Spring semester 2016 was busy in the department, and I am pleased to report progress on several fronts. First, we were successful in hiring a new senior faculty member, Associate Professor Christopher J. Ellison, who is a global expert in polymer science and engineering. Ellison will join CEMS this summer and hold the Piercy Professorship. We look forward to his arrival and bolstering our already world-class polymer science program.

As usual, there were numerous outstanding accomplishments of our faculty and students during the 2015-2016 academic year, many of which you will read about on the following pages. Collectively, our students continue to be among the very best at the University of Minnesota, and I am proud to say that with your generous support, we were able to award $162,000 in undergraduate scholarships to many deserving students this year. At Commencement in May, the department conferred bachelors degrees to 94 ChE students and 47 MSE students. Without a doubt, the Class of 2016 benefited tremendously from alumni support, and I take this opportunity to thank you for your generosity. Likewise, our first year Ph.D. students were the recipients of approximately $1 million in financial support from our Graduate Student Endowment. That fund continues to grow with your contributions, allowing us to attract the very best graduate students from across the nation and around the globe, which is so vital to our continuing success.

I've said this before, and I'll say it again: my faculty colleagues are an amazing collection of “can do” people who routinely excel in research, teaching and service, and it's why I have always felt privileged to work here. I was especially reminded of this during the past semester when I had a chance to teach our materials processing course to graduating MSE majors. The text for this course, “Materials Processing: A Unified Approach to Processing of Metals, Ceramics and Polymers,” published by Academic Press, was written by CEMS professor Lorraine Francis. This book is a culmination of a ten-year effort by Lorraine to develop a consistent and cross-cutting approach to processing diverse classes of materials. It's a marvelous, unique and timely book that fills a huge gap in the national MSE curriculum, and simultaneously underscores the vital role of materials engineering in manufacturing technology.

Writing a textbook is truly a major undertaking, and there is no shortage of authors in CEMS, including Professors Yiannis Kaznessis, Tim Lodge, Chris Macosko, and Professor Emeritus Lanny Schmidt. Professors Kevin Dorfman and Prodromos Daoutidis recently completed a new textbook entitled, “Numerical Methods with Chemical Engineering Applications.” In addition, Professors Wei-Shou Hu and Eray Aydil are in the midst of authoring books.

At the most basic level, the core motivation for writing a book is the belief that student learning can be improved through a new perspective; that you, the author, have discovered a set of principles, or a unique mode of thinking, that can unlock a field for students. The transformative potential of textbooks is alluring to dedicated educators who want to make a difference. But it is very hard work, and I am certainly proud of the commitment and dedication to teaching exemplified by a significant number of my CEMS colleagues who have chosen to follow this path while remaining top researchers, outstanding lecturers, and excellent department citizens.

As the 2015-2016 academic year closes, I thank you for all you do to support CEMS. Your dedication makes a huge difference to our students and faculty, and it is a primary reason we continue to be one of the greatest engineering departments in the country.
PIERCY PROFESSOR

All roads lead home

CEMS alumnus Neville R. Moody served as the 32nd George T. Piercy Professor.

It would be difficult to find an alumnus more committed to the department, or the state of Minnesota for that matter, than Neville Moody (Metallurgy/MSE ’72; MS ’77; Ph.D. ’81). Throughout his professional career, Moody remained connected to CEMS and specifically, Professor Bill Gerberich. Recently retired after nearly 35 years at Sandia National Laboratories, it seemed only fitting that Moody would find his way home to CEMS again, this time as the 32nd George T. Piercy Distinguished Visiting Professor. Moody describes his experiences in CEMS below.

The early years

When I started at the University in 1968, the department was known as the School of Mines and Metallurgy. I knew I wanted to study engineering but was not sure of which branch of engineering to study so I signed up for a major in metallurgical engineering. It was the only engineering discipline I knew nothing about. Professors Dale Stein, Louie Toth, Morrie Nicholson, Tom Hutchinson, and Jack Sivertsen taught many of my major courses. I also took the first courses that Chris Macosko and Bill Gerberich taught when they joined the department.

Metallurgical engineering was an engineering degree with all the core engineering courses. There were only four of us in my graduating class in a field that was also very small. But, it was a field with good job opportunities.

The late 1960s and early 1970s were the days of Selective Service, and I went through the typical Officer Basic and Advanced training schools, but my permanent assignment was as a metallurgical engineer in the Mobility Equipment Research and Development Command at Fort Belvoir in Virginia. That assignment came about from a letter that Professor Morrie Nicholson had sent to the Army advocating that I be assigned as metallurgical engineer. It was great experience. I found that I enjoyed engineering and especially, the study of fracture (since there were a lot of things that failed in the Army). I also found that the Fracture Mechanics course that Bill Gerberich taught us as undergraduates was at the same level that others were learning as Ph.D. students. Bill was, and is, one of the best in the field, and he is the reason that I returned to Minnesota for my master’s and Ph.D. degrees.

Neville Moody (center) was honored as the CEMS Piercy Professor at the Minneapolis Club in March. Also pictured are Professor Bill Gerberich (left) and Dan Frisbie, Department Head. Photo credit to Rebecca Zienfski, By Rebecca Photography.
Indelible influence

Things have changed over the years. The School of Mines and Metallurgy merged with Chemical Engineering to become the Department of Chemical Engineering and Materials Science in 1971. It has been a great union of disciplines, expanding opportunities for students and faculty in both fields. There are now 10 times as many students studying materials science in the department. And the field has grown as well, encompassing many disciplines and all types of materials.

What is especially impressive is the high regard held for the department and its graduates by the outside world as shown by the department’s peer rankings. The consistently high rankings have greatly benefited all students, alumni, and everyone working in the department. My association to CEMS has especially benefited me in my career, where I have been regarded as coming from a top tier school with an excellent education. It is a tremendous source of pride to be part of this department.

I maintained close ties to Minnesota and Professor Bill Gerberich throughout my career at Sandia. I kept returning to Minnesota as a recruiter in materials science. But a big change occurred when Minnesota was awarded a National Science Foundation (NSF) grant to establish an Engineering Research Center in Interfacial Engineering. It occurred as the Laboratories’ mission was changing to include nanotechnologies. Sandia’s association with the Center was very beneficial. It provided the opportunity for collaborations and working with students. I started hosting students at Sandia, some for multiple summers. Then some students became professors and started sending me some of their top students. I returned twice to Minnesota during Sandia sponsored sabbaticals, allowing me to shift my career focus and keep my research at the forefront of the field.

Professor Bill Gerberich has been, and continues to be, a great mentor, collaborator and friend. What is really fascinating is the way Bill’s students (and their students, and so on) stay in touch and collaborate. It’s quite remarkable to witness firsthand how the CEMS family maintains lifelong connections and remains committed to the success of future generations of CEMS students.

I will be forever grateful to the department and Bill Gerberich for shaping my education and career. I am especially honored to return to campus as the 32nd Piercy Professor. I thoroughly enjoyed my time in a department where I started so many years ago. My time as the Piercy Professor has provided me with an opportunity to continue established collaborations and establish new connections with current students and recent graduates.

As a native Minnesotan, I was fortunate to return to Minnesota in an “El Nino” year with a relatively mild winter. I don’t recall a day during my entire stay that recorded below zero temperatures. But, there was just enough snow to remind me that this was Minnesota, and it’s those cherished memories of the people and places (and weather!) that remind me I’m never very far away from my CEMS home.

CEMS tops national rankings

The latest rankings of chemical engineering and materials science programs by U.S. News and World Report placed CEMS graduate programs at #2 in the nation for chemical engineering and #19 for materials science and engineering.

“The rankings affirm in a public way what we already know about our department, namely, that we have world class faculty members and outstanding students. Together, our researchers are tackling some of the greatest challenges in health, energy and the environment. It is gratifying that our peer institutions recognize our impact,” said Dan Frisbie, head of CEMS.

The U.S. News survey is a reputation-based survey in which department heads and deans from around the country are asked to rank programs each fall. The results are released annually in the spring.

2017 Best Engineering Graduate Schools according to U.S. News and World Report (ranked in 2016):

Chemical Engineering Graduate Programs:
1. Massachusetts Institute of Technology
2. University of Minnesota-Twin Cities; California Institute of Technology; University of California-Berkeley (tied)
5. Stanford University

Materials Science and Engineering Graduate Programs:
1. Massachusetts Institute of Technology
2. Northwestern University; University of California-Santa Barbara (tied)
19. University of Minnesota-Twin Cities; Columbia University; Johns Hopkins University; Ohio State University; Rensselaer Polytechnic Institute; University of California-Los Angeles (tied)
Groundbreaking discoveries

Researchers record first-ever videos showing how heat moves through materials at the speed of sound.

Using a state-of-the-art ultrafast electron microscope, assistant professor David Flannigan, materials science graduate student Daniel R. Cremons and chemical engineering graduate student Dayne A. Plemmons have recorded the first-ever videos showing how heat moves through materials at the nanoscale traveling at the speed of sound. Their research, “Femtosecond Electron Imaging of Defect-Modulated Phonon Dynamics,” is published in Nature Communications and provides unprecedented insight into roles played by individual atomic and nanoscale features that could aid in the design of better, more efficient materials with a wide array of uses, from personal electronics to alternative-energy technologies.

Materials scientists and engineers have spent decades researching how to control thermal energy at the atomic level in order to recycle and use it to dramatically increase efficiencies and ultimately drive down the use of fossil fuels. Such work would be greatly aided by actually watching heat move through materials, but capturing images of the basic physical processes at the heart of thermal-energy motion has presented enormous challenges. This is because the fundamental length scales are nanometers (a billionth of a meter) and the speeds can be many miles per second. Such extreme conditions have made imaging this ubiquitous process extraordinarily challenging.

To overcome these challenges and image the movement of heat energy, the researchers used a cutting-edge FEI Tecnai™ Femto ultrafast electron microscope (UEM) capable of examining the dynamics of materials at the atomic and molecular scale over time spans measured in femtoseconds (one millionth of a billionth of a second). In this work, the CEMS team used a brief laser pulse to excite electrons and very rapidly heat crystalline semiconducting materials of tungsten diselenide and germanium. They then captured slow-motion videos (slowed by over a billion times the normal speed) of the resulting waves of energy moving through the crystals.

“In many applications, scientists and engineers want to understand thermal-energy motion, control it, collect it, and precisely guide it to do useful work or very quickly move it away from sensitive components,” Flannigan said. “Because the lengths and times are so small and so fast, it has been very difficult to understand in detail how this occurs in materials that have imperfections, as essentially all materials do. Literally watching this process happen would go a very long way in building our understanding, and now we can do just that.”

Flannigan’s research team is motivated by the prospect of advancing their conceptual knowledge as well as that in the field. “On a personal level, the importance of this work is in pushing the boundaries of what is known and operating on the cusp of the scientific unknown. The ability to observe phonons with a nanoscale imaging technique is something we never considered when designing our experiments previously, so the future is extremely bright for our group,” Cremons said.

“For the next steps in our research, we would like to further understand the mechanisms of contrast in the videos [as it is quite interesting that no other operational UEM has observed this phenomena] and the physical processes that occur to launch the waves we observe,” noted Plemmons. “To actually show someone, in a single video, the structural dynamics that occur for a particular material and structure is a powerful tool. I think this ability will be helpful in developing smart materials and structures for selectively guiding heat, confining mechanical energy in resonant cavities, and understanding how transient structural deformations couple with optical, electrical, and magnetic degrees of freedom on the nanoscale.”

The research was funded primarily by the National Science Foundation through the University of Minnesota Materials Research Science and Engineering Center.
**Russ Holmes**

Associate Professor Russell J. Holmes is among seven recipients of the 2016 Horace T. Morse-University of Minnesota Alumni Association Award for Outstanding Contributions to Undergraduate Education. Each year since 1965, the University of Minnesota has recognized a select group of faculty members for their outstanding contributions to undergraduate education. The award, named for a former dean of General College, is made possible through generous support of the University of Minnesota Alumni Association and the Office of the Senior Vice President for Academic Affairs and Provost.

Holmes is a gifted educator who is routinely identified by graduating seniors as the best instructor in the materials science and engineering (MSE) curriculum. He teaches difficult required courses, helping students master challenging concepts. His impact as a teacher and mentor has helped the program grow; the number of students majoring in MSE has more than doubled in the last five years. Holmes is also very committed to involving undergraduates and even local high school students in his internationally recognized research program.

**Kacey Gregerson**

Kacey Gregerson joined the CEMS staff in February 2016 as Academic Advisor and Assistant to the Directors of Undergraduate Studies. She holds an undergraduate degree in mass communication from the University of Wisconsin-Eau Claire and a Master’s in Counseling and Student Personnel from Minnesota State University, Mankato. Her previous professional experience includes serving as an academic advisor in the College of Liberal Arts at the University of Minnesota and Anoka-Ramsey Community College, as well as a position as a judicial officer at the University of Alabama. In her free time, Gregerson enjoys running, playing piano, listening to music and the TED Radio Hour during her commute, reading, and spending as much time as possible with her family, which includes her husband, Aaron, her one-year-old daughter, Eliana, and their rambunctious dog, Cooper.

**Lisa Wissbaum**

Lisa Wissbaum was recently hired as Managing Director for the Materials Research Science and Engineering Center (MRSEC) and is a graduate of the University of Minnesota, with a Master’s of Public Affairs from the Hubert H. Humphrey Institute, with a concentration in economic and community development. She has prior experience managing National Science Foundation Engineering Research Centers and awards in the University of Minnesota’s College of Science and Engineering from 2005-2015. Prior to 2005, Wissbaum worked in travel management.

Wissbaum was born and raised in the Saint Paul, Minnesota Midway neighborhood, which her five brothers and two sisters still call home. She resides with her husband and daughter - way out in Eagan (as her father used to say)! She enjoys traveling, running, and biking.

**Kechun Zhang**

Kechun Zhang was promoted to the rank of Associate Professor with tenure effective AY 2016-17. Through synthetic biology and chemical processing, Zhang’s research addresses energy and environmental challenges.
Three CEMS students win 2016 President’s Student Leadership and Service Awards

Recent graduates Jackson Baril (ChE ’16) and Luis Torrealba (ChE ’16), and Alyssa McKenna, a fourth-year materials science and engineering graduate student, are among 43 recipients of the 2016 President’s Student Leadership and Service Awards (PSLSA). The PSLSA program recognizes the accomplishments and contributions of outstanding student leaders at the University of Minnesota-Twin Cities. Awards are presented to approximately one-half of one percent of the student body for their exceptional leadership and service to the University of Minnesota and the surrounding community.

Jackson Baril was the founding president for Out in Science Technology Engineering (oSTEM@Minnesota), a UMN chapter of a national group for LGBTQ+ students in STEM. He formed a leadership team that wrote the constitution and secured grant funds to send the first UMN representatives to the national convention and to support events such as career workshop social events, ally training for peers in STEM fields, and collaboration with Educate MN for aspiring primary and secondary educators. Among other contributions, Baril served as secretary of the College of Science and Engineering Student Board and a mentor with the University Honors Program. He also volunteers in the Investigational Drugs Service pharmacy at the University of Minnesota Medical Center and as a Spanish interpreter at a free clinic for the uninsured.

Luis Torrealba was recognized for his contributions promoting STEM fields among young Latinos through the Society of Hispanic Professional Engineers (SHPE) student chapter. He has been active in SHPE throughout his entire college career and currently serves as president, concentrating on developing future leaders and growth for even more community impact. He was the chair for the Regional Leadership Development Conference in 2015; this event, held at the University of Minnesota, brought over 200 undergraduate students from across the Midwest for a whole weekend of workshops, activities and networking.

Alyssa McKenna serves as the CEMS Women’s Group Coordinator and Outreach Coordinator and has organized professional development opportunities for women graduate students and outreach events with local elementary schools.

CEMS undergraduate co-founds drug delivery startup

Chemical engineering senior Anthony Tabet and Associate Professor of Biomedical Engineering Chun Wang are co-founders of Locpar, a University of Minnesota drug delivery startup with a mission to improve human health and patient safety by using newly developed biomaterial excipients to load, stabilize, and elute promising pharmaceutical drugs and vaccines that are challenging to deliver.

Wang and Tabet developed these biomaterials—called semi-solid polymers—to overcome critical challenges of existing excipients in stabilizing and solubilizing poorly water soluble drugs and biologics. This enables pharmaceutical companies to bring shelved, high-potential drugs that they have already spent millions of dollars developing (but were unable to be delivered) to the market faster and more frequently.

The pair’s vision for these materials extends beyond these applications as well: they are using these materials in conjunction with the Mayo Clinic to develop a vaccine for melanoma, and are expecting to start clinical trials within a year.

Tabet awarded prestigious 2016 Astronaut Scholarship

Anthony Tabet is one of only two University of Minnesota-Twin Cities students to be awarded a $10,000 scholarship from the Astronaut Scholarship Foundation for the 2016-17 academic year. The scholarship is awarded annually to outstanding undergraduates who intend to pursue research-oriented careers in mathematics, engineering, and the natural and applied sciences. Tabet plans to study chemical, biological or materials engineering in graduate school and develop innovative material platforms for drug delivery, regenerative medicine, and tissue engineering. Among his many accomplishments, Tabet is a co-founder of CoCreateX, a public benefit corporation that provides mentoring and resources to help young entrepreneurs collaboratively develop product ideas. Tabet is a Wallin Scholar, a Goldwater Scholar, and an Amgen Scholar at Stanford University.
Destined for greatness

Congratulations to these CEMS students who earned master’s or Ph.D. degrees during AY 2015-16.

Nahla Saeed Al Amoodi (Ph.D., ChE)
Nonlinear Control of Conventional Steam Power Plant.
Advisor: Prodromos Daoutidis

Palak Ambwani (Ph.D., MSE)
Transport and Magnetism in Bulk and Thin Film Strontium Titanate.
Advisor: Chris Leighton

Abigail Chanda (MS, MSE)
Advisor: Russell Holmes

Andrew J. Corbett (Ph.D., MSE)
Electrohydrodynamic and Thermocapillary Effects on Thin-Film Flows.
Advisor: Satish Kumar

Samuel J. Dalsin (Ph.D., ChE)
Bottlebrush Polymers: Synthesis, Rheology, and Self-Assembly.
Advisor: Frank Bates

Anne C. Ellis (MS, MSE)
Advisor: Robert Tranquillo

Timothy M. Gillard (Ph.D., ChE)
Phase Transitions and Fluctuations in Block Copolymer-Based Soft Materials.
Advisor: Frank Bates

Preston L. Grothe (M, MSE)
A Polymer Driveshaft for use in Orbital and Rotational Atherectomy.
Advisor: Russell Holmes

Eric D. Hinstala (Ph.D., MSE)
Analytical and Experimental Nanomechanical Approaches to Understanding the Ductile-to-Brittle Transition.
Advisor: William Gerberich

Issam M.H. Ismail (Ph.D., ChE)
Graphene Oxide - Towards A Comprehensive Characterization Scheme.
Advisor: Christopher Macosko

Mi Young Jeon (Ph.D., ChE)
Synthesis of Zeolite Nanosheets and Applications in Membranes and Adsorption Separation Processes.
Advisor: Michael Tsapatsis

Aisha T. Khaleel (MS, ChE)
Advisor: Eray Aydil
Co-Advisor: Chris Leighton

Maryam T. Khaleel (Ph.D., ChE)
Nucleation and Growth of Faujasite Zeolite Nanostructures.
Advisor: Michael Tsapatsis

Jessica Kissell (MS, MSE)
Advisor: David Flannigan

Jie Lu (Ph.D., MSE)
Mechanisms of Chain Exchange in Block Copolymer Micelles.
Advisor: Timothy Lodge

Ankit Mahajan (Ph.D., MSE)
New Approaches for Printed Electronics Manufacturing.
Advisor: C. Daniel Frisbie

Abhiram Muralidhar (Ph.D., MSE)
Equilibrium Properties of DNA and Other Semiflexible Polymers Confined in Nanochannels.
Advisor: Kevin Dorfman

Yunfei Wu (Ph.D., MSE)
Surface Electrostatic Properties of Organic Semiconductors.
Advisor: C. Daniel Frisbie

Yunlong Zou (Ph.D., MSE)
Realizing Efficient Energy Harvesting from Organic Photovoltaic Cells.
Advisor: Russell Holmes

Visualizing Core Orbitals, and Detecting Charge Transfer Using the TEM.
Advisor: Andre Mkhoyan

Tessie R. Panthani (Ph.D., ChE)
Structure-Property Relationships in Poly(lactide)-based Triblock and Multiblock Copolymers.
Advisor: Frank Bates

Sonja B. Riemenschneider (Ph.D., ChE)
Development of Pre-Vascularized Tissues Containing Aligned and Perfusable Microvessels.
Advisor: Robert Tranquillo

Qiong Tang (MS, MSE)
Advisor: Joe Zasadzinski

Zaifei Wang (Ph.D., MSE)
Producing Melt Blown Nano-/Micro-Fibers with Unique Surface Wetting Properties.
Advisor: Christopher Macosko

Huaiyu Yan (MS, ChE)
Advisor: Frank Bates

Lei Zhang (MS, MSE)
Advisor: Jeffrey Derby

Xin Zhang (Ph.D., MSE)
Synthesis, Characterization and Electronic Transport Properties of Thin Film Iron Pyrite for Photovoltaic Applications.
Advisor: Chris Leighton

Qiong Tang (MS, MSE)
Advisor: Joe Zasadzinski

Mathew A. Williams (Ph.D., MSE)
Experimental and Analytical Approaches to Understanding the Ductile-to-Brittle Transition.
Advisor: William Gerberich
Charting the course

CEMS graduate student Tom Fielitz dedicates himself to science and sailing.

For fourth-year chemical engineering graduate student Tom Fielitz, “This Was His Idea” is not only a fitting name for his hand-built wooden boat, but a reflection of the scientist inside the sailor; cultivating ideas, conducting research, and problem solving to achieve a goal. While Fielitz did not break a bottle of champagne across the boat’s bow to mark its maiden voyage on Lake Nokomis in September 2015, perhaps some good luck was achieved through a few pieces of wood on the boat which came from the crates in which Professor David Flannigan’s TEM microscope was shipped to the department. Fielitz further explains the process below.

Early inspiration

I grew up a short distance from Lake Huron, and like my father, have always been fascinated by water. There’s something magical about the personality and utility of water as a transportation medium - yes, it’s all H$_2$O, but there’s so much more that goes into it. My dad sailed a 21’ sailboat for years until I was born, so maybe it’s in my blood. We have a couple ponds on our farm, and I grew up sailing an old Sunflower sailboat that my dad bought in college - I have fond memories of going back and forth on that pond all summer long, and I still get that same thrill when I go out now. Woodworking for me grew out of a desire to create things that nobody had made before, combined with a deep admiration of the strength, beauty, and availability of wood.

Realization of a dream

I’ve always dreamed of building a sailboat, and I had some pretty specific ideas that allowed me to design and build it just how I wanted so that it would fit Alyssa (Alyssa McKenna, a fourth-year materials science and engineering graduate student) and me for weekend adventures around the cities. I love sailing, and wanted to own a boat so that I could go out anytime I wanted. I had previously built a small rowboat with my dad and sewed a sail for a canoe, so I was pretty sure I could do this. When I set out to do something, I usually start with the assumption that I have no idea what I’m doing, but I’m going to make it work anyway. Watching a boat slowly come together before my eyes was the most rewarding part, all the way up to the launch, because I was proving to myself that I could actually do it. I was so proud when it floated and sailed, and I’m looking forward to using it a lot this summer.

Setting sail

I would like to build at least one more boat in the near future, and I’m really interested in the idea of building a larger catamaran or mono-hull sailboat (~14-16’ long) so that we have more cockpit space and greater stability on the water. Boat building is something I definitely plan to keep doing, and that may branch into building boats for sale once I’m more confident in my designs and craftsmanship. After all, you can only build so many boats for yourself before you start running out of room or time to use them all!
Graduate Fellowships

Dedicated fellowship gifts sustain CEMS graduate programs.

The First Year Graduate Student Fellowship Initiative
Xuekui Duan, Ashish Jayamaran, Hak Rae Lee, William Nunn, Thu Phan, Ian Slauch, Diqing Su, Mathew Thomas, Jie Tu

Neal Amundson Fellowship in Chemical Engineering and Materials Science
Hongyun Xu

Neal R. and Shirley D. Amundson Fellowship
Hongyun Xu

James Andrews Fellowship
Athena Metaxas

Rutherford Aris Memorial Fellowship
Guo Kang Cheong, Sagar Udyyavara

Bill and Marcia Ball Fellowship
Nicholas Hampu

Frank and Janis Bates Research Fellowship
Zhengyang Liu

Laurence W. Booher Fellowship
Ryan Gnabasik

Phyllis B. Branin Fellowship
John Caputo, Brandon Foley, Bryan Voigt, Blake Wolf

Lap and Jody Chan Fellowship
Matthew Palys

Howard W. and Mary S. Cox Fellowship
Mathew Thomas

Ed and Betsy Cussler Fellowship
Hak Rae Lee

Erling A. Dalaker Fellowship
Aditya Bhandari

H. Ted Davis Fellowship
Alan Albrecht, Gregory Facas, Ryan Gnabasik

Gary and Helen Dowling Fellowship
Jie Tu

Arnie Fredrickson Fellowship Fund
Hannah Seo

Fridley Fellowship
Xudong Hang, Minchul Kim, Zion Lee, Meryl Lewis, Matheus Dorneles de Mello

Lynn Frostman and Mike Zum Mallen Fellowship
Diqing Su

William Warren Gerberich Fellowship in the Solid Mechanics of Plasticity and Fracture
Eric Hinstala, Claire Teresi

Herbert S. Isbin Fellowship
Hannah Seo

Kaler Family Fellowship in Chemical Engineering and Materials Science
Gregory Facas

Kenneth H. Keller Graduate Fellowship
Minchul Kim

Usha Kumar Fellowship
Matthew Carlson

Jan J. and Sofia Milner Laskowski Fellowship
Meryl Lewis

Chris and Kathleen Macsko Fellowship
Xuekui Duan

Materials Science Graduate Fellowship
Nezhueyotl Izquierdo

Robert V. Mattern Fellowship Fund
William Nunn

George Philippidis Fellowship in Biochemical Engineering
Minchul Kim

Peter and Gene Pierce Family Fellowship Fund
Matheus Dorneles de Mello

William E. Ranz Fellowship Fund
Johnathan O'Donnell

Sebastian C. Reyes Fellowship
Gokul Hariharan

Stephen J. Salter Fellowship Fund

L.E. and D.H. Scriven Research Fellowship Fund
Xudong Hang, Pedram Motallebnejad, Jyun-Ting Wu

Jacqueline and Richard Schmeal Fellowship
Pavlos Pachidis

Lanny and Charlotte Schmidt and Duane Goesch and Nancy M. Dickerson Fellowship
Xuekui Duan, Austin Miner

Nancy Scott and Kevin Gromley Fellowship
Ian Slauch

Bill and Triana Silliman Fellowship
Krystopher Jochen

Marvin S. and Norma V. Sivertsen Fellowship
Ian Suddard-Bangsund

Curtis M. and Joyce P. Stendahl Graduate Fellowship
Wentao Tang

Robert and Beverly Sundahl Fellowship
Johnathan O'Donnell

The Teletzke Family Fellowship
Mridul Yadav

Matthew Tirrell Fellowship
John Suddard-Bangsund

Pat Whitcomb and Patty Napier Fellowship
Johnathan O'Donnell
Learning beyond the classroom

CEMS undergraduates gain insight and experience through research opportunities.

When did you start to think like a scientist? Was it in childhood when you may have toyed with your first microscope, when you donned a lab coat and goggles to conduct your first experiment in science class, or perhaps when you landed your first “real” job? Many CEMS undergraduate students are already shifting their perspective and accelerating their scientific knowledge by conducting research.

Research 101

For Lindsey Borgeson (MSE ’18), there was no reason to delay destiny. Although just a sophomore when she started conducting research in Professor Chris Leighton’s lab, Borgeson wanted to enhance her learning for upcoming materials science courses in the curriculum. She will use her experiences to guide her to a research or industrial career.

Borgeson has had the opportunity to work on one of Leighton’s many projects in which the goal is to analyze the impact that both p-type and n-type doping has on the physical properties, such as electron mobility of semiconductors. Borgeson’s specific role so far has been to help prepare the doped semiconductor target in order for its physical properties to be examined and compared to the undoped semiconductor. Additionally, Borgeson has already experienced the benefits of her hands-on learning. “I’ve really enjoyed seeing the outcomes of several experiments that I’ve only ever discussed conceptually in class. It’s one thing to know that dopants can alter the properties of a material; it’s another to actually see those alterations and know that I helped with the process of doping the material,” remarked Borgeson.

Kevin Fox (ChE ’17) was similarly motivated to see real-world applications of his classroom learning in the lab. “It’s not enough for me to do something on paper; I want to know how it is being used to help people and how I can be a part of that. I also enjoy the challenge that research brings that requires scientific creativity. It’s not something that I have been able to learn in classes, so I am thankful to be able to have the opportunity to learn it through research,” said Fox.

As an undergraduate researcher in Professor Kechun Zhang’s lab since 2015, Fox works on the metabolic engineering of E. coli in order to produce valuable chemicals that are normally produced from petroleum methods. “By doing research in Dr. Zhang’s lab I have found a new passion in biochemistry and its application to chemical engineering problems. The research that I have done has helped me to decide to pursue a doctorate with an emphasis on biochemical research, specifically in an application to chemical engineering.”

Fox also extended his learning outside the bounds of Minnesota, completing a summer research experience in Dr. Dean Toste’s lab at the University of California-Berkeley. While there, Fox conducted research on catalytic chemical reactions in order to convert sugars into monomers.

Positive gains

For some undergraduate students, the motivation and inspiration to pursue research opportunities guides their educational and career paths in unique directions. Anthony Tabet (ChE ’17) began his scientific training
Anthony Tabet during his senior year of high school in Dr. Aaron Massari’s lab in the Department of Chemistry. At that time, he was intent on pursuing a career in the liberal arts and planned on majoring in philosophy and political science. But, during that year, he decided to take a chemistry course for fun. “I was incredibly fortunate to have a passionate and engaging instructor who ingrained a sense of curiosity and interest of soft materials in me—indeed, it was that class that led me to pursue a research position with Dr. Massari. My experiences in lab were enlightening and exciting, and the ability to work on projects related to polymeric materials for energy and other applications showed me how intellectually satisfying a career in research could be,” Tabet remarked.

Tabet is now working in Professor Chun Wang’s lab in the Department of Biomedical Engineering and has led a project that leverages a novel class of fluidic, hydrophobic polymers for drug delivery (read more about Tabet’s accomplishments on page six).

Tabet has also transformed his passion for research to help others and recently co-founded a public benefit corporation called CoCreateX to provide resources, infrastructure, and networking opportunities for young adults to collaboratively develop product ideas with the mentorship of more seasoned entrepreneurs to guide them to success,” Tabet remarked.

Stephanie Hart (ChE, Chemistry ’17) is also inspiring young women to succeed in science and engineering through her involvement with “Chemists in the Library” and “Energy and U” programs at the University. She has been using stimulated Raman spectroscopy to examine ultrafast structural dynamics driving singlet fission in organic molecules with applications to the development of photovoltaic materials with Professor Renee Frontiera in the Department of Chemistry. For her research, Hart has been awarded a Thomas Dubruil Memorial Award for Outstanding Achievement in Undergraduate Research by the Department of Chemistry, and she will spend the summer of 2016 as an Amgen Scholar at MIT.

“The most enjoyable part of my research experience has been the independence I’ve had with my project. The Frontiera Lab is a fairly new group, and as such, I’ve been able to take ownership of my project. This has pushed me to develop my skills as a spectroscopist and aspiring scientist,” said Hart.

In recognition of their exceptional research accomplishments, Hart and Tabet were named 2016 Barry M. Goldwater Scholars. The prestigious, competitive scholarship is awarded annually to outstanding students who intend to pursue research-oriented careers in math, natural sciences, or engineering. Both Hart and Tabet plan to pursue Ph.D. degrees.

Forward thinking

Recent graduates Connie Dong (MSE ’16) and Ryan Hool (ChE ’16) both cite their undergraduate research experiences as tremendous assets when applying to graduate schools. Dong will attend the University of California, Santa Barbara and Hool is headed to the University of Illinois Urbana-Champaign.

“My research experience has been the biggest influence on my future career goals, and the time I have put into research has helped me to gain knowledge and hands-on experience for many experimental techniques,” said Hool. Dong agreed, “My experiences in the lab helped me decide to pursue graduate school upon graduation because I found my research to be extremely fulfilling. I strongly believe that my research experiences also made me a stronger applicant to graduate school and provided me with the confidence to succeed.”

Achieving academic and career success seems evident and attainable for these determined, enthusiastic undergraduates. Through their research, they are not only pushing the boundaries of what is known in science and technology, but more importantly, discovering their own capabilities to lead purpose-driven lives.

Stephanie Hart
FACULTY SPOTLIGHT

Catalyst for success

Awarded the prestigious 2016 Ipatieff Prize, Aditya Bhan’s research is fueling changes in energy.

Aditya Bhan, Associate Professor

Associate Professor Aditya Bhan’s favorite aphorism is that “catalysts only exist under reaction conditions; they are materials otherwise.” Conditions have been seemingly perfect for Bhan lately, as he was awarded the 2016 Ipatieff Prize at the American Chemical Society (ACS) National Meeting and Exposition in March 2016. Bhan further explains his research and motivations as an academic scholar and instructor.

Energy impact

Simply put, an extensive set of reactions and chemistries underlies the synthesis of fuels and chemicals that are the foundations of modern-day conveniences. For example, nearly half a gallon of fuel is used per person on earth every day, and my research group examines how those chemistries occur on catalytic materials and how to improve them.

My research attempts to synthesize energy carriers and polymer precursors from non-petroleum feedstock while concurrently managing the environmental consequences of carbon use, which is one of the most pressing challenges of science, engineering, and society. My goal is to develop catalytic technologies that solve a key piece of this challenge by efficiently controlling hydrocarbon-based reaction pathways important in energy conversion and use, chemical synthesis, and environmental control. With these goals in mind, my research focuses on developing new catalytic conversion technologies for renewable biomass-derived feedstocks and activation of light alkanes that are major constituents of natural gas.

Specifically, my research group is interested in the mechanistic characterization of technologically-relevant catalytic processes in the petrochemical industry including methanol-to-hydrocarbons conversion, partial oxidation of olefins and aldehydes on mixed metal oxide catalysts, naptha reforming, and light alkane dehydrogenation as well as emerging applications in the conversion of biomass-derived lignin and sugar monomers to olefins and aromatics. My research is characterized by (i) experimental capabilities to examine the structure and function of real catalytic solids, (ii) the ability to apply these methods to a range of catalytic structures and catalytic reactions, and (iii) the ability to develop detailed mechanistic and kinetic models of these complex chemistries.

Research evolution

I was fortunate to work with companies during the course of my PhD and postdoctoral training, while having the opportunity to pursue basic science focused on detail-oriented work. My postdoctoral research resulted in two patents, which are licensed by BP Chemicals, and this theme of conducting research in “chemistry and catalysis with relevance” has continued to motivate me. Another significant research motivation for me is that chemical catalysis plays a role in almost all petrochemical processes, and the scale of this industry implies that one paints on a very large canvas. I hope to make similarly large-scale research contributions, while concurrently providing a nourishing, focused, and challenging learning environment, both in the classroom and in my research group.
Research in the heterogeneous catalysis field has thrived over the past decade and the reasons are two-fold: first, the feedstock for the petrochemical industry continues to evolve and diversify. This transformation in the feedstock, in turn, requires the development of new and improved catalytic formulations and requires scientists to assess the underlying fundamental chemistries and descriptors which allow solids to catalyze certain pathways efficiently. The second reason is the emergence and application of advanced characterization, synthesis, and computational chemistry tools, which has resulted in this field becoming highly interdisciplinary. My personal motivation remains the basic catalytic chemistry underlying large scale and often complex industrially-relevant chemical reaction processes. These research directions have emerged and evolved over the past nine years that I have been at CEMS as a result of my learning and that of my students, and collaborations with other faculty.

Teacher scholar

What I tell students in my class is that first and foremost I am a student of the subject and my goal and ambition is to learn and my job is such that I teach. The CEMS teaching model was critically important in my choice of starting my academic career at the University of Minnesota. The opportunity to team teach in the lecture-recitation format and obtain feedback from my colleagues, learn new topics as I rotate in and out of various classes, and to sit in classes taught by my colleagues, is truly unique to CEMS. My personal experience in each of those areas has been both educational and fun.

As academics, our scientific output is either students or research publications/patents, and I think we largely agree that our most valuable asset is the students. My research group, at present, is comprised of 14 graduate students and post-docs and two undergraduate students. We have been fortunate to have research support from both federal funding agencies, such as the NSF and DOE and the petrochemical industry, in particular The Dow Chemical Company. Our most significant scientific goal is to be aspirational in our research endeavors, and the CEMS community provides an excellent network of dedicated students and faculty members who share that commitment.

Lodge elected to American Academy of Arts and Sciences

Regents Professor Timothy P. Lodge is among 213 new members elected to the American Academy of Arts and Sciences (AAAS), one of the nation’s most prestigious academic honorary societies. The Academy honors remarkable men and women who have made preeminent contributions to their fields and the world. Members are leaders in the academic disciplines, the arts, business, and public affairs. The new class of AAAS members will be inducted at a ceremony on Saturday, October 8, 2016 in Cambridge, Massachusetts.

Lodge, who holds appointments in both the Department of Chemical Engineering and Materials Science and the Department of Chemistry, is one of the most productive, innovative, and influential polymer scientists in the world, focusing his research on the structure and dynamics of polymeric systems. He has published more than 350 papers on his innovative research and received numerous professional accolades. Lodge was recognized as a Fellow of the American Chemical Society (2010) and the Association for the Advancement of Science (2009). He has been awarded two of the most prestigious international awards in the demanding fields of both polymer physics and polymer chemistry—the American Physical Society Polymer Physics Prize (2004) and the American Chemical Society Award in Polymer Chemistry (2009). Few scientists in the world have claimed both of these prizes.
Gifts in action

Valspar Student Activity Fund creates immediate impact for student groups.

The Departments of Chemistry and Chemical Engineering and Materials Science are already benefiting from the Valspar Student Activity Fund, made possible through a generous gift from the Valspar Foundation. During the 2015-16 academic year, many undergraduate and graduate student groups were able to utilize Valspar funding for a variety of activities to enhance their learning and outreach activities.

Material Advantage

Elin LaBreck, outgoing president of the Material Advantage (MA) undergraduate student group, explained that the Valspar gift allowed their members to attend the 2015 Materials Science & Technology Conference in Columbus, Ohio. “For the very first time, our MA chapter was able to represent the University of Minnesota at the collegiate ceramic mug competition and compete against the six other universities in attendance. We entered a ceramic mug that was designed, cast, fired and tested by students. We learned so much from attending the competition and are excited to return in 2016! The funds supplied by Valspar will be very important to help us replenish our ceramic mug supplies as well as secure our travel plans for the 2016 competition,” said LaBreck.

Material Advantage has long been dedicated to outreach activities, especially in local schools to educate students about the materials science field and conduct experiments and demonstrations to promote the field. In January 2016, group members attended four large events at the Science Museum of Minnesota as part of the annual Science Fusion series, aimed to show young people of under-served communities career opportunities in science. In total, MA visited over 800 K–12 students during the past academic year, undoubtedly influencing future generations of materials scientists.

POLY/PMSE

This student-run organization affiliated with the ACS Division of Chemistry (POLY) and the Division of Polymeric Materials: Science and Engineering (PMSE) has provided an avenue for presenting technical material, discussing new ideas, and recognizing excellence in emerging polymer research areas for student, postdoctoral, and faculty audiences since its inception in August 2015. The chapter has added additional seminars and provided new networking opportunities that were not previously accessible to the graduate student community interested in polymer research.

With generous support from Valspar, the POLY/PMSE group has achieved many of its initial chapter goals, including facilitating seminars related to the field of polymers, organizing social events, and hosting career development and networking opportunities. In addition, the Valspar funding will allow the chapter to expand its offerings and host a speaker from a national lab in the upcoming months and support some students to attend the National Graduate Research Polymer Conference (NGRPC) being held at the University of Akron in 2016.

Annabelle Watts, a graduate student in the Department of Chemistry and POLY/PMSE treasurer, remarked, “The activities we have coordinated embody the goals set forth as a new POLY/PMSE student chapter here at the University of Minnesota, and we look forward to serving the interests of the graduate student community in the coming academic year.”

Joint Safety Team

The University of Minnesota Joint Safety Team (JST), a researcher-led organization in Chemistry and CEMS, focuses on improving the culture of safety in chemical laboratories through four main goals: compliance,
Paying it forward

Alumni establish enduring gifts to honor the legacies of those that inspired them.

Dr. Doraiswami and Mrs. Geetha Ramkrishna Fellowship in Chemical Engineering

Professor Doraiswami “Ramki” Ramkrishna and his wife, Geetha Ramkrishna, believe in the transformative power of education and established this fellowship in recognition of Professor Ramkrishna’s education at the University of Minnesota under the advisement of Professors Arnie Fredrickson and Henry Tsuchiya. Owing greatly to Professors Rutherford Aris and Neal Amundson for their mentorships, the Ramkrishnas have made this investment to ensure the preservation of mathematical modeling’s critical role in advancing the field of chemical engineering. Professor Ramkrishna obtained his bachelor of chemical engineering degree from University of Mumbai in 1960, and his Ph.D. in chemical engineering from the University of Minnesota in 1965. He and Professor Neal Amundson collaborated extensively, co-authoring numerous papers and a seminal text, “Linear Operator Methods in Chemical Engineering.” Following his Ph.D., he was an assistant professor for two years at Minnesota before returning to the Indian Institute of Technology Kanpur where he served on the faculty for nearly seven years. He returned to the United States in 1974 as a visiting associate professor at the University of Wisconsin, thereafter as a visiting professor at Minnesota in 1975 before joining Purdue University as a professor of chemical engineering in 1976. In 1994, he was appointed H. C. Peffer Distinguished Professor of Chemical Engineering. His connections to Minnesota remained strong; in 1988 he served as the second George T. Piercy Distinguished Professor, and in 2004 was nominated by Professor Rutherford Aris for an honorary doctorate of science, becoming one of only six chemical engineers to receive this prestigious recognition from the University of Minnesota. In 2009, Professor Ramkrishna was inducted into the National Academy of Engineering.

Tom P. Dennison

An extraordinary bequest from the estate of the late Tom P. Dennison [ChE ’68], will benefit the First-Year Graduate Student Fellowship. Mr. Dennison’s lifetime of generosity to the Department of Chemical Engineering and Materials Science exceeded $1 million to support graduate education, an endeavor vital to maintaining the department’s reputation of excellence and sustaining its mission to train future generations of outstanding engineers and scientists.

Future uses for Valspar funding may include first aid/CPR training and certification for at least one person in each lab or helping to fund flame-resistant lab coats or better eye protection.

Clifford Gee, Joint Safety Team president, is hopeful that the group’s efforts provide more than just an exemplary model of safety culture and actually have the potential to impact others more broadly. “Over the past few months, we have been contacted by several other universities interested in implementing a similar type of program to improve their own safety culture. We are excited for the potential to help provide safety resources and ideas to others and are thankful for the support from Valspar to continue to do so.”
“What can you do with a science, technology, engineering or math degree?” I asked. “Anything!” The voices of forty middle school girls (plus two boys!) in the Stratford School coding club roared their response. Yes, with a STEM education, especially a degree from the University of Minnesota Department of Chemical Engineering and Materials Science (CEMS), “anything” was the right answer!

Decades ago, I was fortunate to graduate with a BChE degree from the best chemical engineering program in the country. I didn’t know how great it was at the time. My undergraduate education, along with a Master’s of Management Technology degree, tremendous faculty support, and my association with CEMS and my fellow alumni, has taken me on an adventure through multiple states, industries and careers. The value of those CEMS educational and leadership experiences continues to amaze me. It is an investment that has sustainable returns.

Many people ask me how a chemical engineer ended up running private schools. It isn’t such a strange journey. I found that my engineering degree and volunteerism with the CEMS department helped me identify opportunities, set direction, assess financial viability, and ensure execution to capture growth. I have used these skills, but not in the typical chemical engineering process industries. My career has challenged me with learning moments as diverse as exploding pallets of cornbread, salsa surging the wrong way through a pigeon pump (yes, it does what you think), food sticking to extruders, retaining walls that wouldn’t retain, and buggy software and buggy facilities. I have been humbled putting my CEMS skills to the test.

“The value of my education and leadership experiences in CEMS continues to amaze me. It is an investment that has sustainable returns.”

— BARBARA TIMM-BROCK

Armed with my University of Minnesota degrees, I have been privileged to lead innovation and growth as a senior executive in the retail food industry, restaurant business, facilities services, contract services for universities and prep schools, tutoring, franchising, and now as Chief Operating Officer for Stratford School, a private Preschool through 8th grade leader in STEM education, where we develop future innovators, creative problem-solvers, and leaders.

The consistent theme in my life has been education. I am, as we all should be, a lifelong student and teacher. You do not need a teaching degree, just a passion for students and learning and a growth mindset. I have volunteered in an educational capacity throughout my career, starting in my 20’s when I served as a co-curricular instructor with 4th and 5th graders, hoping to keep the flame of scientific and mathematical curiosity burning in girls. We are still on that journey and need every CEMS alumnus to engage in this as a parent, volunteer and teacher. We need a lot more engineers, scientists, and coders!

At the time I entered the CEMS program, more women than ever were choosing engineering as a major. Sadly, the numbers haven’t increased - in fact, many programs have fewer women enrolled since those heady days. We had the Society of Women Engineers to support us, where I gained leadership skills as a student officer. My own engineering society, AIChE, was open to female leadership; I was elected president of my student chapter. Through the thoughtful and supportive guidance of our chapter advisors, Professors Matthew Tirrell and Klavs Jensen, I grew as a leader and a person while receiving the best chemical engineering education available. Professors Ed Cussler and Wilmer Miller each employed me as a student researcher, and Ken Valentas inspired me. All of this guidance led me to start my career as a process engineer in the food industry.

My experience was so positive that soon after graduation I became a lifetime member of the ITAS Alumni Association, now known as the CEMS Alumni Association. As a member, I have gained leadership skills as a director and president-elect of the association, and through my work on the board of the nonprofit CEMS Foundation, we have continued to support the education of future leaders. I am, as we all should be, a lifelong student and teacher.

Barbara Timm-Brock
Society. I soon joined the board where I helped develop the mentoring program. Later in my 20’s, I became president of that organization and worked with our board to develop the first strategic plan. People believed in me and supported me in these growth experiences; they were fueled by my CEMS roots. So when I was asked if I wanted to contribute as a volunteer for Campaign First, a dedicated effort to raise $20 million to fund first-year graduate student research through named fellowships, I said “Heck yes!” I felt honored to support a department and people who had given so much to me. During the campaign, it was thrilling to speak with alumni spanning many decades and many regions of the country, who had widely varying careers. Many also said “Yes!” to Campaign First and with that support, CEMS has prospered. We have now reached the 10th anniversary year of Campaign First, and we can’t rest on our laurels.

Those Stratford School middle school coders will compete in a global marketplace, as does the University of Minnesota Chemical Engineering and Materials Science department. I will continue to contribute to ensure CEMS stays competitive and that degree keeps its first-class value. I feel privileged to continue to be a part of such a great department and group of alumni who continue to come together to keep CEMS first - in the world and in our hearts.

Mark your calendars
2016 AIChE Annual Meeting
Meet the Presidents
Monday, November 14, 2016
10:45 a.m. - 12:15 p.m. PST
Hilton San Francisco Union Square, Grand Ballroom A

University Presidents with degrees in chemical engineering will address issues impacting higher education, and in particular, engineering education and professions. The intent is to inform and stimulate a broad audience – academe, industry, and national laboratories – based on the unique perspective of a President.

Featured speakers:
• John Anderson, President, Illinois Institute of Technology (retired)
• Paul Johnson, President, Colorado School of Mines
• Eric W. Kaler (Ph.D. ChE ’82), President, University of Minnesota

Alumni and Friends Reception
Tuesday, November 15, 2016
Time and Location TBD

CEMS alumni and other friends are encouraged to attend, especially those living in the San Francisco area.
Every journey starts with a single step

A student research project ultimately guided G. Charles Hann’s (ChE ’45; MS ’51) career path.

One of the best-kept secrets in Minnesota is the consistent, prominent academic ranking of the University of Minnesota’s Chemical Engineering and Materials Science (CEMS) department. Organizations that evaluate engineering academic programs nationally and internationally annually place CEMS near the top (for example, according to the 2017 U.S. News and World Report, chemical engineering tied for second and materials science and engineering tied for 19th in the nation).

The reason, of course, is directly traceable to the vision and leadership of former department head Neal R. Amundson. I first met Neal when I was an undergraduate student in the early 1940s. He was a graduate student and an instructor in the department.

When I returned to attend graduate school in the fall of 1946 (after serving in the Navy in the South Pacific), Neal, having by then earned his Ph.D., was on the faculty. In those years, it was the habit of a group of graduate students to gather for lunch in one of the laboratory spaces. Neal, as a young faculty member (then, perhaps the youngest), would join the noon “talk sessions” from time to time.

My research project equipment was located along one wall in the large Unit Operations area of the department, which was located in the basement of the Chemistry building [now Smith Hall]. I was doing a fluid mechanics study with some interesting mathematics content. Neal would often stop by to chat informally and to quiz me about my work. As I reflect on that period, I suspect that he, an exceptional mathematician, must have been somewhat amused, if not bemused, by the extent of my ignorance.

After completing most of the required course work, and having delved well into my research project, I was beginning to question whether it had sufficient substance for a Ph.D. I have to admit that I chose it largely because the technology, which had played a very significant role in the production of high octane aviation gasoline during WWII, was then being highly publicized. Hardly a good reason.

Discussions with my advisor, Professor Art Stoppel, were continuing along this line when a new factor developed. One of the other faculty members [Professor Ed Piret] was, unbeknown to me, then engaged in consulting work for 3M Company (“Minnesota Mining and Manufacturing Company” as it was known at the time). He started dropping by my work area with some regularity, and questioning me about my project. While I was flattered by the attention, of course, I had no idea [and never learned until later] why he was doing so.

After some months of this, he asked me if I would be interested in talking with Minnesota Mining [or just “Mining” as many then called the company]. He told me only that he believed the company might be interested in what I was doing.

Ultimately, I agreed to do so, and within a few weeks he had arranged an appointment. I first met with the leader of one of the sections of the company’s Central Research department. This led to two subsequent visits, during which I was introduced to the head of Central Research, the head of one of the divisional laboratories, a divisional vice president [who later became president of the company], the engineering vice president, and several others. I was quizzed about my research project, but told nothing about the nature of the company’s interest.
Shortly after my third visit (in the fall of 1948), I received an attractive job offer to work under the Central Research section leader with whom I had first met. After discussing it with my advisor (and with the senior faculty member who had introduced me, with my wife, of course, and others), I agreed to accept.

I decided I would add only a MS degree to my BChE (Neal was a member of the examining committee before which I defended my thesis) and join “Mining” in January 1949. To avoid anything that might possibly be considered confidential, I shall not reveal any specifics about my 3M job, but, because it was such a great learning experience, will describe what happened.

When I reported for work, I quickly learned that I would be assisting in the development of a new composition of matter having very unusual, but essential, physical and chemical properties in an area of technology with respect to which I had zero prior experience (but, in which, the Ph.D. section leader was a recognized national authority)

Then, assuming this undertaking is successful, I would then be expected to employ my graduate school project technology to design, construct, and operate, a lab scale (or small pilot plant) operation capable of producing the new material. By then I clearly understood it to be an essential component of an envisioned new product for one of the company’s emerging, and rapidly growing, product divisions. In other words, my possibly ill-advised, but serendipitous, project choice had led directly to the job.

I would be doing much of the same kind of work required to earn a Ph.D., except that I would be paid a salary for doing it and, as it turned out, have my name on some patents. To summarize my three years of work, the result of the first phase was a complete success, and the pilot-plant operation for production of a crucial new-product component was designed, built and operated exactly as required. The envisioned new product was unquestionably an outstanding technological success. However, for reasons not originally foreseen by the company’s management, the new product itself turned out to be an utter failure in the market place. For a then newly-minted chemical engineer, it was an important learning experience. The technology that I was hired to bring to the company, while never used for the new product, has been employed in the production of other products. This, of course, was another important learning experience.

With advancement, first in Central Research then in two of the company’s operating divisions, and having received an offer for overseas experience in the International Division, I seemed to be progressing. It was then, after seventeen years, that I received a job offer that resulted in my leaving 3M Company (as it had become known). My decision had nothing to do with 3M’s very successful manufacturing and marketing operations, nor my continued extremely high regard for the company. I was recruited by Apache Corporation, a small, and soon-to-be NYSE-listed, independent petroleum production company to employ my chemical engineering (or “process engineering”) training in a field of endeavor outside 3M’s area of interest: i.e., large scale non-traditional project financing. But, that is another story.

After twenty years with Apache Corporation, I retired as a vice president, at age 65 [27 years ago], and with some associates established and became president of Norwood Capital Group, Inc., a small specialized project-financing company with a focus on small businesses. It was not until after I had left the University that I learned how the chemical engineering undergraduate curriculum had been completely changed by Neal Amundson’s mathematics imprint. While his genius may have been evident, but not fully appreciated at the time I knew him, being among Neal’s early acquaintances is a cherished memory.

Do you have an interesting historical perspective on the department or a lifetime of memories to share? We’d like to feature you “In Retrospect.” Please contact us (612.624.0836 or cemsalum@umn.edu).
1988

**Jeff Schwarz** (ChE ’88).

I reside in the St. Croix Valley of Wisconsin with my wife Sharon and sons Zam and Zeke, and I have designed and built public wastewater treatment and conveyance systems for the Metropolitan Council in the Twin Cities for almost 20 years. I play guitar with a skiffle band called Woodshop (www. Woodshoprock.com) and recently published a novel called Karl and the Kooltones under the pen name JS Quelch, available at Amazon.com. Contact me at woodshopmail@comcast.net if you would like to book the band or purchase a signed copy of the book.

1990

**Raj Melkote** (Ph.D. ChE ’90).

After 2.5 years with Honeywell’s PPE division, I recently joined Brooks Automation in Chelmsford, Massachusetts as Senior Director of Cryogenics Engineering. In this role, I am responsible for R&D and product development in vacuum and chiller systems [as cold as 4K] for a variety of applications. My wife Gita and I are going on our 9th year in the Hartford, Connecticut area, but will likely relocate to the Boston area later this year. Our only daughter, Ashvini, was accepted by the University of Minnesota but, eschewing a chance to follow in her dad’s footsteps, will be joining Boston University this fall as a freshman in Neuroscience. I’m proud to say that Gopher apparel does dominate her wardrobe, however.

I’m pleased to share a memory from my days in CEMS. The picture shows a number of us from Professor Klavs Jensen’s group. We were all attending the AIChE conference in Washington, D.C. in November 1988, and arrived early to take in some sightseeing. From left to right: T.J. “Lakis” Mountziaris (postdoc; now on the UMass faculty); Kostas Giapis (Ph.D. 1989; now on the CalTech faculty); Mark Ellis (Ph.D. 1989; now with 3M); and the late Manoj Dalvie (Ph.D. 1989).

1990

**Mirta I. Aranguren** (Ph.D. ChE ’90) and **Jorge F. Gonzalez** (Ph.D. ChE ’90).

Shortly after leaving Minnesota, we became Professors in the Department of Chemical Engineering, in Mar del Plata, Argentina. Mirta is now the head of the Ecomaterials research group and Jorge is head of the Biochemical Engineering group. Our kids, who are not really kids anymore: Pablo (26), Maria Belen (24) and Juan Manuel (20) keep doing well. This year, we were delighted to receive the visit from CEMS Professor Chris Macosko and his wife, Kathleen. We had a great time going around our city, giving them a taste of our seafood and our “asado” (the Argentinian barbecue). Their visit revived our desire to visit Minnesota!

2000

**Matthew McGee** (ChE ’00).

In January 2016, my wife Julie and I celebrated my retirement after 20 years of service in the Army National Guard. After three overseas deployments, graduate school, seven household moves, four kids in five years (the oldest is now seven), and now a one-year-old puppy, she received a nice award and some well deserved recognition there from the Pentagon. We reside in Chanhassen, Minnesota. I work for Mayo Clinic Health System as a physician assistant in the emergency room in Mankato. I have been practicing for six years. I took additional training and
recently passed the national certifying exam for physician assistants in emergency medicine. I am enjoying those extra weekends away from drill every month now... cleaning the house!

2016

Jackson Baril [ChE ’16].

My most memorable moment was when Professor Dorfman administered his last Numerical Methods final exam, and then walked around disappointingly as he watched us fail to answer almost any questions fully or correctly. I also enjoyed playing intramural volleyball since fall of freshman year. In August, I will attend the University of Minnesota Medical School here in Minneapolis to earn my M.D. I’m most excited for a relaxing summer break!

I’m also looking forward to anatomy lab and exploring the various medical specialties and career paths. In five years, I hope to be in a surgical or family medicine residency program in a new city!

Baril was one of two featured student speakers at the College of Science and Engineering Commencement on May 13, 2016. Here is an excerpt from his speech:

One of my most challenging moments was during finals week the fall of my junior year. I was excited to be in the thick of the chemical engineering program, learning the core chemical engineering knowledge my fall semester before I would put it into practice for the remaining three. It was also then that I decided that I would apply to medical school, so that tough grading curve started to matter even more. Despite my focus, I failed a final exam. And this wasn’t the, “Oh I failed it” that some people say when they get a C on an exam; I actually failed and got a 42% when the average was well above that. My heart fell, stress came crashing down on me from everywhere, and I had three more finals to go!! Honestly, I thought my dream of becoming a physician was being brought down by one bad day and one bad test because for some reason, I was drawn to this crazy major.

It was then that my good friend, Heather, pulled me back from the verge of tears. She told me it would all be okay even though I wasn’t sure she even knew that and got me to focus on studying for my remaining exams. She also – and this was the key – gave me chocolate! I finished the semester strong and still passed all of my classes with a solid C+ in Thermodynamics, and I owe a lot of that to Heather. Class of 2016: who was your Heather? I want you to think about the people who never doubted you for a second: the professors and advisors guiding your way; your parents, guardians, friends and family sitting in those seats; or the friends who were on that same journey beside you? Whoever it was, we all had someone in this arena that cared for our best selves even when we couldn’t see the person they saw in us. I hope some of the connections you formed here last a lifetime, but for those that don’t, just remember how they helped you and how you can be that same lifeline for someone else.

Ladies and gentlemen, we’re all headed in different directions after today, but we all share one thing in common: we are all now official members of what is called, the “scientific community.” It’s been a tough road, but I think we’ve earned that membership, and all the privileges that come with it. For it is the scientific community that determines what chemical reactions and materials airbags should use, builds our informational, power, and physical networks that connect our world, and it’s a community that creates and discovers life-changing and lifesaving technologies to better our society. But the role of the scientific community goes beyond discovery and creation, a fact that I think many overlook and one that doesn’t register with most people when you tell them you’re a scientist, mathematician, or engineer. For it is you, and only you, that fully understand the technology and processes we work with. So it is you, and only you, who can be the arbiters of technology who decides what is safe and ethical. Take process engineers, there will be some time where you want to increase yields or production rates which could easily be done by increasing a reactor’s set point temperature, but remember, no matter what external pressures you face, as a process engineer you know to think about the pressure that matters: the one inside the reactor. That’s why only you can make that important and informed decision that we know involves the safety of your equipment assets and most important assets: humans. I bet starting out you had no idea that your science, math, or engineering degree makes you a judge for things like that, but I hope your integrity will guide you.

Now I know for some of you this next part is hard to hear, but you’ll likely be working closely with members of the other colleges here at the U despite our friendly rivalries. But remember this is to your advantage, because the best scientific community is one that works well with others. So, Class of 2016, keep building on one another, and go out and teach others. As you stand on the shoulders of giants, including the U of M class of 1966 alumni that are here with us today, you may feel scared and uncertain like me, but remember that your life is beginning again. That doesn’t mean everything before today hasn’t mattered – quite the opposite, because of your work you are now an official member of the scientific community, and I can’t wait to see what we accomplish together.

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**Ryan Davidson Chan** [ChE ‘16].

Despite the humbling scores, sleepless nights, daily adrenaline rushes, and the constant fear of failing a class, it’s the perseverance and grit of my fellow chemical engineering classmates that I’ll never forget. Rain or shine, we can get the job done. I’m thankful for the training that our professors and instructors gave to us. They’ve made sure that we’ll be successful in anything we attempt to take on. I’ll be attending graduate school here at the University of Minnesota, and I’m most excited to spend holidays not studying for exams. In five years, I hope to catch up with my friends in chemical engineering and perhaps work alongside them.

**Connie Dong** [MSE ‘16].

Some of my most memorable experiences are using the Charpy impact hammer in Materials Properties lab, 3D printing a 3D printer for a design project in Materials Processing, and demonstrating a superconductor at the Science Museum with Material Advantage! I’ll be attending graduate school at the University of California, Santa Barbara for materials science. I’m most excited to be living in Santa Barbara for graduate school since it’s right near the ocean and is gorgeous there!

**Ben Jones** [MSE ‘16].

Though no single event ranks highest, my time in the small MSE department is filled with memories of the personal care and attention of passionate faculty. It has meant a lot to me to be recognized by my professors and given time and a half by them when I need it. Additionally, the hands-on lab experiences and the variety of experiments that we get to do as undergrads has greatly developed my passion for materials science. For at least one year after school, I will be working with The Navigators, a Christian ministry. I will be part of a program called EDGE Corps and focus on my personal development and engaging others. After this, I am still unsure; I may continue in the program for the typical second year or seek employment in industry.

I am most excited to be done with homework and to start a family. The only thing that I am somewhat close to being certain on in five years’ time is being married [in January 2017]. Beyond that, I am trusting God that I will be where I need to be, whether it is in ministry or as a materials scientist in industry or pursuing an advanced degree (all reasonable options).

**Ryan Hool** [ChE ‘16].

My most memorable experiences in CEMS include the close friends I made as we worked through the rigorous coursework, and my research in Professor Leighton’s group. I will be starting my pursuit of a Ph.D. in materials science and engineering at the University of Illinois Urbana-Champaign, where I’m most excited to delve more deeply into research and Christian ministry in this new environment. After completing my Ph.D., I’ll most likely work in industry or at a national laboratory to research semiconductors.

**Priyanka Ketkar** [ChE ‘16].

My most memorable experience is the extent to which I bonded with all of my classmates. I feel like I worked well with my classmates and learned from them on an academic level. In addition, I also made lasting friendships beyond the academic setting. Upon graduation, I will be attending graduate school at the University of Delaware. I’m most excited to apply what I learned to solve real-world problems. While I feel that my undergraduate courses developed my skills, I spent very little time during my undergraduate years contributing to solving problems in the world. I am interested in renewable energy or energy storage research, and I am excited that I can finally use the skills I’ve developed to directly contribute to bettering those technologies and hopefully making a positive impact on the environment. Moreover, I am interested in being able to work intimately with my research topic of interest, as I really enjoyed this during my undergraduate research experience. I would ultimately like to work in industrial R&D on some sort of renewable energy, battery, or fuel cell technology.
Noumon Munir [MSE ’16].

The design projects during senior year were memorable because I was able to apply all the knowledge and experience I had learned in my previous classes to those projects. A lot of the topics we learned sparked my interest in additional learning opportunities or possible career options. I’m considering taking the Fundamentals of Engineering (FE) exam in the fall. I might also pursue a Master’s degree in the future.

Wenshi Zhang [ChE ’16].

As an undergraduate student, I learned a lot, but slept little. I’ve made a lot of valuable connections for the future. I will never forget all the nights I stayed up for Unit Ops reports and having to run a unit after three hours of sleep. Upon graduation, I will be working as a chemical engineer at ExxonMobil Corporation in the Chemicals division. I’m looking forward to applying my engineering knowledge in a real-world setting and conducting hands-on engineering. I’m excited to live as an adult and not worry about taking exams or turning in homework. In the future, I’d like to work with pilot plants and scale-up processes. I want to analyze pilot plant data to see what problems they would face during the scale-up process.

Professor Raul Caretta hosted a tour of the Unit Operations Laboratory for CEMS alumni participating in the College of Science and Engineering Golden Medallion Society Reunion, including Gene Brumm (center) and Rich Hokanson (right).

In Memoriam


Robert V. Mattern [ChE ’44, Ph.D. ’52] passed away on April 23, 2016. After earning his degree, Mattern enlisted in the United States Navy and served in WWII. He then returned to the university to earn his Ph.D. and had an illustrious career with Shell Oil Company. After retirement, he was a dedicated American Red Cross volunteer for more than 19 years. Mattern was a tremendous philanthropist, establishing the Robert V. Mattern Fellowship and Joan Mattern Scholarship (in honor of his late wife, Joan) to support CEMS students.


Donald H. Smith [ChE ’44] on December 14, 2015.

H.V. Venkatasetty on February 14, 2016. Dr. H.V. Venkatasetty, a well-known electrochemist, passed away at age 87. Dr. “Setty” as he was known to his colleagues, spent 30 years of his career at Honeywell Research Center and retired as Senior Fellow. Later, as Research Associate of Chemical Engineering and Materials Science, he developed electrochemical microsensors for the Navy and for NASA. Venkatasetty worked in CEMS with Professor William H. Smyrl and will be deeply missed.
UPCOMING EVENTS

Join Us!
CEMS Homecoming
and
25th Class Reunion for Ph.D. Alumni ('89, '90, '91, '92)
Saturday, October 22, 2016

CEMS Homecoming Breakfast
8:30 a.m. to 10:30 a.m. at Amundson Hall

Homecoming Football Game
11:00 a.m. at TCF Bank Stadium

More information forthcoming. Please contact cemsalum@umn.edu to express interest in these events.