FALL 2019
GRAND FORKS, NORTH DAKOTA

Kinetics

THE UNIVERSITY OF NORTH DAKOTA
CHEMICAL ENGINEERING NEWSLETTER

Chemical Engineering

CHAIR'S MESSAGE

FRANK BOWMAN
ASSOCIATE PROFESSOR

Hello alumni and friends of UND ChE. It's time for another edition of *Kinetics* and we hope you enjoy reading about all the great things that have happened with the department this past year.

After a few years of sabbaticals, retirements, and leadership changes, we had more of a normal year. It was wonderful having the entire ChE faculty and staff team return intact with everyone together on campus. We are excited that after working as a temporary Instructor for a year and a half Dr. Beth Klemetstrud is now a tenure track Assistant Professor. We look forward to her contributing to the department for years to come. Once again we had a near record graduating class with a total of 45 students receiving their BSChE degrees. And as is typical we continue to adapt our curriculum to better prepare students for the challenges of a ChE career. This year we will be adding a new "Computing Tools for Chemical Engineers" course to the freshman year to help students begin to master the software engineers use for problem solving and communication.

Even our winter weather was "normal" (for North Dakota) with numerous big snowstorms leading to multiple campus closures and some

(Continued on page 2)

Join UND ChE On LinkedIn

We have a UND Chemical Engineering group on LinkedIn. This will allow our alumni to connect with one another and to get the latest updates from the department. We will also use this site to post job announcements for alumni and students. Join now and find out what over 350 of your fellow ChE alumni are up to!

To join, go to www.linkedin.com and search for "UND Chemical Engineering" under groups.

QUIETLY COMPUTING EXCELLENCE: CHE'S GAUTHAM KRISHNAMOORTHY

Dean Hesham El-Rewini revived a dormant College of Engineering and Mines (CEM) honor last fall, the Olson Professorship. The Professorship is awarded to a mid- or senior-career member of the faculty based on the following criteria:

- Proven research abilities as evidenced by external funding, publications, presentations, etc.
- A proven teaching record as evidenced by innovative teaching/learning methods, course development, effective delivery methods, student mentoring, etc.
- Good citizenship and active service in support of department, college, university and community activities

After reviewing nominations from across the college, it was clear to the selection committee that the honor should go to ChE's **Gautham Krishnamoorthy.** Dr. Krishnamoorthy was nominated by Department chair **Frank Bowman.**

Originally hired as a non-tenure track assistant professor in 2009, Dr. Krishnamoorthy quickly established his capabilities as both a researcher and teacher. In 2011 he was named the Ann and Norman Hoffman Assistant Professor of National Defense/Energetics.

"We were very fortunate to be able to fund Gautham's original position from soft money resources", recalls fellow ChE faculty member **Wayne Seames**. At the time we were looking for someone with design experience so that I could devote more of my time to large SUNRISE grants we

(Continued on page 3)

FRANK BOWMAN, CHAIR AND TOM OWENS ASSOCIATE PROFESSOR

(from pg. 1)

spring flooding.

My teaching and research continue to move forward. I taught ChE 201 ChE Fundamentals once again in both the fall and spring. This summer I developed a new fully online version of the course that is being offered for the first time this fall. Now our distance students won't have to watch video of on-campus students working together on problems but can have a guided, more interactive problem-solving experience of their own.

My research efforts have made good progress this year. PhD student Carlos Bucaram completed a set of atmospheric model simulations looking at air quality in ND and the upper Midwest. We should have a paper coming out soon describing those results. We just finished another year of our NSF-sponsored REU program [see pg. 6], with a total of 10 undergraduate students from all across the country working at UND on interdisciplinary research projects with faculty mentors from ChE, Chemistry, and Atmospheric Sciences. I've also continued to be involved with K-12 STEM education research, wrapping up a 3 year grant looking at training to help middle and high school teachers provide engineering problem based learning. That work has led to some new connections with faculty in UND's Teaching & Learning program, with whom I'm working on several related research proposals.

At home, the Bowman household has shrunk a little, with two children now in college. Ryon is in her last year of nursing at BYU. And I was pleasantly surprised to get the following text from Allie in her first year at Clarkson: "Hey so I'm thinking of switching my major to ChE. What do you think?" We have three kids still at home, one each in high school, middle school, and elementary. And that means trips to band, speech, basketball, tennis, and track events. Alisa is now a licensed social worker, with a new job that she absolutely loves as a school social worker for the Grand Forks Public Schools.

Best wishes to all of you! Please keep us posted on your accomplishments and stop by anytime you are in the area. We love to hear what you've been up to! «

UND AICHE STUDENT CHAPTER NEWS

by Andrew Dockter, 2019 UND AIChE Student Chapter President

UND's student chapter of the American Institute of Chemical Engineers had another successful school year of events, travel, and outreach. Many UND students participated in this year's AICHE Regional Student Conference at Colorado School of Mines in Golden, Colorado. Students had the opportunity to network with students in our region, as well as discover research being done by fellow students. Thank you to the support from all our Alumni that helped make the trip possible. Our ChE Jeopardy team did very well at regionals, we came up one question short, in what was a heated match to advance to the finals.

UND Students at the AICHE Annual Student Conference, from left to right: Kaylee Smith, Paige Marcy, Fatmata Coomber, Andrew Dockter, Mohamed Mohamed

The ChemE Car team also worked diligently to develop a car. Unfortunately, the car could not be completed in time for competition. The team hopes to compete in next year's regionals, with the help of incoming freshman. The UND student chapter would like to thank everyone who donates and supports the ChemE Car team. If you would like to sponsor the UND team, please contact our finance officer at sarah.hamel@und.edu. Members of our chapter also attended the national Annual Student Conference in Pittsburgh and participated in workshops for career development.

AIChE members also supported PowerOn!, CEM's K-12 outreach program that continues to be involved in Grand Forks community's events to get local kids excited about STEM. We also had the pleasure of hosting several different companies for info sessions with our engineering student body. We would like to thank all our Alumni who took part and came to speak. If you would like to speak to UND students at our monthly AICHE meetings, please contact me at: Andrew.t.dockter@und.edu.

Finally, to finish the year and keeping with tradition, our chapter held our annual senior roast at the Boardwalk Bar and Grill to celebrate all the seniors completing plant design and graduating from the program. This past year was filled with exciting events and we are excited for the opportunities going forward.«

LEAD STORY CONTINUED

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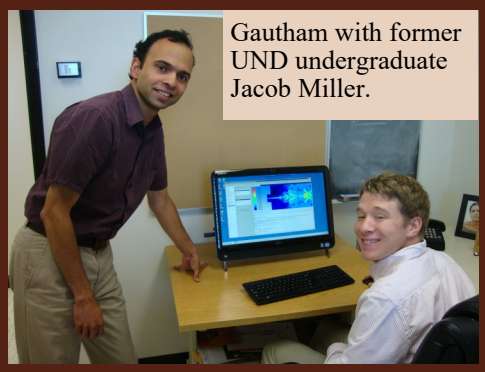


Gautham with former UND undergraduate Jacob Miller.

had received at that time," Seames continued. "The selection committee told us that they had two outstanding candidates (the other was Dr. **Robert Wills** who served on the faculty from 2009-2015). The faculty all took a deep breath and decided to find a way to fund both positions. Fortunately, the Hoffman's came along with their generous donation at just the right time so that we could convert Gautham's position to a permanent tenure-track position."

Their faith in Dr. Krishnamoorthy was not misplaced. He has established himself as one of the most productive researchers in the department. He has been awarded over $2.1 million in research funding and published 27 peer-reviewed research papers based on work conducted at UND. Eleven of these papers had graduate students as co-authors while 7 had undergraduate co-authors.

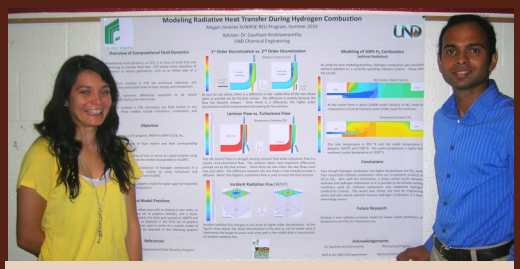
Just this past year he has been awarded two grants from the Department of Energy valued at over $550,000 [see insert below] to develop models of next generation coal combustion systems.

Gautham's research focus is to develop and use computational fluid dynamic (CFD) techniques efficiently and at appropriate fidelities to tackle a fairly broad-range of industrially relevant. multi-physics flow problems. He accomplishes this by developing performance and modeling enhancements to open-source and commercial software and by utilizing uncertainty quantification, surrogate (reduced-order) modeling, and other data driven paradigms. He involves both undergraduates and graduate students in his research group.

Gautham has also proven to be one of the top teachers in the department. He has taught numerous undergraduate and graduate courses, including the development of three new graduate courses that have formed the basis for our Concentration in Energetics, and a new undergraduate molecular thermodynamics course. He works to continually improve the quality of his teaching and has incorporated innovative content and learning methods into both his courses and other courses across the department and college.

Dr. Krishnamoorthy is also a strong contributor to the department and college in many other ways. For example during the 2017/18 academic year he took on a much heavier teaching load to accommodate the absence of **Yun Ji,** who was on developmental leave. This was especially difficult because of his growing research commitments, but he shouldered the extra work without complaint. At the same time he continued to serve as Graduate Director, and assisted with numerous other service activities including academic advising, hosting prospective student visits, and serving on College and University committees.

Olson Professorship evaluations were conducted by the college's four Chester Fritz Distinguished Professors including ChE's **Michael Mann** and **Wayne Seames**. Both Mann and Seames were prior recipients of the Olson Professorship award under former CEM Dean John Watson.«



Gautham Krishnamoorthy with former REU student Megan Jimenez, one of the many undergraduate students he has included in his research.

KRISHNAMOORTHY AWARDED TWO COAL COMBUSTION MODELING GRANTS FROM THE DEPARTMENT OF ENERGY

ChE's Gautham Krishnamoorthy was awarded grants from two DOE coal research programs this past year. The aim of the first project, "An Integrated Approach to Predicting Ash Deposition and Heat Transfer in Coal-Fired Boilers" is to develop an advanced online technology to predict, monitor, and manage fireside ash deposition in coal-fired boilers thereby allowing for more efficient operations under a range of load conditions. Functional relationships for predicting ash deposition and nitrogen oxide formation will be developed using CFD simulations and integrated into real-time prediction and monitoring tools that can be installed in power plants.

In the second project, "A Multiphase Modeling Framework for Second Generation Post-Combustion Carbon Capture Systems ", Gautham and his students will develop a predictive capability targeting CO_2 absorption enhancement during the scale-up of 2nd generation post-combustion carbon capture technologies. Specifically, CFD simulations in structured packing configurations will be carried out to arrive at absorber configurations and solvent flow rates that enhance mass transfer rates while minimizing pressure losses and liquid hold-up within absorbers. «

Brian Tande Takes CEM Interim Dean Job

Longtime ChE faculty member says it's full speed ahead while permanent successor is sought

Extracted from a 4/9/19 UND Today story by David Dodds, University Relations.

UND Vice President for Academic Affairs and Provost **Tom DiLorenzo** appointed **Brian Tande** to serve as interim dean of the UND College of Engineering & Mines (CEM).

Tande took over for **Hesham El-Rewini**, who left in July to become the Provost at Marymount University in Arlington, Va.

"I'm delighted that Dr. Tande has stepped up to lead the College of Engineering & Mines as interim dean," DiLorenzo said. "He's an innovative collaborator and natural entrepreneur who brings a wide array of academic and private-sector experience in the science of engineering, research and commercialization. And much of that experience was honed right here at UND."

"I also want to thank the faculty of the College who met with me to discuss how to proceed in selecting an interim dean. Their input and recommendations were central to Dr. Tande's selection."

Outstanding professor

Tande, a Stanley, N.D., native holds BS chemistry and BSChE degrees from the Univ. of Minnesota and a PhD in ChE from the University of Delaware. He spent the 2018/19 academic year serving as the CEM associate dean. He's also director of CEM's Grand Challenge Scholars program, and served as interim director of the School of Electrical Engineering and Computer Science in 2018.

Brian served in UND's ChE Department from 2006-2017, and was named CEM Professor of the Year in 2010. In 2017, he left UND for a stint at Kansas State University, where he was the graduate programs director and an associate professor of chemical engineering. He returned to UND in June 2018.

His time at UND also has included posts as a faculty fellow in the School of Entrepreneurship, a director of the Jodsaas Center for Engineering Leadership and Entrepreneurship and a department chair in chemical engineering from 2013-17.

Private experience

In the private-sector, Tande was a product developer working with high-performance polymers for GE Plastics, in Mt. Vernon, IN, and a director of operations and quality improvement manager with Fargo-based Tecton Products, LLC, a fiberglass composites manufacturer for the window and door industry. He's also a co-founder of two companies that have developed UV-reflective coating materials for the hunting products and healthcare industries. One of those, Lumacept, Inc., has commercialized a patented coating technology that is used in the disinfection of hospital rooms. Tande has also worked as an independent consultant in materials development and has delivered workshops on engineering statistics and experimental design.

Tande says the opportunity to lead UND's CEM is an honor, especially during a time of transition, following El-Rewini, who served as dean since 2008.

"It's a huge responsibility, but having spent 12 years here as a faculty member, department chair and now as Associate Dean," Tande said. "I feel I have a solid understanding of what needs to be done. Besides that, I have been able to learn from one of the best. Hesham has not only been an outstanding leader for CEM, he has also been a good friend and a mentor to me."

In addition to his teaching and administrative work, Tande is the author or co-author of at least 25 peer-reviewed research papers, and is a named inventor on 10 separate U.S. patents.

Strategic support

Tande says that in his new role as interim dean he wants to ensure the College fully supports UND's strategic plan by growing online programs, improving retention and graduation rates and expanding research.

"The College cannot afford to take its foot off the gas," Tande said. "I intend to keep us moving full speed ahead while a permanent dean is found."«

Mike Mann Appointed Interim Associate Dean for Research

One of **Brian Tande's** first actions as Interim Dean was to parcel out some of his Associate Dean duties to others in the college. Will Semke, Professor and Chair of Mechanical Engineering, was appointed Interim Associate Dean for Academics and **Michael Mann**, Chester Fritz Distinguished Professor of Chemical Engineering was appointed Interim Associate Dean for Research. This appointment is in addition to his current duties as Director of the Institute of Energy Studies. Mike is well used to the role, as he already heads up the college's faculty research council. He also has prior experience as Interim Dean and as Associate Dean for the college.«

CEM'S DISTANCE DEGREE PROGRAM MARKS 30TH YEAR

Adapted from the original UND Today story by Dima Williams, 6/10/19

Last June, over 60 current online students joined current CEM faculty and staff, along with distance engineering degree program (DEDP) pioneers Arnie Johnson (EE), Don Moen (ME), and **Tom Owens** (ChE) to celebrate the 30th anniversary of UND's DEDP.

A novel, outlandish and brazen idea in the 1980s, the program remains somewhat of a maverick, a unique opportunity in the academic and professional realms of engineering.

"We are the only university in the U.S. and as far as I know in the world that offers a full suite of accredited engineering degree programs, that are delivered via distance to undergraduate students," said CEM Dean **Hesham El-Rewini**.

Former UND ChE Professor and Chair, Tom Owens was one of the featured speakers at the 30th Anniversary of DEDP Celebration. Photo by Dima Williams/UND Today

THE BEGINNING

In the fall of 1988, at the Conference for Industry and Education Collaboration, Jim Carter, then a manager at 3M Corporation, approached then-CEM Dean Alan Fletcher with a proposition – a UND course for 3M's full-time employees.

After some deliberation, the corporate engineering degree program (CEDP) was born. At first, each lesson was recorded and copied onto videotapes which were then mailed to each student. CEDP students were 2-3 weeks behind the local student cohort. Assignments and exams would arrive with a lag of almost a month as well.

Cameras would sometimes fail, and Instructors sometimes had to repeat a lecture to the cameras in an empty room. Chalk on old-fashioned blackboards did not appear clear on camera, so early instructors scribbled with black markers on large sheets of white paper.

Soon, additional companies wanted to join the CEDP program, which was finally made available to any qualified student and renamed the DEDP program. Innovative improvements have been a hallmark of the program. For example, ME and EE capstone design courses shifted from requiring on-campus work to on-the-job-site projects.

"The fact that we were the very first to offer such an innovative program was extremely exciting," said **Lynette Krenelka**, executive director of TTaDA who used to provide technological and logistical support to the program through what was then the Office of Continuing Education. "We were serving a student population that was older than average."

ACCREDITATION

The year of 1997 is etched into the psyche of UND. Spring delivered a record flood that shuttered campus only months before CEM was due for the DEDP's first rigorous accreditation audit by ABET.

"The accreditation was a big deal because the concern with accreditation was that the distance programs were different from on-campus programs," said **Tom Owens**, chemical engineering professor and one-time interim dean.

Further compounding the process was ABET's new approach that dictated the assessment of students' outcomes rather than professors' inputs. At the time, the distance program had no graduates yet, Owens said. Still, it earned full accreditation, attesting that CEM, in the quality of its classes, did not distinguish between on-campus and distance students.

"That was a big deal," Owens said. "It still is a big deal."

STUDENT FOCUS

Today, some 15 years after replacing videotapes for online platforms, the distance engineering program boasts over 500 alumni – and hundreds more engineers in the making.

Through over 100 courses a semester, CEM offers fully online education – bachelors and graduate degrees, certificates and/or diplomas – in 28 engineering fields.

The last 30 years of pioneering "leaps and bounds" that have resulted in this array of options have a single impetus.

"This is about students," said Owens. "It always has been."«

Melanie Jensen named one of Prairie Business' Top 25 Women of the Year

Melanie Jensen, Senior Chemical Engineer and CO_2 Capture and Infrastructure Engineering Team Lead at the UND EERC was one of the women featured in this year's Prairie Business magazine's top 25 Women in Business issue. Melanie graduated from UND with her BSChE degree in 1983.

Ms. Jensen has worked at the EERC for more than 30 years. She has pioneered new technologies to convert North Dakota lignite to liquid fuels and developed techniques to clean up gaseous and liquid emissions.

Recently, Ms. Jensen has focused on reducing CO_2 emissions from industrial sources through capture, compression, and pipeline transport of the CO_2 to geologic sites, where it can be used for enhanced oil recovery and/or safety stored.

Melanie enjoys the variety and challenges inherent in her job and loves working with her fellow scientists and engineers at the EERC. She proudly mentors those who are considering careers in STEM fields and gives back to the community by volunteering with her certified therapy dog Rose.

Congratulations Melanie!

GAUTHAM KRISHNAMOORTHY, ANN AND NORMAN HOFFMAN ASSOCIATE PROFESSOR OF NATIONAL DEFENSE/ENERGETICS

Greetings! The corridors of the Chemical Engineering Department were buzzing with activity during the past year (as you will read in this newsletter) and it became increasingly difficult to bug each other by dropping by for a friendly chat! Still, we managed to maintain the same camaraderie as in previous years during our weekly faculty meetings and student interactions. As the years roll by and I begin my second decade at UND this November, I am increasingly convinced that our department could be the poster child for how a team should function effectively.

Last spring I taught: ChE530 Combustion: Theory and Modeling while this fall I am teaching ChE 301 Transport Phenomena and ChE532 Explosives: Theory and Modeling. With **Yun Ji** back from her 2018/19 sabbatical, my teaching load was reduced drastically from the year she was gone and opened up a lot of time to pursue research. I am currently heavily invested in four research grants that take up the bulk of my time [see cover page story].

Trevor Seidel, a graduate student that **Wayne Seames** and I co-advised successfully defended his M.S thesis this summer and has moved to the Seattle area. While I always have mixed feelings when our really good graduate students leave, I am equally pleased to welcome new graduate students (Monika Kuznia and Eli Peske) into my research group. Monika is one of a number of new students in the department that is doing her graduate degree remotely. She is doing the combined program with her BSChE degree via our DEDP program [see pg. 5].

On the personal front, my family and I are cherishing our life in Grand Forks and as is customary, took a long road trip this summer (this time to Florida and its neighboring states).«

BOWMAN CONTINUES TO LEAD UND CHEM ENG/CHEMISTRY/ATMOSPHERIC SCIENCE NSF-SPONSORED REU

2019 PROGRAM IS THE 15TH CONSECUTIVE YEAR!

Ten chemical engineering, chemistry, and atmospheric science students from across the country came to UND this summer to participate in the Interdisciplinary Renewable and Environmental Collaborative (IREC) Research Experience for Undergraduates (REU).

The Summer 2019 cohort of REU students during a tour of the EERC with ChE faculty advisor Yun Ji

The program, led by ChE's **Frank Bowman** and funded by a National Science Foundation grant, continues 15 consecutive years of similar summer undergraduate research efforts! During the 10-week program, visiting students are mentored by interdisciplinary teams of UND faculty and graduate student researchers from ChE, Chemistry, Atmospheric Sciences, and the Institute for Energy Studies, working together in their labs and at community outreach events.

This year's research projects targeted development of biodegradable polymers from renewable resources, life cycle analysis of biofuels and wind turbines in North Dakota, synthesis of lithium ion battery materials, analysis of organic compounds in atmospheric particulate matter, characterization of lignin degradation, synthesis of fluorescent nanoparticles, and development of oxygen carriers for chemical looping systems. As a part of the program, students also received weekly training in science communication, community outreach, and research ethics. «

YUN JI, ASSOCIATE PROFESSOR

Time flies! This is my 10th year at UND. I teach ChE 303 Chemical Engineering Thermodynamics and ChE 515 Design of Engineering Experiments in the fall semester and ChE 332 Lab III and ChE 435/535 Materials and Corrosion in the spring semester.

I had a lot of fun and built research collaborations during my sabbatical leave in the 2017/2018 academic year. Through the collaborations in China, I was able to invite seven exchange students from Shannxi University of Science & Technology this year to work on small projects at UND [see below]. I also took over as graduate program director for the department from Gautham Krishnamoorthy, I hope to build pipelines to our graduate programs with my collaborators in China and Finland in the future. My research work is going well.

On a personal note, my daughter (Briley, 11) is in middle school now. I still remembered she came to Grand Forks when she was 6 months old. It seems like just yesterday. My twins (Corey and Casey, 8) and youngest son (Ethan, 6) like their school very much. Briley is their role model. My life becomes easier as the kids grow older.«

JI HOSTS INTERNATIONAL EXCHANGE STUDENTS

Last year we started the international student exchange program with Shannxi University of Science and Technology in China. This program allows Master students from other countries to come to the U.S. and spend three months conducting research projects with the researchers in the UND ChE department. The program aims to provide the opportunity for international students to learn about U.S. culture and gain research experience at UND. It also can build a bridge for international students to apply for our graduate programs. To date, we have hosted seven visiting students, four in 2018 and three in 2019 (shown in photo) from China. We hope to host more visiting students from other countries as well in the future.

Research projects include: studying ways to convert cellulosic materials into negative electrode materials for lithium batteries, to use hydrothermal carbonization to generate lithium battery anode materials, and the removal of hydrogen sulfide from gases by partial oxidation to elemental sulfur using chelated iron catalysts.

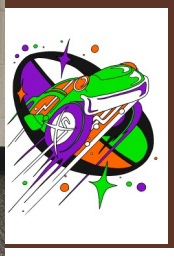
Photo from left to right: Feiyan Ma, Jing Fan and Mei Yuan. All are second year M.S. students from the College of Chemistry and Chemical Engineering, Shaanxi University of Science & Technology, Xi'an, China.

POWER ON! CONTINUES TO INSPIRE REGIONAL YOUTH FOR SCIENCE

Power ON! had another successful year under the leadership of **Beth Klemetsrud**. This year we had 12 outreach events, some of them on campus and others around our community. The highlights always include the Rydell Car Show, SuperScience Day, and visiting local schools. This year we partnered with AISES (American Indians in Science and Engineering Society) and spent time doing outreach in the Red Lake Nation in Minnesota and the Turtle Mountain Nation in North Dakota.

One of Beth's favorite moments this year was when Dean El-Rewini was asking the students from Red Lake "What is the job of an engineer?", without thinking twice a student answered "To make people's lives better". "It was the best answer I've heard and a great reminder as to why engineering outreach is so important," Beth stated.

Our student volunteers were nothing short of amazing and we couldn't do this work without them. Special thanks to Zach Krill who helped organize all of the events for the fall semester and to William Moe who took over spring semester. We look forward to celebrating our 16th year and hope that we can continue being an integral part of science outreach in the Greater Grand Forks Community.«



Rewarded for greater service:

EERC CEO TOM ERICKSON RECEIVES UND PRESIDENT'S MEDAL

Extracted from a 6/4/19 Story in UND Today by Patrick Miller, Marketing & Communications Division, UND

Last June ChE alum **Tom Erickson** (BSChE 1988, MSChE 1990), Energy & Environmental Research Center CEO, became the 34th person to receive the UND President's Medal when University President **Mark Kennedy** made the surprise presentation before employees at the Center.

Photo by Patrick C. Miller/UND Today.

"I was very surprised and very humbled by the opportunity," Erickson said after the ceremony. "It's a tremendous honor, one that I hope I can share in ways with the entire EERC."

This was one of Kennedy's last Presidential acts prior to leaving UND in June. Kennedy cited Erickson's record of helping the EERC attract millions of dollars annually in government and private research dollars to deal with energy and environmental challenges on the state, national and international levels. He also noted Erickson's volunteer work with the Community Violence Intervention Center.

"The way that we survive is by writing proposals and doing great world-class research," Erickson noted. "It takes everyone from our research teams to our support staff to our buildings and grounds folks who keep everything up and operational to make it a success."

Record of accomplishments

During Erickson's tenure at the EERC and under his leadership, the Center has:

- Formed the Plains CO_2 Reduction Partnership (PCORP) funded by the U.S. Department of Energy, which includes five states, two Canadian provinces and numerous industry partners. Under PCORP, the ERRC is working with a ND ethanol producer to implement geologic CO_2 storage, with a ND power plant to capture and store more than 50 million tons of CO_2, and launched a commercial-scale evaluation of CO_2 storage and enhanced oil recovery in the Bakken shale formation.

- Worked with the oil and gas industry to focus on enhanced oil recovery. In the Bakken shale formation, this has the potential to quadruple the recovery rate of ND's oil and gas resources. The EERC has also sought to maximize the use of natural gas as a source of value-added products such as petrochemicals and fertilizers.

- Capitalized on synergies between the agriculture and energy sectors to advance technologies for ethanol and other biofuels. In addition, the EERC has developed agricultural products such as fertilizer from energy production.

- Participated in an innovative consortium to improve pipeline safety with the oil and gas industry and the ND Industrial Commission to eliminate pipeline leaks by exploring emerging technologies to dramatically improve pipeline safety in the state.

- Assisted in enhancing the reliability of the U.S. electrical grid, advancing energy storage systems and increasing pipeline infrastructure. These efforts are reducing the carbon footprint of energy production while helping to boost U.S. energy exports.

- Helped develop the next generation of coal-fired power plants to use ND's 25 billion tons of recoverable lignite coal resources in the most efficient and environmentally friendly manner possible. The power plant of the future will also be capable of providing rare earth elements, carbon fiber and other high-value products to make better use of the state's energy resources.

- Contributed to energy and environmental knowledge worldwide by developing outreach and education tools to better inform the public. At a recent U.S. Senate committee hearing on Capitol Hill, the EERC was singled out by Julio Friedman of the Center for Global Energy for being an exceptional example of building clear, robust and transparent partnerships to engage

(Continued on page 9)

Jason Laumb Receives Community Leadership Award

EERC Principal Engineer **Jason Laumb**, UND MSChE 2000 was awarded the Mike Maidenberg Emerging Leader Award from the Community Foundation of Grand Forks.

The Mike Maidenberg Leadership Endowment was established at the Community Foundation in 2004 to honor Grand Forks Herald publisher Mike Maidenberg on his retirement and to commemorate his civic leadership within the community.

Each year, the award recipient selects a nonprofit and/or government entity to be awarded 2 scholarships to attend the The Grand Forks/East Grand Forks Chamber of Commerce Leadership Class.

Jason was nominated by his peers in the 2018 Chamber Leadership Class.

Congratulations, Jason!

PRESIDENTIAL MEDAL AWARDED TO TOM ERICKSON

(continued from pg. 8)

communities and stakeholders.

Erickson's Bio

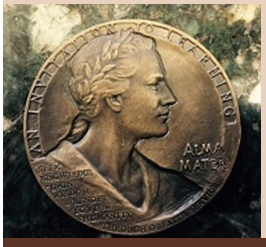
Erickson was served as CEO of the EERC from October 2014 through July 2019 [see below for his current position]. He led a multidisciplinary science, engineering, and support team of 220 people who focus on research and development leading to the demonstration and commercialization of innovative energy and environmental technologies.

Prior to becoming CEO, Erickson served as an EERC associate director for business, operations and Intellectual property where he oversaw activities related to safety, facilities, business functions, and protection and commercialization of intellectual property. He also served as associate director for research, where he developed advanced power and fuel systems from fossil and renewable energy sources.

Then UND President Mark Kennedy with Tom Erickson at the Award Ceremony.
Photo by Patrick C. Miller/UND Today

Erickson holds M.S. and B.S. degrees in chemical engineering from UND. He has authored and coauthored numerous professional publications.

The President's Medal was designed by sculptor Avard Fairbanks and embodies the concept of "An Invitation to Learning."



Fairbanks served as sculptor-in-residence at UND in 1966 and earlier created the iconic pioneer family monument that stands today on the State Capitol grounds in Bismarck. The obverse of the medal bears a head-and-shoulders rendering of Alma Mater, circled by the phrase: "An Invitation to Learning" with an additional inscription that reads "Seek knowledge, gain wisdom, and render love for humanity through greater service." The reverse carries an image of three anonymous people (two males and a female), eyes fixed forward toward a torch, with a heading that reads "University of North Dakota," circling the top.«

ERICKSON TO LEAD NEW STATE ENERGY RESEARCH CENTER

EERC leader & ChE alum announces transition to head up exploratory research center.

Extracted from the original UND Today story by P. Miller (6/19)

Five years after being appointed to head the EERC, Tom Erickson is transitioning to a new opportunity – leader of the new State Energy Research Center (SERC) of North Dakota.

In an email to EERC employees, Erickson said, "I feel it is the right time for me, and honestly, the right time for the EERC to transition to a new CEO. I will continue to fill the role as CEO until a new person has been named [Charles Gorecki took over in August]. I am extremely excited to transition to the SERC, as well as to other duties supporting EERC's researchers and management team."

Erickson noted that he began working on the SERC initiative almost as soon as he was named head of the EERC. In April, 2019 the ND Legislature passed a bill signed by Gov. Doug Burgum creating and funding SERC, which will operate from the EERC. The new center will receive $5 million per biennium to conduct exploratory, transformational and innovative research that advances future energy opportunities to benefit ND's economy and environment. Under the legislation, 1% of oil and gas production and oil extraction tax revenues are allocated to fund SERC.

SERC's research is intended to facilitate the development and use of the state's energy resources in a clean, efficient manner. The center will provide access to energy experts who provide timely scientific and engineering studies in support of North Dakota's interests. In addition, SERC will engage in education and outreach activities related to energy resources.

"The SERC is an incredible opportunity to accelerate the EERC and I want to focus my time on it," Erickson wrote in his email to employees. "I promise you that I will work, and fight, as hard at advancing the SERC as I have as CEO for you [EERC staff]."«

Replacing the Memorial Union: A Fond farewell and the dawn of new era at UND

Adapted from original articles by David Dodds, UND Communications (7/16/19)

This 1967 image shows the Memorial Union after then-recent additions to the original construction. Archival image.

One of UND's most used and beloved buildings is being replaced. Last November, UND's students voted to replace the Memorial Union with a new structure, with funds coming from an increase in student fees. But the fee increase will not be as bad as originally planned because one of **Interim President Joshua Wynne's** first actions when he took office was to pause the demolition work in order to find a revised funding plan to decrease student impact of funding the new student center. The project is a major part of the University's plans for campus renewal and enhancing the student experience on campus. By the time you read this Newsletter, the old Union will be nearly gone and a new, improved Union will be in the process of being built.

"The groundbreaking, which I think will take place sometime around Homecoming, will also be very important," **Jed Shivers, Vice President for Finance & Administration** said. "We look forward to that groundbreaking ceremony. I think that will be a really big moment."

Incoming UND Student Body Presidet, Gracie Lian, also expressed delight in the decision to build the new Memorial Union. UND student leaders, including Lian's predecessor Erik Hanson, have been advocating for a new Memorial Union to replace the University's current student center, which is nearly 60 years old and in need of significant repairs and updating.

"All the people I've talked to – they are so excited about a new Memorial Union," Lian said, following the project's approval. "They keep asking me, 'When is this going to happen?'"

Cassie Gerhardt

At the February 28, 2019 Founder's Day Banquet, **Cassie Gerhardt**, associate dean of students and director of student involvement & parent programs, shared her reflections on the Memorial Union. The Banquet was one of the last major events to be held in the Memorial Union. Gerhardt, who spent time in the union as a UND student and later as a student administrator, whose longtime office sat on the third floor, proved to be the perfect spokeswoman for the storied building.

"Likely many of you, I have a fond memory … or two or 22 … that I could share about the Memorial Union. As we move forward with plans to retire this facility in order to build a new Memorial Union, I've thought about the stories people have shared with me about their Memorial Union memories. Some of these may resonate with you …

- You probably have memories of a meeting or two or 2,000 that you've attended in the Memorial Union … perhaps some are even memories of worthwhile and productive meetings.
- Many of you have attended countless events in the Memorial Union
- It's possible that you bowled at the bowling alley that used to be downstairs
- Some of you have regularly visited the Memorial Union to grab a bag of popcorn for a snack or lunch … it's at the popcorn machine that I often run into my friends and colleagues,
- Maybe you shared a memorable lunch or coffee with a friend in the Centennial Dining Room, or perhaps you met the person who would become your best friend in the Terrace Dining Center like I did in 1992.
- Did you ever purchase your textbooks or a UND sweatshirt from the Bookstore when it was located on the first floor?
- Maybe you've presented a lecture in the Memorial Union or you've performed a concert or two.
- Maybe you took your Billiards class in the lower level when pool tables were part of the décor.
- Did you learn to sew or tie dye or use the dark room in the University Craft Center that once occupied the third floor?
- For many, memories of the Memorial Union come in the form of involvement during college … whether it was involvement in student organizations, a Greek organization or Student Government, or attendance at events hosted in the Memorial Union …

(Continued on page 11)

MICHAEL MANN

CHESTER FRITZ DISTINGUISHED PROFESSOR AND EXECUTIVE DIRECTOR OF THE INSTITUTE OF ENERGY STUDIES

Another year has passed by. Time seems to go so quickly. Probably a sign of getting old. Not too much new for me. Last year I introduced you to my grandson. We have been really enjoying him and are fortunate that my son is still in school at UND, so we are called upon frequently to babysit – a job that we truly enjoy. Other than that, when I am not on campus I find time to do some woodworking, shoot sporting clays, and help my wife in the garden.

While I am on campus, I split my time between ChE, the Institute for Energy Studies, directing our graduate programs in Energy Engineering and Environmental Engineering, and other "duties as assigned" from the Dean. It makes for long days and a full calendar. I taught ChE 102, Introduction to Chemical Engineering for the 20th year in the Spring. I have handed the course over to **Ed Kolodka** as we have moved the course to the fall semester and added another Freshman course, Computing Tools for Chemical Engineers, which will be taught by our newest member of the faculty, **Beth Klemtsrud**. I reintroduced ChE 503 Fuels Technology to the curriculum last fall, a course we haven't taught for a number of years. I also developed an Energy System Engineering course that will become a part of our Energy Engineering program, and am working on a Project Management for Engineers course. I have been able to make use of some good PhD students to help me develop these last two courses, which I think will be good additions to the program.

In my role as Director of the Institute for Energy Studies, I spend a lot of time developing projects and helping write proposals. Our primary research areas include extraction of rare earth elements from coal, development of new electrode materials for lithium ion batteries, chemical looping technologies, and treating highly saline brine solutions from the Bakken, but we have dabbled in many more areas as well. We continue to expand our base of commercial clients, which helps balance the funding. Part of the mission of the Institute is to better integrate research across campus and I have worked with other researchers in developing proposals with faculty from all engineering departments, chemistry, physics, sociology, public health and education! My role in the energy area will also be expanding during the upcoming year as I have recently been appointed to serve as the champion for UND's Energy and Environmental Sustainability Grand Challenge.

As always, keep in touch. I do enjoy hearing from you.«

Memories of the Old Memorial Union

(continued from pg. 10)

before Facebook, Instagram and Snap Chat, the Memorial Union was THE place to be, and be seen, for so many. As an undergraduate, I dreamed of having an office in this building for that very reason.

- Some of you may have taken a nap or two somewhere in the building when you should have been in class.
- Perhaps you remember the North Dakota Museum of Art being in this building before it relocated across campus.
- Your memories may be of the fire in April 1988 that started in the storage room of the Bookstore and caused significant smoke damage throughout the building.
- Or, fast forward to 1997 and your memories may be of the Flood that brought 2 feet of raw sewage and storm sewer water to the lower level, causing significant damage which forced the beloved bowling lanes to be cemented in.
- Maybe your memories are of a haircut at Tom & Jerry's Campus Barbershop, which holds the record of having been the longest Memorial Union tenant at over 50 years.
- Perhaps your memories are of water coming through the floor in the middle of the Terrace Dining Center when the down leader exploded as Welcome Weekend was beginning.
- It's possible you skipped a class in order to spend time with a friend in the Memorial Union.
- Maybe you hung out and watched TV in the Memorial Union between classes."

What is your remembrance of the Memorial Union. Please post your reflections on our LinkedIn! Page [see cover page for details] and we can all enjoy reminiscing together!

WAYNE SEAMES

DISTINGUISHED PROFESSOR AND DIRECTOR OF THE ND SUNRISE PROGRAM

Hello to all!

2019 is a milestone year for me. 40 years ago I graduated with my BSChE degree from the University of Arizona and the 2019/20 academic year is my 20th year as a member of the UND ChE faculty. It's hard to believe I've hit these milestones already. In engineering we assume a constant measurement for time, but emotionally I think time speeds up as we move towards our "golden years."

We have had a lot of changes at UND over the past couple of years, and most of the colleagues I started with (in other parts of UND) have moved on to other universities or taken early retirement. The legislature did not restore the funding that was cut severely during the last session, so we continue to juggle things in order to get everything done. We've also had a nearly complete changeover in UND Administration with searches now underway for a new President (will be my 5th) and a new CEM Dean (my 4th). However, through it all UND ChE continues to make undergraduate educational excellence our first priority and to minimize any impact of these challenges to our students. I believe you will agree with me, that in this, we have succeeded.

I enjoyed working with another amazing cohort of students, both local and distance, as they invested their efforts in learning the "craft" of chemical engineering. This year I am teaching ChE 408 Process Dynamics and Control and ChE 411 Process Design and Economics in the fall and ChE 412/413/414 Plant Design II in the Spring and Summer. **Ed Kolodka** is once again helping with ChE411 this fall, freeing some of my time up for other activities for the department and college.

My research exploring ways to transform lignocellosic materials into renewable fuels and chemicals continues. We are close to perfecting the reaction conditions to catalytically convert simple sugars into lactic and levulinic acid. Our studies on ways to partially cleave and process lignin into useful aromatic-rich materials like carbon fibers also continues. We've also been looking at technologies to overcome the barriers to algae biorefineries for the past 4 years and finally began publishing results this year. I also have two students in our new on-line PhD program. These students perform their research in their home locations (one is in Winnipeg, Canada and the other in San Jose, Ca) with remote oversight and take their courses via distance. Both of their projects are associated with wastewater treating/water quality.

With no big trip to Leeds, UK this year, my wife and I stayed closer to home and enjoyed watching our three grandchildren grow another year. We did manage to get down to Tucson in the March and again in August and to take an exciting tour of Southwestern Minnesota in the Summer.

Stay in touch, with us and with each other (if you haven't found our LinkedIn group, you are missing out). Remember, you never leave the UND ChE family, you just get to do less homework!«

Seames Chosen as Flag Marshal at Spring 2019 Commencement

UND holds general commencement ceremonies at the end of each academic term: spring, summer, and fall. For each ceremony a UND faculty member, chosen from the ranks of the Chester Fritz Distinguished Professors, carries the University Flag and leads the commencement procession. It is an honor to be chosen for this service and is an acknowledgement by the University's Administration of the significant contributions made by the Marshall to UND.

The Faculty Flag Marshal at the Spring, 2019 Undergraduate ceremony was **Wayne Seames**, Chester Fritz Distinguished Professor of ChE. This is Wayne's second selection as Flag Marshal. He also led the procession at the Spring 2013 Commencement. Wayne's selection further enhances UND ChE's reputation for excellence in all facets of academia.«

Like 'Ted Talks' for Theses

UND '3MT' NATIONAL FINALIST IAN FOERSTER SET BAR HIGH

Extracted from a 1/17/19 UND today article by Jan Orvik, UND Relations

Three minutes. One slide. That's what it took for **Ian Foerster** to earn a trip to Las Vegas last year, where he won big – a trip to Washington, D.C.

Described as "Ted Talks for Scholars," the Three Minute Thesis (3MT) features students who present their research in just three minutes to judges and the public.

"It's really important for students to learn how to communicate their research to the general public," said Matt Gilmore, associate professor of atmospheric sciences and the driving force behind bringing the competition to UND. "A lot of us get asked at Thanksgiving dinner what we do, and we often see glazed eyes," Gilmore continued. "We just don't get enough practice explaining it in a way that anyone can understand."

UND Associate Dean of Graduate Studies Chris Nelson (center with clock) honors UND's 2018 3MT Competition runner-up, Ryan Menath (left), an Air Force combat pilot and history major at UND, and champion, ChE **Major Ian Foerster (right).** Photo by Shawna Schill/UND Today

That's where 3MT comes in. The competition, which begins with workshops for graduate students in the fall, helps student researchers hone their presentation and learn to explain complicated topics.

"It's a multi-step process with a lot of practice, peer and trainer feedback and revision," said Gilmore.

Ian Foerster agrees. "3MT is structured to be a learning experience," said Foerster, who tied for first place in Las Vegas and earned a trip to Washington D.C. for a 3MT showcase. "You build on your skills in organization, editing, presentation. I enjoyed the competitions and meeting students who are passionate about what they do and interested in what others do."

Farm to Fiber

Foerster, a PhD student in ChE [Advisor: **Wayne Seames**] who grew up on a farm near Pisek, N.D., is working on three projects. For 3MT, he focused on his research converting waste products from soybean biofuel manufacturing into high-value carbon fiber, which is stronger than steel, yet lighter, and used in planes, cars and golf clubs. Currently, carbon fiber is made from petroleum products and is expensive. He hopes to cut costs and use renewable sources, such as soybeans, to make the fiber. That adds value to the soybeans.

Foerster is also doing research in cooperation with the Univ. of Leeds in the U.K. and sponsored by the National Science Foundation, to extract oils from microalgae, which has a similar oil to soybeans. They're working on ways to crack the cell wall and extract the oils most efficiently for biofuels.

"It's a third-generation biofuel," Foerster said. "You can harvest a lot of it very quickly, and grow it in a tank, which is a non-traditional setting."

His third project, in cooperation with NDSU and sponsored by the USDA Sungrant Program, uses similar techniques to extract sugars from sorghum, a forage crop and cattle feed. Those sugars can be fermented to make ethanol, but Foerster and his collaborators are working to find ways to skip the fermentation and reform the sugars into upgraded fuels and chemicals that are more useful than ethanol.

Taking part in 3MT

Regardless of the research, Foerster appreciates the opportunity to take part in 3MT. "UND does important research," he said. "I find my research very rewarding and challenging. Very few people get to do it. The 3MT competition shows that I'm able to be concise and explain my research to audiences."

Preparing for 3MT takes practice, Foerster said.

"You need to hold peoples' attention for three minutes," he said. "If people aren't interested for the first minute, there is no reason to keep listening. You need to hook them in the beginning and make people think your work is as interesting as you know it is. That's the trick."

Another benefit, added Nelson, is that 3MT lets the public know what UND is doing.

"Speaking in language accessible to all about the kinds of exciting, groundbreaking research that goes on behind the bricks and mortar, its value and relevance to our local and regional communities, as in the case of Ian's soybean research, not only cultivates an important, lifelong skill in our students, but also helps to cultivate stronger relationships with the public that supports UND," said Nelson.

"These skills transfer to the job market," said Gilmore. "You have to be able to interact with people and explain what you're doing. That's what employers are looking for."«

ALI ALSHAMI

ASSISTANT PROFESSOR

Greetings!

I hope all of you have enjoyed a healthy and prosperous year and that your "winter of 18/19" was not as cold as the one we experienced here in Grand Forks. According to the National Weather Service, in late January 2019 Grand Forks registered temperatures that were colder than the North Pole! February was a bit warmer than January, yet it also registered to be the second coldest February on record in North Dakota. This weather did not stop the Alshami's from making the best of it. The family and I managed to squeeze in a few weekends for downhill skiing in the Detroit Lakes Mountain, plus sledding down the sliding hills by Lincoln Park, and some ice skating a few times on rinks around the Grand Forks area.

One would naturally assume that record low temperatures, record snowfall levels, and "bomb cyclones" ultimately would affect classes and teaching schedules for faculty and students alike, but that was not the case for us. Classes went on uninterrupted despite a few days of school-closure thanks largely to our distance teaching technologies. Students hardly missed anything with on-line lectures and teaching instructions and using the internet for communications.

Last spring I continued to teach: 1) CHE 305, Separations and 2) CHE 315 Statistical Data Analysis & Design of Experiments. I also taught CHE 431 Laboratory IV in the Summer for DEDP students and this Fall for our local students. I am also teaching CHE 505 Biochemical Engineering this Fall. I also serve as the department's cooperative education coordinator. As an on-going experiment that is dynamic and forward looking, I continue to look for ways to implement more active teaching and learning strategies (in class and on-line) into my courses.

Research has also been going very well. I have been fortunate to have had an excellent pool of graduate students and their hard work is now coming to fruition. We concluded our phase one research into potential production of high value biochemicals using carbon monoxide from coal gasification as a food source, and are in the process of searching for funding for the second phase. The second phase mostly concerns further optimization of production of bioethanol from the carbon monoxide fermentation. We also have progressed well in our membranes research for water and gas separation processes. We have successfully developed and fabricated an array of polymeric, graphene and graphene-oxide, and mixed-matrix membranes for both gas and liquid separations.

On the personal level, life has been great! The wife and I have been indeed fortunate and living our dream. We both have been blessed with gratifying and enriching careers that revolve around educating and providing health care to present and future generations. Our two sons, Ryan and Zack, are growing up too fast! We can hardly keep up with them and with their many sports competitions and events.

The past year has been a blessing for me, my family and my students; I hope it has been the same for you and your loved ones.«

DECEMBER 2018 B.S. CHE GRADUATES

Pictured are the December 2018 Order of the Engineer Inductees (from left:):

Madalyn Tessier, Christopher Michalek, Paige Marcy, Ellen Walstad, Nicholas Niederkorn, Joseph Dietz, and Brytton George.

BSChE graduates not shown:

Ryan Spellman (DEDP),
Evan Sutherland (DEDP)

BETHANY KLEMETSRUD
ASSISTANT PROFESSOR

Among her other accomplishments this year, Beth won the 2nd Annual CEM Salsa contest last September!

Well, I survived my second year at UND and have now moved into a tenure track position! This means that I no longer get lost around campus, have achieved the Midwestern status of going to Target and running into everyone I know, and feel very much at home in the department. I enjoyed being able to start out as an Instructor and just when I started thinking I knew what I was doing, I now get to learn how to navigate the world of research at UND. I am excited to be given the opportunity to mentor graduate and undergraduate researchers and help them discover their passion and role in research. I hope to spend this first year developing my research plan, modelling pyrolysis kinetics and assisting the college and University with life cycle assessment (LCA).

I was awarded a SEED grant from the college to start implementing LCA work with our undergraduate researchers. This past summer I took part in the IREC REU program [pg. 6] and had two students doing research. Brenda Barrera and Alissa Muggli were my first undergraduate researchers from the REU program and the two of them were a joy to work with. Alissa is the daughter of former UND ChE faculty member **Darrin Muggli** who is now Head of Engineering at Benedictine College, KS. I look forward to developing my research program and could not have started out as strong without these two hardworking students.

This past Spring I taught ChE206 Unit Operations and ChE340 Professional Integrity while this summer I taught ChE335 Summer Lab 2 and ChE340 Professional Integrity. It has been a struggle some days trying to figure out the best teaching style, but each day teaching has been incredibly rewarding. I am continuously taking suggestions and feedback from the students and updating the courses. I am teaching ChE331 Lab 2 this fall and next spring will be teaching ChE206 Unit Operations, ENGR340 Professional Integrity (this course has gotten so popular with other engineering students that CEM decided to make it a general engineering course), along with ChE 103 Computing Tools, our newest course. Upon listening to student feedback, I worked with other faculty in the department to design this course, which will provide foundational knowledge on the software used in our discipline.

For service to the department I have been helping develop new goals and events centered around entrepreneurial ideas for the Jodsaas Center [if you have any ideas or want to help lead a workshop, please email me]. This year was another great year of being able to lead the PowerON! Outreach program [see pg 7]. I'm also the faculty adviser for the UND Chapter of the American Indians in Science and Engineering Society. This past year I brought 10 of our Native American students to the national conference in Oklahoma City.

This past summer our family went on a vacation to the Black Hills and managed to escape right before Sturgis started. Being a North Dakotan, I'm a little ashamed to say that it was my first trip out west and to the Black Hills. It was absolutely beautiful. I'm hoping I find time this fall to go to Teddy Roosevelt National park. I also managed to sneak away for a trip to Holden Village located in the North Cascade Mountains in Washington. I enjoyed every minute being off the grid and being immersed in nature. I'm still in awe of being back home and being able to spend so much time with my family. My 3 year old nephew asks every time they drive through Forks "Is this Aunty Beth's town" and I happily tell him yes. I'm thinking of asking the city to officially change the name. I'm excited to see what my 3rd year at UND brings!«

KLEMETSRUD— "I WANT TO BE A ROLE MODEL"

(extracted from the original article by Jan Orvik published in UND today on January 31, 2019)

Beth Klemetsrud, assistant professor of chemical engineering, describes herself as a "straight-up North Dakotan." She grew up in Devils Lake and the White Earth Indian Reservation.

"Grand Forks is home," Klemetsrud said. "UND is a natural fit, and I really enjoy it. The students are fantastic, and the department is incredibly supportive and congenial."

Klemetsrud, who teaches unit operations, ethics, and lab classes, conducts research in renewable energy and sustainability assessment.

"I'm looking at energy systems and other processes from the cradle to the grave, that is, from the time material leaves the earth until it finally returns at the end of its useful life, and how to best reduce the environmental impacts of these processes," Klemetsrud said.

She also plans to work with tribal communities. "I'm most excited when my research positively impacts tribal lands and communities," she said.

She earned degrees from the University of Minnesota-Duluth and Michigan Tech.

"As an undergraduate, I realized that not a lot of people with my background are faculty," Klemetsrud said. "I want to be a role model for people with similar backgrounds."«

EDWARD KOLODKA
ASSOCIATE PROFESSOR

Wow, another year at UND has come and gone already! In the Fall 2018 semester I taught ChE 509 Advanced Reactor Design and co-taught ChE 431 Lab 4, and ChE 411 Plant Design 1. In the Spring 2019 semester I taught ChE 321 Reactor Design, ChE 416 Product Design, and ChE 232 Lab 1. This upcoming year will bring new challenges as I will be taking over more of Plant Design. This is our most challenging class, both to take and to teach, and I still have a lot to learn. As a side note we really should place Wayne in a large bubble because the years of experience he was are irreplaceable. I will also be teaching ChE 102 Intro to ChE which we are moving to the Fall term. It will really be an exciting change in pace transitioning from seniors taking Plant Design to wide-eyed, not-sure-what-to-expect freshmen taking Into to ChE. During the Spring semester I will continue teaching ChE 321Reactor Design ChE 416 Product Design, and ChE 232 Lab 1.

I also continue to pursue research focused around polymer engineering. My current projects are developing strategies to accelerate the degradation of commodity polymers such as polyethylene, polypropylene, and polystyrene without adversely impacting their properties or shelf lives and on developing polymeric membranes with novel properties.

My family continues to flourish here in the high tundra (Grand Forks). My wife Jenn is doing very well while my son Dimitri will be starting his final year in junior high and my daughter Alena will be entering her final year of grade school. Big transitions will be occurring soon! My family picture was taken in the Grand Canyon of the Yellowstone (in the National Park).«

SPRING 2019 B.S. CHE GRADS

Spring Pictured: Front row from right: Cassandra Schaeffer, Alicia Keeling, Cara Bjerke, Dr. Klemetsrud, Kalea Hoff, KayLee Smith, and Samantha Link
Middle row from right: Hannah Gombold (2020), Alexis Fry, Mikaila Kringstad, Jacob Dahl, Ben Koster, Michael Dahlson, Tanya McGrady, Deborah Ngoyi, Jiselle Thornby, Drs. Bowman and Kolodka.
Back row from right Huan Nguyen, Lucas Weimer, Grady Mauch, Michael Hefta, Dr. Mann, Andrew Kohler, James Lepke, Jakob Crumb, Dr. Tande.
Spring Not shown: Tyler Rodriguez, Johnathon Dobie, Jacob Geritz, Tyler Gochenour (DEDP), Amanda Keegan, Lawrence Ngong, Nicholas Niederkorn, Jason Power, Alexandre Santos (DEDP), Brandon Severson (DEDP), Beau Tetreault.

ALUMNI AND DEVELOPMENT

DEB AUSTRENG AND ROBIN TURNER

Well, they did it again!

All you have to do is glance through the pages of this year's *Kinetics* to realize that UND Chemical Engineering faculty, students, and alumni continue to do amazing things. With faculty like Department Chair Frank Bowman, Interim Dean Brian Tande, and Olson Award Winner Gautham Krishnamoorthy [see pg. 1], not to mention the department's two Distinguished Professors (Mike Mann and Wayne Seames), the culture of excellence that is embedded in this department continues, as it was handed down from the faculty of previous decades to the current group. You can be comforted by the knowledge that your college home is still in good hands.

However, there are many things about the department you might not still recognize, as ChE faculty are usually among the earliest adopters of new ways of doing things and of the technology that makes these possible. But the culture of excellence, that was here when you were a student, that is still here.

We hope you agree and will continue to provide the critical financial support they need so that these great programs can continue without placing a greater burden on our students in the form of tuition and fees.

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Whether you're interested in supporting student scholarships, endowed faculty positions, or the renovation of laboratories (we still have one student lab plus a couple of research labs that need renovation), you can make a difference with an outright gift, a pledge over time, or a bequest.

To learn more about providing support to UND ChE, contact **Robin Turner** by phone, text, or email.

To make a gift:

1) Visit undfoundation.org/engineering and select "Chemical Engineering" from the Designation menu
2) By check with "Chemical Engineering" in the memo line to: UND Foundation, 3501 University Ave. Stop 8157, Grand Forks, ND 58202-8157«

TOM OWENS CHEMICAL ENGINEERING FELLOWSHIP - SLOWLY BUILDING

We are still requesting donations for this endowment. Our goal is to reach the "Endowed Chair" level, originally established at $1.5 million. Endowments such as this one are becoming increasingly more important as the costs to provide a high quality engineering education continues to increase while state funding support continues to decrease (when accounting for inflation).

Tom Owens was an inspirational leader and mentor for the hundreds of students that passed through the UND ChE program during his tenure. This endowment honors his service to UND. Please consider a contribution to this endowment. The goal is to provide at least 50% of the salary for the Owens Chair so that we can maintain our current faculty size well into the future. Additional support is needed to reach this goal – outright gifts, pledges, and testamentary provisions are just a few of the many ways to support this endowment.

For further information concerning the Tom Owens endowed chair in Chemical Engineering please contact Robin Turner (see above) or the ChE department. «

CHE ASSOCIATED MERIT AID SCHOLARSHIPS

Daryl L. and Diane A. Anderson Scholarship
Alexander Geritz & Tiffany Metzger - $1200 ea
Madelyn Jean - $800
Nikesh Acharya & Eli Peske - $600 ea
Reed Albrecht - $500

Albert Cooley ChE Scholarship
Rachelle Amundson, Gabrielle Donais,
Clara Kaufmann, Lindsey Malina,
Brianna Metzger & William Moe - $250 ea,
Abbie Radermacher - $100

E. E. Gullekson ChE Scholarship
Mary Hilpisch, Zachary Meduna,
& Andrew Dockter - $1000 ea
Anthony Welling, Hannah Gombold,
Allison Zipp & Joshua Wilmer - $600 ea
Shannon Morgan - $500
Wyatt Larson, Mack Buchholtz, &
Alaura Anderson - $400 ea
Emily Skaare - $300

Wayne R. Kube Memorial Scholarship
Levi Stegner - $850
Patrick Alicki - $363
Gabriel Schettler - $250
Abbie Radermacher - $150

Margo A. Wolff Scholarship - $1144
Allison Zipp

Wendy Sellheim Spenst ChE Memorial Scholarship
Mark Miller - $1000
Wyatt Larson - $200

Raymond & Edyth Sullivan Memorial Eng Scholarship
William Moe - $2200
Levi Stegner & William Prody - $1500 ea
Mack Buchholtz & Zachary Meduna - $1000 ea

Everett Webb Engineering Scholarship
Mark Miller - $1500
Andrew Dockter - $900

William F. and Inez L. McDonald Scholarship
Tiffany Metzger - $2200
Rachelle Amundson - $2000
Allison Zipp - $1056
Andrew Dockter - $900

The Olson Family Scholarship
Alaura Anderson, Gabrielle Donais,
Brianna Metzger, Abbie Radermacher
& Clara Kaufmann - $1500 ea

Whiting Petroleum Corp. Scholarship - $1000 ea
Kelsey Baker, Rachelle Blasczyk,
Caylie Graeber, Jenna Wilka, Sadey Koch

A.M. Souby Scholarship
Morgan Schmitz - $1000
Patrick Alicki - $637
Kelsey Baker - $500
Barry Takwa - $485

David A. Veeder Scholarship
Nathan Manni - $1500
Rachel Blasczyk, Jaden Brandner, Cole Brenner,
Bryce Holtan & Carter Pendergrass - $1000 ea
Tayor Borowicz - $500

These scholarships were made possible by the generous support provided by CEM alumni. If you are interested in learning how you can support a student scholarship, please contact Robin Turner (contact details on pg. 17).

THANK YOU TO ALL OUR SCHOLARSHIP SUPPORTERS!!

SUMMER 2019 B.S. CHE GRADUATES

- Eshetu Abajifar (DEDP)
- Kyle Gietzen,
- Gabriel LaBarre
- Max McCann
- Sandra Vreeman (DEDP)
- Stephen Weilersbacher (DEDP)
- Joseph Winters (DEDP)

Congratulations!«

Kinetics was produced by Wayne Seames with contributions from the faculty & staff of the UND ChE Department and by University & Public Affairs .

2018-19 ACADEMIC ACHIEVEMENT AWARDS

FRESHMAN

William Moe – student of the year,
Gabriel Schettler & Lindsey Malina– finalists

SOPHOMORE

Levi Stegner (right) – student of the year,
Allison Zipp (left) **&**
Zach Meduna (center) – finalists

JUNIOR

Tiffany Metzger (right) student of the year,
Mark Miller &
Madelyn Jean (left) – finalists

BIOMASS SOLUTIONS SPONSORED PROJECT AWARD

Beau Tetreault, Jason Power, and Tanya McGrady

"Ethanol from Sugar Refinery Waste Streams"

A.M. SOUBY SENIOR AWARD FOR EXCELLENCE IN PLANT DESIGN

Kalea Hoff, Alicia Keeling, Jonathan Dobie, and Jacob Geritz, with Technical Advisor: Frank Bowman

"Acrylic Acid Production "

Kalea Hoff, Alicia Keeling, Jonathan Dobie, and Jacob Geritz were also awarded 2nd place in the CEM Freeman Award competition and 2nd place in the "Process category" at the CEM Design Expo.

THE CHE ALUMNI AWARD FOR EXCELLENCE IN SENIOR PLANT DESIGN

Mikaila Kringstad, Samantha Link, Alexis Fry, and Deborah Ngoyi

"Improved Sugar Refining from Beets"

CONGRATULATIONS TO ALL OF OUR STUDENTS FOR THEIR ACCOMPLISHMENTS!

ALUMNI CONTRIBUTION REPORT

Thank you for your generous contributions! This year we received $18,410 for the **Thomas Owens Endowment**, $25,785 for department priority needs, and $2,582 towards student scholarship endowments.

Earnings from ChE and General Engineering scholarship endowments allowed us to award over $55,000 in scholarships to chemical engineering students for the coming year.

UND ChE relies on your contributions to allow us to function, as state appropriations provide less than half of the operating funds we need to run the department. We expend more funds from Alumni donations on departmental operations than from state appropriated funds!

In addition to our day-to-day expenses like paper, photocopies, etc., alumni donations are used for lab supplies and maintenance and other unanticipated costs (like replacing old computers when they can no longer be repaired). Alumni-provided endowment funds also allow us to provide many enhancements to the program that directly benefit the students and the quality of education we deliver.

Alumni contributions also allow us to provide a small monetary gift with our Academic Achievement Awards, given to the top students in the freshman, sophomore, and junior classes, for the Excellence in Senior Plant Design Award, and for cake and punch at the ceremony where we present those awards [see page 19].

We continue to provide scholarships through the various endowments so graciously supported by our alumni. A list of these is provided on pg. 18.

We would like to personally thank those who have given to UND ChE. If you contributed to the department and are not on this list, let us know, but please forgive us. We do our best to keep our database current, but we sometimes make mistakes.«

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If you are supposed to be on this list but we somehow missed you, please forgive us; it is not intentional. This is an amateur production!

FACULTY RESEARCH HIGHLIGHTS

NEW RESEARCH GRANTS

- Jun Li, Hossein Salehfar and **Michael Mann** were awarded $399,778 from the US Department of Energy for a project entitled "Incorporating Blockchain/P2P Technology into an SDN-Enabled Cybersecurity System to Safeguard Fossil Fuel Power Generation Systems"
- **Gautham Krishnamoorthy** was awarded $399,238 through the Department of Energy – National Energy Technology Laboratory, University Coal Research Program for his proposal "An Integrated Approach to Predicting Ash Deposition and Heat Transfer in Coal Fired Boilers."
- **Gautham Krishnamoorthy** was awarded $153,000 through the Department of Energy – National Energy Technology Laboratory, University Coalition for Fossil Energy Research for his proposal "A Multiphase Modeling Framework for Second Generation Post-Combustion Carbon Capture Systems."
- Surojit Gupta and **Yun Ji** were awarded $90,600 from the ND Corn Utilization Council for a project entitled, "Valorization of Corn as a Feedstock for Designing of High Value Functional Materials".
- **Wayne Seames** and **Yun Ji** were awarded $75,000 from the ND Corn Utilization Council for a project entitled: "Chemicals from Corn Stover to Increase Corn Producer Revenue".
- **Ali Alshami** was awarded $50,000 from the City of Grand Forks for a project entitled: "Grand Forks Water Treatment RO Membrane Concentrate Line Scaling, and Methods of Prevention Study".
- **Yun Ji** was awarded $40,735 from the City of Grand Forks for a project entitled: "Biosolids Waste Treatment".
- Yong Hou, Hossein Salehfar and **Michael Mann** were awarded $15,000 from the ND Agriculture Product Utilization Commission for a project entitled: "Advanced Integrated Solar-LFP Battery Powered Water Pump".

RESEARCH PRESENTATIONS

- **Gautham Krishnamoorthy**, Trevor Seidel and **Wayne Seames** ,"Characterizing Flame Stability and Radiative Heat Transfer in Oxy-Coal Flames," 44th Clearwater Clean Energy Conference, Clearwater, FL, June 2019.
- Humphrey Chukwuto, **Frank Bowman**, "CCN Activity and Particle Growth of Aging Diesel Exhaust Particles," 10th International Aerosol Conference, St. Louis, MO, September 4, 2018.
- Nolan Theaker, Brittany Rew, **Michael Mann**, Steve Benson, "Update on the Bench-Scale Extraction of Rare Earth Elements from North Dakota Lignite," AIChE National Meeting, Pittsburgh, PA, Oct 28-Nov 2, 2018.
- **Ali Alshami** and Jeremy Lewis, "Formation of Activated Carbon/Polymer Bilayer Membranes By Solution Electrospraying for Water Purification," AIChE National Meeting, Pittsburgh, PA, November 2018.
- Johannes George van der Watt, Junior Nasah, **Gautham Krishnamoorthy**, Teagan Nelson and Srivats Srinivasachar, "Development of a Spouted Fluid Bed Reactor for Chemical Looping Combustion," 44th Clearwater Clean Energy Conference, Clearwater, FL, June 2019.
- Justin Baker, Shuai Xu, Justin Mann, Andrew Dockter, Yong Hou, **Michael Mann**, Xiaodong Hou, "Preparation of Lithium Ion Battery Cathode Composites using Leonardiute-Derived Humic Acid", AIChE National Meeting, Pittsburgh, PA, Oct 28-Nov 2, 2018.
- Humphrey Chukwuto, **Frank Bowman**, "CCN Activity and Particle Growth of Aging Diesel Exhaust Particles", AIChE National Meeting, Pittsburgh, PA, October 31, 2018.
- Olusegun Tomonewo, Haddi Jabbari, Chioma Onwumelu, **Michael Mann**, "Characterization of the Middle Bakken Formation using NMR and SEM Techniques", 53rd ARMA Symposium, New York, NY, June 22-27, 2019.

RESEARCH PUBLICATIONS (Student Authors Underlined)

- Arash Abarghani, Mehdi Ostadhassan, Thomas Gentzis, Humberto Carvajal-Ortiz, Seare Ocubalidet, Bailey Bubach, **Michael Mann**, Xiaodong Hou (2019), "Correlating Rock-Eval™ T_{max} with Bitumen Reflectance from Organic Petrology in the Bakken Formation", International Journal of Coal Geology, 205: 87-104.
- Lauren Clarke, **Gautham Krishnamoorthy**, "Pre-Conditioning Strategies to Accelerate the Convergence of Iterative Methods in Multiphase Flow Simulations", Mathematics and Computers in Simulation (2019), 165: 200-222
- Ganna Flanagan, Anastasia A. Andrianova, Jana Casey, Eric Hellrung, Bonnie A. Diep, **Wayne S. Seames**, Alena Kubatova (2018), "Simultaneous high-temperature gas chromatography with flame ionization and mass spectrometric analysis of monocarboxylic acids and acylglycerols in biofuels and biofuel intermediate products", J. Chromatography A, 1584:165-178.
- S. Gupta, M. Dey, Caleb, Sabah, K. Hall, **Y. Ji** (2019), "Synthesis and Characterization of Novel Foams by Pyrolysis of Lignin", Tappi, 18(01), 45-56.
- **Yun Ji,** Y. Peng, A. Strand, S. Fu, A. Sundberg, E. Retulainen (2018), "Fiber Evolution during Alkaline Treatment and Its Impact on Handsheet

(Continued on page 22)

GRADUATING M.S. AND PH.D. STUDENTS

May 2019

- Justin Baker, MSChE, "Extraction and Purification of Humic Acid from Leonardite as a Graphene Precursor for Lithium Ion Battery Cathodes", **Advisor: Michael Mann**
- Jeremy Lewis, MSChE, "Enhancing Liquid and Gas Separation with Activated Carbon and Mixed-Matrix Membranes", **Advisor: Ali Alshami**
- Grace Ricker, MSChE, "Indoor Radon Concentration Fluctuations, Weather, and Active Soil Depressurization Systems", **Advisor: Michael Mann**
- Maram Al-Sayaghi, MSChE, "Indoor The Effect of Different Dianhydride Precursors on the Synthesis, Characterization and Gas Separation Properties of PI and PBO Derived from BISAPAF ", **Advisor: Ali Alshami**
- Irina Tsriyapkina, MSENE, "Technology and Economy Analysis of Waste Truck Tires Management", **Advisor: Michael Mann**

August 2019

- William Hammann, MSChE, "The Extraction of Carbohydrates from the Microalgae Species *Chlorella Vulgaris*", **Advisor: Wayne Seames**
- Trevor Siedel, MSChE, "Predicting Flame Stability, Ash Deposition and Radiative Heat Transfer Characteristics during Oxy-Fuel Combustion of Pulverized Coal Using Different Multiphase Modeling Frameworks. **Advisors: Gautham Krishnamoorthy and Wayne Seames**
- Johannes Van der Watt, PhD ChE, "Modeling and Improving Oxygen Carrier Performance in Chemical Looping Combustion Systems", **Advisor: Michael Mann**

FACULTY PUBLICATIONS AND MAJOR PRESENTATIONS

(Continued from page 21)

Properties", BioResources, 13(4), 7310-7324.

- Jeremy Lewis, Maram Al-sayaghi, Chris Buelke, **Ali Alshami** (2019), "Activated carbon in mixed-matrix membranes", Separation & Purification Reviews Journal.
- J. Li, R. Cheng, H. Xiu, T. Song, M. Zhang, Q. Liu, X. Zhang, E. Kozliak, **Y. Ji**, (2018), "Foam Materials with Controllable Pore Structure Prepared from Nanofibrillated Cellulose with Addition of Alcohols", Industrial Crops and Products, 125, 314-322
- J. Li, R. Cheng, H. Xiu, M. Zhang, Q. Liu, T. Song, H. Dong, B. Yao, X. Zhang, E. Kozliak, **Y. Ji**, (2018), "Pore Structure and Pertinent Physical Properties of Nanofibrillated Cellulose (NFC)-based Foam Materials", Carbohydrate Polymers, 201, 141-150.
- J. Li, H. Dong, H. Xiu, T. Song, X. Yang, F. Ma, P. Feng, X. Zhang, E. Kozliak, **Y. Ji**, (2019), "Structure and Performance Control of Plant Fiber Based Foam Material by Fibrillation via Refining Treatment", Industrial Crops and Products, 128, 186-193.
- J. Li, T. Song, H. Xiu, Rui Cheng, X. Yang, Q. Liu, X. Zhang, E. Kozliak, **Y. Ji**, (2019), "Control of Structure and Properties of Nanofibrillated Cellulose (NFC) Based Foam Materials by using Ethanol Additives prior to Freeze Drying", Wood Sci & Technology, 1-18.
- J. Pere, E. Pääkkönen, **Y. Ji**, E. Retulainen (2019), "Influence of Hemicellulose Content on Fiber Properties, Strength and Formability of Handsheets", BioResources, 14(1), 251-263
- Sara Pourjafar, Jasmine Kreft, Bilek Honza, Evguenii Kozliak, **Wayne Seames** (2018), "Exploring Larger Pore Size Catalysts for the Decomposition of Lignin", AIMS Energy, 6(6):993-1008.
- **Wayne Seames**, Swapnil Fegade, Inna Sakodynskaya, Darrin Muggli, **Brian Tande**, Alena Kubátová, Evguenii Kozliak (2018), "The Aromatization of Propene Via Nano-Size HZSM-5", American Journal of Applied Chemistry, 6(5):175-188.
- Trevor Seidel, **Gautham Krishnamoorthy**, **Wayne Seames** (2019), "Characterizing Flame Stability and Radiative Heat Transfer in Non-Swirling Oxy-Coal Flames Using Different Multiphase Modeling Frameworks", Fuel, 256:115948.
- S. Vijjamarri, M. Hull, **E. Kolodka**, G. Du (2018), "Renewable Isohexide-Based, Hydrolytically Degradable Poly(silyl ether)s with High Thermal Stability" ChemSusChem, 11(17):2881-2888.
- H. Xiu, R. Cheng, J. Li, F. Ma, T. Song, X. Yang, P. Feng, X. Zhang, E. Kozliak, **Y. Ji**, (2019) "Effects of Acid Hydrolysis Waste Liquid Recycle on Preparation of Microcrystalline Cellulose", Green Processing and Synthesis, 8(1), 348-354.«

UNIVERSITY OF NORTH DAKOTA

DEPARMENT OF CHEMICAL ENGINEERING

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Fax: 701.777.3773

email: und.chemical.engineering@und.edu

BSChE Graduates Huan Nguyen, Jason Power, Cassandra Shaffer, Kaylee Smith, and Beau Tetreault celebrate at the end of the 2019 Spring Commencement Ceremony«

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