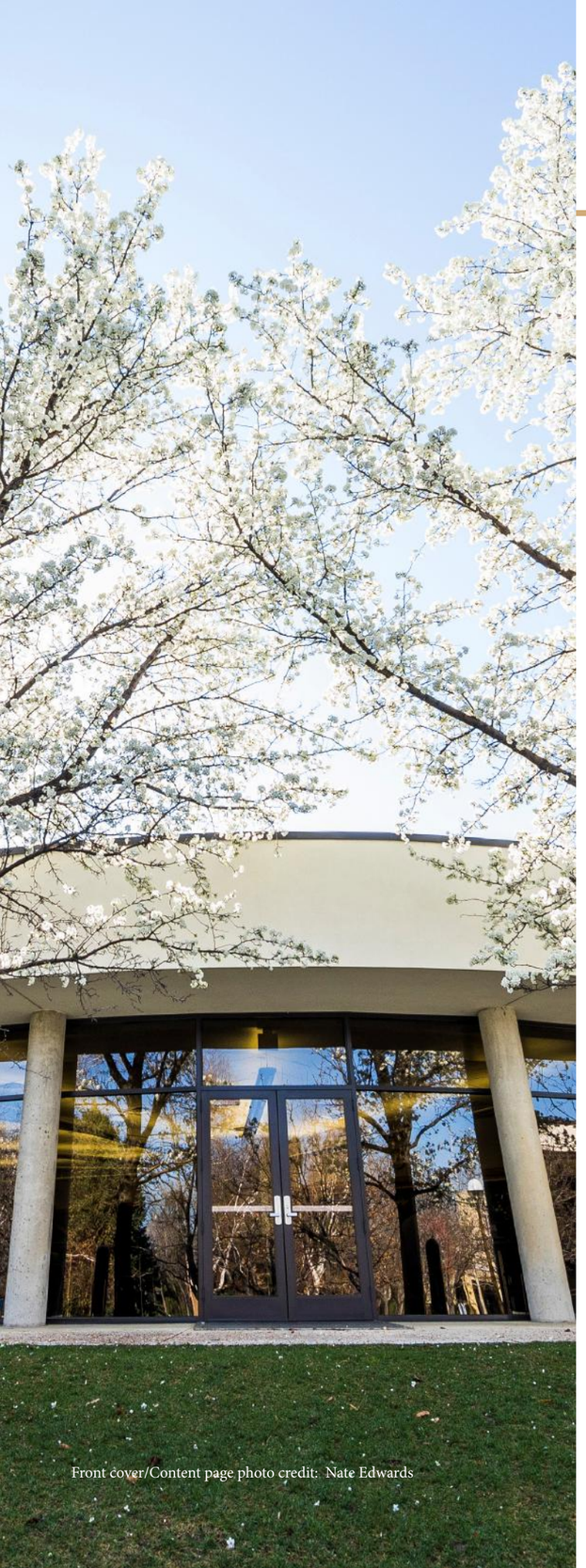
CHEMIGRAM

2020

Department of Chemistry and Biochemistry
BRIGHAM YOUNG UNIVERSITY



Front cover/Content page photo credit: Nate Edwards

CONTENT

The year 2020 has certainly turned out to be different than we expected! COVID-19 has interfered with many planned activities, including our celebration of the 100th anniversary of the establishment of the BYU Department of Chemistry and Biochemistry. But we are adjusting to the changes and I am confident we will come through this year stronger than ever. Challenging circumstances like these can bring out the best in us, and although I knew before this year that this department is made up of great people, the challenges this year have made that even more apparent. It has been hugely gratifying to see the sacrifices faculty, staff, and students have made to keep the Department operating at a high level while maintaining safety through the pandemic. It is a privilege to get to work with so many willing, thoughtful, serving people. In the pages that follow, you will see abundant evidence of the good things individuals in our Department are doing to serve the mission of BYU.

For example, this last year saw a number of colleagues advancing in rank due to their excellent efforts in teaching, scholarship, and service. Dan Ess was promoted to Full Professor a year earlier than the usual minimum time in rank; we congratulate Dan on outstanding work. Both Ken Christensen and Rebecca Sansom received continuing faculty status (with promotion to Associate Professor as well for Rebecca). Pam Van Ry, James Moody, and Daniel Mortensen all advanced to candidacy for continuing status. We also were happy to see Josh Andersen return from his leave at the Walter and Eliza Hall Medical Research Institute in Australia, with new research skills and continued enthusiasm.

We appreciate many years of superb work from Steven Graves and Steve Goates, both of whom moved on to well-earned retirements this year. We will miss the wealth of wise experience they take with them. At the same time, we are delighted to have David Hansen come from Genentech to join our biochemistry faculty, and look forward to learning from him.

We are sad to note the passing last October of Lessa Robins, wife of former faculty member Roland K. Robins. The generosity of the Robins family continues to bless the lives of many of our graduate students each year, through fellowships the family established.

Although we are sorry to lose Steven Johnson as our Business Office Manager, we are glad to continue working with him in his new role as College Controller/Assistant Dean of the

College of Physical and Mathematical Sciences, and we are happy to welcome Jody Hall as our new Financial Manager.

The Department continues to serve our students well, teaching more than 11,000 enrollments, and mentoring more than 300 undergraduate research assistants who worked nearly 90,000 paid hours in our laboratories last year. We continue to stay on the cutting edge of our various disciplines, with more the $4 million in external research funding coming to the department in 2019. And of course this would not be possible without the dedicated effort of more than 100 graduate students who assist both in mentoring and in research.

Without question the department would not be strong in the face of today's challenges without the foundation built by emeritus faculty and staff, friends of the department, and our wonderful students and alumni. I hope this finds all of you faring well in these challenging times. So, while COVID-19 has brought some unexpected challenges, we are meeting them enthusiastically and look forward to some deferred celebration with you when we come out on the other side!

David V. Dearden

2019 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.

EXPERIENTIAL LEARNING

Mentored Research

88,033	Total Hours of Undergraduate Research
322	Total Undergraduates
160	Majors
144	Non-majors
18	Non-BYU Undergraduates
9	Talmage Fellows
9	R.E.U. Fellows (Research Experience for Undergrads, funded by NSF grant)

EFFECTIVE TEACHING

Students

11,374	Enrollments
424	Majors (36% female, 64% male)
56	BA or BS graduates
115	Graduate students
17	PhD Graduates
1	MS Graduates

Student Destinations

30%	Grad School
28%	Professional School
18%	Jobs as Chemist/Biochemist
12%	Teaching Chemistry
12%	Other

PRODUCTIVE SCHOLARSHIP

Scholarship

161	peer-reviewed publications
102	with student authors
$4.0	million in external funding

In conjunction with the 100th anniversary of the department, we are excited to announce the development of a donor-generated student travel fund. This fund will assist undergraduates and graduates who have been invited to present their research at national meeetings with travel expenses. Having an opportunity to present their research takes a student's learning to a whole new level, provides opportunities for networking, and influences their choice of career in chemistry-related fields. Donations of any amount are welcome. As a thank-you, we will send you an element tile from the historic periodic tables that hung in the lecture halls in the BNSN (Benson Science Building) until they were retired and replaced with new electronic periodic tables in 2019. We are happy to accept your gift in the form of a check or you may donate online through Philanthropies at BYU (note on your donation – "student travel aid").

Please feel free to contact us with any questions regarding your philanthropic gift. Thank you for your generous support of our students.

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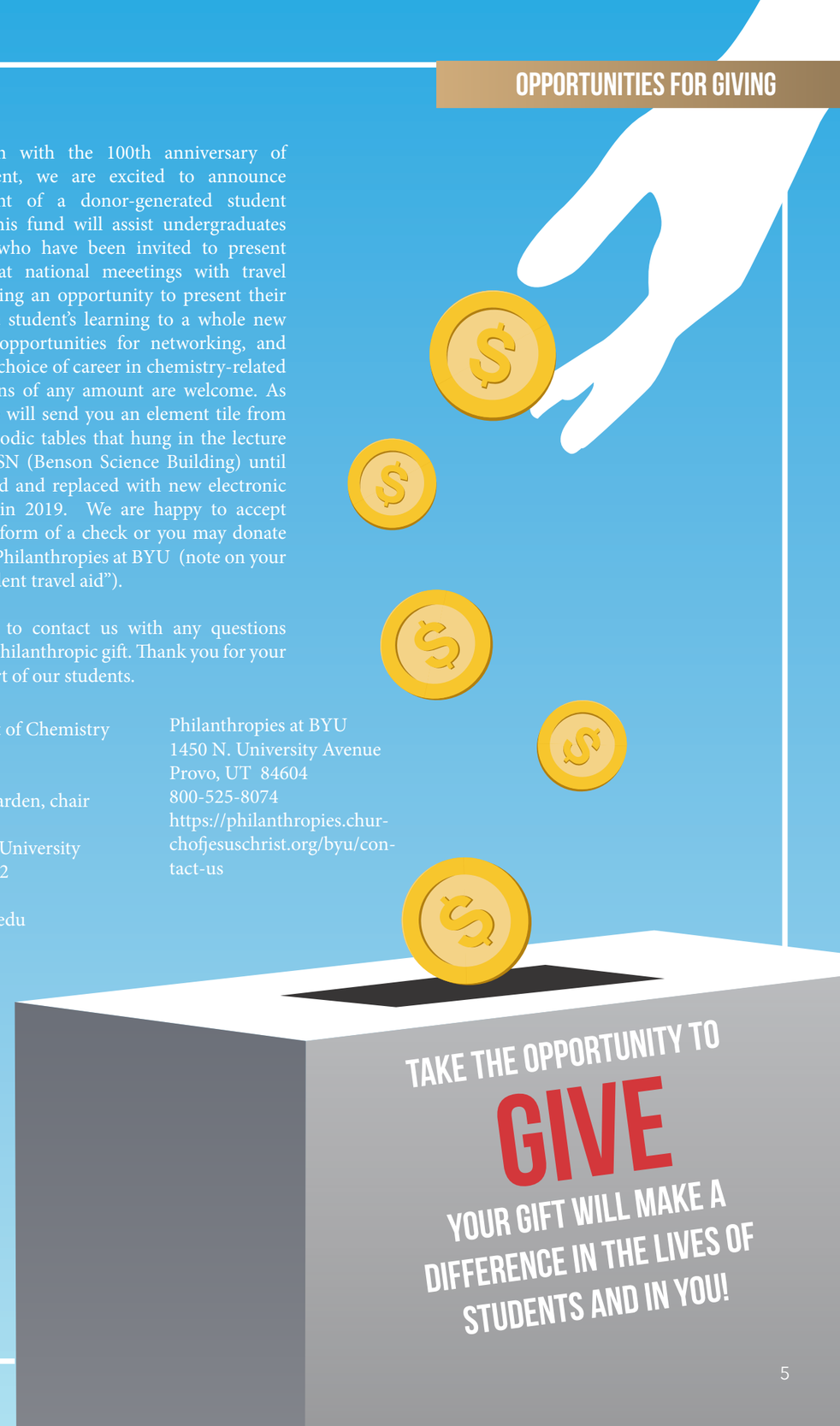
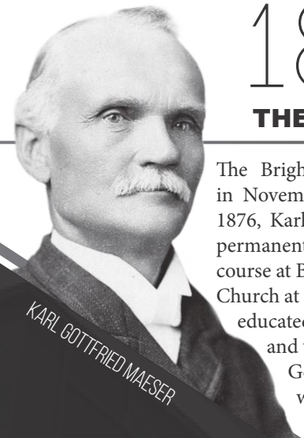



KARL GOTTFRIED MAESER

1870s

THE FIRST CHEMISTRY CLASS

The Brigham Young Academy (BYA) was founded in November, 1875 by Brigham Young. On 15 April 1876, Karl Gottfried Maeser was appointed to be the permanent principal. Maeser taught the first chemistry course at BYA in 1879-1880. Maeser had joined the LDS Church at the age of 26 in 1854 in Germany. He was well educated and had been a teacher as well as a professor and vice-director at several education institutes in Germany. He came to Utah in 1860 where he was appointed by Brigham Young to oversee the Union Academy. His ability to teach and to direct academic institutes led Brigham Young to appoint him as principal of the BYA.

1880s

James E. Talmage


JAMES E. TALMAGE

James E. Talmage was chosen by Maeser to be a chemistry instructor based on personal confidence gained as his teacher. Talmage arrived in Utah from England in 1876 at the age of fourteen. He enrolled in Brigham Young Academy (BYA) and over the next eight years took virtually every grammar, academic, normal, and scientific class offered. Maeser recognized great talent in Talmage. Following receipt of his normal diploma in 1879, Talmage began to teach full-time time at BYA. In the fall of 1880, he taught chemistry following a three-week intensive course in qualitative analysis from Thomas Hadley of Ogden.

1920s

The First Department Chair

On November 19, 1903, the Board of Trustees changed the name of BYA to Brigham Young University (BYU). The next year, Charles E. Maw, the man who would shape chemistry at BYU for the next four decades, joined the faculty. He was the first individual on the faculty to have formal training in chemistry through the BS level. Following graduation from BYA in 1897, he was approached by Benjamin Cluff, president of BYA, who encouraged him to get a degree in chemistry and then join the faculty. His lifelong interest was in analytical chemistry. By today's standards, his physical assets were severely limited. He had one room which had to serve as a classroom, laboratory, and stockroom. There were a few chemicals and a few simple pieces of glassware. When Maw asked for cupboards and fume hoods, he learned to be grateful for lumber from which he and his students made rough furniture.

1950s

The Early Department

In 1946, Joseph K. Nicholes was appointed chairman of the department. Nicholes had an important role in the early development of the modern chemistry department. He was chairman during the planning and construction of the Eyring Science Center (ESC). This building housed chemistry along with several other departments. When occupied in 1950, the ESC was one of the finest science buildings in the United States. Student enrollments grew steadily over the next 25 years until a cap on enrollment at 25,000 was imposed in the early 1970s. To meet the increasing instructional needs of the department, new faculty members were hired nearly every year until there were several people qualified to teach and develop research programs in the five areas of chemistry, i.e., analytical, biochemistry, inorganic, organic, and physical. The increased number and quality of entering students gave the faculty increased access to individuals with interests in research.

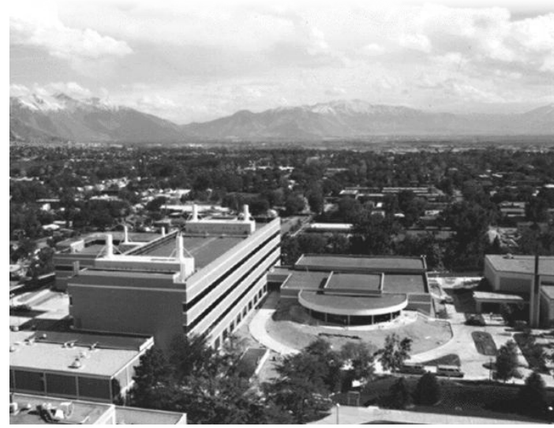

H. SMITH BROADBENT

1970s

The First PhD Program

H. Smith Broadbent was the first to be appointed to a three-year term as Department Chairman in 1955. The Department of Chemistry was one of the first departments authorized to initiate a PhD program. In this program, research was tied closely to the academic program. Undergraduates had the opportunity to work closely with graduate students for prolonged periods. The department graduate program has produced an impressive number of graduates. Work with these graduate students has enabled individual faculty members to enhance the reputation of the department outside the university through publication and presentation of results, invitations to present invited lectures, and active membership in various professional societies.

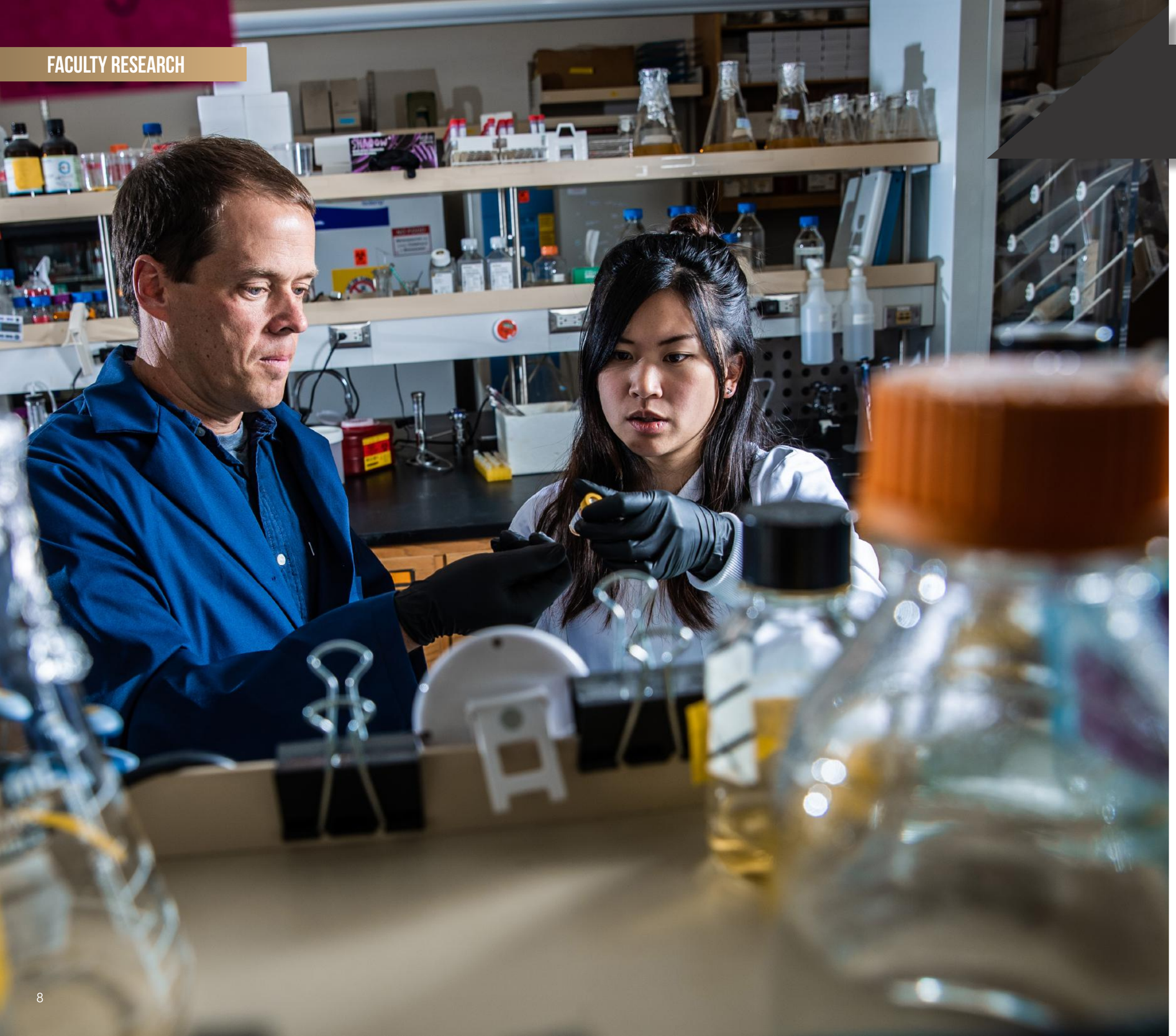
1920~2020



1990s

The Ezra Taft Benson Building

The department in 1995 had a reputation within the university and throughout the world for high quality teaching, first-class research work, and excellent students. The Ezra Taft Benson Science Building replaced the ESC to provide the finest education possible in science and to keep up with modern discovery. The design for the Ezra Taft Benson Science Building featured three connected wings, according to Gene Libutti of BYU Physical Facilities. The east wing houses biochemistry facilities, while the central and west wings have faculty and student offices, classrooms, and laboratories for the other areas of chemistry: physical, analytical, inorganic, and organic.



Fighting Cancer with Chemistry

Joshua L. Andersen has been working with his lab to conduct research that focuses on understanding the mechanisms that control tumor cell growth and survival in order to uncover mechanisms that can be targeted therapeutically.

The group's research involved an investigation of the protein 14-3-3 which is overexpressed in a variety of cancers and is frequently a driving force behind aggressive cancer growth and chemoresistance. In their research, they chose to focus on the interaction between the 14-3-3 protein and the kinase enzyme TNK1. There were points when the research seemed up against insurmountable hurdles. It was "90% of the way into the trash bin," said Andersen.

However, PhD student Tsz Yin Chan refused to give up and eventually completed the experiment that proved to be the turning point in the project. Eventually, the group was able to collaborate with Tolero Pharmaceuticals to develop a first-of-its-kind TNK1 inhibitor. Their tests of the inhibitor showed success in vivo to treat TNK1 mediated tumor growth. "This project was like a *Lord of the Rings* adventure," says Andersen. "Lots of twists and turns, challenges, roadblocks, metaphorical dragons to slay, etc. The fact that we overcame these obstacles is due to the ingenuity and grit of wonderful students in my lab."

Chan and Chrissy Egbert were two PhD students who were instrumental in the research process, but Dr. Andersen was quick to credit contributions from other graduate students, undergraduate students, postdocs, and faculty researchers from BYU and around the country.

The success of this project has created opportunities for further research for the next several years. This past year, the American Chemical Society awarded Andersen and his team a Research Scholar grant in order to continue their work.

"Overall, I'd say this has probably been the most challenging and simultaneously rewarding project of my entire career," said Andersen. The group has submitted a major manuscript on their research, which is currently under peer review.

Written by Emma Parnell / Photo by Rebekah Baker

Metabolic Molecule Identification for Alzheimer's

John C. Price is conducting research which focuses on measuring the control of replacement or turnover for molecules in the body, effectively filling the gap within the scientific community where this information is often inferred from surrogate measurements. Price's group uses metabolic isotope labeling to mark and identify each new molecule the body produces, then measures isotope percentages using mass spectrometry to know the rate of replacement. Although this is a very old idea, his group was one of the first to understand how to apply it to a host of different molecules within a living person. The group uses this data to better understand and discover how human bodies control the speed and location of synthesis and degradation for each molecule. Their current research monitors regional control of synthesis and degradation for proteins and lipids within the body and specifically within the brain.

This research process has been filled with ups and downs for the researchers. "The number one challenge I face is that I need to be an expert in ten different fields from biochemistry to electrical engineering to make this research happen," says Price. "I love learning, but one of the most important things I have learned is that working with good people is critical." Price was drawn to BYU in part to work with Dr. Paul Farnsworth (emeritus) an expert in atmospheric pressure ionization methods, which are important to his research program. Price has also mentored multiple talented and hardworking students, and he was quick to thank them all. While difficult, the research remains exciting and important. "I feel like we are learning the processes that were used to create life from the dust of the earth. That part is exciting." said Price.

For the future of this project, Price hopes to expand the group's research to identifying the unifying metabolic changes that occur within the brain during the development of Alzheimer's disease. While many low penetrance risk factors have been discovered such as genetic mutations or lifestyle decisions, it has been difficult for scientists to find the connections between them. Price's lab will continue to develop tools and methods as they explore the changes in brain metabolism which connect all these low penetrance risk factors and predispose the brain to development of Alzheimer's disease.

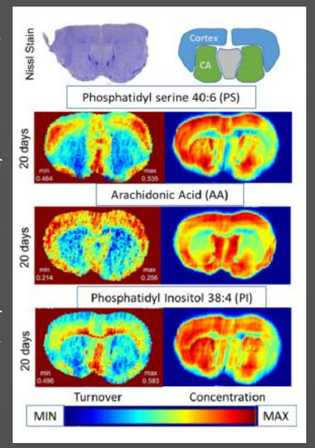


Figure: Images of the brain organization were originally collected using dyes that absorb light (Nissle stain). The Price lab has developed methods to take pictures of the distribution of molecules like these three lipids throughout the same section of brain. The lipids concentration distributions (right hand column) are effectively independent of the concentration but very connected to organization of the brain into defined functional regions.

Written by Emma Parnell / Photo by Rebekah Baker

Coated Endotracheal Tubes for COVID-19

Paul Savage is leading a research team working to study the development of small molecule mimics of endogenous antimicrobial peptides, which has generated ceragenins that kill bacteria and fungi. This research has led to the development of novel antimicrobial coating that prevents microbial growth on endotracheal tubes.

The other branch of research the team focuses on is the generation of adjuvants for natural killer T cells. This research has given the team a means of modifying immune responses, and the development of the molecule ABX196, which reverses the immune inhibition by stimulating responses from the natural killer T cells. The group hopes to use this in relation to immune therapies for cancer.

Both projects have taken years of research and development to get to the point where they could be developed into drugs and tests that are ready to be evaluated with humans. The projects, like every project, have had their ups and downs. "There have been far too many challenges to list, but we have been patient, worked hard, and have been greatly blessed," said Savage. Now, in the clinical trial phase, the team is continuing to refine and adjust the products until they are ready for medical use.

Currently, clinical trials are being held for both projects across North and South America. Savage's development of coated endotracheal tubes has been approved in Canada and Belize to use on patients suffering from COVID-19. Trials are still being held for ABX196. However, the future looks bright for these researchers. "My hope is that our research will save lives and enter broad clinical use," said Savage. The possibilities for both of these projects are monumental in the medical field. Finding successful immunotherapy options for cancer treatment could save countless lives.

Written by Emma Parnell / Photo by Yao Kuang Lee

Steven R. Goates

Dr. Steven R. Goates, professor of analytical chemistry, retired on July 1, 2020. He was a graduate of the BYU Chemistry Department in 1976, and received his masters and doctorate degrees from the University of Michigan in 1977 and 1981 respectively, where he used electron diffraction to study various properties of small molecules. Before beginning his position as a faculty member at BYU, Goates was a postdoctoral fellow at Columbia University using lasers to study the dynamics of molecular interactions. For more than 30 years at BYU, his research has focused on spectroscopic, especially laser spectroscopic, investigations of physical and analytical chemistry processes. During his tenure at BYU, Goates has been a visiting scientist at Massachusetts Institute of Technology, Oxford University, and National Institute of Standards and Technology.

Goates has received several awards and recognitions for his work in the BYU chemistry department, including the Karl G. Maeser Excellence in Teaching Award, the General Education Professorship, and the Joseph K. Nicholes University Citizenship Award. However, Goates is most proud of the student-initiated recognitions he has received, and the award nominations his students receive because of what they learned from him. As an invaluable member of the chemistry department, he has taught nineteen classes during his time at BYU and effectively mentored many undergraduate and graduate students. This group of former research students includes 5 current faculty members in the department. He plans to continue his research for several years in order to finish the collaborative projects that are still underway.

One thing that speaks most highly of Goates is the way he treats everyone including faculty, staff, students in his classes, and student employees. He treats everyone with the utmost respect. He learns the names of students and student employees, treats them as if they are the most important people he knows, and recognizes their accomplishments in meaningful ways. He's been known to help students in need, going way beyond his job description as a faculty member. "I will really miss teaching and interacting with students, getting them to perform or show off their talents before class and play my trumpet for them," said Goates. However, He is looking forward to spending more time with his grandchildren and enjoying his favorite outdoor activities such as hiking, snowshoeing, and kayaking.

We congratulate Steve Goates on his many successes and wish him all the best for his retirement.

Written by Eric Sevy and Emma Parnell/ Photo by BYU Photo

Steven W. Graves

After teaching for nearly forty years, twenty-two of which were with the BYU Chemistry Department, Steven W. Graves retired on January 1, 2020. He received his undergraduate degree from the University of Utah in 1969, and a PhD in Bioinorganic Chemistry from Yale University in 1978.

Graves taught for many years before coming to BYU, in universities such as Harvard Medical School, Massachusetts College of Pharmacy and Allied Health Sciences, and the University of Utah School of Medicine. His work in medical chemistry and inhibitors of disease has allowed him to publish over 80 papers and chapters on his research.

Much of Graves's research has focused on preeclampsia, a complication of pregnancy resulting in life-threatening hypertension. He investigated the role of the digitalis-like factor and its regulation of the sodium/potassium ATPase as a potential source of this hypertension. He used mass spectrometry to identify biomarkers that predict preeclampsia before the onset of hypertension in an effort to identify expectant mothers at risk and provide preventative care.

He also applied his mass spectrometry capabilities to search for biomarkers of early onset Alzheimer's disease so that prophylactic measures could be applied to prevent or delay onset of Alzheimer's.

In addition to his research contributions, Graves taught thousands of biochemistry students, helping them to understand the amazing chemistry that underlies living things as they begin their careers in the biomedical sciences.

Graves remains heavily involved with the research and work of the department, and is a frequent visitor to campus.

We wish Steve Graves the best, and congratulate him on his retirement.

Written by Barry Willardson and Emma Parnell/ Photo by Yao Kuang Lee

DAVID HANSEN

Dr. David Hansen joined the department faculty on May 13, 2020. Dr. Hansen earned his bachelor's degree in molecular biology at BYU in 2000, and spent his undergraduate years researching with the Merrill Christensen Lab. After his graduation, Hansen moved to the San Francisco Bay area, where he earned his PhD at Stanford University Medical School studying the biochemical regulation of cell cycle transitions in the Cancer Biology Program. His postdoctoral study kept him in the area at the University of California San Francisco, where he studied neural stem cells and human brain development in the Department of Neurology. For the last nine years, Hansen has led his own research group and several antibody drug development teams at Genentech, Inc., located in south San Francisco.

The majority of Hansen's research focuses on the involvement of microglia in Alzheimer's pathogenesis. A recent publication Hansen and his team published in the *Journal of Neuroscience* discusses "that deletion of the Trem2 gene, which encodes a key cell surface receptor that activates tyrosine kinase signaling in microglia, increases the neurotoxicity of beta-amyloid plaques in the PS2APP mouse model. The human TREM2 gene is genetically linked with Alzheimer's risk, and numerous pharmaceutical companies are currently developing TREM2 agonists as a novel approach for Alzheimer's therapy." Hansen will continue his research in his new position at BYU, where he says he will "characterize the biochemical properties and cellular functions of these Alzheimer's-related microglial proteins, thus defining how microglia guard against Alzheimer's disease and identifying novel mechanisms by which this protective function could be enhanced therapeutically."

Hansen, besides being an impressive researcher and scientist, is an avid musician. He plays the piano, sings, and arranges music. When he's not directing ward or stake choirs, or starring in performances of the *Lamb of God* oratorio, Hansen enjoys frisbee, backpacking, and fishing, specifically in the Wind River Mountains. Hansen has always wanted to be a professor at BYU, and is excited to warm up his wife Annie, a life-long Ute-fan, to the Y way of life.

Written by Emma Parnell / Photo by Yao Kuang Lee

DUANE TUCKER

Duane Tucker was hired by the Chemistry Department as the Chemstores Receiving Manager in Spring of 2020, replacing Spencer Sarager. Tucker has worked for BYU for twelve years now, assisting and managing print and mail, dining services, physical facilities, and the BYU Central Stores before it was discontinued. Now he approaches his new position with excitement. "I am excited to work to make Chemstores a happy place to visit," said Tucker. When not working, Tucker is an auto enthusiast and enjoys running. Tucker has competed in the intramural activity Run for Your Life four times.

Written by Emma Parnell / Photo by Yao Kuang Lee

DR. ADAM T. WOOLLEY

This year Adam T. Woolley has been awarded the Sponsored Research Recognition Award by Brigham Young University in recognition of his consistent funding by external agencies for nearly 20 years. This funding is varied and extensive, including the National Institutes of Health, where obtaining grants is extremely competitive.

Woolley also received recognition by being included in the *Analytical Scientist* 2019 Power List. His inclusion as one of the noted scientists means that he is considered one of the 100 most influential researchers in the field of analytical chemistry. Woolley attributes his inclusion to the many talented researchers he has worked with during his career.

DR. DANIEL H. ESS

Daniel Ess was recognized as the receipient of the Karl G. Maeser Research and Creative Arts Award at the 2019 Annual University Conference. This award is presented each year to a faculty member of BYU who has shown exceptional distinction in research or creative arts or performances. Dr. Ess received the award because of his research with high-performance supercomputers to model and predict the results of chemical reactions and to design catalytic systems that make reactions more energy-efficient. Ess's lab has become well-known for developing computational techniques to design new molecular organometallic catalysts for industrial energy and materials processes.

DR. RYAN KELLY

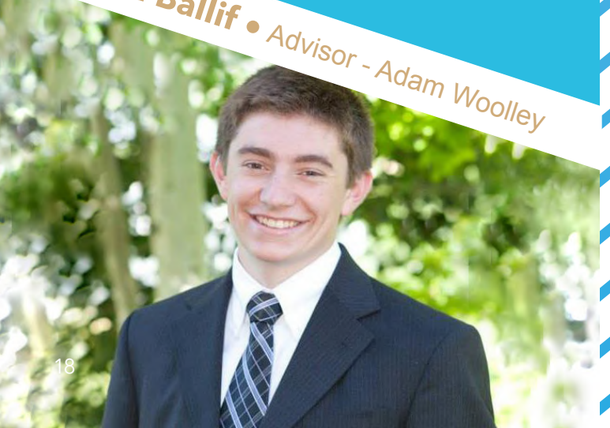
Ryan Kelly received the 2020 HTC Innovation Award. This award recognizes the achievements of a talented scientist who has made pioneering contributions to the field of separation science by introducing new methodologies, instrumentation or techniques in the field, with a strong focus on applicability. Kelly's research is focused on the development of new technological solutions in separations, microfluidics and mass spectrometry for improved biochemical analyses. To this end, he has developed novel techniques based on 1D and 2D LC, hyphenated LC-ion mobility spectrometry-MS, and novel preconcentration/injection strategies for capillary LC-MS and electrophoresis-MS. These advances now enable >1000 proteins to be identified from single cells, which has strong potential to advance biomedical research.

DR. MILTON LEE

Lee has been included on the *Analytical Scientist* Power List for the year 2019. Lee, who retired from BYU in 2015, has remained an active member of the scientific community, and has published over 550 publications during his career, as well as receiving over 40 awards, all of them meaningful and prestigious. This particular inclusion qualifies him as one of the top 20 analytical scientists in the nation.

MENTORED UNDERGRADUATE RESEARCH

Daniel Ballif • Advisor - Adam Woolley



3D printed, microfluidic lab-on-a-chip devices rely on a photopolymerizing resin in the printing process. The composition and properties of this resin, such as rigidity, flexibility, charge, or chemical properties affect the use of these devices. Dr. Woolley and I have shown that the monomer poly(ethylene glycol)diacrylate (PEGDA), the photoinitiatorIrgacure 819, and the UV absorber Sudan I created a suitable resin for 3D printing of microfluidic devices for electrophoretic separations. This resin formula combined with a custom printer allow for truly microfluidic channel printing. Understanding the effects that different polymers and UV absorbers have on the physical and chemical properties of a microfluidic allows for the customization of the resin for different experiments requiring different properties. My research aims to develop and characterize the properties of a resin based on the monomer methyl methacrylate.

This semester of research experience has coincided with a materials science class that I am taking. The class was informative, but applying many of the principles that I learned in my research has been a great learning opportunity. The ideas have been cemented in my mind in a more useful way. I truly believe that this experience is going to benefit me for the rest of my life, whether through principles and practices learned and developed or by giving me the experience necessary to get my first job.

Grace Neilsen • Advisor - Brian Woodfield

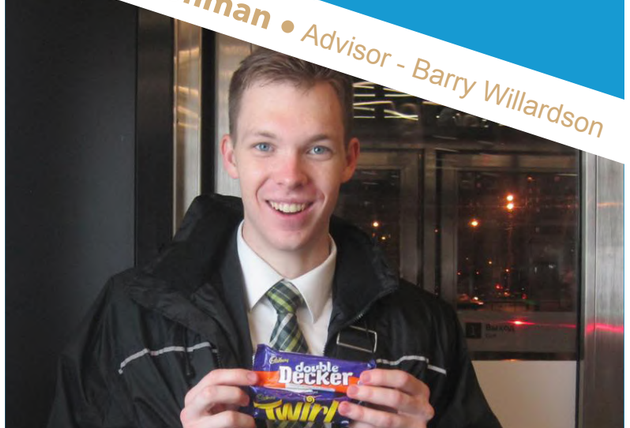
Our group specializes in taking heat capacity measurements under pressures at low temperatures. Currently, we are investigating the sodalite topology of the zinc 2-methylimidazolate framework (ZIF-8) and its CO2 adsorption properties. To better understand the mechanism behind these structural changes, we have repeated our experiments from last year using Argon. From the measurements we have taken, it appears that the significant heat capacity anomaly occurring at higher T in our CO2 measurements is not present in Ar. We will now continue measurements using different proportions of Argon and CO2 to see how this changes the anomaly.

This experience with mentored undergraduate research has elevated my educational experience to a more applicable level. I have felt enriched by seeing the scientific process put into action to solve practical problems and answer important questions. Seeing this bigger picture in a very tangible way through the URA program makes me more motivated to study and learn as we enter into another school year. I thank you for your generous donation. Thank you for the opportunity to apply my education in a new way and to explore a career usually reserved for those with much higher degrees.

We are studying the structure and mechanism of the CCT chaperonin as it interacts with substrates such as G-Beta 5 and MLST8. We have managed to isolate G-beta 5 bound in CCT and have pinpointed its binding sites, but we are currently running experiments to prove that it is actually folded by CCT. We are performing Immuno-precipitation cross linking prove this. If CCT does actually fold G-beta 5, and not just bind to it to help it fold itself, then we could potentially figure out how to help CCT fold mutant G-beta 5 and successfully find treatments for conditions that occur when G-beta 5 is mutated and nonfunctional, such as vision loss. We could also find certain chains of amino acids that bind to CCT and prohibit the binding and folding of certain substrates, which could help regulate certain forms of cancer and diseases that require a lot of substrate that CCT binds.

This mentoring experience has significantly helped me in learning what it is I like to do and what I am passionate about. I have found that I love knowing how something will be relevant to helping people in their everyday lives. I really love this part of my education, as it helps me feel like I am actually progressing in both knowledge and skills, learning how to cell culture, transform and transfect DNA, clone DNA, and design experiments that will test our relevant hypothesis. I have even been able to contribute ideas to my advisors and mentors in order to get better results that allow us to change our experiments.

Joseph Bohman • Advisor - Barry Willardson



Peyton Bishop • Advisor - Ryan Kelly

In the field of mass spectrometry (MS)-based proteomics, achieving an in depth profiling of proteins has traditionally required thousands of cells due to instrumentation limitations. We are working towards successful in-depth proteomic profiling of single cells. My project focuses on testing parameters to optimize our sample preparation protocol. The current well size of the peptides we use has a diameter which is three times larger than that of many cells. This may cause large sample loss due to adhesion, which will be important to reduce. This allows us to determine the amount and concentration of trypsin that yields the best readings. Our current protocol calls for an overnight digestion. However, if we increase the concentration of trypsin by decreasing well size and volume, the rate of the digestion will increase because of Michaelis-Menten kinetics. Reducing this step to a couple of hours will allow us to prepare samples completely in one work day.

In my mentored research experience, I have learned that there are no shortcuts and I must be actively engaged in the work I am doing. In the beginning of my research, I would try to do my work in a quick and efficient manner, but I learned that in order to avoid error, I needed to slow down the process and be as meticulous and careful as possible. If I am equally as detail-oriented and active in my education, I will become a successful lifelong learner. I have also learned that doing scientific research is difficult and unexpected failures are frequent. Because no one is telling me exactly what to do in my undergraduate research, I have to face my own failures.

3 x 3MT

Chemistry PhD Student Reuben Dass Wins First Prize in Three 3MT Competitions

Reuben Dass, a 3rd year PhD student has received the first prize for his 3-Minute Thesis not only at this year's department-level 3MT competition, but took home first prize at the college level and university level as well. Dass's research, entitled, "Synthesis and Optimization of Novel pyrazolo[1,5-a]pyrimidines With Selective Activity Against JAK1-JH2 and VPS4" focused on making highly selective kinase inhibitors that act as potential anticancer agents.

Dass's extensive research involved screening groups of strategically modified molecules against cancer cells and selecting those with the best biological activity to undergo further evaluation. Part of this evaluation involved testing the molecules against a high number of kinases in a kinase screen in order to discover how their modifications had affected the kinase sensitivity and potency of the compounds.

Through this research, Dass's team has discovered a high selective dual kinase inhibitor, named RD-I-53, that inhibits only two kinases by an average of 99.4%. These kinases are JAK1-JH2 and VPS34, and both are involved in the formation and development of drug resistance through autophagy in cancers. Dass's further research will involve continuing to test and modify RD-I-53 in order to enhance its biological activity and make it eligible for clinical testing.

The competition was fierce, but Dass was ready for it, largely thanks to help with preparation from his wife Sarah. "I first heard about the 3MT competition in 2019. I attended the university-wide event and was amazed at the talent that was showcased. It's not easy to simplify abstruse or esoteric concepts to a level that even the most unknowing of individuals would understand and be able to critically process such information." After seeing others' research presentations, Dass made a goal to come back to the competition in 2020 as a presenter. Despite the nerves and the steep competition, Dass knew he had succeeded "when I could see my audiences' eyes light up as I was presenting. I knew then they understood the significance of my work and discovery. That was a personal victory."

Dass's research won't stop with his first-prize win. After finishing his PhD at BYU Dass plans to continue his work in the pharmaceutical industry. "I have always been interested in cancer research," said Dass. "My aim as a cancer researcher is to develop non-invasive, life-saving and affordable procedures and medication so that everyone will have a fighting chance against cancer and not lose so much of what life has to offer in the process."

Written by Emma Parnell / Photo courtesy of BYU Graduate Studies

From Undergrads to Authors

Two undergraduate students in Dr. Brian Woodfield's lab were listed as primary authors in a publication published earlier this year in the *Journal of the American Chemical Society*, an honor usually reserved for graduate students. The students, Peter Rosen and Matthew Dickson, were authors on the paper "Thermodynamic Evidence of Structural Transformations in CO2-Loaded Metal–Organic Framework Zn(MeIm)2 from Heat Capacity Measurements."

Matthew Dickson

The paper's research focused on the low-temperature heat capacities of zeolitic imidazolate framework 8 (ZIF-8), exploring the gate-opening that can occur given the proper conditions. Gate-opening occurs when the methylimidazolate linkers in the substance rotate, widening the pores of the molecule and allowing more (or larger) molecules in. This process can be used as an adjustable molecule sorter which can be helpful in such things as cleaning factory exhaust. Previously, it was believed that in order to open the shutters with carbon dioxide one needed the kind of pressure found inside the Earth's mantle, but the researchers found evidence that bike tire pressures can do the trick as long as the ZIF-8 is cold enough. "It was cool to (somewhat unexpectedly) discover something new about a useful material," said Dickson.

Peter Rosen

As for the honor of being a primary author, both Dickson and Rosen were quick to thank Woodfield for the opportunities they'd been presented. "Dr. Woodfield actively encourages us to be as autonomous as possible, even as undergraduates," said Rosen. "From the time I started working in the lab until recently, there were no graduate students working on our heat capacity projects, so we as undergraduates had ownership of the projects we were working on and therefore had responsibility for the entire research process all the way through publication." Dickson was quick to agree. "Dr. Woodfield trusts his students with the whole research process, from developing new experimental methods, to sifting through academic papers in order to understand what we've measured, to presenting what we find by writing papers."

Written by Emma Parnell / Photo courtesy of Peter Rosen and Matthew Dickson

Wendy Billings Awarded Prestigious Barry M. Goldwater Scholarship

BYU student Wendy Billings was recently named a Barry M. Goldwater Scholars for the 2020–2021 academic year. She will receive a scholarship of up to $7,500 for the next academic year.

Billings, a junior from Orem, Utah, is a chemistry major and intends to pursue a career in research and plans to begin applying for PhD programs toward the end of this year.

"I always knew I wanted a career in science, but I also just really enjoy learning," Billings said. "I love research especially because I'm always asking new questions and learning new things. Researchers are never able to know everything about the subject they study, so it always keeps them learning."

Billings started participating in research at BYU while still a student in high school. She worked as an intern in the lab of Dr. Joshua L. Price the summer between her junior and senior years of high school and has conducted research with BYU professors Price, Dennis Della Corte, and David Wingate. Billings has co-authored multiple academic research papers and presented at college, national and international conferences in her field. Her research focuses on the structure of proteins and their potential use in pharmaceuticals.

"Wendy has been an essential resource in my lab over the last 12 months," said Della Corte, a professor in the physics department with whom Billings has worked. "She has driven, after short training periods, two research topics from concept to publication. Without her willingness to work, ability to succeed, and driven personality, we would not have achieved as much in such a short time."

Written by Paul Swenson/ Photo by Nate Edwards

The "seLFI" of the future

Three Student Researchers Develop Revolutionary New Rapid Diagnostic Test

Three BYU chemistry students Annie Armitstead, Lara Grether, and Kealani Creech have developed a new type of diagnostic test called the "seLFI" whose versatility and inexpensive production costs have potentially monumental effects on the future of medical chemistry. The seLFI, also called the Simple Empowering Lateral Flow Immunoassay, is a new type of rapid diagnostic test developed by these student researchers with Dr. Richard Watt. "We decided on that name because the product was simple enough that it could be taken to small team operations, whether that was someone like us in a lab where you don't have a lot of funding but you want to try to figure out antibody pairings, or do tests with LFIs, or whether that be in low resource settings," said Grether.

This project began years ago with a friendship between Dr. Watt and Annie Armitstead's father BYU chemical engineering professor Dr. Kelly Pitts in their undergraduate years. When Armitstead came to BYU and enrolled in Watt's biochemistry class, Watt and Pitts knew there would never be a better time to work together. The two men set out to find a way to create an LFI test that was more cost effective to make it available to a wider audience and to increase further research opportunities. Lateral Flow Immunoassay tests are expensive and complicated to produce, and are largely unavailable to those with a lower income. When Grether joined the team after joining Watt's lab, she and Armitstead began with the goal to create an LFI test without including sample pads, conjugate pads, or nitrocellulose and absorbance pads in order to reduce the cost. At the time, they were told this goal was impossible.

"I remember hearing 'this is never gonna work. You guys won't be able to do blood samples. You just can't do that without a sample pad.' I thought, 'Okay, but I'm going to try. And we're going to get it to a point where we can," said Grether. They began their research by trying to print the necessary antibodies for the tests onto nitro-cellulose paper but found that the specialty paper jammed in a regular printer. Eventually, the two found success with roller ball pens, when they emptied out the ink, cleaned them extensively, and added an antibody solution to the pens. Grether and Armitstead began the testing, finding that by using the specialty roller-ball pens they had created, the seLFI tests could be printed onto regular printer paper they chemically modified with potassium periodate. "One treatment of potassium periodate can make about 1,400 tests," said Kealani Creech. The ability to make this number of tests from a single sheet of printer paper is a truly revolutionary discovery, lowering the cost of production compared to regular LFI tests by nearly 90%. It was about this time that Creech joined the research team. She brought new insight by expanding their research to test human subjects, starting with fetal bovine serum, and eventually moving onto urine samples. While it was originally used to detect the hCG protein in order to test for pregnancy, it can be broadened to test for any substance. Watt hopes to one day expand the test so that individuals can take daily seLFI tests in order to ensure their bodies are functioning correctly.

Additionally, these tests are as rapid as the more expensive LFI tests, taking one and a half to two minutes to show results, so they could allow for faster diagnostics with viruses and help medical professionals more quickly diagnose individuals afflicted with dangerous diseases like the coronavirus that is currently so worrisome. As for the future, these researchers have high hopes for the seLFI product. "If this was available to labs everywhere," said Armitstead, "you could have hundreds of thousands of labs working at the same time, instead of only giving it to people who have money. So this lowers that barrier of development to people like us who don't have much funding."

Edited by Emma Parnell/ Photo courtesy of Kealani Creech, Annie Armitstead and Lara Grether

NINA MARKHAM

Teacher, Vlogger, Rocket Launcher

Dr. Nina Markham, BS '90 has used her degree to teach the next generation of scientists in revolutionary and modern ways. After graduating with a bachelor's degree in chemistry, Markham went on to the University of Utah to earn a PhD in Experimental Pathology with an emphasis in Immunology. She completed a postdoc at Parke-Davis Warner-Lambert in Ann Arbor, Michigan, and earned her teaching certificate from St. Joseph's University in Pennsylvania.

Dr. Markham's teaching journey began by volunteering and participating in her children's education. "Watching our children go through the public schools, advising teachers and teaching them science to enrich their programs, I started formulating ideas about good education from observation," said Markham. Her observations led to the hands-on teaching style she has cultivated in schools all over the world. "I wanted to be the teacher that I always wished my children to have," she said.

Dr. Markham has been involved in several education programs around the world, one of which is an iGEM team in a school in Lima, Peru. iGEM is a non-profit organization dedicated to the advancement of synthetic biology, education and competition. The team, headed by Markham, aimed to advance the field of synthetic biology, and create collaborative opportunities for the students' research. At first, the team met at a university to do their research, but eventually the group grew to be large enough that they were incorporated into a nearby high school where they could build a synthetic biology lab in Markham's classroom. Their research with Tecnologica de Alimentos Somos (the largest distributor of anchovy-based fishmeal in the world), in which they designed modified bacteria to test for heavy metals within the products, allowed them be the only high school in South America to win the American Schools in South America (AASSA) Global Citizen Award in March 2019.

"It's a team of intrinsically motivated students. It's a team that has learned to work together. It's a team of that is proud of work they have done. That is truly special. Really I don't think you'll find that in the average classroom," said one of the students.

Markham has lived and taught abroad for over a decade, but she continues to relate to her students wherever she goes. Her efforts include a YouTube channel, originally meant as a review for her students, but the videos have grown to reach a worldwide audience, with several students and teachers reaching out to Dr. Markham and thanking her for her insights, especially after the pandemic began and many had to leave their classrooms. Dr. Markham said her students also love the fact that she's now a "famous vlogger."

Dr. Markham also encourages her students through a lot of hands-on learning. At a school in Saudi Arabia, she developed a STEAM program in an effort to give students access to important skills such as novel and adaptive thinking, transdisciplinarity, a design mindset, collaborative skills, and new media literacy. "I was so frustrated with the 'old school' mentality that is still so prevalent in education around the world," said Markham. "I feel like students are not really being prepared to enter the modern-day workforce." Dr. Markham took it upon herself to research and develop a course that incorporated Project-Based Learning techniques and real-world applications. Students continue to contact her years later to thank her for the practicable skills they learned in her classroom.

At a school in the Netherlands, Dr. Markham encouraged her students to apply for a European Space Agency (ESA) competition. The students were able to travel to the Arctic Circle in Norway to compete in a CANSAT competition in which they built a satellite that fit inside of an aluminum can and then shot it out of a rocket into Norwegian airspace. The students learned how to build and program a satellite, make a parachute, collect data while the satellite fell from the sky and then retrieve the satellite with telemetry.

After her time abroad, Dr. Markham was nervous to enter a regular American school when the family moved back stateside to care for elderly family members. However, her history with innovative, hands-on teaching led her to the Cascade Midway Academy in Des Moines, Washington. As one of the founding teachers and STEM leaders, Dr. Markham is helping to develop a Project-Based Learning curriculum (PBL) coupled with a Learning to Leave component where students spend one day a week off-campus in an internship gaining skills and experience true job exploration. No doubt Dr. Markham's teaching efforts have given students across the world a new appreciation for the sciences, and her methods truly embrace the words every BYU student knows by heart, "The World is Our Campus."

Written by Emma Parnell / Photo courtesy of Nina Markham

Brian Anderson

After completing his postdoctoral research at the Advanced Imaging Research Center at UT-Southwestern, BYU chemistry alum Brian Anderson has been working at LGC – Berry & Associates, a supplier of specialty oligonucleotide reagents. While the company's research spans the whole of synthetic chemistry, their recent work has been wholly dedicated to battling the COVID-19 pandemic. LGC is the provider of the key reagents for all COVID-19 test kits. Their hard work has allowed people to continue to get tested for the disease. Anderson looks back with gratitude toward his mentors Dr. Burt and Dr. Savage.

Chunhong Li

Chunhong Li has stayed true to his chemistry department roots, working in the pharmaceutical field as an organic chemist. Li is now working on his own startup company 4th Phase Water Technologies. The company is working toward commercializing strong, flexible, robust, durable ultrathin and lightweight polymer-free carbon nanotube (CNT) sheets for filtration applications. Currently, they are doing research with the National Science Foundation I-Corps and interviewing over 100 industrial experts to understand the needs and challenges in biopharmaceutical manufacturing related to membrane filtration.

Li credits large parts of his success to the principles he learned in Dr. Paul Savage's lab and the genuine scientific curiosity for new discovery that continues to be exhibited there. "I have only fond memories of my time at BYU," said Li.

Randy Stoltenberg

After graduating from BYU's chemistry department in 2005, Randy Stoltenberg completed his PhD at Stanford University, where his thesis focused on an interesting intersection of nanotechnology, surface science, and DNA sequencing. After his doctorate degree, Dr. Stoltenberg began working with the Advanced Technology Center of Lockheed Martin Space Systems, where he researched and developed specific nanotechnologies. After seven years at Lockheed, Dr. Stoltenberg left to join Kuprion, a startup created to commercialize the technology he developed at Lockheed. While usually used in the electronics field, they have shifted their focus in the last two months to work with antimicrobial sciences during the COVID-19 crisis. Dr. Stoltenberg remembers his time at BYU with gratitude and fond memories of learning to approach every question with this in mind: how precisely do I need to know this answer?

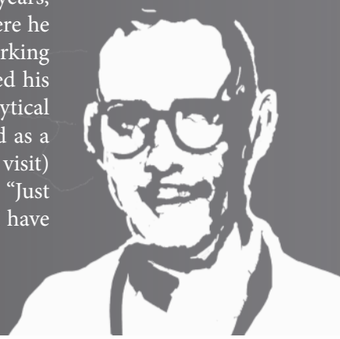
Anna Nielsen Bickham

Dr. Anna Nielsen Bickham, recent recipient of her PhD from the BYU chemistry department, was awarded the AES Blue Fingers Student Award at the 2020 SciX conference. The award is given annually in recognition of the most outstanding student paper submitted for the AES Annual Conference by a graduate student. Bickham received her bachelor's degree at Brigham Young University Idaho before completing her PhD at BYU. Her research focused on studying microfluidics and it was her paper entitled "3D Printed Microfluidic Devices for Extraction, Fluorescent Labeling, and Separation of Preterm Birth Biomarkers" that led her to receiveing the award.

Bickham is currently working on a start-up business called Acrea3D, which will market high-resolution 3D printers for rapid prototyping and the development of microfluidic devices. In her free time, Dr. Bickham enjoys hiking, reading, and playing tennis.

Hernan Fuentes

Since his graduation in 2007, Fuentes completed his postdoctoral research at the University of Michigan, Ann Arbor. After successfully working on the development and approval of a combination therapy for HIV in San Fransisco for several years, Fuentes moved to a smaller company in the bay area where he works as a Senior Director of Analytical Development, working on rare diseases for unmet medical needs. He also funded his own company in Colombia to provide third party analytical services to pharmaceutical companies. "Being recognized as a distinguished alumni (at the 2019 graduate student site visit) was indeed memorable and a true honor," said Fuentes. "Just being on campus and recognizing that, thanks to BYU, I have achieved many professional goals was a special feeling."



Chemistry Alumnus Recipient of CPMS Alumni Achievement Award

Scott Strobel, BYU chemistry and biochemistry alumnus, has been awarded the 2020 Alumni Achievement Award from the College of Physical and Mathematical Sciences at Brigham Young University. After receiving a bachelor's degree in biochemistry from BYU in 1987, Strobel went on to complete a PhD in biology at the California Institute of Technology in 1992 and did postdoctoral research at the University of Colorado at Boulder.

In 1995, Strobel joined the faculty at Yale University as an assistant professor of molecular biophysics and biochemistry. His research throughout his career has focused on RNA catalysis in systems ranging from group I intron splicing to the peptidyl transferase center of the ribosome using structural and biochemical approaches. He also studies the structural basis of riboswitch function. Strobel currently serves as the provost for Yale University.

Strobel's work in biophysical chemistry on the enzymatic catalysis of RNA has led to his recognition as the recipient of the Alumni Achievement Award. The award is given annually to an alumnus who has made significant contributions in his or her professional field. This year, the chemistry department is celebrating its 100th anniversary, so it is especially fitting that the recipient of the award is a former chemistry student.

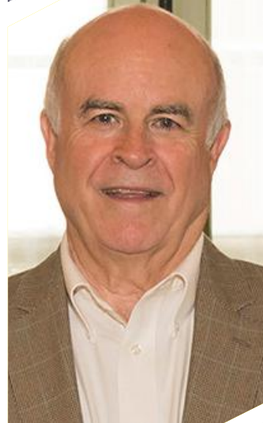
Pending any COVID-19 related travel restrictions, Strobel will be presenting a lecture on his research during homecoming week during October 6-10, and will be presented with the award at that time. Details will be announced by the university as they are available.

Written by Emma Parnell / Photo courtesy of BYU Alumni Web

Broadbent Lecture Series

This year marks the 32nd annual Broadbent Lecture Series, created in honor of H. Smith Broadbent to celebrate his forty years as a professor at BYU and his advances within the field of organic chemistry. The department welcomed Professor John F. Hartwig from the University of California, Berkeley as the Broadbent guest lecturer. Dr. Hartwig's work involving catalysis has earned him over 20 awards and recognitions, and he has served as the Henry Rapoport Professor of Chemistry since 2011. Hartwig's lectures, given January 13-14, followed his research on catalysis, how catalysts can be used to create faster reactions, and to create new molecules that can aid in solving problems from producing more food with limited land to solving medical crises. Hartwig gave students a brief overview of how chemical synthesis can positively affect daily life, as well as several examples of the research his lab has done involving catalysis.

In his public lecture, he showed students how chemical synthesis has been used to create a simple household ingredient: acetic acid (vinegar). Naturally, this substance is formed from bacteria in sugar, but with the roughly five billion pounds of acetic acid needed per year, sugar is the least efficient way to make it. Chemists have had to find other ways to produce it, most commonly through chemical reactions involving coal. Through an extensive process in which catalysts play integral roles chemists have been able to use synthesis in order to fill a need that nature cannot keep up with. Hartwig's technical lecture followed specific projects his lab team has been working on within this vein of cross-coupling and catalysis. Their work has focused on the integration of functional groups into usually unreactive complex molecules, which has been a long-standing issue within synthetic chemistry. Hartwig and his lab continue to seek for new systems for the functionalization of C-H and O-H bonds in complex molecules, hoping to develop new types of catalysts with the ability to achieve selective catalysis with transition metal centers.



Izatt-Christensen Lecture

The 12th annual Izatt-Christensen lecture, held in honor of Reed Izatt and James Christensen, was held on February 20th and 21st. The guest lecturer, Dr. Thomas F. Edgar, presented two lectures hosted by the Chemical Engineering Department over a two day span. His lectures, entitled "Power Systems of the Future: Perspectives on Carbon Emissions and Power Production and Energy, Efficiency, Smart Grids, and Process Control" focus on the role of power and how energy efficiency can be used to reduce the use of fossil fuels and the emission of greenhouse gases. Dr. Edgar is a member of the National Academy of Engineering, co-founder of the Smart Manufacturing Leadership Coalition, and a professor of chemical engineering at the University of Texas.

Rossiter Memorial Lecture, TBA

The 2020 Rossiter Memorial Lecture Series has been postponed due to COVID-19, and will now take place in 2021. Dr. Jillian Dempsey of the University of North Carolina, Chapel Hill, will be speaking to students and faculty in attendance at that time. Her lectures, entitled, "Driving the Production of Chemical Fuels from Sunlight" and "Elucidating Proton-Coupled Electron Transfer Mechanisms Underpinning the Catalytic Generation of Renewable Fuels" will discuss her research into solar energy and understanding the proton-coupled electron transfer reactions that underpin fuel production and elucidating electron transfer processes across materials interfaces.

Graduate Awards

Loren & Maurine F. Bryner
Kelton Forson

Jennie R. Swensen
Theresa Smith Josh Tseng

Telford & Frank Woolley Memorial Research
Dulashani Ranasinghe
JD Singleton Dhananjay Patel
George Major Clayton Moss

Garth L. Lee
Daniel Joaquin

Milton L. Lee Analytical Chemistry
Chloe Chan

Bradshaw Organic Chemistry
Concordia Lo

Charles E. & Margaret P. Maw
Grant Ludlam

Keith P. Anderson Outstanding Graduating PhD Student
Anna Nielsen Bickham

Roland K. Robins
Basu Aryal Isaac Smith
Erin Martinez Yiran Liang
Tianyao Meng Reuben Dass
Tahereh Gholian Avval
Andrew Arslanian
Brittany Knighton

Undergraduate Awards

Keith P. Anderson Outstanding Graduating BA/BS Student
Seth Fankhauser

Eliot A. Butler Service Award
Megan Anderson Porter

Outstanding Freshman Chemistry Major
Riley Eastmond

Outstanding Freshman Chemistry Non-major
Matt Van Leeuwen

Ida Tanner Hamblin Outstanding Female in Chemistry
Grace Neilsen

ACS Outstanding Junior in Analytical Chemistry
Gabriele Pinto

ACS Outstanding Junior in Organic Chemistry
Kaitlyn Baker

Outstanding Organic Chemistry Non-Major
Naomi Young

Chemistry Literature Award
Matthew Teynor

ACS Outstanding Major in Physical Chemistry
Daniel Hart

Outstanding Biochemistry Major
Braden Kartchner

Outstanding Biochemistry Non-major
Spencer Asay

ACS Outstanding Student in Inorganic Chemistry
Tabitha Caldwell

Outstanding Senior in Analytical Chemistry
Nathan Giauque

Thank you to our donors whose endowed funds have allowed us to present these scholarships and fellowships

Undergrad Scholarships

Hiram and Permelia Dayton Scholarship
Tyler Bishop
Courtney Dawes
Alice Jensen
Carley Martinez

Dennis V. and Shirley J. Knudson Scholarship
Matthew Brown
Benjamin Chipman
Katelyn Nichols

Ida Tanner Hamblin Scholarship
Rachel Bybee
Moriah Longhurst
Claire Rader
Courtney Vavricka

Parley Nels and Parley LeRoi Nelson Scholarship
Jason Haack

Boyd A. Waite Scholarship
Ekow Amakye
Dallin Smith

H. Tracy Hall Scholarship
Daniel Bradford
Cory Cox
Robert Hadfield
Jacob Luddington
Jacob Nichols
Joshua Porter
Vance Willis
Joseph Wilson

Kenneth W. Brighton Scholarship
Matthew Dickson
Shi Liang
Sariah Muh
Savannah Porter

Byron J. Wilson Scholarship
Tanner Roylance
Dallin Smith

ACS-Student Research Conference

First Place Awards

Basu Aryal
Enoch Councill
Tsz Yin Chan
Joseph Bohman
Andrew Arslanian
Lindsey Daems
Kaitlyn Baker
Nicholas Chartrand
Christina Egbert
Blake Nordblad
Concordia Lo
Garrison Nickel
Gabriel Valdivia
Charles Bahr
James Woods
Kristina Kohler
Emma Orcutt
Mikayla Twiggs
Peter Fullmer
Dallin Ashton
Daniel Poulson
Colin Muir
Tanner Hardy
Dallin Arnold
Anna Schouten

Second Place Awards

Keith Willes
Maggie Osterhaus
John Valdoz
Connor Holman
Jansen Engelbrecht
Dallin Parker
Skylar Van Horne
Ashley Markham
Madison Frey
Diego Moya
Taylor Loftus
Josh Wheeler
Matthew Dickson
Chad Quilling
Cody Roberts
David Foote
Benjamin Chipman
Jatinder Singh
Andrew Atoa
Emily Gardner
Maren Kenison
Dallin Smith
Emma Carlson
James Coombs
Radhya Wel-igama Gamage

100 YEARS OF CHEMISTRY BIOCHEMISTRY BYU

1920-2020

Due to the COVID-19 pandemic, we have had to cancel all of our 100th Anniversary celebration events. We hope to celebrate the Department's 101st anniversary in Fall 2021. Please watch for upcoming anouncements of our 2021 celebration.

CHEMIGRAM

Editorial Director: Sue Mortensen / Graphic Designer: Yao Kuang Lee / Lead Writer and Editor: Emma Parnell

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