors
6	Talmage Fellows
1	R.E.U. Fellows (Research Experience for Undergrads, funded by NSF grant)

Thanks to the donors whose gifts and endowments have funded undergraduate research awards

- James A. and Virginia S. Ott endowments for Undergraduate Research.
- D. Clark and Pam Turner endowments for Undergraduate Research.
- Steven Kearnes
- College of Physical and Mathematical Sciences

PRODUCTIVE SCHOLARSHIP

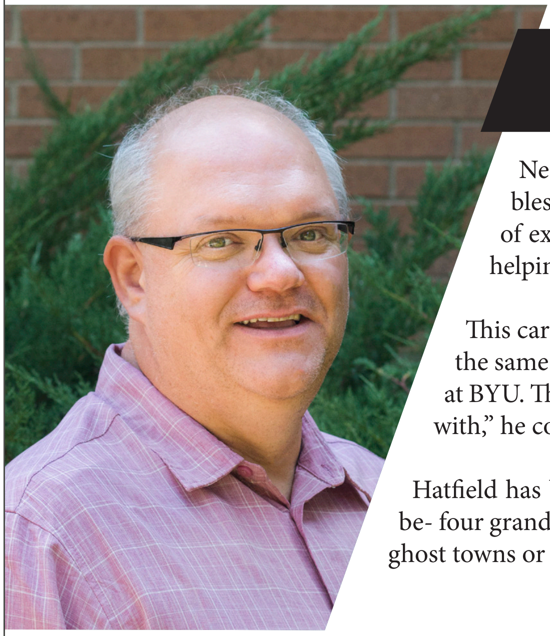
GRANT JENSEN

Grant Jensen ('94) joined the department as a new faculty member on November 1, 2020 and was appointed dean of the College of Physical and Mathematical Sciences, a position that he will hold for a term of five years. Jensen, a BYU alumnus, met his wife while here at school. Together they have six children, three of whom are currently enrolled at BYU. He graduated from BYU in physics and math as the valedictorian of his college and went on to earn his PhD in biophysics from Stanford University. There, he devoted much of his time researching the structure of the enzyme RNA polymerase alongside Nobel Laureate Roger Kornberg. His post-doctoral work included research at the Lawrence Berkeley National Laboratory.

Joining the California Institute of Technology (Caltech) in 2002, Jensen mentored students in a highly esteemed research group, publishing nearly 200 articles, and pioneering the field of electron cryotomography (cryo-ET). He remained there for 18 years until he was brought on by BYU last fall. Jensen has received many prestigious grants to support his research including funding from the National Institute of Health and the Howard Hughes Medical Institute. While leaving Caltech was a difficult decision for Jensen, he felt guided to make the change and come to BYU. "If the Lord is going to direct His church to own and operate a university, that is probably where I belong. Sign me up – I want to help."

JODY HALL

Jody Hall has been working as the Business Office Manager for almost a year now. Hall previously worked for a private company as the controller for nearly 35 years. When the company moved its accounting functions to Ohio, Hall decided to relocate and apply for a job in the business office and has been here ever since. Hall's work here is largely focused on the accounting responsibilities of the department, including reviewing department-wide expenses, preparing monthly financial reports, balancing accounts, and performing a daily inventory review. When discussing his change of employment he describes it as, "A wonderful change." His favorite part of this change is the opportunity he has to interact with the student staff and visit with students who come into the business office. In his free time, Hall enjoys fishing and spending time with his wife of 34 years, seven children and eight grandchildren.



NEAL HATFIELD

Neal Hatfield recently joined the Science Support Shop as an electronic technician and feels blessed to be a part of the Chemistry and Biochemistry Department team. Hatfield brings 31 years of experience working as a biomedical technician and field service technician to the department, helping to repair lab equipment and provide general assistance.

This career change has brought great joy to Hatfield. "I love the fact that I work with people that have the same values and principles as I do. I am very grateful, fortunate and blessed to be able to work here at BYU. The people at BYU- whether it be faculty, students or staff- are wonderful to be around and work with," he commented.

Hatfield has been married for 34 years and loves spending time with his wife, six children, and soon-to-be- four grandchildren. Hatfield is currently working on a house remodel, but he loves to spend time visiting ghost towns or just enjoying life with his wife and kids.

TEACHING IN A COVID ERA

From home lab kits to on-campus mask-wearing to over a year of socially distanced learning, this year brought a variety of new challenges and changes to the Department of Chemistry and Biochemistry. The COVID-19 pandemic required teachers and students to transition their lives and learning online. This shift was far from straightforward, requiring technological advancements and training, scheduling changes, and the restructuring of course curriculum to better suit an online learning environment.

Professors Rebecca Sansom, Steve Wood, and Matt Peterson looked back on the past year. While the changes have been difficult for many, Wood noted one of the benefits to online learning and teaching is that, “There is no back seat… everyone has a front row seat. So there isn’t the distraction as there is sometimes in a classroom. You’re right there. Everybody has the best view in the house.”

> “There is no back seat… You’re right there. Everybody has the best view in the house.”

Most instructors only worried about transitioning a classroom to a digital environment. Sansom faced the challenge of creating a comparable campus lab experience for students at home. “One of the

While this past year has been challenging for many due to the pandemic, Sansom sums it up very well, "It's always the case in life that you can look back on things and wish you had done them differently … We were all living through a pandemic for the first time in our lives, a thing that we probably didn't even realize could happen …. What I have seen from my colleagues is an extraordinary effort to put students first, to think very carefully about student learning, to do the very best that we can to make sure that students are having a great experience here at BYU."

Written by Audrey Davis Ahlstrom
Photo by Nate Edward

things that I'm proudest of is creating an online equivalent," Sansom commented. While there were challenges and trials in the process, she noted how proud she was of the efforts everyone put in to make it happen, "It's not exactly the same as doing it in person… but it's pretty close."

This school year was especially difficult for teachers and students around the globe as it has challenged individuals to build relationships with each other without ever physically meeting one another. Wood taught completely remotely for a year and is proud of his students for performing just as well remotely as his previous students had performed in person, but he felt that his students experienced a "connection without feeling connected."

While the true student to teacher connection may be lost, adjusting from teaching in person to a completely online format is something that each individual should be proud of. Peterson said, "The pandemic took all of us by surprise… I had to adapt rapidly, almost overnight, to a new manner of teaching, for which I was totally unprepared... It was a super steep learning curve… the only way to get over it was to roll up my sleeves and go to work," By the end of the 2020-2021 school year, he had recorded nearly 100 hourlong organic chemistry lessons.

"IT'S A TRAP!"

IZATT-CHRISTENSEN FACULTY EXCELLENCE IN RESEARCH

Dr. Austin's Advancements Toward Mass Spectrometry and Portable Mass Analyzers

On March 9th, 2021 Dr. Daniel Austin was presented the Izatt-Christensen Faculty Excellence in Research award for his extensive laboratory innovations and accomplishments. This endowed award of excellence is presented annually, alternating between BYU's Chemical Engineering and Chemistry and Biochemistry faculty.

Due to current COVID-19 restrictions and guidelines, Dr. David Dearden presented the award to Austin on behalf of Dr. Reed M. Izatt who, along with many others, was able to attend the event via Zoom. Austin gave a dynamic presentation on his research of "Ion Trap Mass Spectrometers for Portable Chemical Analysis," and his prospects for future developments in this field.

Resolving Troubles at Sea

The British Empire of the 17th, 18th, and 19th centuries became known as "the empire where the sun never sets." While conquering land and sea, the British suffered heavy losses due to the worldwide inability to calculate longitudinal coordinates. After years of extensive research and experimentation from big thinkers and clockmakers alike, John Harrison created the world's first marine chronometer in 1760, an invention that would solve these issues. This seemingly simple portable device not only saved the lives of many British sailors and many of the empire's ships, but revolutionized maritime navigation.

Austin explained that there would be priceless benefits as a result of making and distributing portable chemical analyzers, often referred to as portable mass spectrometers. These devices would be able to provide real time information when measuring sensitive samples. This technology is capable of "measuring components that are variable in time or space, screening for the most interesting or valuable samples, [and] analyzing remote and [potentially] dangerous locations."

In order to give his audience an idea of what these devices could look like, Austin gave the example of the innovative apparatus from Star Trek called the "tricorder." It is a portable device that can be used anywhere to provide information like, "data sensing, analysis, and recording" of nearby environmental variables.

Miniaturization Efforts

Austin and his research team hope to accomplish further innovation toward similar helpful devices by way of a portable mass analyzer, or mass spectrometer. Currently most mass spectrometers are large, heavy, and non-portable. For this purpose Austin and his team have been busy at work to improve the accuracy and portability of these devices by a means that is low in cost and permits wide distribution. One method that has helped this process move forward is the invention of ion traps.

What are ion traps?

"Of all the different kinds of mass analyzers, most of the miniaturization efforts around the world focus on ion traps." As he described his own focus on miniaturizing ion traps, Austin explained, "Anytime we track an ion, or a population of ions… we can measure the mass-to-charge ratio… enabl[ing] us to determine the composition of the sample." These miniaturization efforts have followed an extensive process of trial and error. Beginning with the quadrupole ion trap, then the linear ion trap, and most recently making progress toward developing a toroidal ion trap with cylindrical electrodes, these efforts continue and small changes bring about a range of results.

3 Approaches to Miniaturized Ion Traps

Research has been focused largely on three approaches to making better miniaturized ion traps. Production of these ion traps includes novel advancements such as lithographically patterned plates, the wire ion trap, and the coaxial trap with an integrated injector. Using lithographically patterned plates allows for the creation of the same electrical field shape without the conventional ion trap approach. It is simple, being made of only a few central parts, yet just as effective as many of the current designs. Throughout the years, many improvements have allowed for better results, including moving the plates themselves closer together. This helped Austin's team produce a 360 micron design approximately the size of a quarter.

Similar to the convenience of science fiction's tricorder, Austin emphasized how invaluable it could be for military personnel, doctors, and scientists to have a comparable portable device while exploring unknown terrain. With it they could promptly and accurately survey an area and alert them to any potential danger in the vicinity. Receiving this information in real time would help with quick decision-making and allow for more educated responses to environmental shifts.

Unlike the lithographically patterned plates, the wire ion trap model consists of four screws, various nuts, wires, and a pair of circuit boards. While slightly larger than the 360 Micron design, the smallest wire ion trap that Austin's team has produced is about the size and length of a AA battery. This design provides for mass resolution and accuracy and can be produced at an ultra-low cost - less than $10 per wire ion trap.

Austin's most recent focus is making an ion trap using a coaxial trap. In essence he is combining a toroidal trap and a cylindrical trap. This ion trap is a new addition to research in his lab and has thus far been limited to testing simulations and outlining projected model designs. Austin anticipates this trap will have three main regions, namely, "the rectilinear ion guide, the toroidal AC electrode trap region, and the ion ejection slit." Austin hopes that this new design will increase scan functions and make the readings more accurate, while still allowing in situ ionization and facilitating integration with chromatography.

Revolutions in history, science and the media encourage innovations in portable devices for chemical analysis. Austin has contributed greatly to many of these efforts through his research.

Written by Audrey Davis Ahlstrom

Photos courtesy of BYU Photo, Jacob Larsen, and Dr. Daniel Austin

Due to BYU's COVID-19 and social distancing requirements, the majority of guests attended via Zoom.

SO LONG SUPERBUGS

New blood test detects presence of deadly superbugs in under an hour

Pictured are Drs. Richard Robison, Adam Woolley, Aaron Hawkins, and William Pitt.

If you have antibiotic-resistant bacteria in your blood, you need to know pretty quickly what's going on in there. These types of bacteria, called superbugs, are a growing and deadly threat.

"Once you're trying to diagnose the disease, the clock is ticking," said Aaron Hawkins, BYU professor of electrical and computer engineering. "Every hour the disease is untreated, survivability drops by about 7%. You want to know what you're fighting immediately so you can apply the right treatments." Unfortunately, current superbug testing methods take 24 hours — or longer — which can lead to long term damage to the individual.

Four BYU professors across four disciplines — molecular biology, chemistry, integrated optics and chemical processing — are here to help. Hawkins, along with professors Adam Woolley, William Pitt and Richard Robison, and UC Santa Cruz professor Holger Schmidt, published the details of their new method in the journal Lab on a Chip.

They've created a method to extract superbugs from whole blood, prep them for testing and then provide a diagnosis all in under one hour, accomplishing the goal of their combined efforts.

Not only have they found a way to deliver results under the one-hour benchmark, they can also simultaneously test for three different superbugs in that window.

"The ability to test for three different bacteria was made possible by Dr. Robert Hanson, a 2021 biochemistry PhD graduate, who successfully developed novel DNA capture materials in these microdevices," Woolley reported. "Hanson's biochemistry expertise played a critical role in the success of this project in connecting the fields of microbiology and engineering."

In order to perform this diagnosis, the system takes a sample of a patient's blood and first spins out the billions of blood cells in order to isolate the bacteria. DNA is then extracted from these bacteria and, if they match known sequences from antibiotic-resistant strains, the DNA will be labeled with fluorescent molecules. Sampled DNA is pushed through a fluid channel on the microchip where it passes through a tiny curtain of light. A fluorescent signal coming from labeled DNA indicates when drug-resistant bacteria are present.

The team's ability to rapidly detect multiple bacteria on the same chip at the same time, known as multiplexing, came through their development of a number of technical innovations. By developing new efficiencies to spinning technology, the team created a faster way to do the separation (separating the bacteria from the blood), built new chips to process the samples and engineered an optical detection method that uses various laser colors to identify different bacteria.

The innovations come after five years of work and academic publications funded by a $5.4 million grant from the National Institutes of Health.

But the team is not stopping here. Their plan is to take this technology to market and install the one-centimeter-square chip on a disposable cartridge, making it an inexpensive and accessible way for their research advancements to be used in a hospital environment. Efforts to accomplish these measures are being made each day and the team continues to push forward, fighting for these innovations to be available to those in need.

Written by Todd Hollingshead and Audrey Davis Ahlstrom
Photos by BYU photographer Claire Moore


Elements of the new BYU-devised system for rapid detection of superbugs in blood.

MACHINE LEARNING:

THE CATALYST FOR DESIGNING A NEW MOLECULAR CATALYST

BYU team combines supercomputers and Henry Eyring's 90-year-old theory to create a new chemical catalyst

Mastering the art of machine learning, or the branch of artificial intelligence and computer science that focuses on data analysis to imitate human learning, is no easy feat. Dr. Daniel Ess and his student researchers have taken on this task with an energy and excitement that has brought about substantial findings.

> "This is the first example of anyone using machine learning to predict the selectivity of a catalytic chemical reaction."

BYU engineering student Nick Rollins joined Dan Ess' team and almost immediately received the assignment of becoming an expert in machine learning. This challenged Rollins' patience and passion for the subject at hand, but his hard work continues to be well worth it, especially after how things started out for him. "That became three months of headaches and pain killers, but I learned so much from it. The only reason I have the knowledge and skills I do now was really because [Dr. Ess] decided to sit an undergrad down and entrust him with this significant part of the project."

Armed with advanced data science principles and techniques and using chemical theories created by Henry Eyring (the father of Church leader Henry B. Eyring), the Ess Research Group was able to model how specific complex chemical reactions take place and design new catalysts for a critical industrial chemistry problem. Their research was recently published in the journal *Chemical Science*.

"It took us about two years to start really getting a grasp of the problem and we still kind of spun our wheels for another two years," Ess said. "Using machine learning became the catalyst for designing a new molecular catalyst."

A catalyst makes chemical reactions go faster by lowering reaction energy barriers. Using catalysts in the chemical industry to make plastics and plastic co-monomers – linear alpha olefins in this case – is critical to save time, energy and resources. In collaboration with chemists at Chevron Phillips Chemical based in Kingwood, Texas, the group uniquely combined Eyring's 90-year-old transition state theory with modern machine learning techniques to design new molecular chromium catalysts for selective ethylene oligomerization, which is a major challenge in the petrochemical industry.

"This is the first example of anyone using machine learning to predict the selectivity of a catalytic chemical reaction," said Dr. Steven Maley, a postdoctoral scholar at BYU and co-author on the paper. "There have been other papers that have used machine learning to predict how reactive catalysts are but not how selective they are, which is a much more difficult thing to predict."

While more than 92% of BYU students are undergraduates, it's worth noting that the authors of this study included an amalgamation of undergraduate and graduate students as well as Maley, a postdoctoral scholar working in collaboration with industrial scientists. Like many high-performing science research groups, postdocs are a critical part of the recipe to help train undergraduate and graduate students and as a team generate high-level research.

"Having postdocs in the lab that already have their PhD provides a culture of cutting-edge research and is critical to help mentor younger students," Ess said.

For Rollins and other undergraduates, a lab full of postdocs and graduate students is an arrangement that gives students the chance to learn the frontiers of science directly from their peers.

"I worked with one grad student in particular, Doo-Hyun Kwon. He was a really great mentor to us," Rollins said. Kwon was a co-author on the manuscript and recently landed a job as a computational chemist at a major pharmaceutical company. "He went beyond just making sure we knew enough to do our work but really making sure we had a solid structure and background of understanding that we could apply to other things."

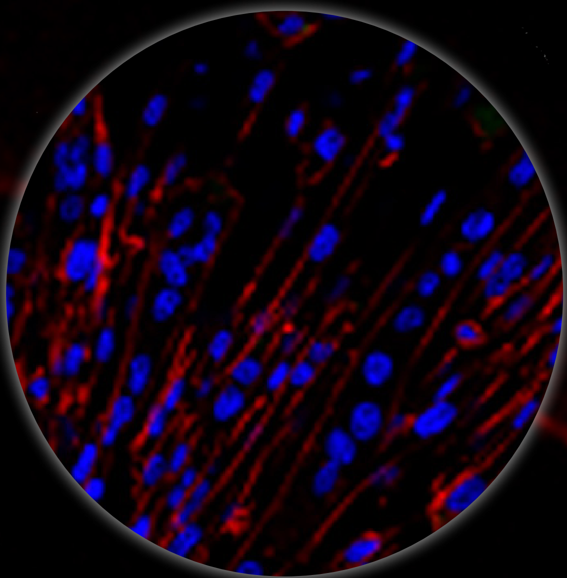
Ess' team continues to take great leaps in research. They hope to one day use machine learning to produce fully-functioning catalysts throughout the field of chemistry. In the meantime, they countinue to work together to make steady progress toward this goal.

Written by Aaron Sorenson and Audrey Davis Ahlstrom
Photo by BYU Photo

A new research paper features a combination of chemistry, physics and computer science to design new catalysts for the petrochemical industry.

Left to Right: Nick Rollins, Daniel Ess and Steven Maley.

ONE MOVE AT A TIME



Weeks at BYU begin with hundreds of students making their way through campus: hiking the stairs up from 800 North on their way to class, to work, to the library, and to the laboratory. Students of the BYU Chemistry Department stand for hours as they pore over microscopes and flasks. Professors stand at the front of lecture halls, gesturing round the room, waving laser pointers, and reaching up to write on whiteboards and blackboards. Most take these everyday actions for granted; however, for those afflicted with muscular dystrophy, a disease where muscles degenerate with use, such actions are difficult and sometimes impossible.

Thus are the Chemistry Department's Van Ry research group motivated in their research. Professor Pam Van Ry and a team of her students are currently seeking a novel treatment for limb-girdle muscular dystrophy (LGMD2B), a type of muscular dystrophy.

Muscles normally break down during exercise, then rebuild stronger and larger, explained Pam Van Ry. "But in muscular dystrophy they don't repair properly," she said. "Because they don't repair, some proteins are 'up-regulated' [increase in quantity] to make up for the muscles that are no longer there. Galectin-1 is one of the proteins that is naturally up-regulated in several types of muscular dystrophy. Our thought was that by further increasing the concentration of galectin-1 we could alleviate some of the manifestations of the disease."

Galectin-1 protein contains what is called a carbohydrate recognition domain, meaning galectin-1 can bind easily with glycosylated proteins and, in this case, facilitate the cellular repair process by bonding with broken muscle proteins and helping membranes remain intact. Van Ry's research team discovered that galectin-1 may be a viable treatment for muscular dystrophy when delivered in small doses that supplement the body's normal supply. The team's research method treats extracted muscle cells and fibers of mice afflicted with LGMD2B. Such research provides the basis for translational medicine — that is, the development of therapeutics in a laboratory setting for patients suffering from a disease in a clinical setting using a lower order mammal such as mice.

The group did not begin by treating whole mice nor humans, only mouse cells or muscle fibers afflicted by LGMD2B. Recent team research shows that injured cells and fibers treated with galectin-1 have increased myogenesis (formation of muscle) and improved membrane repair. "We were super, super stoked," said Van Ry. "We've [shown] that it decreases the disease and it can do so very, very quickly, within ten minutes, which is really crazy. We were very surprised."

After experimenting with multiple dosage volumes and frequencies, the team discovered that mouse cells receiving doses of 2.7 milligrams per kilogram per week of galectin-1 healed muscle damage significantly faster than diseased mice receiving only placebo treatment. Galectin-1 treats more muscular dystrophy symptoms than just muscular degeneration. Part of the research group's work has focused on galectin-1's effect on the immune system.

When people exercise to make their muscles stronger, the muscles go through cycles of degeneration and regeneration. The immune system plays a role in this system in which the immune cells receive a signal saying that the muscles need to be fixed. After the repair is completed, there is a signal to stop. The immune system operates unusually in patients with muscular dystrophy. In these patients, the immune response continues to rise and does not receive the signal to stop. This results in what is called chronic inflammation, which throws off the inflammatory system and other important systems in the body. "I call it the Goldilocks effect," said Van Ry. "You have an initial immune response and then you have another immune response that counteracts [the first-telling the first response to stop]. It's always this balancing act going on inside of you … in muscular dystrophy their system [stays] in a hyperactive immune response."

Such an immune response exhausts and weakens the body. Galectin-1 can modulate some of these responses — treating another symptom of muscular dystrophy — while acting as a "glue" for the outer membranes of muscle fibers which aids in repair.

In addition to lab work, Van Ry's team visited conferences and collaborated with other researchers in pursuit of success. "It has been a rewarding process … [learning from] other teams and individuals working together towards a common goal of improving … the well-being of individuals suffering from such a debilitating disease," said Mary Vallecillo-Zuniga, one of Van Ry's graduate researchers.

Vallecillo-Zuniga currently seeks a PhD degree in biochemistry. In Van Ry's lab, Vallecillo-Zuniga designs and performs various experiments and analyzes and presents findings to the team and other researchers. She and her fellow graduate students Ashley (Markham) Chang, Jonard Valdoz, and Matthew Rathgeber help Van Ry train and supervise the research team's seven undergraduate students. Also, part of the team are Emory scholar Dr. Connie Arthur and Harvard scholar Dr. Sean Stowell, who is a BYU alumnus.

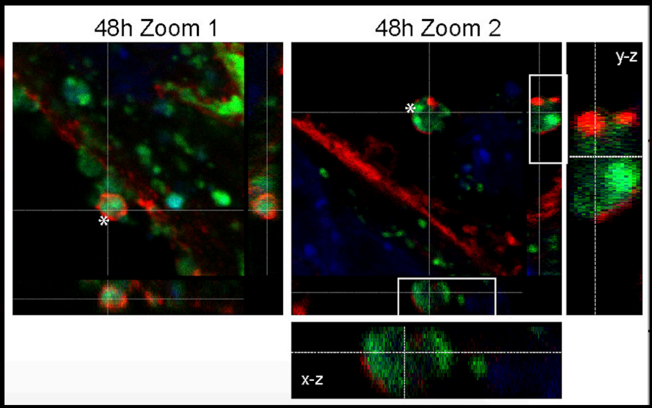
The Van Ry group continues to study the treatment of muscular dystrophy in mice. In the future, the group hopes to test galectin-1 therapy on other, larger animals before progressing to human trials. "A [cure] is quite a ways out … minimally … ten to fifteen years. It takes quite a while," lamented Van Ry. "My hope is that by working with the Jain Foundation they can speed [our work] because they have so many [experts] affiliated in the field of muscular dystrophy."

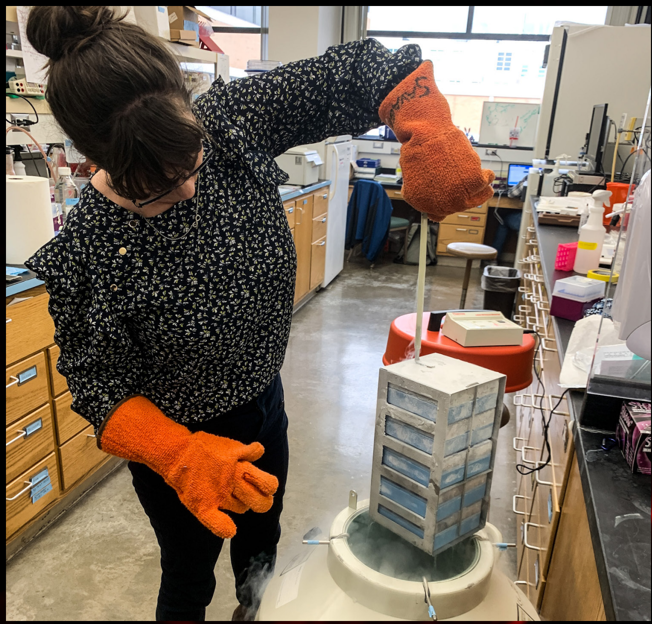
"I love being a part of the muscular dystrophy team," commented Vallecillo-Zuniga. "This project has given me an opportunity to serve and give hope to people suffering from [muscular dystrophy]."

The Van Ry lab published a paper in the biochemistry journal PLOS One entitled, "Galectin-1: A Potential Protein Therapy for Limb-Girdle Muscular Dystrophy 2B" describing their research and conclusions in detail. Van Ry has patented galectin-1 as a therapeutic and has met with several prospective pharmaceutical companies in hopes of getting the therapy to patients.

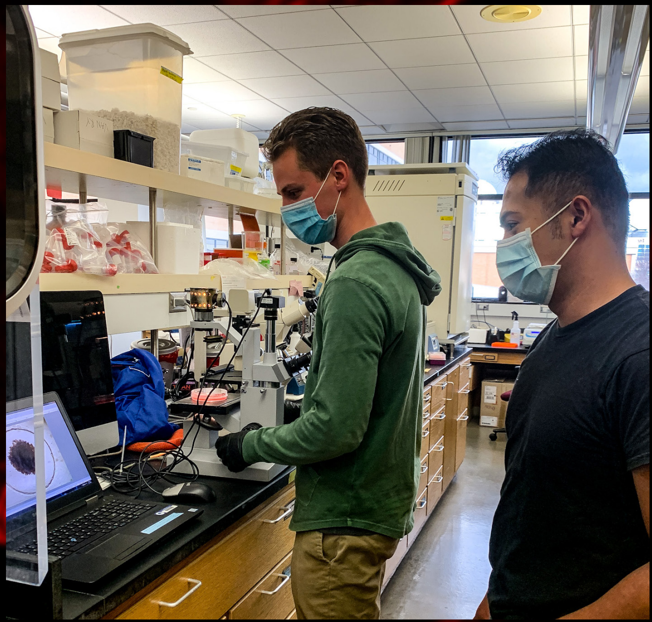
Editor's Note: The Van Ry lab expects to publish a detailed update on this research in Fall 2021.

Written by Sydney Jezik
Photo courtesy of Van Ry lab and Sydney Jezik





Professor Pam Van Ry inspecting frozen mouse muscle cells



Undergraduate Dallin Jacobs and graduate student Jonard Valdoz analyzing a cell culture.

ADAM WOOLLEY

Appointed dean of Graduate Students

Adam Woolley was recently appointed as the dean of Graduate Studies at BYU effective May 2021.

Before receiving his PhD at University of California, Berkeley, Woolley studied chemistry as a BYU undergraduate student. For his postdoctoral work, Woolley worked at Harvard University. Last year marked 20 years since he joined BYUs Department of Chemistry and Biochemistry.

STEVEN CASTLE

Appointed new director of the Simmons Center for Cancer Research

In August of 2020 James Porter, Dean of Life Sciences and Gus Hart, Dean of the College of Physical and Mathematical Sciences, announced that Steve Castle was appointed as the new director of the Simmons Center for Cancer Research.

Castle earned his bachelor's degree from BYU in 1995 and completed his PhD at The Scripps Research Institute in 2000. He also completed an NIH postdoctoral fellowship at UC Irvine in 2002.

As part of his new position, Castle will be supervising all programs and strategies needed to help the research teams progress in the Simmons Center. Hart said, "We are grateful for Steve's leadership style and strong science. We expect the center will continue to thrive with his insight and thoughtful approach."

PAUL B. SAVAGE

Steven V. White University Professorship

This award encourages and acknowledges senior faculty members who are outstanding scholars, teachers, and university citizens. It may specifically recognize excellence in scholarship and creative work or reward superior classroom teaching

Paul B. Savage's research is focused on strategies for the prevention and treatment of infectious disease. He has authored more than 200 peer-reviewed publications, and several biomedical products based on his work are currently in late-stage clinical trials. He is also an excellent mentor, receiving some of the highest teaching ratings in the department.

BARRY WILLARDSON

Eliot A. Butler Professorship

The Eliot A. Butler Professorship is named in honor of BYU emeritus chemistry professor Eliot Butler. Professor Butler taught at BYU from 1956 to 1991. He devoted fifteen of those years to administrative assignments, including department chair, college dean, and associate academic vice president. Butler was an exceptional, positive mentor to thousands of students and colleagues. Whether in a research lab, the classroom, or through a brief encounter, one left striving for a greater level of excellence in their work. His demeanor and character, as well as the depth and breadth of his knowledge is honored in this award.

Dr. Willardson notes that Dr. Butler taught his freshmen chemistry class at BYU and solidified his commitment to study chemistry. After graduate work at Purdue, a postdoctoral and research position at Los Alamos National Laboratories, Dr. Willardson returned to join BYU faculty as a biochemist. In his 25 years at BYU, Dr. Willardson has taught and mentored a host of BYU graduate and undergraduate students. His reputation for expecting excellence would elicit a smile of approval from Dr. Butler.

STACEY J. SMITH

Early Career Teaching Award

This award encourages and acknowledges outstanding promise and contributions in teaching by faculty at an early stage in their careers.

In addition to managing the university's X-ray diffraction facility, Stacey J. Smith teaches large courses in general chemistry. She receives consistently strong student ratings and has had a key role in unifying the curriculum. Smith has solved structures for hundreds of crystals and coauthored more than 25 research publications, always mentoring students in the process.

SCOTT R. BURT

Karl G. Maeser Professional Faculty Excellence Award

This award recognizes outstanding achievement in fulfilling professional faculty responsibilities and is made possible by the generosity of the Karl G. Maeser Scholarship Society.

Scott R. Burt manages a state-of-the-art facility for nuclear magnetic resonance and recently upgraded the facility with $1.8 million in new instruments. He also carries teaching and citizenship assignments comparable to those of professorial faculty, receiving excellent teaching ratings. Burt has coauthored 20 research publications and mentored hundreds of students.

PAUL FARNSWORTH

Journal Recognizes Innovative BYU Researcher

Dr. Paul Farnsworth, a BYU alumnus and emeritus faculty member, is highly regarded in the world of analytical chemistry. Recently, *Spectrochimica Acta Part B: Atomic Spectrometry* dedicated its February 2021 issue to him for his lifetime of research in analytical atomic spectroscopy and the legacy he has left behind. Farnsworth's far-reaching work is not only noteworthy, but has had an important influence on his colleagues and students.

Farnsworth's research collaborators offered testament to his sound, ground-breaking work in ICP spectrometry sampling methods and "processes that occur in the ICP-MS interface." Dr. Gary Hieftje, with whom Farnsworth worked as a post doctoral fellow praised Farnsworth as a "scientist of the first rank" and "one of the most innovative thinkers in our field."

Dr. Nicolo Omenetto, a colleague from the University of Florida and a longstanding friend of Farnsworth's, noted, "Paul was gifted with all the major qualities of an analytical spectroscopist. I am sure his interaction with students and colleagues was permeated with respect, concern, and integrity."

TODD FLUCKIGER

SAERA Award

Created by BYU's Presidential Council, Staff and Administration Employee Recognition Awards (SAERA) honor BYU staff for contributing to their department's excellence.

Fluckiger is the department's purchasing agent, but his responsibilities were recently expanded to help Chem Stores with some much-needed assistance. This award recognized how well he integrated his expanded role, fostered an increased sense of teamwork within his area, and maintained a key role in projects across the university campus.

BART WHITEHEAD

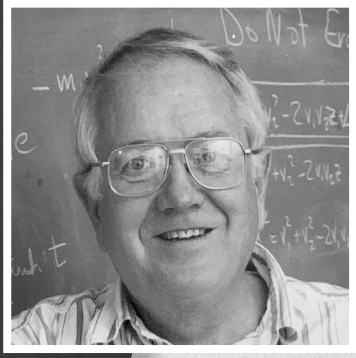
DECEMBER 12, 1954 - JUNE 12, 2021

Bart Whitehead, a beloved staff member, husband, father, and friend passed away peacefully on June 12, 2021. After six years battling kidney and liver illness, he died surrounded by his loved ones.

Whitehead always had a passion for electronics and helping others. He tried to make everything fun and brought the things he learned at work home with him. He received his certification from Utah Technical College, and soon after joined BYU's team in 1988, dedicating 32 years of service to the Department of Chemistry and Biochemistry and the College of Life Sciences. In 2016, he received one of BYU's annual President's Appreciation Awards.

He is survived by his wife Nina and three children; Nathan, Angela, and Lisa.

Written by Audrey Davis Ahlstrom / Photo by BYU Photo



DOUGLAS HENDERSON

JULY 28, 1934 - SEPTEMBER 25, 2020

BYU Department of Chemistry and Biochemistry emeritus faculty member Douglas Henderson passed away early in the morning of Friday, September 25th, 2020, after a long battle with cancer. He is survived by his wife, Rose-Marie, and daughters Barbara, Dianne, and Sharon.

Dr. Henderson is further survived by a legacy of excellence in scholarship and instruction on levels international as well as local. After completing a graduate degree in mathematics from the University of British Columbia, Henderson obtained a PhD in physics at the University of Utah in 1961. In the course of his work, Henderson acquired a deep interest in mathematical, physical, chemical, and biophysical theory. Following the completion of his PhD, Henderson taught at the University of Idaho, Arizona State University, the University of Waterloo, Canada, and the Autonomous Metropolitan University in Mexico City. He then departed academia for a time and spent the majority of his research career at the IBM Almaden Research Center of San Jose, California. After retiring from the IBM Almaden Research Center, Henderson continued his research at BYU in the chemistry department.

Henderson held honorary ranks at the University of Hong Kong, the Rush Medical University in Chicago, and the Ukrainian National Academy of Science. He published over 500 scientific articles in his lifetime, including many papers related to the theory of liquids. Henderson continued writing, editing, and publishing articles until his death. His activity garnered great recognition, including a national award from the American Chemical Society (ACS).

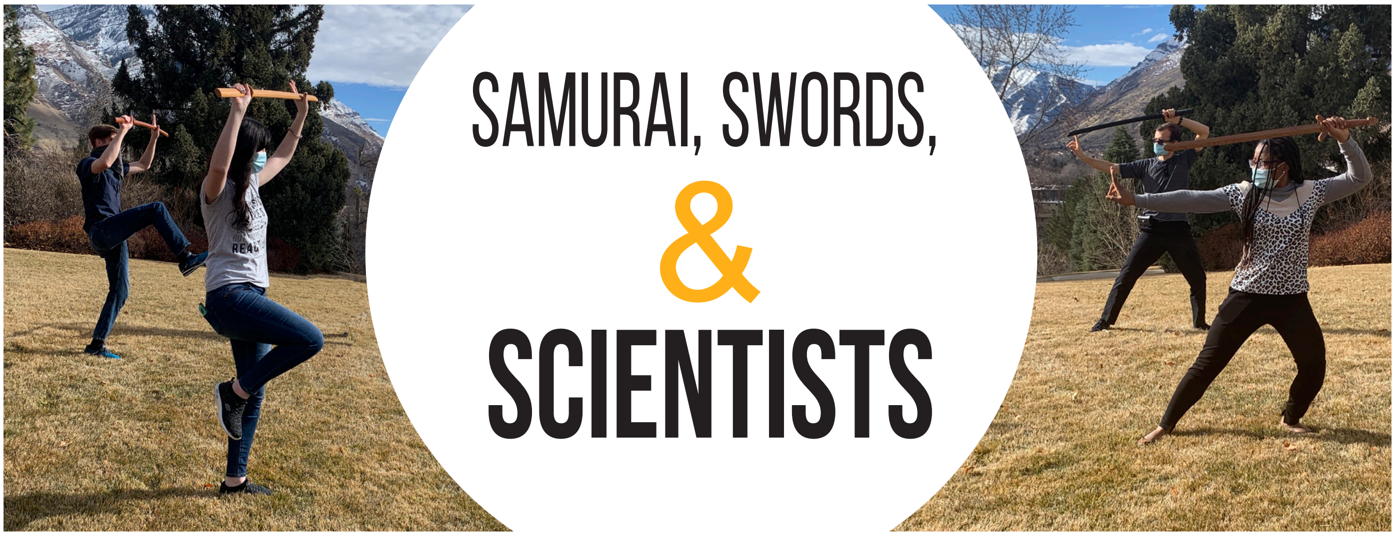
Chemistry Department chair David Dearden wrote that Henderson "raised the level of discourse for all of us, demonstrating… what it takes to function at the top levels of science. He wasn't satisfied with a rote answer, but wanted to understand things thoroughly, based on fundamental principles. His example was inspiring."

Written by Sydney Jezik / Photo courtesy of Sue Mortensen

SAMURAI, SWORDS, & SCIENTISTS

LOOK OUT, BYU ... There's a new club on campus and **THEY'VE GOT SWORDS!**

Scientists with Sword Skills (SwiSS) is exactly what it sounds like: a group of scientists (all members are currently from the Department of Chemistry & Biochemistry) with swords and the skills to use them… skills honed under the watchful eye of the club advisor, department postdoctoral fellow Dr. Richard Carson. "The genesis of all this occurred when I was a graduate student in the JC Price lab here at BYU," said Carson. "A friend of mine, Dr. Bradley Naylor, had completed his PhD defense and was graduating. For a graduation present, I gave him a nice wooden bokken [training sword] complete with a silk sword bag, which was my humorous little way of acknowledging his habit of idly swinging meter sticks [and] metal rods… when he would walk around in the lab and the office."



SWiSS members practicing different kenjutsu forms

Carson's path as a martial artist began in childhood, meandered in and out of various styles in college, and finally arrived at Shaolin kempo in graduate school. Shaolin kempo is a blend of many martial arts disciplines, including karate, kung-fu, judo, and more. Weapons are an optional area of study under Shaolin kempo; Carson's sensei at the local ZUltimate dojo offered to instruct him in the use of the katana, a curved sword traditional to martial artists (including samurai), three years ago. Years later, when Naylor returned to BYU as a postdoctoral fellow, Carson shared his sword skills with him. Carson and Naylor's weekly practice sessions attracted attention from the rest of the department. First one graduate student joined, then two more; soon the number of swordsmen and swordswomen numbered about ten. "I just kept saying 'yes' to any requests for instruction," explained Carson.

The students have now organized themselves into a BYUSA-chartered club, with graduate students Madi Johnston and Nathaniel Axtell as club president and vice president, respectively. BYUSA membership permits the club to book large indoor practice rooms as well as obtain extra funding to help members obtain swords.

Club meetings begin with warm-ups. First, the students bow in a circle, then draw their bokkens. Carson leads them through a routine. After everyone is sufficiently loosened up, practice begins in earnest. The scientists practice balance, awareness, and, above all, sword-fighting. They pivot and kick, advance and retreat, and slash and whip their blades in a manner reminiscent of a dance — in a clear, careful choreography that could be just a little dangerous if one was to fall in the way of their bokkens. As the students practice, Carson walks among them, offering advice and praise.

"[What we do] is kenjutsu, not kendo, meaning we are not learning to fight each other with swords, just doing kata and whatnot," said Axtell. "Kata is like a dance routine for practicing martial arts." "To do it requires a lot of attention to position and rhythm," confirmed Johnston. "I would recommend learning kenjutsu because it has physical benefits and is also a good way to de-stress. After a day of experiments and classwork, it is great to focus on something that works a different part of your brain."

COVID-19 prevented SwiSS from meeting in the fall. But now safety restrictions have lightened, the club has resumed meeting. They practice for 30-40 minutes at a time in open spots across campus, including the duck pond and the arboretum.

"I want to encourage students to join SwiSS," said Johnston. "You don't need any experience to join… for most of us, this was our first experience with kenjutsu."

Photo & text by Sydney Jezik

LIGHTNING STRIKES TWICE

Chemistry Does It Again - 3MT Competition

Graduate student Concordia Lo swept the department, college and university levels of this year’s 3-Minute Thesis (3MT) competition, marking yet another year with a winner from the Department of Chemistry and Biochemistry.

The annual 3MT competition takes place in conjunction with both the College of Physical and Mathematical Sciences and BYU and is an opportunity for students to share a three minute thesis on their research.

Lo’s presentation was titled, “Synthesis of Simplified Yaku'amide A Analogues: Using a Marine Sponge to Wipe Out Cancer.” In her own words, yaku’amide A is, “A promising anticancer peptide discovered in a marine sponge [that] most likely belongs to a class of novel anticancer agents.” In her presentation she shared that by further researching the synthesis of Yaku’amide, potent anticancer peptides can be developed. As a research team, Lo and her associates used computational studies and were able to, “design and synthesize simplified analogues of yaku'amide A which we will send out for further testing.”

Of her experience in the competition, Lo said, “I wasn't planning on participating in the competition, but some of the graduate students in my lab were interested and invited me to do it with them.” Admitting how grateful she was to have participated in the competition, Lo reflected that, “COVID made it hard for us to connect with other graduate students in the department who are outside of our lab or area… This experience was really nice because I was able to learn about everyone's research.”

Captivating her audience, Lo advanced from the department and college levels of the competition, landing herself a slot in the university-wide competition. She noted that these “practice rounds” allowed her to gain the practice and comfort necessary to prepare for a winning presentation for the final round of the competition. In addition to winning the competition, Lo also received the Presenter’s Choice Award.

Written by Audrey Davis Ahlstrom
Photos courtesy of Concordia Lo

BEST FUNDAMENTAL STUDENT PAPER - THE INTERNATIONAL JOURNAL OF MASS SPECTROMETRY

Radhya Gamage, a third-year graduate student in Daniel Austin's lab, received the Best Fundamental Student Paper award from the *International Journal of Mass Spectrometry*. Her research group's paper is titled, "The Effects of Electrode Misalignments on the Performance of a Miniaturized Linear Wire Ion Trap Mass Spectrometer." The award will be presented to her at the ASMS 2021 conference in Philadelphia this fall.

AWARD FROM THE AMERICAN VACUUM SOCIETY

Tahereh G. Avval (Linford lab) earned an award from the American Vacuum Society (AVS) for her research on the surface chemistry of glass. The AVS issues an annual award titled, the "Applied Surface Science Division (ASSD) Award," to a number of excelling chemistry students. As a finalist, Avval was asked to share a five-minute presentation summarizing her work for the committee. Avval won second place, which included a cash reward for her research efforts. Of this experience, Avval said, "I [am] pleased and honored to [have] competed for the ASSD student award… I was able to do a really nice presentation... second place is a great honor for an award like this."

NASA JET PROPULSION LAB

Elaura Gustafson (Austin lab) has been accepted to this summer's NASA Planetary Science Summer School in the NASA Jet Propulsion Lab. She will be focusing on the early stages of mission design. Gustafson has always had a fascination with the earth and outer space, making this opportunity feel like a dream come true. The program itself will be virtual this year due to COVID, but is an incredible experience nonetheless. Gustafson has also received last year's Graduate Student Award from the American Society for Mass Spectrometry (ASMS). Recognizing up to 20 graduate students nationwide each year, the award focuses on students whose, "academic achievements and current mass spectrometry research display a high level of excellence and distinction."

JAIN FOUNDATION GRANT RECEIPIENT

In April, 2019, Mary Vallecillo (Van Ry lab) was presenting her research in the Muscular Dystrophy Conference (MDA) in Orlando, FL when her research caught the attention of the Jain Foundation. Since then, Vallecillo has received a Jain Foundation grant to help support her research with Pam Van Ry. Their team focuses on developing a novel therapeutic intervention for patients with muscular dystrophy in order to increase muscle membrane repair and modulate inflammation.

KAITLYNN MITCHELL

Mentor - Adam Woolley

Multiplex detection of DNA targets

A sepsis patient needs timely treatment with antibiotics, but it currently takes 12 – 24 hours to test for bacterial antibiotic resistance. The Woolley lab and collaborators are developing microfluidic devices capable of detecting antibiotic resistance genes within two hours. These devices separate DNA targets that encode antibiotic resistance genes by hybridizing them to capture probes suspended in monolith columns. My future efforts will focus on multiplex capture of plasmid targets, which will require on-chip DNA melting before hybridizing to the monolith. Plasmid targets will more closely resemble DNA extracted from clinical blood samples.

My experience in the research lab has given me more exposure to the various applications of chemistry and biochemistry. Working in the lab, I have gained a lot of experience problem solving when there is not a single answer, like there often is in the classroom. I enjoy learning how to explore options and being willing to make mistakes. Presenting in the BYU Student Research Conference taught me how to present my work to people outside of my lab as well as learn from other presenters, even though I had no former knowledge of their research. My mentored research experience has been a highlight for my time at BYU and my education would not be nearly as complete without it. Thank you so much for your contributions that have made this possible.

KENNETH VIRGIN

Mentor - John Price

Mouse Brain In Situ Lipid Analysis

Apolipoprotein E (apoE) is a lipid transporter and the strongest genetic correlate to Alzheimer's disease (AD). My research focuses on the hypothesis that apoE variant mice have differing lipid regulation in specific regions of the brain. I am studying how apoE correlates to different lipid concentrations and turnover in different regions of the brain. By studying concentration and turnover, we can understand how lipids are regulated in the brain. This semester, I analyzed wild-type mouse brains. I found that the cerebellum generally has a higher turnover of lipids than other brain regions. I also saw that each lipid in our brain has a distinct pattern of high and low concentration and turnover throughout the brain. Now that I have completed this experiment on wild-type mice, it will be simple to repeat it on mice with different apoE alleles.

My mentored experience helped me grow substantially. Not only did I grow in my knowledge of what I researched, I learned valuable skills to help me learn and thrive in my future career in the medical field. My typical duties as a research assistant include analyzing past research, forming new hypotheses, and designing experiments to test these hypotheses- a recursive process. Once an experiment is complete, the data introduces new questions to research and new hypotheses to test, and thus, the cycle repeats. Often, it is frustrating when an experiment doesn't yield the results I anticipated because it means that the project will be pushed back until a new experiment is performed. Through this, I learned to set goals with setbacks in mind. I am learning how to set more realistic goals that stretch me but allow me time to refine my research to optimize my results before the deadline. By applying the cycle of research, hypothesis, and experiment, I will learn the skills I need and develop new techniques in modern medicine without sacrificing quality for time.

SHI LIANG

Mentor - James Moody

Hydrogenase EGF Interactions

[FeFe] – hydrogenases catalyze the reduction of protons to form hydrogen, which can serve as a cleaner energy source. [FeFe] – hydrogenases are an oxygen-sensitive and more active form of hydrogenases. They form complex-cofactor to catalyze the reduction of H+ and the vital part of the complex is the H cluster. The assembly of the H cluster requires three maturase enzymes including HydE, HydF, and HydG. CO, CN- and dithiolate connect to the irons in the H cluster to stabilize the complex. Our long-term goal is to successfully assemble [FeFe] – hydrogenase complex in vitro by understanding the catalytic mechanism and express the same complex under aerobic conditions. The objective of this proposal is to determine how the HydE and HydG interact individually with the scaffold protein HydF in E.Coli. We hypothesize that HydG needs to bind HydF before HydE to allow proper binding of HydE which would induce the maturation of the hydrogenase.

It was another wonderful semester with Dr.Moody and grad Student Parag. This semester I am very busy and both Dr.Moody and Parag have been very supportive. Often I need to go home without my current task fully done and Parag would help me finish it. This really helps my project moving forward. I feel from this experience that we all have times that are overwhelming and it is okay to ask for help because there are always people willing to help. That makes me think that I want to be there for others when they need it. I want to thank the donors for the URA. I have been receiving URA for a full year now and I feel I have learned not just to be a good biochemist but more importantly a decent human being, to take responsibility in a group, and to care for one another. I want to thank the generous donors who allow me to have a great experience.

AKWASI ANSAH ANTWI

Mentor - Paul Savage

Polysaccharides Synthesis

The project's objective is to investigate the recognition of sugars by B cells with the aid of T cells in order to elicit high affinity neutralizing antibodies and define and synthesize sugar epitopes of targeted pathogens. My responsibility was to try many different synthetic conditions to optimize the reaction yields from starting material to find the best conditions for each of these synthetic steps and then go through the rest of multiple-step synthesis and make building blocks on a large scale. Previously, I worked on exploring a new synthetic route to synthesize a fictionalized intermediate D-fucosamine. After which I used this synthesized building block to couple with another disaccharide donor to generate trisaccharide, which will eventually be transformed into a target molecule . Finally, the synthesis of subunits of polysaccharides from Staphylococcus aureus 8 is used in the development of a carbohydrate- based vaccine.

During my time in the lab, I have learned how to be proactive and diligent with my experiments. My knowledge of organic solvents and their role in chemical reaction has increased sharply. Lastly I have been able to make a solid connection of my book knowledge on organic chemistry with my lab experiences.

PAIGE PETERSEN

Mentor - David Michaelis

BNA Crystal Optimization

Terahertz spectroscopy is an emerging field of research that has important applications in areas such as sensing and bioimaging. THz spectroscopy can be applied to security scanners and in medical imaging as an alternative to X-rays as it is non-destructive. Currently, the best generators are organic crystals, which are currently difficult to grow and therefore expensive to purchase. By improving the process of synthesizing these crystals, THz technology can be made more widely available. My time was spent working with BNA, a crystal that we already know produces THz well. Our research has been focusing on how specific characteristics of a crystal affects its THz output. My focus has been on growing as many BNA crystals as possible and optimizing the melting process we use to grow them. Our efforts will expand the knowledge we have as to how to determine whether a crystal will be a strong THz producer.

I am immensely grateful for the opportunity I have had to work in the Michaelis lab. This past semester I have had the unique opportunity to learn the ins and outs of the synthesis, growth, and processing of a particular crystal. As a chemical engineering major, this research is especially applicable to me as my particular aims are to improve and optimize processes. There have been several instances that I have been able to draw on my lab experiences in the classroom and visa versa. I find myself having an increased sense of confidence in my abilities as well as my understanding of what I do not know. By allowing me to ask questions, create experiments, and ultimately find answers to said questions, I have been able to become a more self reliant, resourceful student and researcher. I thank the generous donors who have made this experience possible, it truly has been one full of productivity and learning.

MADISON RHOADES

Mentor - Eric Sevy

Vibrational Gateway Modes

Our lab focuses on determining the rates of complex gaseous reactions, like combustion, by understanding how the density of the molecular vibrational state affects the energy transfer probability distribution function, P(E,E'). Findings suggest that gateway modes, vibrational energy states that have a greater probability of transferring collisional energy, have a large impact on vibrational state density and thus P(E,E'). These states are determined by comparing the vibrational state density to the vibrational energy. My project centers on calculating the vibrational state densities of tetrafluorobenzene to determine their gateway modes and results will be compared to experimental studies, to determine if this is an efficient method to determine gateway modes.

Working in Dr. Sevy's research group this semester has allowed me to practice patience and perseverance. I have finished calculating the energy state densities for each vibrational mode of tetrafluorobenzene, but my work is more significant if it can be compared to other benzene derivatives. This semester I worked on calculating the slope of the energy state density of each vibrational mode. I found no correlation when I compared the frequency and slope of the state density between all the vibrational modes. This finding was perplexing, because previous work has shown correlation in monofluorobenzene. I am recalculating results from previous work to see if there are any subtle differences in the methods. Having this experience has inspired me to exercise more patience with my career plans and persevere in my challenging classes this semester. The generosity of donors has made it possible for me to spend more time pursuing this field of research.

21st CENTURY TEACHING IN DINOSAUR COUNTRY

Mike Christiansen ('10) attributes much of his fundamental chemistry knowledge to his experience as an undergraduate and graduate student. Now a tenured professor at USU's Vernal Utah campus in the heart of dinosaur fossil country, he has developed an intense passion for teaching, even saying that he would do it for free! "When I'm teaching, I feel like I'm flying. I absolutely love seeing students' faces light up when they finally understand something they were struggling with. The exhilaration of knowing that I helped in that process is priceless."

Tha pandemic has only allowed Christiansen to expand the teaching tactics he currently uses and increase his ability to connect with his students. "The transition to Zoom was pretty seamless for me because it is very similar to the kind of teaching that USU has been doing for the past 15-plus years. I teach students live in different geographic locations. I see distance learning students on a split-screen display in the back of my room, while they see me on a large-screen display at the front of their classrooms." He attributes this comfortable transition to the consistent effort USU has made over more than a decade to reach students via remote learning. Even when Christiansen and his wife got COVID-19 last year, he was able to continue researching and teaching while quarantining for nearly four weeks.

Christiansen recently published his first textbook and continues with his university research and teaching.

FROM PUPIL TO PROFESSOR

Chris Tracy ('14) spent years in the Benson building establishing strong relationships with faculty members and mentors. The five-year program allowed him to work alongside Barry Willardson in the lab and prepared him for four years of postdoctoral work at the University of Utah. He and fellow BYU Chemistry alumna Sarah Franklin ('03, '06) worked together in the Nora Eccles Harrison Cardiovascular Research and Training Institute.

Tracy's current work as Mass Spectrometry Instrumentation Manager and adjunct faculty at Wake Forest University requires him to call upon the knowledge and experience he gained at BYU. "We had excellent training in education [including] learning how to interface and talk intelligently about scientific things… a huge part of... pursuing more research," he recalls. "It was a great environment. We [had] wonderful faculty [who] helped me move from being an undergraduate student to their equal."

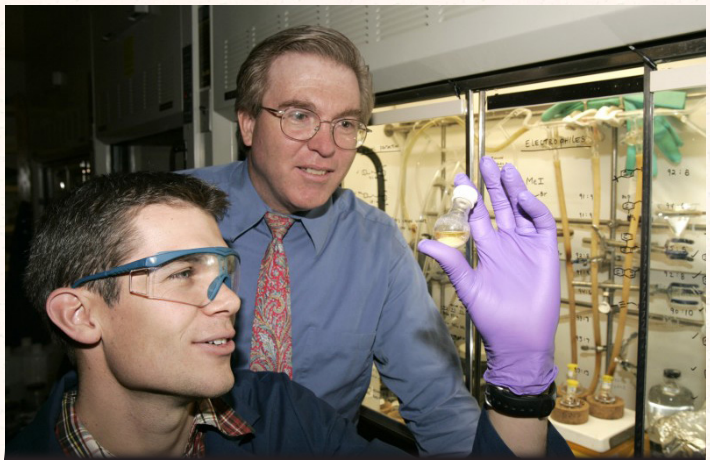
The constant flow of research projects and teaching responsibilities in the biochemistry lab course along with his work with the campus' mass spectrometers gives Tracy a full, exciting schedule at Wake Forest. He attributes much of his teaching ability to the strong examples of excellent teaching he encountered here at BYU and hopes to model the labs he teaches after those who mentored him while in school.

Written by Audrey Davis Ahlstrom

ON THE RESEARCH FRONTIER:

A BYU ALUMNUS AND PFIZER EMPLOYEE DEDICATED TO REVOLUTIONIZING CANCER TREATMENT

Erik Hicken finished his schooling at BYU in 2005 after receiving his degree in organic chemistry, and working in Dr. Merritt Andrus' lab. Of his experience at BYU he remembered, "I got a breadth of experience which has really set me up for success going forward… It was a great place to work." In Andrus' lab he was able to begin his years of cancer-related research, including studies in the total synthesis of geldanamycin.



Erik Hicken joined Dr. Andrus on the study as coauthors on creation of type 2 diabetes drugs .

"I got a breadth of experience which has really set me up for success going forward."

Following Hicken's time at BYU, he worked in EJ Corey's highly specialized synthetic organic chemistry lab at Harvard that focused on making derivatives of an olfactory antagonist. Soon after, he accepted a job at a small biotech company, Array Biopharma, where he stayed for twelve years until the company was acquired by Pfizer. He stayed onsite working as an associate research fellow. Hicken's experience at BYU helped prepare him for his current field of work. When asked whether his research in Andrus' lab is similar to his current research at Pfizer he noted, "There's a lot of similarities. Here we don't focus on making a drug that's isolated from a plant or from a tree or from a bacteria, but we're trying to make new drugs with specific biological activity." He continued, "The same skills I learned at BYU I apply here at work everyday."

At Pfizer, Hicken and his team are currently focused on developing drugs to treat cancer that has spread to the brain. This can be challenging because the brain is very particular about what it lets past the blood brain barrier. The first step for Hicken's team is developing the new drug and then ensuring that the drug is specifically CNS penetrant. Their goal as a team is to treat brain tumors that spread (metastasize) from other cancers. While the research is ever-continuing, Hicken feels blessed to be a part of something he has been passionate about since his undergraduate studies at BYU, recalling that the Lord has led him to where he is supposed to be and with whom he is supposed to work. Most recently, he has been able to work on two drugs that are currently in clinical trials.

He reflected that it isn't uncommon for "people to work in this industry their entire lives and never actually be able to work on a program that is successful and goes into the clinics to actually treat patients." While their research may not always be fruitful in terms of producing a new drug each time they run new experiments, Hicken says, "What you do adds to the general collective knowledge and makes everyone better." Even after years in the lab, Hicken still loves it. He calls it his "fortress of solitude," and says it's a way for him to escape the distractions around him and refocus on the science that allows him to truly help people. While the pandemic briefly affected work schedules at Pfizer, his work continued. Now, the entire staff in the building are fully vaccinated and work has resumed its normal hours and productivity has not suffered.

In his career to date, Hicken feels grateful for his experience at BYU. He feels especially grateful that it helped him to see the value of a good work-life balance. "When I was working at BYU, I felt like I could still be productive and I didn't have to leave my family for extended periods of time. BYU taught me that you can be a nice guy, like Merrit Andrus, and you can still be productive and have a big strong research group without having to sacrifice the most important things in life, which are our relationships with our families."

"BYU taught me that you can be a nice guy… without having to sacrifice the most important things in life, which are our relationships with our families."

Hicken maintains that focus today with his wife and four wonderful children. He is proud to share that his oldest will be starting her freshman year at BYU in the fall and is hoping to pursue a career in nursing.

Written by Audrey Davis Ahlstrom
Photos courtesy of Mark A. Philbrick and Erik Hicken

Erik Hicken with his wife and four children

CPMS STUDENT RESEARCH CONFERENCE

Session Winners

Radhya Gamage
Yiran Liang
Kelton Forson
Concordia Lo
Aldair Alejandro
Basu Aryal
Jonard Valdoz
Ashley Chang
Theresa Smith
Braydan Bezzant
Jacob Luddington
Ken Virgin
Brandon Hemeyer
Kristina Kohler
Daniel Poulson
Anna Everett
Callum Flowerday
Samuel Parry
Kaitlynn Mitchell
Karyna Howell
Kate Petersen
Colin Smith
Dakota Jones
Tanner Nelson
Natalie Green
Samuel Mansfield
Peter Rosen
Dalin Arnold
Savannah Porter
Spencer Johnson

Second Place

Elaura Gustafson
Jacob Nielsen
Daniel Joaquin
Erin Martinez
Josh Wheeler
Clayton Moss
Roshan Loku
Rusty Denton
Mary Vallecillo
Isabella James
Shi Liang
Benjamin Johnson
Preston Humphries
Chad Quilling
Trent Johnson
Maren Kenison
Sara Schenk
Roger Woolley
Ronald A Zegarra
Samuel Squires
Trevan Asay
Joshua Daum
Gavin Morris
Joel Chistopherson
Joel Woolley
Morgan Coombs
Matthew Lutz
Emma Nelson
Nathan Morgan
Taylor Nielson

GRADUATE AWARDS

Loren & Maurine F. Bryner Fellowships
Reuben Daas
Alexandra Larson

Jennie R. Swensen Fellowships
Daniel Call
Sara Soleimani
Chloe Chan

Telford & Frank Woolley Memorial Research Fellowship
Theresa Smith

Roland K. Robins Fellowships
Daniel Joaquin
Andrew Arslanian
Radhya Gamage
George Major
Hans Anderson
Chrissy Egbert
Clayton Moss

J. Rex and Marcia A. Goates Research Fellowship
Yesman Akuoko

Bradshaw Organic Chemistry Fellowship
Kimberlee Stern

Charles E. & Margaret P. Maw Fellowship
Yiran Liang

Keith P. Anderson Outstanding Graduating Students
Outstanding MS Graduate – Trevor Godfrey
Outstanding PhD Graduate – Qiang Xiao

Garth L. Lee Award
Aaron Zaugg

Thank you to our donors whose endowed gifts have funded these scholarships and fellowships

UNDERGRAD FELLOWSHIPS AND SCHOLARSHIPS

James A. and Virginia S. Ott Research Fellows
Carley Martinez
Claire Rader
Maria Pedroza
Nathan Towne
Trent Johnson

D. Clark and Pam Turner Research Fellows
Josue Dominguez Ramos
Daisy Harmon
Emma Nelson
Sydney Johnson

Kearnes Research Fellows
Brenan Cullimore
Nathan Pringle

Ida Tanner Hamblin Scholarships
Claire Rader
Lillian Stillwell

Kenneth W. Brighton Scholarships
Chloe Smith
Grant Flindt
Joshua Porter
Jason Haack
Benjamin Jones

Byron J. Wilson Scholarships
Tanner Roylance
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Lily Pita

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Nicholas Dalley
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Kai Hang Ho
Noah Moran
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Daniel Bradford

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William Hirschi
Conner Murray

Dennis V. and Shirley J. Knudson Scholarships
Minhee Cho
Rowan Berry
Matthew Brown
Lauryn Jacobs
Katelyn Nichols
Kyli Humble
Nathan Schank

Hiram and Permelia Dayton Scholarships
Keegan Mussalo
Cade Nordhagen
Spencer Shumway
Carley Martinez
Courtney Dawes

UNDERGRADUATE AWARDS

Keith P. Anderson Outstanding Graduating BA/BS Student
Outstanding BS Graduate – Daniel Hart

Eliot A. Butler Service Award
Nathan Schank

Ida Tanner Hamblin Outstanding Female in Chemistry
Kaitlynn Mitchell

Outstanding Freshman Chemistry Major
Camryn Young

Outstanding Freshman Chemistry Non-major
Brendan Stapley

ACS Organic Chemistry Major Award
Alex Daum

Outstanding Organic Chemistry Non-Major
Derick Bunn

Outstanding Biochemistry Major
Ken Virgin

Outstanding Biochemistry Non-major
Brayden Tolman

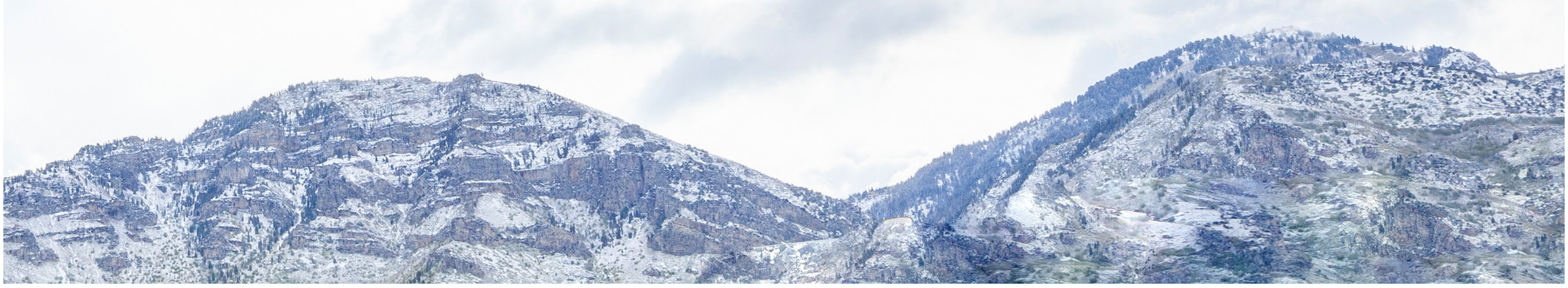
Chemistry Literature Award
Zac Jones

ACS Outstanding Junior in Analytical Chemistry Major
Parker Nasman

Outstanding Senior in Analytical Chemistry
Daniel Hart

ACS Outstanding Student in Inorganic Chemistry
Dallin Smith

ACS Outstanding Major in Physical Chemistry
Matthew Teynor
Gabe Pinto



DEPARTMENT OF CHEMISTRY
AND BIOCHEMISTRY
BRIGHAM YOUNG UNIVERSITY
C-100 BNSN
PROVO, UT 84602-1030

JOIN US FOR OUR HOMECOMING & 101ST ANNIVERSARY CELEBRATION

ACTIVITIES

Homecoming Dinner
Thursday, October 7
Reception: 6 p.m.
Dinner: 6:30 p.m.
Location: W170 BNSN

RSVP by September 17th
akennington@chem.byu.edu
801-422-3667

CPMS Alumni Achievement Lecture
Speaker: Scott Strobel, Yale Provost
Lecture: Thursday, October 7, 11:00 a.m.
Location: 1170 TMCB