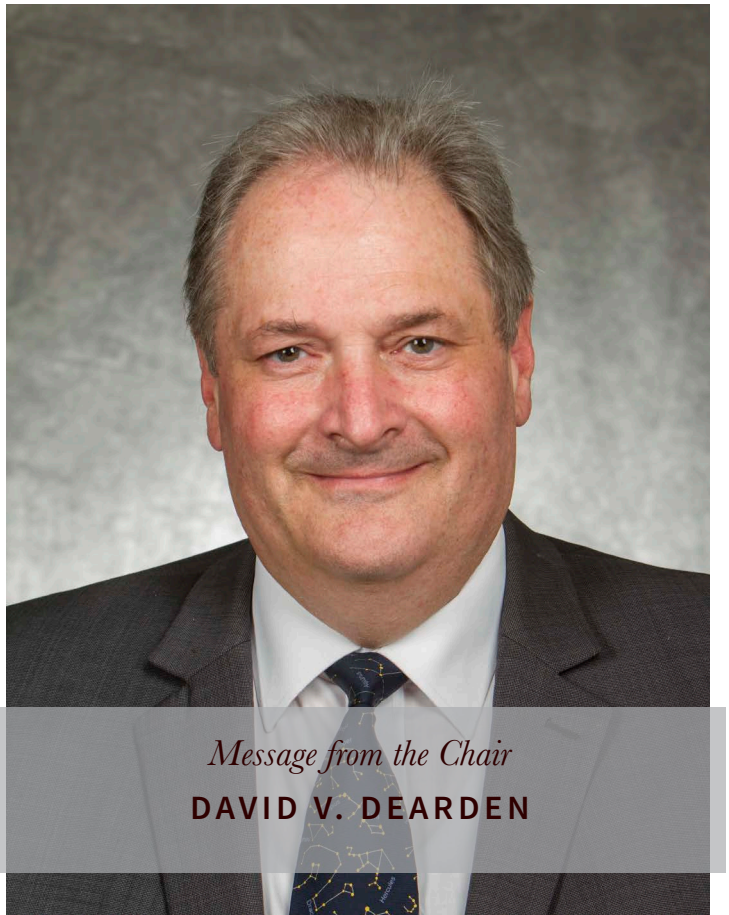
CHEMIGRAM

The newsletter for BYU's Department of Chemistry and Biochemistry



Message from the Chair

DAVID V. DEARDEN

It is extremely humbling to come to work in a position where so many of my heroes, people who have made a difference in my life, have served. I am reminded of the famous Isaac Newton quote, where Sir Isaac noted that his view was good because he stood on the shoulders of giants. Our past department chairs are such giants; we owe a tremendous amount to those who have built what we have today. However, they are not the only ones on whose shoulders we stand. We also stand on the shoulders of all who have studied here and gone on to do great things in their families, their communities, the church, and the world. Thank you for providing us with such a rich legacy and high vantage point as we move forward.

A persistent theme in chairs messages over past years has been change. We have certainly experienced tremendous change in the department over the past year. Obviously, a new guy is writing this article, but that is only the most recent in a series of changes. The past year has seen the retirements of Wayne Anderson, our long-time grants and contracts administrator, and Peggy Erickson, our department administrative assistant who has long just made things work. We miss the wisdom and institutional memory that Wayne and Peggy have; fortunately, both are still just a phone call away. We are excited to have the services of Jeff Ballew in administering grants and contracts, and Sue Mortensen as our administrative assistant. Anna Kennington has replaced Sue as department secretary. Jeff, Sue, and Anna bring great talent to the department and will help us continue the traditions of excellence that have been established by their predecessors. They make the department office a professional, congenial place to work.

On the faculty side, after a distinguished career of scholarship, teaching, and service, Milton Lee retired during the last year. Milton has set a very high bar for the rest of us, and we wish him the best. We are also delighted to note that during the past year Daniel Austin, Jaron Hansen, and Roger Harrison were all promoted to full professor; Dan Ess received continuing faculty status and promotion to associate professor; and Joshua Anderson, David Michaelis, JC Price, and Stacey Smith were all advanced to candidacy for continuing faculty status. We continue to seek new faculty colleagues to help us carry the work forward. If you know of anyone you think might fit, please encourage them to apply.

Last year, department personnel were recognized for a number of important awards; these are described in the pages that follow. We congratulate all who won awards and all those who made the behind-the-scenes contributions that helped the awards to happen.

Just a few weeks ago, new departmental leadership was announced. We are deeply indebted to Greg Burton, Adam Woolley, and Steve Wood for the sacrifices they have made and the excellent leadership they have provided for our department. We wish them well as they leave the department office to return to the research and teaching activities we enjoy as faculty. I am grateful to be joined in the department office by associate chairs Barry Willardson, a biochemist who will head up supervision of our graduate program and departmental budget issues, and Roger Harrison, an inorganic chemist who will focus on undergraduate teaching. Both Barry and Roger are active researchers well respected in the scientific community, excellent teachers, and team players who are committed to making BYU and the department places where new knowledge is discovered and passed forward to benefit the world, and where faith is confirmed and strengthened. It is both humbling and exciting to be part of this work, and I look forward to working with all of you as we strive to peer just a little bit farther.

NEWS

Barry Willardson BYU Devotional: Our True Home in Heaven

July 15th, 2015

Through missionary stories, scientific analogies, and the scriptures, Dr. Barry M. Willardson showed how students can grow closer to God and better understand their spiritual heritage.

"Find out if . . . God is our Father, if we are strangers and pilgrims, and if we are to become like our Father," Willardson said. "Find out if it is true."

Willardson suggested that students first think about their origins and all of God's creations. He said that if students learn for themselves, they will be more able to understand their heritage.

"God can reveal His existence, purposes, and truths to us by spiritual means that are just as real as physical scientific observations," Willardson said.

Willardson also told the students to remember their purpose on earth and their spiritual origins. He said they need to overlook the problems in their lives to focus on the big picture.

"Sometimes small flaws can put our lives out of focus, and we cannot see our divine origins," Willardson said. "In such circumstances, our lives need not be scrapped."

Willardson testified to the students that Christ and the Atonement would help them fix their flaws and understand their true origin.

"At some point . . . our time as mortals on this earth will end and we will learn that we were truly strangers and pilgrims here," Willardson said. "Jesus has overcome death and, as a result, so will we."

Written by Tanner Call

Student Research Makes Cover of *ABC Journal*

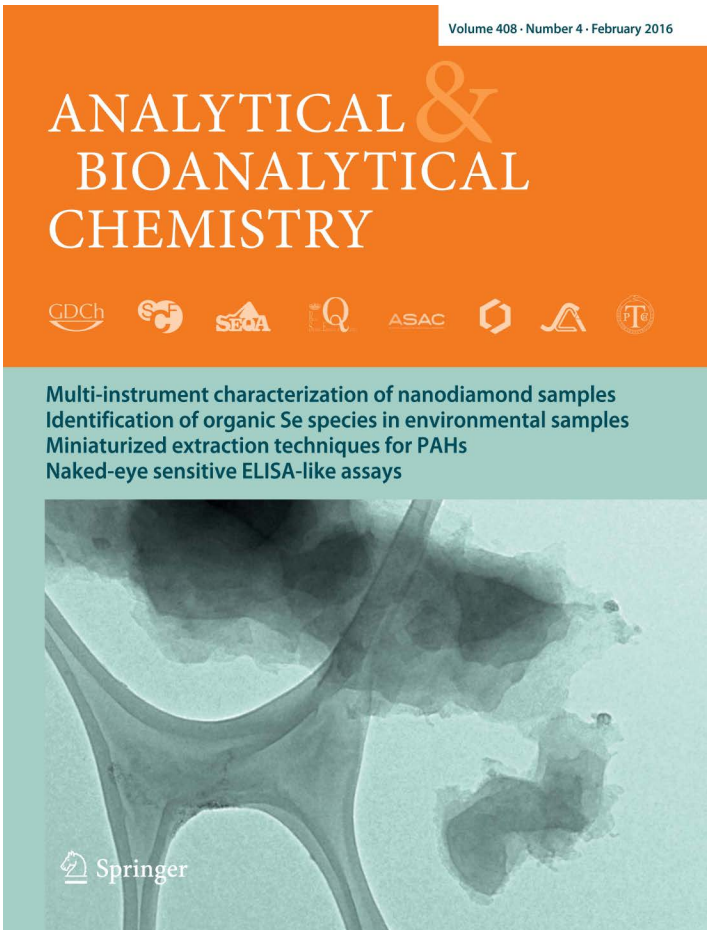
Recent BYU PhD, Bhupinder Singh, was honored to find an article featured on the cover of *Analytical and Bioanalytical Chemistry* in which he was the lead author. The article, titled "Multi-instrument characterization of five nanodiamond samples: a thorough example of nanomaterial characterization," was the culmination of a project Singh started when he first joined Dr. Matthew R. Linford's lab in 2011.

Nanodiamonds are around four to ten nanometers in size and have possible applications in many fields including dentistry, electronics, and oncology.

The study of nanomaterials science has attracted great attention in recent years. In their article, Singh and his team report that "the terms 'nanomaterial,' 'nanoparticle,' and 'nanostructure' were mentioned fewer than 100 times in publications in 1990," but in 2011, "these terms appeared in almost 45,000 publications . . . a remarkable increase."

Researchers are beginning to recognize both the importance and the complexity of nanomaterials, yet present studies only show moderate characterization of the materials in question. To combat this deficiency, Singh's team used XPS, ToF-SIMS, ICP-MS, DRIFT, XRD, TEM, EELS, BET, PSD, and chemometrics analysis to analyze five samples, resulting in the most comprehensive characterization of nanodiamonds to date.

Two of Singh's other collaborators also belong to the Department of Chemistry and Biochemistry: Dr. Stacey J. Smith and Dr. Paul B. Farnsworth.



Written by Jordan Wright

Jennifer Nielson BYU Devotional: Experiment and Experience

March 3rd, 2015

In her devotional, Dr. Jennifer B. Nielson shared an experience she had while earning her PhD at the University of California, San Diego. Her faculty adviser, Dr. Perrin, had asked her to replicate experiments that a finishing graduate had worked out. The experiments were being prepared to be published in the *Journal of the American Chemical Society,* a top journal in Nielson's field. When she finished the experiments, her results were the complete opposite of the original findings.

"My failure to replicate felt like evidence that I was terrible in the lab," Nielson said.

After working hard and conducting a number of similar experiments, Nielson and Perrin had to eventually publish another paper in the same journal retracting the previous claims in order to offer the correct conclusion. Nielson told the audience she had learned a lot from this experience.

"This experience confirmed to me that experiments help us gain truth; that we can become stronger from struggles," Nielson said. "I believe that life experiences, which we might also call experiments, are meant to enable us to grow and become Christlike."

Through this, Nielson pointed out a connection between experiment, experience, and trial. Students normally think of trials as difficult times in their lives. In science, though, trial means more than that.

"The word trial in science is not associated with just difficult parts of the experiment; it is the experiment," Nielson said. Nielson concluded her talk with one final thought: "Let's use our life experiments with Christ's help to turn theory into reality."

Written by Holly Kendall

Getting Utah's Young Scientists Ready for College

BYU professor Rebecca L. Sansom was selected as a member of Utah's State Science Education Coordinating Committee (SSECC), which works with K–12 science education throughout the state. Members represent all the major institutions of science education in Utah, including K–12 school districts, colleges and universities, and informal education centers like museums.

Sansom has participated in the committee for the last three years and was originally chosen because of her role as science specialist in the Jordan School District. Because of her new position as an assistant teaching professor at BYU, she now plays a different role in SSECC. "I represent the interests of higher education," she explained, "by helping the committee think about what it means to be college-ready."

Sansom's past projects with SSECC have included writing and validating sections of the high school chemistry SAGE test and contributing to the open source textbooks available for all K–12 schools in Utah. In the future, she will help draft new state chemistry standards for middle and high schools.

"A great foundation in K–12 science education is necessary for Utah students to continue to succeed and make an impact in STEM careers," she said. "I'm grateful that I can work with some of the best science educators in the state to improve the science experience for K–12 students throughout Utah."

Written by Jordan Wright

Chemistry Graduate Adding to BYU's Good Name

Suresh Kumar, a recent PhD graduate in chemistry from New Delhi, India, spent his years at BYU studying new methods for early diagnosis of preterm birth (PTB), or birth before 37 weeks of gestation. His research received national attention at the International Symposium on Capillary Chromatography (ISCC), held in Fort Worth, Texas, when he won the first place poster award and a $500 cash prize.

"It was exciting. I wasn't expecting it," Kumar said. "I was ready to catch my flight when they announced my name." The presentation was titled, "Integration of solid-phase extraction and microchip electrophoresis for preterm birth biomarker analysis." Kumar, together with a few bright research fellows, was able to create a miniature device that can read the components in blood samples.

"There are some important components in the blood which we can recognize on that device," Kumar said. "Based on the concentration of those components . . . we can estimate the risk of preterm birth nine weeks before the delivery."

One of the main problems with PTB, according to Kumar, is that it can only be diagnosed once the contractions start, and at that point it is too late for doctors to intervene. He is confident that this method of early diagnosis would help in delaying the delivery and could save millions of lives.

Written by Jeremy Stanford

Research Pays Off at ACS National Meeting

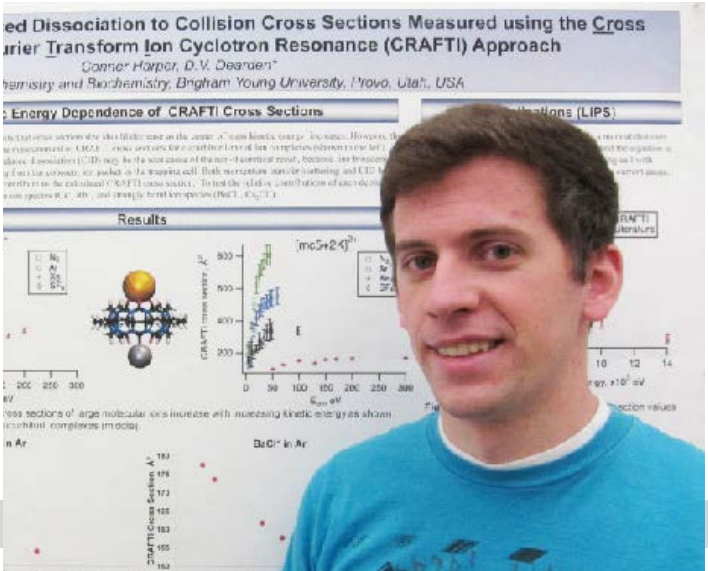
At a recent ACS (American Chemical Society) national meeting in Denver, Colorado, BYU alumni Conner Harper was awarded three hundred dollars for his research in Physical Chemistry with Dr. David V. Dearden's group.

Harper's research project started when the Dearden group found an anomaly while measuring ion cross-sections. While the principles of traditional collision theory led them to believe that increasing the kinetic energy of their analyte ions should decrease the measured cross section, they observed the opposite trend. The group hypothesized that collisions with background neutral gas were causing the dissociation of the ions, an effect that would explain their non-traditional results.

Harper conducted the experiments to establish this hypothesis using non-dissociable ions as a control group. The poster that won him the award, entitled "Contributions of collision-induced dissociation to collision cross sections measured using the cross sectional areas by Fourier transform ion cyclotron resonance (CRAFTI) approach," wowed the judges.

More important to Harper, however, was the chance to attend his first national meeting. "I enjoyed both the scholarly atmosphere and the science that was discussed," he said. Each national meeting attracts an estimated 11,000 to 13,000 chemists, including academic professionals, chemical engineers, and students like Harper. The conferences exist for networking, sharing research, and learning about new technologies in the world of chemistry. "The conference was a great experience for me," Harper said.

Written by Jordan Wright



BYU Professor Engaged in Groundbreaking Research

For more than 30 years, Dr. David V. Dearden has been working with mass spectrometry—a scientific method to weigh molecules. "If you can weigh a molecule, you can tell what atoms are in it . . . [and] how the atoms are connected to each other," Dearden said. "But mass spectrometry doesn't usually tell you anything about how the molecules are folded up."

If a molecule or protein in the body is shaped incorrectly, it can cause severe health issues and even diseases such as Alzheimer's. If mass spectrometers could be used to determine a molecule's shape, scientists would be able to better construct correctly-formed molecules and understand deformed ones.

"For more than 15 years, we've been working on the idea that you ought to be able to make these measurements in an FTICR mass spectrometer," Dearden said. "About five or so years ago we figured out how to do it. Ever since then we've been working on refining the technique and trying to get people to accept it."

Although his technique is groundbreaking, Dearden has encountered his fair share of skeptics, but he gladly accepts the questions and criticisms. His recent article, "Effects of kinetic energy and collision gas on measurement of cross sections by Fourier transform ion cyclotron resonance mass spectrometry," was published in the *International Journal of Mass Spectrometry* in February 2015.

"This instrument is really good at measuring mass . . . so if we can add to it this capability of measuring shape as well, then we've got an extremely powerful combination," Dearden said. "We think, in the long run, we're going to have an extremely powerful new technique."

Written by Tanner Call

Dr. Watt and Dr. Watt: A Family Affair in the Chemistry Department

Some fathers and sons bond over woodshop projects or fishing trips, but father and son BYU professors Dr. Gerald D. Watt and Dr. Richard K. Watt have always bonded instead over chemical reactions.

"I remember after my first year in college . . . when I went home at Christmastime, my dad had a reaction going in the lab, so we went into the lab to finish it," Richard said. "We went into his office to start talking about science and then about three hours later, my mom called and said, 'Are you guys okay?' Science has been a real strong bond that we both liked. It's a hobby that we do together."

Richard never had his father as a professor, but he has still learned from his father's example, and his decision to become a professor himself was heavily motivated by Gerald's influence.

"A huge influence in my life was seeing his example and seeing what he did, how he did it, and how much he enjoyed it," Richard said. "He'll say he's never gone to work a day in his life because he comes in and he plays every day."

Gerald retired in 2006, but he and Richard still interact regularly at BYU. Currently, Richard and Gerald are working together on a project that turns biomass (lawn clippings, corn, leaves, etc.) into electricity. Though it was never their plan, the project is a new way for them to grow and learn together as father as son.

Written by Jennifer Johnson and Madison Parks

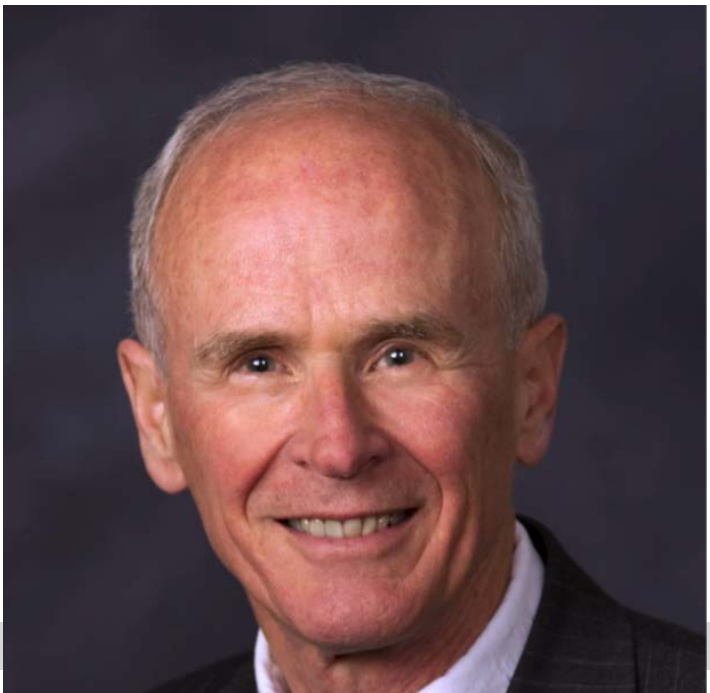
RETIREMENTS

Milton Lee

Dr. Milton Lee certainly is an iconic figure who will be sorely missed by this department. Lee was honored with the 2016 LCGC Lifetime Achievement in Chromatography Award, and has obtained 20 patents, received 35 major awards, commercialized three instruments, founded three analytical instrument companies, published over 570 journal articles, and even started his own scientific journal. "His ability to spin out chemical instrumentation of high complexity to the market and at the same time continue as a leading researcher and teacher is an amazing achievement," said Karin Markides, a former postdoctoral student of Lee's, in a LCGC interview. "The impact of his career is too large to measure." Many agree that Lee's greatest contribution to his field, however, is not his impressive industrial work, but the 96 graduate students he has mentored in his lab at BYU. Lee treated his students like family, celebrated their triumphs, and supported them in difficult moments. Today, many of his students are teachers themselves. Others lead successful industrial companies. Regardless of their career paths, they agree that Lee's influence helped them reach their goals. We congratulate Dr. Lee for his success and wish him the best for his well-deserved retirement.

Written by Taelin Dedrick and Jordan Wright
Photo by BYU Photo

Wayne Anderson



Wayne J. Anderson retired from BYU in September 2015 after twenty years of service as the Research Grants and Personnel Administrator for the BYU Department of Chemistry & Biochemistry. Previous to BYU he was a research physicist, teacher and administrator for the United States Air Force, the Office of the Secretary of Defense, and New Mexico's Phillips Laboratory. At BYU, Wayne administered research grants and department personnel and taught courses in physics, chemistry and physical sciences. Wayne and his wife Genan are currently serving an LDS mission in South Korea, where they are in charge of military relations. Wayne leaves with our deepest gratitude.

Written by Jeff Ballew | Photo by BYU Photo

Peggy Erickson

The Department of Chemistry and Biochemistry has been fortunate over the years to have a number of exceptionally capable and dedicated administrative and staff employees whose contributions have been essential to the department's success. Peggy Erickson has been one of those employees. Peggy joined the department as the department secretary in 1992. She held that position for sixteen years. Peggy's work as department secretary was notable for her positive, can-do approach to assignments, for her careful hiring and training of student assistants, and for the helpful and professional manner in which she dealt with anyone who walked into the department office.

In 2008 Peggy moved to the position of Administrative Assistant in the department. With the same professionalism and positive approach that had characterized her work as department secretary, Peggy became the face of the department for students seeking advisement. She provided essential support to two department chairs. As one of those chairs, I can attest to the fact that without Peggy's support, my job would have been immeasurably more difficult.

Peggy retired from BYU in February of this year. We miss her and wish her the best in her retirement.

Written by Paul Farnsworth | Photo by BYU Photo

ANNOUNCEMENTS

We would like to thank all the recent retirees for their dedicated work and service. They will be missed.
We would also like to welcome new faces to the department office and note a familiar face in a new position

Jeff Ballew replaced Wayne Anderson as the department Research Administrator.

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Sue Mortensen took over as Administrative Assistant after Peggy Erickson's retirement.

• • •

Anna Kennington was brought on as the Department Secretary after Sue transferred positions.

AWARDS AND RECOGNITION

Steven Graves: University Technology Transfer Award

While doctors currently perform surgeries and subjective tests to diagnose patients, Dr. Steven W. Graves's research is geared to find a more effective way to not only diagnose, but also predict various diseases before they occur.

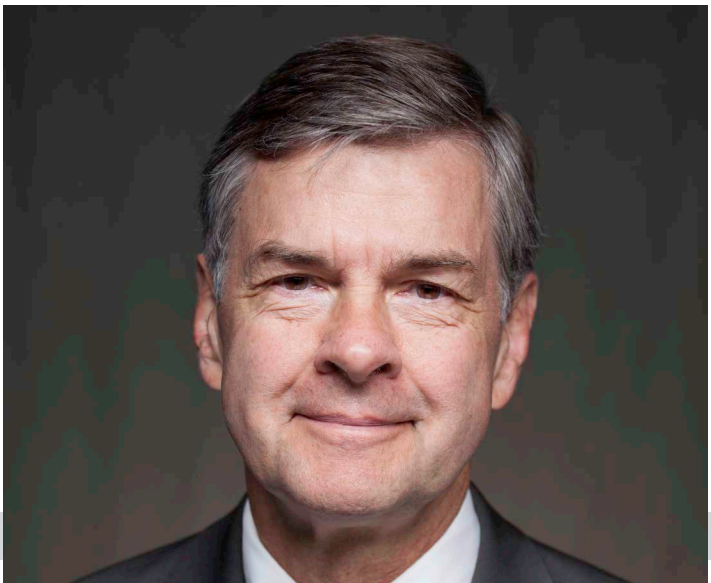
His hope is that by performing a simple blood test, doctors will be able to predict Alzheimer's disease, easily diagnose endometriosis, and foresee if a woman could give birth prematurely. The current tests that are done to identify these issues either do not exist, or they are long, tiresome, and sometimes a painful process.

Not only could this research greatly benefit the medical world, it has also led to Graves receiving the University Technology Transfer Award. Given by the BYU Technology Transfer Office, this award recognizes those whose research has made a significant contribution and has led them to develop a useful invention.

Graves expressed his gratitude to the college, the Technology Transfer Office, and especially to the graduate and undergraduate students who work with him on this research.

"I'm very grateful for the students who have really made this happen," Graves said. "The idea may have started with me, but they really made it happen."

Written by Camilla Stimpson | Photo by BYU Photo



Matthew Linford: Alcuin Fellowship

Students are not always the only ones working in the classroom—Dr. Matthew R. Linford works alongside his students in class.

Linford was recently awarded an Alcuin Fellowship award at the Annual University Conference, which recognizes a teacher-scholar who has made significant contributions to the general education and honors curriculum.

Linford has many qualities that make him an effective professor. One of those qualities is that he comes to class ready to solve problems on the board with his students, to help them all get a better grasp of the problem and how to solve it.

"I believe that the students need to see someone actually working the problems, as they might, and explaining the thought process that goes into solving them in real time," Linford said. Preparation is key for Linford's theory of solving problems on the spot. Setting aside time before the lecture, Linford is able to practice and work through concepts beforehand. As he does this, students are able to understand the theories being presented and are able to apply it to their own work.

"I love it when the light goes on," Linford said. "I love it when I've explained a new concept in a way that's understandable to someone."

Written by Camilla Stimpson | Photo by BYU Photo

Daniel Ess: BYU Young Scholar Award

For the past five years, assistant professor Dr. Daniel H. Ess has used computation and theory to make significant contributions to the field of chemistry.

Ess develops and utilizes quantum-chemistry methods to discover mechanisms, reactivity principles, and selectivity for specific chemical reactions. He and his research group emphasize quantitative simulation of chemical reactions and the development of qualitative models used for experimental predictions.

"I like to make discoveries that make an impact on experimental chemistry and teach chemists new ways to think and solve chemical problems," Ess said.

For his work, Ess was recently awarded the BYU Young Scholar Award. This award recognizes faculty members in the early stages of their careers who have shown outstanding scholarship. Ess has published nearly 50 peer-reviewed scientific papers that have appeared in journals such as *Science* and the *Journal of the American Chemical Society*. Ess has also been awarded several grants from the Department of Energy, the National Institutes of Health, and the chemical industry.

In addition to running a high-powered research group, Ess enjoys teaching.

"The balance of research and teaching at BYU is very rewarding," Ess said. "I make teaching as high of a priority as research, even though the amount of time is probably not equal."

Ess's job allows him to experience the best of both worlds: He is able to ask and answer questions about chemical reactions and help students gain knowledge on a subject he loves.

Written byTiana Moe

Adam Woolley: University Professorship Award and AES Mid-Career Award

The greatest joy that Dr. Adam T. Woolley feels in his work is when his students grasp the theories he is presenting.

"The really exciting thing is seeing people understand things they haven't understood before," Woolley said. "I love when they get it. That 'aha moment' when a student grasps a difficult concept, for me that's one of the best things."

Woolley, former associate chair of the Department of Chemistry and Biochemistry, was awarded a University Professorship at BYU's Annual University Conference. This award honors senior faculty members who are remarkable scholars, teachers, and university citizens. It also distinguishes those who excel in creative work, scholarship, and classroom teaching.

"I was really surprised. It's a great honor. I look at some of my colleagues who have had similar awards and they're really people I look up to," Woolley said. "It's humbling to be in such great company."

A few months later, Woolley was also recognized with the American Electrophoresis Society (AES) Mid-Career Award. This award honors those who have made exceptional contributions to the field of electrophoresis during their career.

Woolley has adapted many strategies to keep his students informed and engaged, and the more students learn, the bigger the evolution Woolley sees in them and their work.

"[I love] watching them develop to where they're scientists, and they're colleagues as well," Woolley said. "The students that really develop that way, we can have a conversation and bounce ideas off each other."

Written by Camilla Stimpson | Photo by BYU Photo

Steven Goates: BYU Karl G. Maeser Excellence in Teaching Award

Many of Dr. Steven R. Goates's students describe him as a goofball—a goofball they love to take classes from.

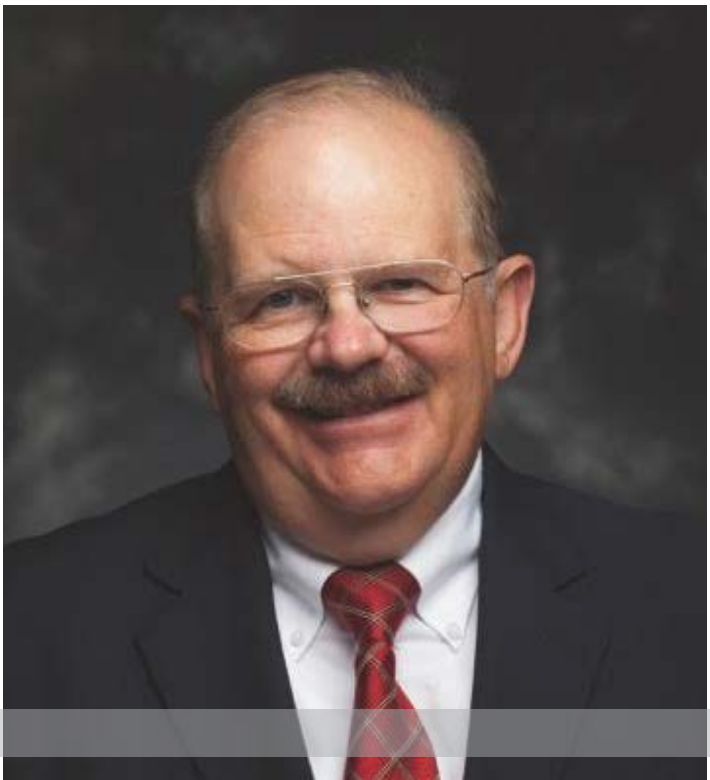
"You need to care about the students [but not] care about what they think of you," Goates said. "You can't worry about being popular. You can't worry if they're going to grouse about you, but you have to care about them. A good part of teaching is what I call cheerleading: convincing people that they can do hard things." Because of his outstanding teaching methods and connection to the students, Goates was awarded the BYU Karl G. Maeser Excellence in Teaching Award at the Annual University Conference this August.

Goates attributes much of his success with students to the teaching methods he learned from other professors. "I'm always experimenting with new things and stealing ideas from other people," he said. "It's important for teachers to share information about what works and what doesn't work."

When Goates is able to help students learn and get excited about chemistry, he knows he's doing a good job.

"A student has to want to learn. [I] try to light the fire and get them excited," Goates said. "A lot of people say chemistry is hard and my response to that is, 'Yeah, isn't that great?' I don't want to do something that's easy. I want to be challenged. I really enjoy seeing the light come on, seeing people progress and grapple with new concepts."

Written by Tanner Call | Photo by BYU Photo



Jaron Hansen: BYU Class of 1949 Young Faculty Award

When students enter Dr. Jaron C. Hansen's classroom, they can expect their minds to be stretched and their hands to get dirty as they work actively in the field.

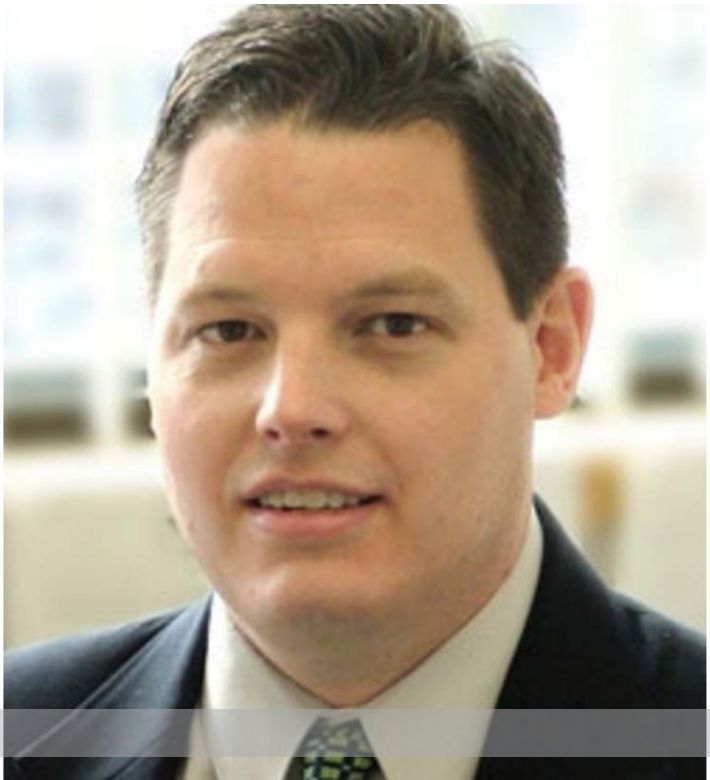
"By far the best learning experience they can have [is] . . . seeing how these things are all interconnected," Hansen said, "and actually working with them on projects so that their hands are getting dirty as they apply the things they learn."

As an associate professor in chemistry and biochemistry, Hansen's main areas of research are air sampling and renewable energy. Students work with Hansen to build various instruments: graduate students construct tools to measure the compounds of air pollution, and some students have accompanied Hansen to southern California to monitor air pollution in an effort to understand where the pollution is coming from.

Student involvement is very rewarding for Hansen. "It leaves you with a really great feeling . . . to see these students that are able to apply things that they learned in the classroom to bring to pass these great ideas that we have," he said.

Hansen was awarded the BYU Class of 1949 Young Faculty Award at the 2015 Annual University Conference. The award honors junior faculty who give outstanding contributions. It is awarded based on a combination of published papers and the strength of research that has been directed. It is made possible thanks to the BYU class of 1949.

Written by Camilla Stimpson



Jennifer Nielson: Karl G. Maeser Professional Faculty Excellence Award

Dr. Jennifer B. Nielson is a chemistry enthusiast, humanitarian, and self-proclaimed "nerd"—but first and foremost she is a teacher.

"At this point I've taught over 10,000 students and I've been here ten years, so that tells you the volume of students that I interact with" Nielson said.

Nielson's passion, experience, and skill in teaching recently led to her receiving the BYU Karl G. Maeser Professional Faculty Excellence Award at this year's Annual University Conference. This award recognizes outstanding achievement among professional faculty in citizenship and professional service.

Her zeal for teaching extends to her work with secondary schools in Kampala, Uganda. Despite the extensive years of chemistry instruction Ugandan students receive (four to six years), Nielson said most students perform poorly and aren't interested in the subject.

"I realized I can't reach all the students, [but] what I can do is reach the faculty," Nielson said.

After this realization, Nielson created a workshop for teachers where she taught them a more demonstrative teaching style to help them better engage their students. She returns to Uganda annually to teach more workshops and train teachers to run the workshops so the program will be sustainable.

This year, Nielson plans to teach two workshops: one for current teachers and one for students training to be teachers. Additionally, she's currently working with the Ugandan Ministry of Education to redesign their chemistry curriculum.

Written by Ashley Lee | Photo by BYU Photo

Steven Wood: General Education Professorship

Dr. Steven G. Wood's chemistry class is filled with the sights and sounds of excitement as he conducts various experiments for his students.

This enthusiasm has caught the attention of the university. Wood, former associate chair of the Department of Chemistry and Biochemistry, was awarded a General Education Professorship at the Annual University Conference for his outstanding contributions to undergraduate general education and honors courses.

Wood has contributed countless hours and insights to general education and honors courses at BYU. He has taken part in providing tools for general education classes, including online videos that explain difficult theories in simple ways.

"There's no way to make somebody learn," Wood explained, "but [we] want to have an environment that makes the material accessible to students in a way that they can connect with it."

Demonstrations have proven to be an effective way to engage his students and help them remember important concepts. Wood has treated his class to countless activities. He has blown up balloons, brewed solutions to change colors, and even throws a chemistry magic show once per semester. Bringing creativity into his teaching allows Wood to open up the minds of his students and introduce new ways of learning and thinking.

"You want to pique their interest," Wood said. "When students realize that there is a better way to learn than just memorizing, they're able to internalize that and be empowered. That makes a difference forever."

Written by Camilla Stimpson | Photo by BYU Photo

UNDERGRADUATE STUDENT AWARDS

Chemistry Literature Award

Recognizes an outstanding student in Chemistry 391.

KENNETH LEE

Physical Chemistry Award

Recognizes an outstanding student in the Physical Chemistry 462/463 sequence.

OLIVER MOORE

Analytical Chemistry Award

Recognizes an outstanding student in the Analytical Chemistry 521/523 sequence.

JOSH WOODS

Eliot A. Butler Service Award

Recognizes a student who has provided significant service to the department while maintaining a high performance in course work and professional activities. This award is named in honor of Eliot A. Butler, who was a former professor, chair, dean and associate vice president.

JOHN JENSEN
SADIE HIRSCHI

Student Research Conference (SRC) Session Winners

JIUZHI (GEORGE) GAO, EMMA BURRELL, CLAYTON MOSS, CHARLES SHERRILL, TAYYEBEH PANAHI, SPENCER WALLENTINE, MASON SMITH, DIANA SAAVEDRA, CHUCK VOYTON, RICHARD CARSON, KOMAL KEDIA, JEREMY TSANG

ACS Analytical Division Undergraduate

DANIEL THURSTON

ACS Inorganic Division Undergraduate

KARLIE COX

ACS Organic Division Senior

JEFFERSON TYLER

Hypercube Scholar Award

Recognizes an outstanding student in the 105/106/107 sequence.

JACOB BAGLEY

Biochemistry Award

Recognizes an outstanding student in the Biochemistry 481M/482M sequence.

KYLE GASHLER

Inorganic Chemistry Award

Recognizes an outstanding student in the Inorganic Chemistry 514/518 sequence.

SADIE HIRSCHI

Organic Chemistry Award

Recognizes an outstanding student in the Organic Chemistry 351M/352M (majors) sequence and an outstanding student in the 351/352 sequence (non-majors).

JACOB LEFLER (M)
PAUL JOSHUA HURST (M)
SHAE BRYANT (NON-M)

SRC Outstanding Undergraduate Presenters

CLAYTON MOSS, CHARLES SHERRILL, SPENCER WALLENTINE, ELLEN PARKER, BRIGHAM POPE, CLIFTON ANDERSON, JEFFERSON TYLER, RYJUL STOKES, KYLE GASHLER, WENDY BILLINGS, JACOB LEFLER

Keith P. Anderson Outstanding Graduating Senior

Recognizes outstanding graduating senior(s) for overall scholarship and professionalism and classroom performance. This award is named in honor of Keith P. Anderson, a physical chemist who taught at BYU for more than 35 years.

KURT LEININGER

Catalyst Club Award

Recognizes an outstanding junior female student in chemistry or biochemistry. This award is sponsored by the Catalyst Club, an association of women who were current or emeritus members of the department or spouses of current or emeritus members.

KRISTINE SENKANE

Freshman Chemistry Award

Recognizes an outstanding student in the General Chemistry 111/112 (majors) sequence and an outstanding student in the 105/106/107 sequence (non-majors).

DAKOTA JONES (M)
JON TROUT (NON-M)
DONALD PFEIFER (NON-M)

GRADUATE STUDENT AWARDS

Telford & Frank Woolley Memorial Research Award

Recognizes outstanding students who are conducting significant research in cancer or in other health related areas. This award is named in honor of Telford Woolley, a physician who passed away prematurely due to cancer.

ASHARI KANNANGARA
ANKUR JALAN

Garth L. Lee Award

Recognizes an outstanding continuing graduate student for religious commitment, service and scholarship. This fellowship is named in honor of Professor Garth L. Lee, who was a professor of chemistry at Utah State University for many years.

SEUNG-OOK YANG

Loren and Maurine F. Bryner Award

Recognizes advanced continuing graduate students. This award is in honor of Chemistry Emeritus Professor Loren C. Bryner and Emeritus Maurine F. Bryner.

DIANA SAAVEDRA, YU CAI, SARA MATA, MARJAN MOHAMMADIHASHEMI, MICHAEL BEAUCHAMP

Jennie R. Swensen Award

Recognizes advanced continuing graduate students. This award is named in honor of Dr. Albert D. Swensen, in memory of his wife, Jennie Romney Swensen.

KAEO EVERETT, MONIQUE SPEIRS, NICOLE TENSMEYER

GRADUATE RESEARCH FELLOWSHIPS

J. Rex and Marcia A. Goates Fellowship

Recognizes an advanced chemistry graduate student for outstanding scholarship and achievement in research. This award is named in honor of J. Rex and Marcia A. Goates. Dr. Rex Goates served as department chair and dean of the college and was a Maeser Distinguished Faculty Lecturer. The award has been renamed to honor him and his wife. Dr. Rex Goates is the father of Dr. Steven Goates.

CHARLOTTE LEWIS
ANNA NIELSEN

Bradshaw Organic Chemistry Fellowship

Recognizes an advanced organic chemistry graduate student for scholarship and achievement in research. This award is named in honor of Jerald S. Bradshaw, an outstanding emeritus faculty member.

MICHAEL KINGHORN

Charles E. & Margaret P. Maw Fellowship

Recognizes an advanced chemistry graduate student for outstanding scholarship and achievement in research. This award is named in honor of Charles E. Maw who was the founding chair of what became the BYU Department of Chemistry and his wife, Margaret.

WADE ELLIS

Roland K. Robins Fellowships

Recognizes outstanding graduate students for outstanding scholarship and promise in research. These awards were created to honor Dr. Roland K. Robins, who was world-renowned for his creativity and activity in the syntheses of new medicinal compounds.

COURTNEY BANKS, BRADLEY NAYLOR, RICHARD CARSON, YING ZHANG, MUKUL SONKER, MATTHEW OLLERTON

SELECTED

UNDERGRAD RESEARCH AWARDS

SPENCER KRIEGER

mentored by Roger Harrison

"Anion Separation and Preconcentration with a Zinc Containing Tetratopic Cyclen Resorcinarene"

This semester I have been working on separating and preconcentrating perrhenate from sea water using ion chromatography. Dr. Harrison was my mentor and we worked on separating perrhenate from sea water and that could retain it so that it could be concentrated. We found that our new material, zinc cyclen resorcinarene, could both separate perrhenate effectively, and that we can achieve a 50x concentration with this method. We also worked on concentrating perrhenate from synthetic sea water so we could get a good idea of its potential in preconcentration from real sea water. We ran into difficulties preconcentrating perrhenate from real sea water because of the other ions present in the sample. We plan to find solutions to those problems next semester.

Edited by Taelin Dedrick | Photo by Zoie Young

KIT ANDERSON

mentored by Daniel Austin

"Miniaturizing the Mass Spectrometer"

This past semester, under the direction of Dr. Austin, I have been working on miniaturizing a mass spectrometer. Specifically, I have been helping a graduate student to create a working miniature version of an ion trap that was developed by a previous graduate student who also worked under Dr. Austin. While this miniature ion trap has given us signal during this semester, the peaks had very poor resolution and we were also not able to determine what peaks the signal was supposed to be. This occurred while using toluene, so we decided to try another compound, which did not give us any signal. Due to these problems we were unable to find the optimal settings for our instruments or test it with any unknowns. While looking at our set up, Dr. Austin told us that some of our equipment might not be sensitive enough. He also told us that the problem could lie in the fact that our ion trap was able to wiggle a lot. This leads us to where we are now. Currently we are redesigning our ion trap to make it more precise and without wiggle room. We are also designing a new vacuum chamber for it so that it does not appear to need as much space as it currently has.

Editing & Photo by Taelin Dedrick

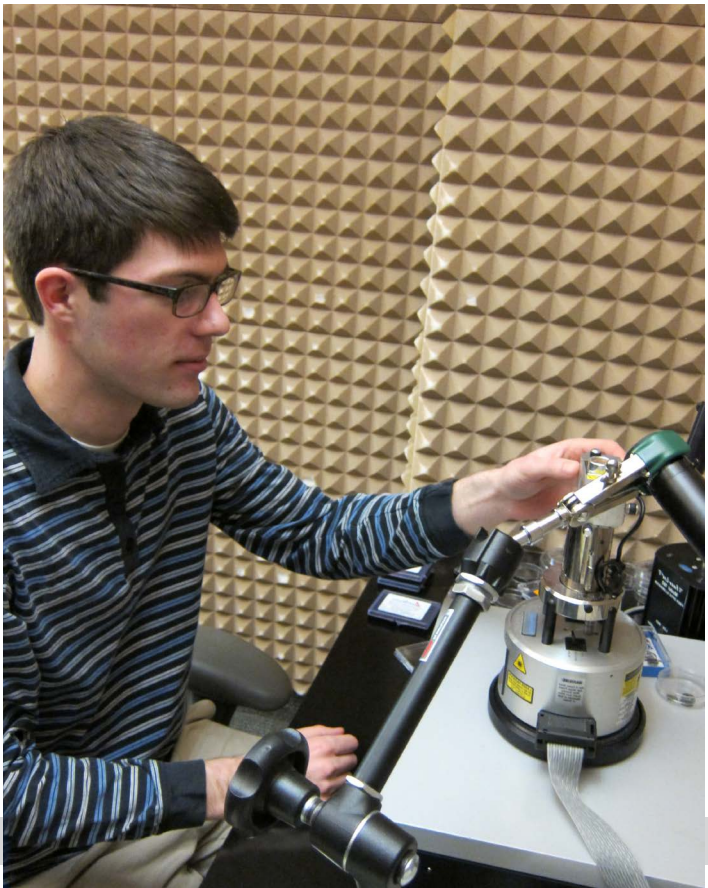
KENNETH LEE

mentored by Adam Woolley

"Nanocircuit Design and Fabrication Using 3-D DNA Origami"

The project was to create three-dimensional DNA origami structures and use them as templates for arranging other nanomaterials. This would suggest the possibility of making compact nanoelectronic devices with 3-D DNA origami. My mentor is Dr. Adam Woolley. The goals were to fold and characterize a new 3-D DNA origami structure and hybridize gold nanoparticles to specific sites on the origami. I designed a hollow cylinder DNA origami using the caDNAno software and folded the structure with a previously developed thermocycler protocol. To characterize the DNA origami, I stained it with heavy metal ions and imaged the stained structures with SEM imaging. After hybridizing gold nanoparticles to the DNA origami, I used SEM imaging again to determine attachment yield. DNA origami staining was not consistent; however, it appears that the DNA origami structure folded correctly. TEM imaging might be a better option to show this result more clearly. Preliminary hybridization experiments suggest that nanoparticles will hybridize to the correct sites on DNA structures. Background particles need to be removed from the sample to increase confidence that they are actually hybridizing to the DNA origami structures rather than landing on the DNA structures by chance.

Edited by Taelin Dedrick | Photo by Zoie Young



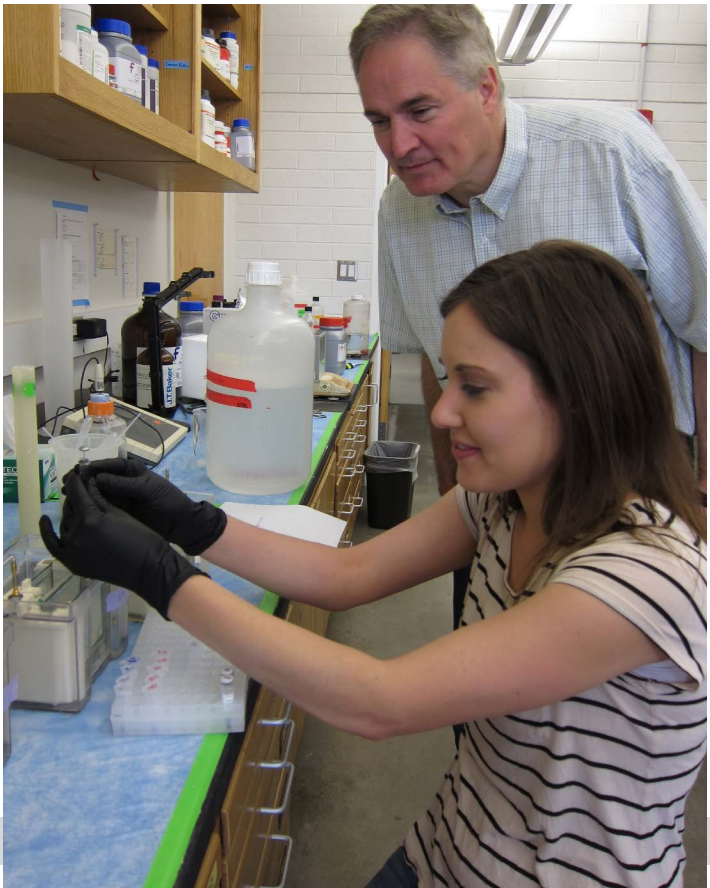
NICOLE TENSMEYER

mentored by Barry Willardson

"Effects of CCT Knockdown on mTOR Complex Function and Signaling"

CCT is a chaperone protein that helps to fold other proteins so that they can function properly. Our lab has shown that CCT helps to fold mLST8, a component of the mTOR complex, a complex responsible for growth signaling. The purpose of my project was to implement CRISPRi, a new technique used to knockdown a protein or diminish that protein's concentration in the cells, in order to knockdown CCT and assess its effects on mTOR function. In order to implement CRISPRi, I produced lentivirus containing the dCas9 protein which can be targeted to silence a gene by a guide RNA or sgRNA. I infected Human Embryonic Kidney (HEK293 and HEK293T) cells with this virus in order to produce a cell line stably expressing dCas9 with an inducible system. I then transfected sgRNA into the cells to target dCas9 to CCT and induced expression of dCas9. I next performed a Western Blot to view the protein levels of CCT, mLST8 and targets of the mTOR signaling pathway. My data shows that we have successfully knocked down CCT once, but we are now attempting to repeat the experiment. If we are successful, we expect to obtain a near complete knockdown of CCT resulting in decreased levels of properly folded mLST8 and inhibited mTOR signaling.

Editing & Photo by Taelin Dedrick



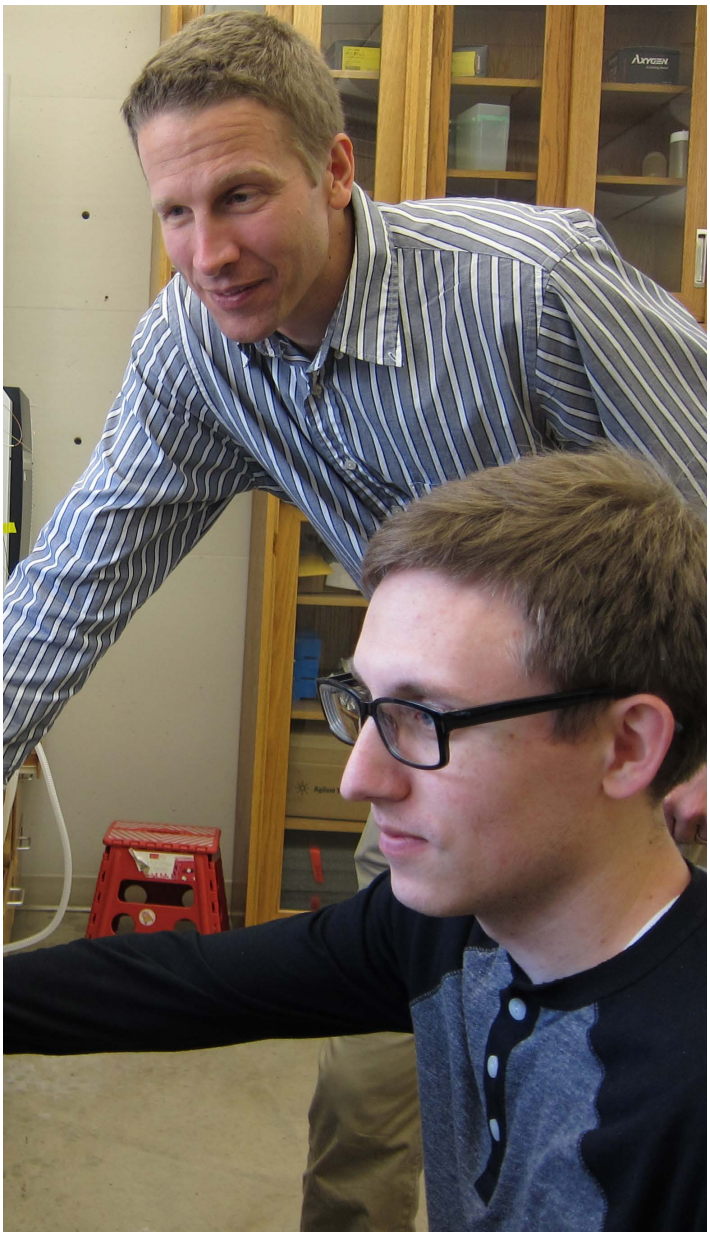
MICHAEL PORTER

mentored by JC Price

"Utilizing Mass Defect to Create a Universal Tool for the Calculation of Protein Turnover Rates"

Dr. Price helped develop a cheaper, more effective method for determining protein synthesis rates. His approach utilizes heavy water. Heavy water is similar to regular water, but the hydrogens in the molecule have been replaced with deuterium; deuterium is a form of hydrogen which contains an extra neutron. Using mass spectrometers, the extra mass can be tracked as it is incorporated into new proteins. Compared to other methods for labeling proteins, heavy water is fairly cheap and easy to administer. Unfortunately, the calculations used in determining the rates are complex and were developed using software that is specific to only one manufacturer of mass spectrometers. This has made automation of the method impossible and collaboration with other labs difficult. We have been working on a software package to solve these problems and overcome differences in the different kinds of mass spectrometers. Our previous work focused on extracting the data from the mass spectrometry files. We have refined our approach and have developed a faster method to extract the information using linear algebra. We also created a user interface for our software so that it is more accessible to other labs and compatible with any type of mass spectrometer. We are currently writing a paper about the software we created and the new methods it implements. We plan on submitting the paper and making the software freely available to other labs in the coming weeks.

Editing & Photo by Taelin Dedrick



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You can help. It makes a difference.

Click on **chemistry.byu.edu/giving** and make a gift to help.
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If you have questions, call **801-422-4501** or email **brenth@byu.edu**

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Brent Hall

LDS Philanthropies liaison for the College of Physical and Mathematical Sciences.

Lead Graphic Designer: Zoie Young
Lead Writer and Editor: Taelin Dedrick

2016

HOMECOMING EVENTS

Please mark your calendars and plan to renew your friendships in the department at our homecoming activities as follows:

DEPARTMENT OF *Chemistry & Biochemistry* ACTIVITIES

October 13th

6:00 *pm*	RECEPTION
6:30 *pm*	DINNER
7:30 *pm*	AWARD PRESENTATION AND SPEAKER

BRIGHAM YOUNG *University* ACTIVITIES

October 14th

8:15 *pm*	FOOTBALL GAME VS. MISSISSIPPI STATE

October 15th

8:30 *am*	PANCAKE BREAKFAST
10:00 *am*	PARADE

Below is a reservation form for the Department Homecoming dinner. Please mail your reservation form to: Homecoming, Department of Chemistry and Biochemistry C-100 BNSN, Brigham Young University, Provo, Utah 84602, call 801-422-3667, or email akennington@chem.byu.edu.

I PLAN TO ATTEND:

Reception & Dinner
Thursday, October 13, 6:00 pm
Reserved Seating

YES ☐ NO ☐

Number Attending _____

Number who are BYU Alumni _____
(Please include yourself in both totals.)

Name: _____

Address: _____

City, State, Zip: _____

e-mail: _____

Contact telephone: _____

PLEASE RSVP NO LATER THAN SEPTEMBER 22