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2017-2018 ChE Newsletter

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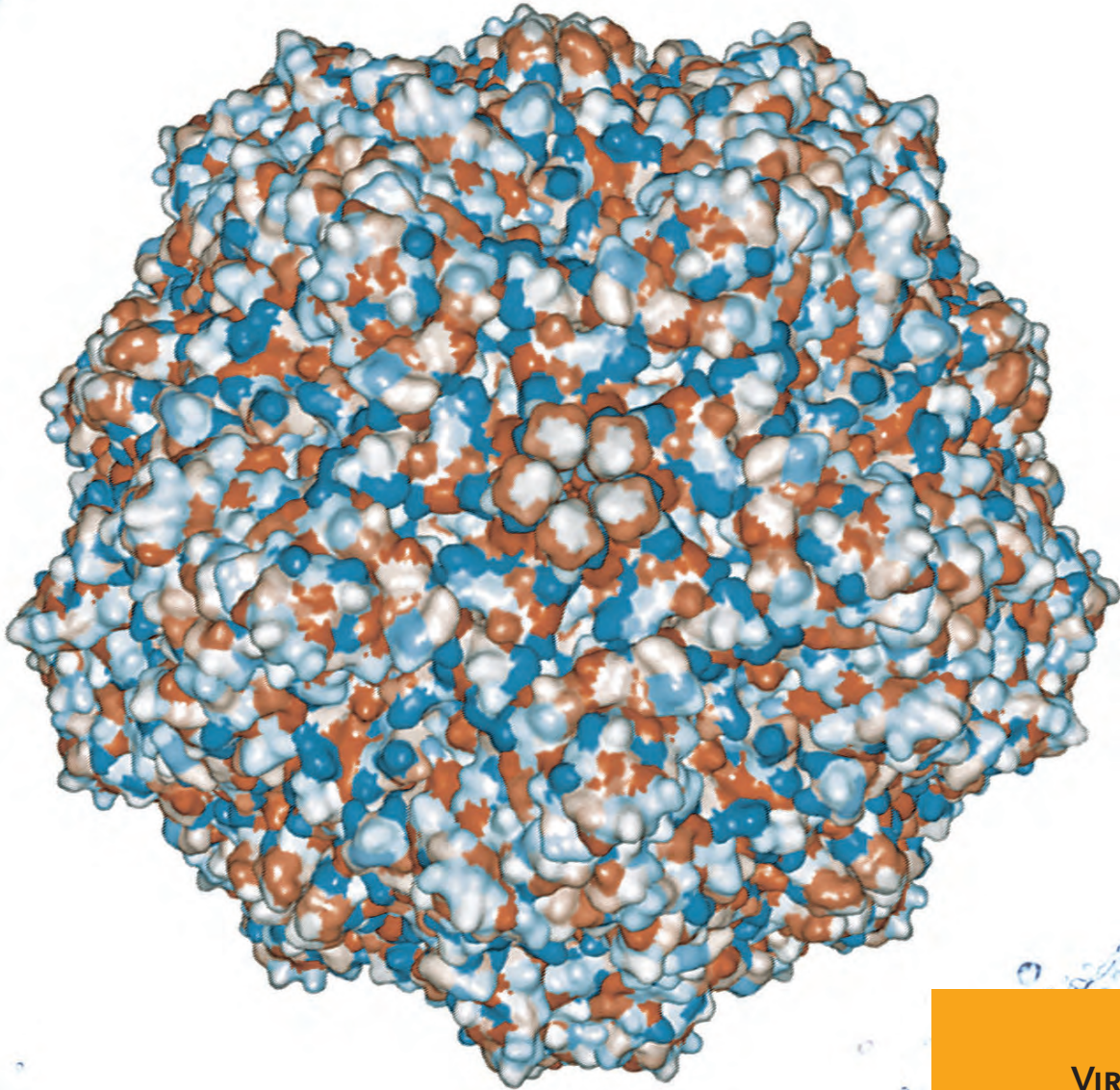
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ChE

CHEMICAL ENGINEERING

2017-2018



**SPOTLIGHT:
VIRUS DETECTION
AND REMOVAL**



**Michigan
Technological
University**



Pradeep Agrawal, Professor and Chair

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Dear Alumni and Friends,

Greetings from the Copper Country! I am pleased to share the latest edition of the ChE Newsletter. It highlights the transitions and major events during the past year.

Professor Kawatra stepped down as department chair in June 2017 and has returned to full-time research and teaching. I join my colleagues in thanking him for his leadership of the Department since 2006. Many parts of the chemical engineering program flourished under his leadership, particularly the Unit Operations Laboratory. We have both an opportunity and an obligation to build on his legacy.

Professor Andre Da Costa joined the Department in November 2017 as Dow Safety Chair, filling a position vacant since the retirement of Professor Dan Crowl. Professor Da Costa's research is in the fields of membrane separations, process safety, and risk analysis. His debut into the academic ranks follows extensive industrial experience.

The past year has witnessed other important changes at Michigan Tech. Soon after joining in July 2017, I learned that a search for president and four college deans was underway. This massive transition was just a coincidence, rather than being precipitated by some crisis or event. President Richard Koubek joined Michigan Tech on July 1, 2018. He previously served as executive vice president and provost at Louisiana State University. I am also pleased to welcome Dr. Janet Callahan, our new dean of engineering. Dean Callahan has a bachelor's degree in chemical engineering, with graduate degrees in material science and engineering. Her academic journey includes Georgia Tech and Boise State University. As you can imagine, the winds of change are blowing all across campus. With change comes new ideas and new energy. I am very excited and optimistic about our prospects in the years to come.

We educate engineers who are creative and innovative thinkers, willing to take risks responsibly. But we must provide our students more than content-based education. We must teach them how to think, how to work well with others, and how to keep up with the changing pace of rapidly growing technology-driven industries. To help prepare them for such an evolving landscape, we need to provide them with flexible options for engaging in continuous learning. Students today are bright, certainly brighter than when I was at their age. They have a hunger to do things that will make an impact, and they want to learn by doing. They want hands-on projects and problem-based learning—the core components of Michigan Tech education.

In more than four decades as an engineer, I have seen incredible advances in technology and engineering tools, which could not have been imagined when I first graduated from college. These advances have made it possible to tackle increasingly complex problems with a global dimension. Solving them requires a multidisciplinary approach. In 2001, Professor James Wei delivered the Amundson Lecture, "Product Engineering: The Third Paradigm of Chemical Engineering?" It recognized the evolving role of product innovation as the new growth engine for

How should we educate and train chemical engineers for jobs that don't yet exist?

innovation and research. Michigan Tech's Enterprise program, which began 15 years ago, challenges students to work in multidisciplinary teams to solve industrially-relevant problems. With 28 Enterprise teams across campus—many involved in product engineering—clearly Michigan Tech is ahead of the curve.

Our graduates must be prepared for big data, artificial intelligence (AI), and machine learning.


How should we educate and train chemical engineers for jobs that don't yet exist? It's an age-old question asked by academia. The answer lies in preparing our graduates for critical thinking, problem-solving, and professional skills—teamwork, communication, business, and leadership.

Core chemical engineering curriculum has not changed significantly in the past half-century, even as sophisticated computational tools have enabled complex problem-solving. The transitions from slide-rule to calculators and calculators to computers have been gradual and without disruption.

More than ever before, with the advent of digital age, today we face an enormous challenge and an even bigger opportunity. Our graduates must be prepared for big data, artificial intelligence (AI), and machine learning. In addition to relying on physics-based models, chemical engineers must be able to extract knowledge from massive data and use this knowledge to design processes and products. Our graduates must have the skill set to effectively participate in systems-level integration involving the multiple digital technologies needed to develop robust, effective, secure products and solutions. These are some of the issues we will explore in the near future to make sure our graduates stay on the cutting edge. We must also continue to strengthen the ethical culture at Michigan Tech as a cornerstone of their education.

As you can imagine, the winds of change are blowing all across campus. I am very optimistic and excited about our prospects in the years to come.

I want to thank you for your support and warm wishes for the Department. Please visit us whenever your travels bring you to the UP region. I greatly look forward to meeting you.



Pradeep K. Agrawal
Professor and Chair, Department of Chemical Engineering

Chemical Engineering Staff

Taana Blom
Administrative Aide

Robert M. Handler
Operations Manager/Senior
Research Engineer, Sustainable
Futures Institute

Jay Meldrum
Executive Director, Michigan Tech
Keweenaw Research Center
Executive Director of
Sustainability, Michigan Tech

Susan Niemi
Staff Assistant

Jerry A. Norkol
Master Machinist

Alexis E. Snell
Department Coordinator

Katie Torrey
Academic Advisor

Scott Wendt
Manager Laboratory Facilities

Stefan Wisniewski
Research Associate

mtu.edu/chemical

ON THE COVER:

Illustration of the water-repellant shell of proteins that make up the capsid of a porcine parvovirus. Dr. Caryn Heldt worked with Pfizer to better understand how surface hydrophobicity could be used to improve vaccination production. See page 17.

About the Department

The Department of Chemical Engineering at Michigan Tech is among the world's leaders in providing quality education and research. We currently have 17 faculty, seven staff, 458 undergraduate students, and 40 graduate students, including 22 PhD students.

We are housed in the Chemical Sciences and Engineering Building at the center of Michigan Tech's campus in Houghton. We offer programs leading to a Bachelor of Science, Master of Science, and Doctor of Philosophy.

Our mission is to provide a high-quality educational experience that prepares graduates to assume leadership roles within the chemical and associated industries; to foster the pursuit of new knowledge and innovative scholarship in the chemical sciences and engineering; and to provide leadership to the chemical engineering profession through scholarship, teaching, and service.

Our facilities—including the Unit Operations Lab, Process Simulation and Control Center, Membrane Separation and Process Safety Lab, and Biofuels and Bio-Based Products Lab—are state of the art. Our BASF and Kimberly-Clark classrooms offer multimedia equipment, videoconferencing, and audiovisual technology.

Our Faculty

Our world-class faculty have published nationally recognized textbooks on safety, environmentally sensitive engineering, rheology, and polymer engineering. They have won numerous honors for their achievements in research and teaching, including the A.M. Gaudin Award for Mining, Metallurgy and Exploration from the American Institute of Metallurgy, the Norton H. Walker Award from the American Institute of Chemical Engineers, and Michigan Tech's Distinguished Teaching Award.

Faculty research areas include chemical process design, polymers, advanced process control, chemical process safety, minerals processing engineering, catalysis and particulate processing, environmental engineering, polymer rheology, biochemical engineering, as well as alternative energy and sustainability.



CPM works on a wide variety of projects, from a stronger hockey stick to a better beer keg washer, and much more. See page 14.

Chemical Engineering Faculty

Pradeep K. Agrawal, PhD

Professor and Chair

University of Delaware

Heterogeneous catalysis, including high-temperature pyrolysis and gasification of biomass

Gerard T. Caneba, PhD

Professor

University of California, Berkeley

Carbon nanotube/polymer composites precipitation polymerization

M. Sean Clancey, PhD

Instructor

Michigan Technological University

Technical communication

Tomas B. Co, PhD

Associate Professor

University of Massachusetts

Process integrity, process modeling, plant-wide control

Andre R. Da Costa, PhD

Professor, Chemical Engineering

Herbert H. Dow Chair in Chemical Process Safety

University of New South Wales

Membrane separation technology, membrane integrity, water treatment and bio/pharma processes, process safety and inherently safer design

Jeana Collins, PhD

Lecturer

Michigan Technological University

Reverse insulator dielectrophoresis

Timothy C. Eisele, PhD

Associate Professor, Endowed Faculty Fellow

Michigan Technological University

Metals extraction, CO₂ sequestration

Caryn L. Heldt, PhD

Associate Professor, Lorna and James Mack Endowed Chair

North Carolina State University

Biosensors, design of biomolecules

S. Komar Kawatra, PhD

Professor

University of Queensland, Australia

Iron and steel making, particle technology

Julie A. King, PhD

Professor, Lorna and James Mack Endowed Chair

Mechanical Engineering, University of Wyoming

Thermally and electrically conductive resins, composites

Adrienne R. Minerick, PhD

Professor, Dean of the School of Technology

University of Notre Dame

Electrokinetics, biomedical microdevices

Faith A. Morrison, PhD

Professor, Associate Dean of the Graduate School

University of Massachusetts

Rheology of complex systems, chemical engineering education

Michael E. Mullins, PhD

Professor

University of Rochester

Environmental kinetics and thermodynamics, engineered nanostructures

Rebecca G. Ong, PhD

Assistant Professor

Michigan State University

Lignocellulosic-based biofuels and biomaterials, sustainability of bioenergy production systems

Lei Pan, PhD

Assistant Professor

Virginia Tech

Mineral and coal processing

Tony N. Rogers, PhD

Associate Professor

Michigan Technological University

Environmental thermodynamics, process design and simulation

John F. Sandell, PhD

Associate Professor

Michigan Technological University

Fire protection and environmental engineering

David R. Shonnard, PhD

Professor, Richard and Bonnie Robbins Chair

in Sustainable Materials

Director, Sustainable Futures Institute

Faculty Fellow, Michigan Tech Vice President for Research

University of California, Davis

Biological engineering, alternative energy, sustainability

Post-Doctoral Fellow

Olumide Winjobi, PhD

Sustainable Futures Institute, Michigan Tech

Techno-economic and life-cycle assessments, and chemical process separation technologies

Cooling Off: New Department Chair Pradeep Agrawal is Ready for Change



Dr. Pradeep Agrawal began his duties as the chair of the Department of Chemical Engineering on July 1, 2017. He came to Michigan Tech after 38 years at Georgia Tech.

MICHIGAN TECH'S NEW Chair of Chemical Engineering was ready for a change, in more ways than one. Pradeep Agrawal came to Michigan Tech after nearly 40 years at the Georgia Institute of Technology. "I felt it was time to change gear for a colder climate," he says.

A change of scenery was indeed one of the factors that led him to pull up stakes and make the more than 1,100-mile trek to Houghton. "It is definitely a renewal of sorts for me personally, as well as a challenge professionally," he says.

But, Agrawal says he didn't move here just for the sake of moving. "The students at Michigan Tech have a strong work ethic and are willing to work hard to succeed in one of the most challenging majors on any campus." And, he says, Michigan Tech isn't just any campus. "The university has excellent infrastructure for both the educational and research missions."

According to Agrawal, Tech places a strong emphasis on hands-on experience, which he says sets it apart from its peers. "Michigan Tech has the best unit operations lab facilities that I have seen in the US, by a wide margin."

Agrawal notes Michigan Tech does have several advantages over schools with larger enrollments. "I was surprised to see that the faculty and staff seem to know the students and their backgrounds so well. This is not based on statistics, but relationships forged with one-on-one interactions." He says such close interactions play a significant role in maintaining high retentions and graduation rates.

"I would like to encourage even greater development of soft or non-technical skills, such as communication, leadership, and teamwork.

He notes that one of Tech's biggest strengths is the opportunity for undergraduate research. "There is often a misconception that you build research

and graduate programs by sacrificing undergraduate education. I beg to differ. In fact, I would submit that a strong undergraduate program would wither in the absence of a research component. The undergrads develop an appreciation for solving problems which span several years and experience the thrill of being on the cutting edge of new technology and discovery. The graduate students get the experience of mentoring, while also getting the help they might be looking for in their research. This is a win-win situation for everyone."

Agrawal says there are several faculty members engaged in cutting-edge research that complements the strengths of the department's undergraduate program. He sees his role here at Michigan Tech as encouraging that development... even if it requires buying a warmer coat and a snow shovel or two.

Andre Da Costa Joins Michigan Tech as Herbert H. Dow Chair in Chemical Process Safety



Dr. Andre Da Costa

INTERNATIONAL SCHOLAR and executive Andre Da Costa joined Michigan Tech in Fall 2017 as a Professor of Chemical Engineering. He is the Herbert H. Dow Chair in Chemical Process Safety.

Dr. Da Costa has extensive global experience in the chemical and oil and gas industries. He came to Michigan Tech from Pacific Gas and Electric Company, where he was Director and Chief of Process Safety Strategy. Previously Da Costa was a chemical engineering manager at Corning, Inc., tasked with rebuilding its chemical engineering function globally across the entire corporation.

Da Costa held several positions at Chevron, including engineering manager for one of the corporation's North American exploration and production business units. Prior to Chevron, he was a process development manager at Membrane Technology and Research, Inc. He led the development of membrane separation processes for natural gas, refining, and petrochemicals, and, as a principal investigator, won competitive research grants from the National Science Foundation, Department of Energy, and the

Environmental Protection Agency.

At Fluor Corporation, Da Costa was a consultant on a variety of multi-billion-dollar oil and gas and mineral processing capital projects for Fortune 500 companies.

Da Costa earned an MS in chemical engineering from D. Mendeleev University of Chemical Technology in Moscow, Russia, and a PhD in chemical

engineering from the University of New South Wales in Sydney, Australia. He holds 14 US patents, and is fluent in five languages—Spanish, English, Portuguese, Russian, and French.

A Fellow of AIChE, Da Costa served on the AIChE Board of Directors as Treasurer and held more than 20 leadership positions.

More (Swiss) cheese, please Developing a process safety cultural mindset

Dr. Andre Da Costa wants to prevent injuries, fatalities and damage that can potentially result from human error in hazardous environments, including but not limited to research labs. His compassion for people and the environment drives him and his mission to thread process safety into our campus DNA.

Enter the Swiss cheese model of process safety. According to Da Costa, we should think of a potential safety hazard as a beam of light. Swiss cheese is punctured with holes—the vulnerabilities in a system that can lead to an incident. The light—the hazard—could potentially shine through the gap in the cheese, the system's hole can result in an incident—like an explosion, a chemical spill and resulting skin burn, or worse.

Multiple layers of cheese represent a process safety system. If several slices of cheese are stacked on top of each other, the holes most

likely will not align, shielding the beam of light, and preventing a hazard from passing through the layers to cause a catastrophe.

"With proper process safety protocols in place—multiple layers of Swiss—holes may be plugged by understanding what can go wrong and designing systems with inherently higher safety," says Da Costa. "Other holes may be plugged by building a culture that promotes people's safe actions."

Before entering a lab, not only does Da Costa hope his students and colleagues have a carefully crafted safety plan, he also hopes they value safety above all else. Safety as a value can foster safe behaviors and prevent incidents.

"In a strong culture that values process safety, everyone maintains a sense of vulnerability and understands that bad things can happen and our actions make a difference."

New! The ChE Learning Commons

A Collaborative Space Where Students Can Interact, Create and Communicate



We seek to provide an important, new space for chemical engineering students at Michigan Tech: The ChE Undergraduate Learning Commons.

This space will be dedicated to serving our undergraduates, who can visit the ChE Learning Commons for academic advising, as well as peer advising, mentoring, and tutoring. The space will include a conference room, library, and group study areas. The space will be welcomed by a number of student organizations, including Michigan Tech's student chapters of AIChE,

"The ChE Learning Commons will encourage greater development of important 'soft skills' in our students: communication, leadership, and teamwork."

Dr. Pradeep Agrawal
ChE Department Chair

Omega Chi Epsilon, TAPPI, SME, and the ChE Student Advisory Board.

John T. Patton, a generous donor of scholarships to chemical engineering students, has offered a one-to-one match for the funds we raise for the ChE Undergraduate Learning Commons. Thus, your support will be matched in equal amount and make twice the impact.

Dr. Patton is a former professor of chemical engineering at Michigan Tech from 1968-77. In 2016 he was recognized with the Michigan Tech Honorary Alumni Award.

We need your help to provide our students with a highly functional, comfortable, and collaborative space.

To make a gift, please visit:

mtu.edu/chemical/departments/giving

**Naming opportunities available for individuals or corporations.
Every gift will be generously matched by Dr. John Patton.**

Why do ChE undergraduates need a place to call their own?

Studies show that students who use learning centers at Michigan Tech get better grades. Michigan Tech has 16 learning centers across campus, staffed by upperdivision students who have mastered the material, but still remember what it's like to struggle with it. The Chemical Engineering Learning Center currently operates in an empty classroom, but will be moving into the new ChE Undergraduate Learning Commons.

Students with similar interests naturally choose to learn and study together. Special programming, mentorship, and community-building help students succeed at Michigan Tech, both inside and out of the classroom. The new ChE Undergraduate Learning Commons will be located nearby but separate from our classrooms and labs, making it easy for our students to gather.

Connecting with others encourages self-growth. An important goal is to foster positive relationships, attitudes, and values among our students. "The ChE Learning Commons will encourage greater development of important 'soft skills' in our students: communication, leadership, and teamwork," notes Agrawal.



Every Gift Will be Matched!

Dr. John T. Patton offers a one-to-one match for the funds we raise for the ChE Undergraduate Learning Commons. Your support will be matched in equal amount and make twice the impact.

"Our ultimate goal for the ChE Learning Commons is to add space and expand, in keeping with some other exceptional learning commons around the world," says Dr. Agrawal.

LEFT Woodruff Library Learning Commons, Atlanta University Center.
BELOW De La Salle University, Manila, Philippines.



ChE Rankings Go Up

College Factual 2018



COLLEGE FACTUAL, a website offering advice to prospective college students and their families has ranked Michigan Tech's chemical engineering program among America's best.

Michigan Tech's chemical engineering program was ranked ninth out of 150 programs nationwide. This is an improvement of 10 slots over the previous year's ranking of No. 19. In addition, *College Factual* ranked Tech's chemical engineering program first among the five programs in Michigan – up from number two last year.

Pradeep Agrawal, chair of chemical engineering at Michigan Tech, says rankings from *College Factual* are notable. "While all rankings should be taken with a grain of salt, I am

particularly pleased with the *College Factual* rankings because these are based on hard data and outcomes, such as graduation and retention rates, and student placement statistics. They are not based on subjective or emotional parameters." He adds, "I am very proud of our faculty, staff and students who work hard towards these positive outcomes."

College Factual, located in Troy, New York, is a leading source of college data analytics and insights with a strong focus on student outcomes. In making their rankings, *College Factual* focuses on actual outcomes, such as graduation and retention rates, student loan default rates, and early and mid-career earnings of graduates.

ChE Outcomes from Michigan Tech Career Services Exit Survey

Undergraduate Outcomes Department of Chemical Engineering

Low Salary	\$32,000
Median Salary	\$67,750
High Salary	\$94,000
Average Salary	\$65,885
Placement Rate	82.46%
Graduates	75

Graduate Placement Department of Chemical Engineering

Low Salary	\$50,000
Median Salary	\$76,000
High Salary	\$90,000
Average Salary	\$72,000
Placement Rate	83.33%
Graduates	6

Source: Michigan Tech Career Services Exit Survey, 2016-2017

Oshkosh Fuels Renewable Energy Education on Campus



Michigan Tech alumnus Rob Messina presents the new Renewable Energy Mission Module (REMM) to ChE staff member Jay Meldrum, advisor of Alternative Energy Enterprise. The REMM is a gift from Oshkosh Corporation.

OSHKOSH CORPORATION has a long history of partnership with Michigan Tech. Their business has expanded to include the brands of McNeilus, JLG, Pierce, IMT, and many others as well as Oshkosh Defense.

In order to help provide meaningful projects to students interested

in alternative forms of energy, Oshkosh provided its Renewable Energy Mission Module (REMM) to the Alternative Energy Enterprise, advised by Jay Meldrum, director of Michigan Tech's Keweenaw Research Center and executive director of sustainability at Michigan Tech, and Chemical

Engineering Professor David Shonnard, Richard and Bonnie Robbins Chair in Sustainable Materials, and director of the Sustainable Futures Institute.

The Oshkosh REMM has an array of technology that includes a folding-blade wind turbine, a solar panel array as well as a chargeable battery pack, integrated generator with exportable power.

Students in the Alternative Energy Enterprise now use the REMM to study alternative energy sources connected to the power grid, measuring energy utilization and effectiveness in the northern climates of Houghton.

Oshkosh engineers are available to help students understand how the REMM functions. "We are pleased to be able to provide this hardware for Huskies to apply in a practical manner what they are learning in the classroom," says Rob Messina, chief technology officer, Oshkosh Corporation. Messina earned a BS in mechanical engineering at Michigan Tech in 1993, and an MS in mechanical engineering at Oakland University in 1995.

Fraternities and Sororities Honor Scott Wendt



Scott Wendt was honored for his dedication to supporting students and helping them succeed.

STUDENT MEMBERS of the Michigan Tech Greek Life community of fraternities and sororities selected Scott Wendt, manager of laboratory facilities, to receive the 2017 Greek Life Outstanding Staff award.

Wendt was chosen for his dedication to supporting students and helping them succeed both inside and outside the classroom, by demonstrating a passion for working with students, and promoting and inspiring the Michigan Tech values of community, scholarship, possibilities, accountability and tenacity.

RIGHT Wendt's distinctive Greek Life Award was created by artist Donica Hope Dravillas at the Garden Brook studio and gallery, of Copper Harbor, Michigan.



Chemical Engineering Class of 2017

Kimberly-Clark Communication Award



Mr. Mark Mleziva of Kimberly-Clark, presented the award to Julia Zayan.

This award recognizes the winner of the Award for Excellence in Communication from the Department of Chemical Engineering for the academic year.

Prevent Accidents with Safety (PAWS) Award



Dr. Julie King presented awards to Mary Kate Mitchell, Whitney Niedzielski, Austin Nyenhuis, Gregory Thelen, and Jason Saliga.

The PAWS Safety Program, initiated and supported by Professor Emeritus Anton Pintar, provides a framework to develop the necessary safety culture within the student community, and for the safety of those around them.

UOP Davis W. Hubbard Plant Design Team Award



Mr. Chris Gosling of UOP, presented the award to Caleb Korson, Whitney Niedzielski, Ryan Smith, and Guy Smith.

This award recognizes an outstanding team in Chemical Engineering Plant Design during the academic year. Also, this award recognizes technical ability, consideration of the safety and environmental aspects of process design, outstanding written and oral communication skills, and overall teamwork and professionalism. This is awarded in memory of Dr. David W. Hubbard.

Dow Chemical Mariott W. Bredekamp Award



Mr. Scott Wendt presented the award to Alexander Tangen, Abigail Payne, Meghan Pierce, and Audra Thurston.

This award, in memory of Dr. Mariott W. Bredekamp, recognizes outstanding technical skills in the laboratory, outstanding teamwork and professionalism, effective oral and written communication, and strong adherence to process safety practices as recognized by peers and supported by faculty.

2017 Convocation Speaker Scott Moffat



Scott Moffat has spent 24 years developing and applying new reagent technology for the mining industry, with extensive global travel to various mining sites and the development of a global network within the mining industry.

Mr. Moffat earned a BS in chemical engineering and a MS in metallurgical engineering, both at Michigan Tech. He began his career as a metallurgical engineer in mining chemicals research and development for American Cyanamid/Cytec Industries, acquired by Solvay in 2015. Since then, he has worked in mineral processing plants in Australia, South America, Europe, the Middle East, and Asia, mostly in R&D, but also in technical sales. He currently manages the Global Research and Innovation Applications Technology Group within Solvay's Industrial Minerals business.

Stanton Township Fire Pump Test



Dr. John Sandell took 18 chemical engineering undergraduates on a field trip to the volunteer fire department in nearby Stanton Township.

Daniel Kulas Earns GLIAC Post-Graduate Scholarship



Daniel Kulas

DANIEL KULAS '17, '18 recently earned his BS and MS in Chemical Engineering at Michigan Tech. A highly accomplished track and field athlete from Iron Mountain, Michigan, Kulas excels on the track, in the classroom, and in the lab. "Daniel is an outstanding Michigan Tech student in all regards—academically,

personally, and in his extra-curricular activities," says advisor Professor David Shonnard. "He is one of the first few chemical engineering students in our accelerated Master's program, and he set a very high bar for other students to follow. It was a great pleasure for me to serve as his MS advisor and mentor on his research project and ultimate publication of scholarly work in a high impact journal."

The article, in the green chemistry and green engineering publication of the American Chemical Society, *Sustainable Chemistry & Engineering*, was titled "Production of Hydrocarbon Fuel Using Two-Step Torrefaction and Fast Pyrolysis of Pine. Part 2: Life-Cycle Carbon Footprint." Olumide Winjobi, Wen Zhou, Daniel Kulas, Jakob Nowicki, and David R. Shonnard authored the paper.

As an undergraduate student Kulas was a member of the Michigan Tech Track and Field and Cross Country teams, and a recipient of the prestigious Great Lakes Intercollegiate Athletic Conference (GLIAC) Pat Riepma Postgraduate Scholarship. The honor, which provides \$5,000 in graduate school financial aid, was voted on by the Faculty Athletic Representatives

(FARs) of the GLIAC member institutions. Kulas is a five-time GLIAC All-Academic Excellence Team honoree and was named a Superior Athlete of the Week three times, all while maintaining a 3.95 GPA.

While at Tech, Kulas won three individual event championships including the 3000 meter run in the Northern Challenge in January of 2016. He also claimed a pair of first place 8k cross country finishes at the UW-Parkside Midwest Open in 2015 and the UW-Parkside Lucian Rosa Invitational in 2014. Kulas logged a career best time of 15:07.55 in the 5000 Meter Run last spring at the University of Wisconsin-Platteville Invitational.

Kulas is currently a chemical engineering doctoral student at Michigan Tech, advised by Professor Andre Da Costa.

Consumer Product Manufacturing: Big Team, Big on Details

WITH 60-PLUS MEMBERS, Consumer Products Manufacturing (CPM) is one of the largest Enterprise teams at Michigan Tech. Each project group has its own team leader, while the overall CPM team is governed by a 15-member E-board. Every seat is filled in the conference room of the Chemical Sciences and Engineering building when the E-board meets with CPM advisors Tony Rogers and Sean Clancey.

CPM has its fingers in a mind-boggling array of projects, including a functional and affordable lower-limb prosthetic; a biogas project to convert food waste from dining halls and convert it into energy to heat buildings

and water; and a commercial beer keg washer. Other teams are working on copper extraction and CO₂ sequestration.

The team's support system is composed of numerous individual, industrial, and public sponsors—and part of the work is being on the lookout for more funding sources. Current sponsors include a Marquette roofer interested in long-wearing, locally sourced, affordable basalt-fiber roofing, and a chemical engineering alumna focused on an oxygen-selective membrane for home whiskey brewers. And there's a team working with Kohler Co. on an initiative to deal with existing

resin waste streams.

"CPM does a good job focusing on all the skills students need for success," says CPM team member Elizabeth Barber, a fifth-year student who's been in Enterprise since her first year at Michigan Tech. It's more of a shadowing when you first come in, understanding how the Enterprise works and how you contribute to the project you're assigned to. The following semester, you're an active member," she explains. "After your second semester, you can sign up for leadership positions."

CPM Enterprise Designs nanoMAG Skis



"nanoMAG" is a Magnesium alloy with a high strength to weight ratio, high fatigue strength, high impact energy, and enhanced damping and noise reduction. CPM has partnered with the makers of nanoMAG in an attempt to develop alpine skis for its client company, Shaggy's Copper Country Skis.

The new skis have better vibration damping properties when compared to current industry leaders. CPM team members worked on FEA simulations, vibration damping tests, manufacturing, and consumer testing on our project. Now that skis are completed, next up for CPM: nanoMAG hockey blades.

An Inexpensive, Energy-Efficient, Easy Way to Recycle Lithium Ion Batteries

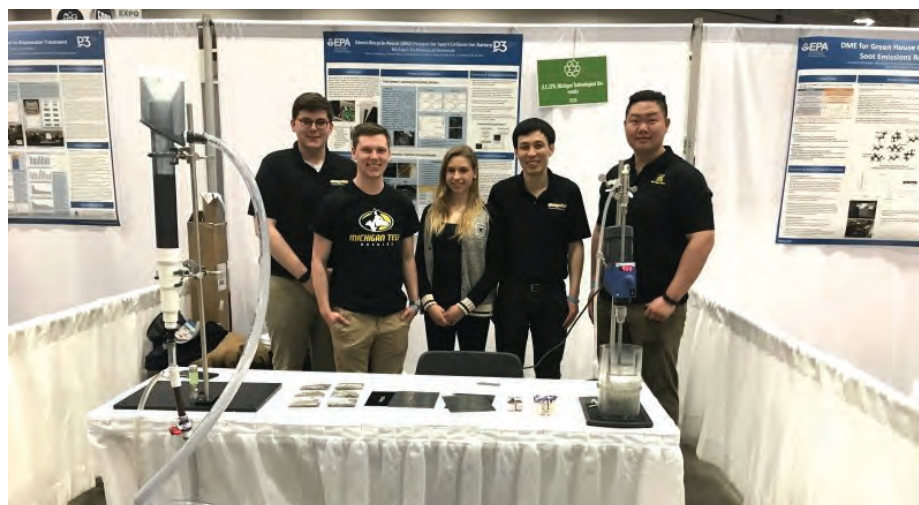
USING CENTURY-OLD minerals processing methods, Michigan Tech chemical engineering students have found a solution to a looming 21st-century problem: how to economically recycle lithium ion batteries.

Assistant Professor Lei Pan's team had worked long and hard on their research project, and they were happy just to be showing their results at the People, Prosperity and the Planet (P3) competition last April in Washington, DC. They didn't expect to be mobbed by enthusiastic onlookers.

"We got a lot of 'oh wow!' responses, from eight-year-olds wanting to know how it worked, to EPA officials wondering why no one had done this before," says senior Zachary Oldenburg.

Pan earned his graduate degrees in mining engineering. It was his idea to adapt 20th century mining technology to recycle lithium ion batteries, from the small ones in cell phones to the multi-kilowatt models that power electric cars. So he gave his students a crash course in basic minerals processing methods and set them loose in the lab.

The team used mining industry technologies to separate everything in the battery: the casing, metal foils and coatings for the anode and cathode,



Dr. Lei Pan with his team: fourth-year students Zachary Oldenburg, Trevyn Payne, and third-year student Lucille Nunneley; and doctoral student Ruitang Zhan.

which includes lithium metal oxide, the most valuable part. The components can be returned to the manufacturer and re-made into new batteries.

"We use standard gravity separations to separate copper from aluminum, and we use froth flotation to recover critical materials, including graphite, lithium and cobalt," Pan notes. "These mining technologies are the cheapest available, and the infrastructure to implement them already exists."

The project was funded by a \$15,000 grant from the EPA. An article on their work, "Recovery of Active Cathode Materials from Lithium-Ion Batteries Using Froth Flotation," was published in *Sustainable Materials and Technologies*.

To advance their research, Pan has received funding from the Michigan Tech Translational Research and Commercialization (MTRAC) statewide Innovation Hub.

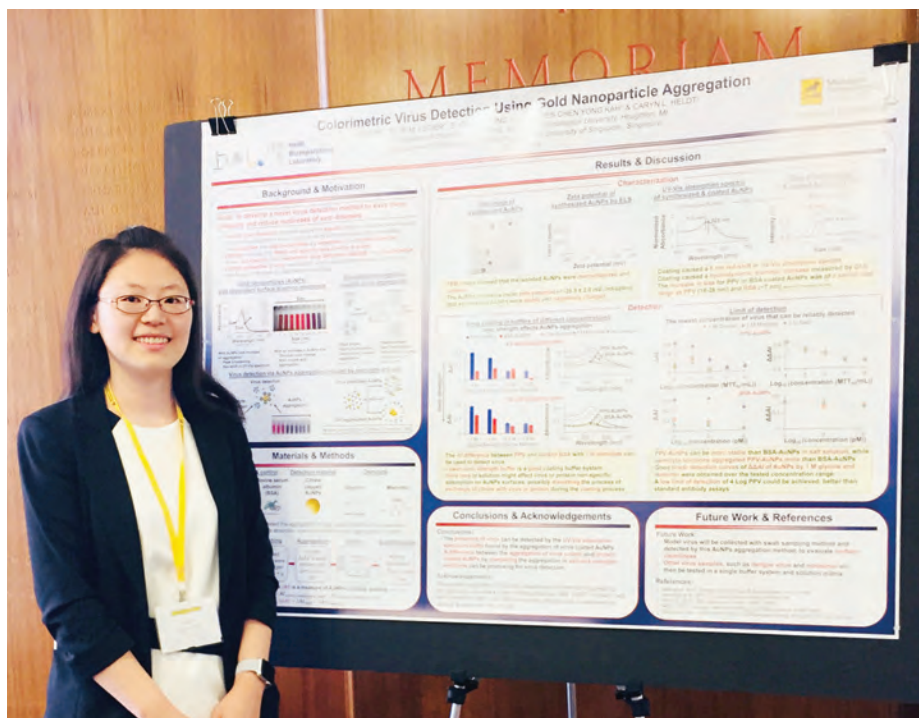


Kudos from AIChE!

AIChE's Youth Council on **Sustainable Science and Technology (YCOSST)** has announced it will be presenting Dr. Pan's team its **YCOSST P3 Award**, which recognizes the project that best employs sustainable practices, interdisciplinary collaborations, engineering principles, and youth involvement.

LEFT Lucille Nunneley demonstrates gravity separation at the People, Prosperity and the Planet (P3) competition last April in Washington, DC.

Xue Mi Wins Top Honors



Xue Mi

GRADUATE STUDENT Xue Mi won the Grand Prize at the 4th Annual Life Science & Technology Institute (LSTI) Research Forum at Michigan Tech. Mi won the graduate category for her poster, "Colorimetric virus detection using gold nanoparticle aggregation."

According to the Centers for Disease Control (CDC), about 19 million people contract gastroenteritis caused by norovirus every year.

A common way to be exposed is through touching contaminated surfaces and objects. But how do you know if an object is contaminated?

"Traditional virus detection methods require the specific detection of either viral capsid proteins by antibodies or viral nucleic acids by complementary oligonucleotides. The antibodies and oligonucleotides are expensive, have limited chemical stability, and can only detect one specific type of virus at a time," Mi explains.

Mi uses the biochemical surface

properties of viruses for nonspecific virus detection, which could become an early screening step for viral cleanliness of a surface.

Gold nanoparticles gather around viruses, making them seem larger. If a virus is present, the aggregating gold nanoparticles changes the sample's color, which is easily seen with the naked eye.

A common way to be exposed to norovirus is through touching contaminated surfaces and objects. But how do you know if an object is contaminated?

Please Send Us Your News!

Tell us your latest news: How has your Michigan Tech education helped you in your current position? Do you have any advice for our current students as they look forward to jobs in chemical engineering? What is happening in your life and career?

Please email your news and photos to Alexis Snell at aesnell@mtu.edu.

We look forward to hearing from you!

Mi's research poster also won third place at the Student Research Symposium of the Upper Peninsula Local Section of the American Chemical Society. The UPLS has more than 100 members across Michigan's Upper Peninsula and far NE Wisconsin.

Advised by Dr. Caryn Heldt, Mi joined the Heldt Bioseparations Lab in 2015.

Caryn Heldt: Vaccines, Removal and Detection

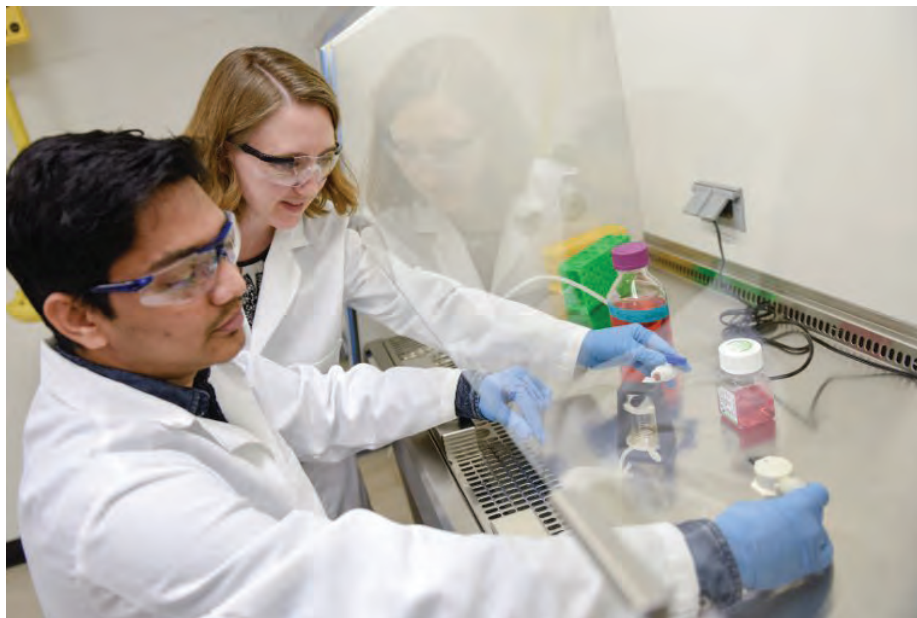
A PERSON DOESN'T have to get sick to catch a virus. Caryn Heldt hopes to catch viruses for detection and vaccinations by understanding their sticky outer layers.

The complex structures making the surface of a virus are small weaves of proteins that make a big impact on how a virus interacts with cells and its environment. A slight change in protein sequence makes this surface slightly water-repelling, or hydrophobic, causing it to stick to other hydrophobic surfaces.

Heldt is the James and Lorna Mack Chair in Bioengineering and an associate professor of chemical engineering at Michigan Tech. Last year she spent a sabbatical in St. Louis working with Pfizer to better understand how surface hydrophobicity could be used to improve vaccine production.

"Vaccine purification is all about surface interactions. If the components break apart then they cannot be used as a therapeutic vaccine," Heldt explains. "Sensing and removing viruses depend on surface interactions, too. In addition, a better understanding of virus hydrophobicity may help biologists understand how a virus interacts with a cell."

Because virus hydrophobicity is relatively new and difficult to measure,

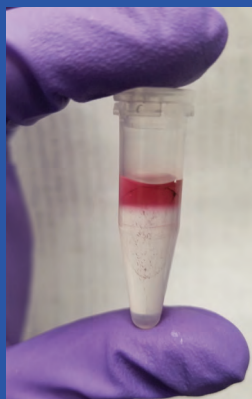
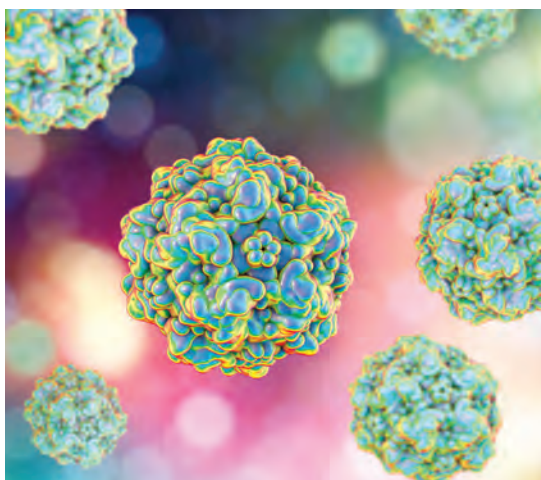


Dr. Caryn Heldt works with graduate student Ashish Saksule in her lab.

Heldt's team focused on using hydrophobicity models as a comparison. They compared the expected hydrophobicity measurements based on the main protein from the virus, the non-enveloped PPV, to well-studied model proteins that span a range of repelling or attracting water. Then they analyzed the samples using two kinds of chromatography along with fluorescent dyes that illuminate sticky, hydrophobic

patches on the proteins.

The strong correlation between the computational and experimental results indicates that PPV—and likely other viruses—have a measurable hydrophobicity. Once the measurements are better understood, then Heldt and other researchers can better catch viruses. Doing so can improve detecting viruses, concentrating them and purifying vaccines.



Faster, More Affordable Vaccines

Dr. Caryn Heldt is the principal investigator on a project that recently received a \$300,000 grant from the National Science Foundation, "Driving Forces in Aqueous Two-Phase Systems for Vaccine Development." Dr. Heldt will explore aqueous two-phase systems (ATPSs) to fulfill the need for new viral particle purification processes that could be run as a continuous operation, reducing both cost and development time for a new vaccine.

Rebecca Ong: Field to Fuel

"MY PARENTS REALLY instilled in me the importance of conservation," says Rebecca Ong, assistant professor of chemical engineering at Michigan Tech. "From an early age, I had this idea of sustainability and the importance of finding sustainable sources of energy."

Ong is a researcher at the Great Lakes Bioenergy Research Center (GLBRC) led by the University of Wisconsin-Madison. The US Department of Energy recently awarded the GLBRC five years of funding to develop sustainable alternatives to transportation fuels and other products currently derived from petroleum. Collaborators include Michigan State University, Michigan Tech, University of British Columbia, and Texas A&M University.

For her part, Ong received a \$321,050 research and development grant, the first year of a potential five-year project for Ong totaling more than \$1.3 million

A double major in chemical engineering and biological sciences at MichiganTech, Ong graduated in 2005 and went on to Michigan State University to earn a PhD in Chemical Engineering in 2011. Her research interests include lignocellulosic biofuels, and the production of co-products from lignocellulosic biomass.



Dr. Rebecca Ong

A love of plants and problem solving drive Ong. Growing up, she was one of the youngest garden club enthusiasts in northern Michigan, a science-loving kid who accompanied her grandparents to club events like "growing great gardens" or "tulip time."

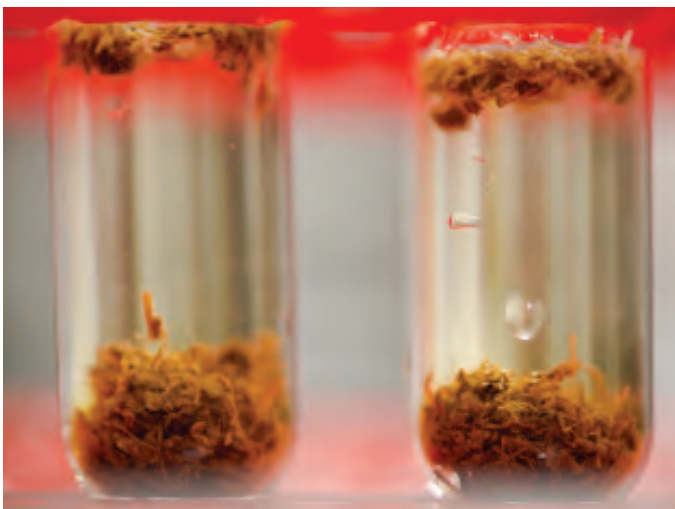
When she wasn't tending the family garden, she was mucking about in nature, learning from parents who had

both trained as foresters.

"I am seeking a thorough understanding of the process of biomass conversion," she adds. Weather patterns, planting decisions, and microorganisms in the soil impact energy crops, as well as the microbes that convert biomass into fuel."

Ong joined the Department of Chemical Engineering at Michigan Tech in 2015 as a part-time instructor, while also working as a part-time research assistant professor at Michigan State University in East Lansing, Michigan. She joined the faculty at Michigan Tech in fall 2016.

The GLBRC, a cross-disciplinary research center, draws on the expertise of over 400 scientists, engineers, students, and staff to develop sustainable biofuels and bioproducts.



"Invisible enzymes are getting to work, breaking down switchgrass, and releasing sugars that microbes will later convert into biofuel," says Ong.

Dean's Teaching Showcase

Tony Rogers (2018) and Julie King (2017)

DURING EACH SPRING semester, the five college deans at Michigan Tech each identify outstanding instructors, who are then formally recognized by the Michigan Tech Center for Teaching and Learning.

Professor Julie King was selected for her passion for excellent teaching and continuous improvement.

Adrienne Minerick (ChE), dean of the School of Technology at Michigan Tech, was Julie's student as part of her bachelor's degree and is now a colleague. She calls King a "highly influential role model for me" as well as for many other students.

More specifically, Minerick says "Julie consistently is recognized by her students for her personal interest, advice and interactions. She stays invested in student success after they leave her classes, approaching those teaching subsequent classes with insights and advocacy strategies. I've never met a stronger advocate for students."



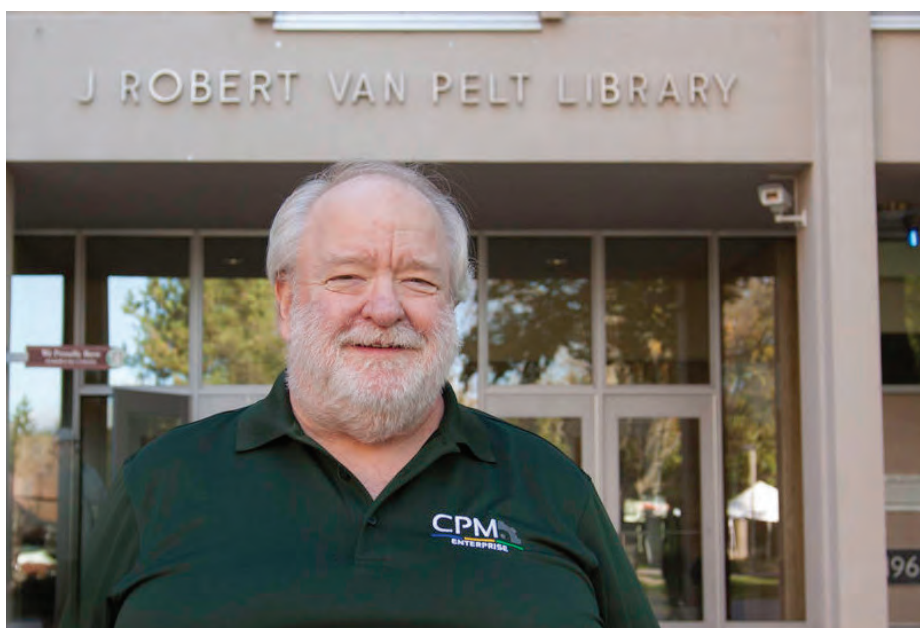
Dr. Julie King

Professor Tony Rogers was selected for his long and excellent history of teaching in three "real-world" aspects of the chemical engineering undergraduate

curriculum: Enterprise, the Unit Operations Lab, and the capstone plant design course.

Rogers has taught the capstone plant design course (Process Analysis & Design) for fourth-year students since 1993. He draws on his industrial design experience at Research Triangle Institute (RTI, Durham, North Carolina) working under contract for industrial clients.

ChE Department Chair, Pradeep Agrawal comments on Rogers' unique focus within this course, saying "While safety and environmental constraints are critical to chemical process design, all project investments are based on economic considerations. Professor Rogers sees to it that chemical engineering students graduate with this important perspective and speak the language of cash-flow analyses and profitability." Rogers has also been advising Consumer Product Manufacturing (CPM) since the Enterprise program first began in 2000.



Dr. Tony Rogers

Chemical Engineering 2017 Academy Inductees

Congratulations to the Newest Members of our Distinguished Academy!

Members of the Distinguished Academy are those whose careers have been marked by extraordinary accomplishments or exemplary service to the profession. Inductees are nominated by department faculty. Academy members are role models of accomplishment for our undergraduate and graduate students.



Keynote remarks were made by Academy Member James Brozzo '53



R. Dyche Anderson and Michael Cleveland

R. Dyche Anderson BS Chemical Engineering '81

R. Dyche Anderson is a native of Wauwatosa, Wisconsin. As a student at Michigan Tech, he was active in Alpha Phi Omega and the student chapter of AIChE. Anderson joined Ford Motor Company in 1996 to work on electric vehicle batteries, and in 2008 moved into research, taking lead of the newly established research group for battery controls at Ford Research & Advanced Engineering. He is now a Technical Expert for Ford Battery Controls & Safety, a role that involves significant consulting with product teams on battery controls, systems, and diagnostics. Dyche is the recipient of Ford's highest technical award, the Henry Ford Technology Award, for the development of model-based battery controls.



S. Komar Kawatra and Glenn F. Lawrence

Glenn F. Lawrence BS Chemical Engineering '75

Glenn Lawrence was an active member of both the Michigan Tech Band and Huskies Pep Band as a student. Upon graduation, he returned home to New Jersey and achieved his goal of working for Merck & Co. He went on to hold positions in manufacturing, and chemical and biologics/vaccine process engineering. In the early '90s, Lawrence was selected to lead the process design of a very promising drug (CRIXIVAN®) for the AIDS epidemic. He retired from Merck after 37 years and now works as a consultant, advising large and emerging pharmaceutical and biotechnology firms for a life science consulting firm. Lawrence serves on the ChE Department's External Advisory Board.



Mark M. Mleziva and Christopher Gosling

Mark M. Mleziva BS Chemical Engineering '92

Mark Mleziva has worked in research- and operations roles at Kimberly-Clark Corporation for more than 25 years. He earned a Certificate in Business Administration from University of Wisconsin-Oshkosh in 2005 and completed the University of Cambridge Business and the Environment Program in 2008. He currently explores, develops, and commercializes innovative sustainability-focused solutions as senior research manager at Kimberly-Clark, focused on engineering environmental sustainable technologies. Mleziva serves on the external advisory boards of Michigan Tech's Sustainable Futures Institute and the Department of Chemical Engineering.



Alan Wagner and Scott Moffatt

Scott A. Moffatt

BS, MS Chemical Engineering '93

Scott Moffatt earned a BS in chemical engineering and a MS in metallurgical engineering at Michigan Tech. He began his career as a metallurgical engineer in mining chemicals research and development for American Cyanamid/Cytec Industries, acquired by Solvay in 2015. Over the course of his 24-year career, he has held different positions within mining chemicals R&D, sales, and currently manages the Global Research and Innovation Applications Technology Group within Solvay's Industrial Minerals business. Moffatt has worked on a wide range of applications in mineral processing plants in Australia, South America, Europe, the Middle East, and Asia.



Professor Kawatra, his wife Geeta, and daughter, Ayushi. Dr. Kawatra stepped down as chemical engineering department chair in June 2017, returning to research and teaching.

Refer a student

Most of our students enrolled today have learned about Michigan Tech from someone who shared their experiences with them, or heard about the strong reputation of Michigan Tech graduates in their workplace.

Please continue the tradition of one-on-one recruitment—reach out and share Michigan Tech with someone deciding on their future. Tell your story, and help connect the next generation of Huskies!

mtu.edu/admissions/refer

Georgia Pacific Visits the UO Lab—to Award a Gift of \$25,000



GENEROUS FINANCIAL and engineering support from Georgia Pacific Corp. will soon bring the paper industry into the Unit Operations Laboratory. Working in close conjunction, with GP representative Martin Hynnek, students have designed, quoted, and started construction of a hydrocyclone paper fiber cleaning experiment complete with an attached quality control laboratory. Students will complete the shakedown and quality control procedures for the 2018 school year, before engaging in an ongoing partnership with Georgia Pacific to upgrade the experiment through several planned phases.

LEFT TO RIGHT Martin Hynnek, Dr. Pradeep Agrawal, Chad Freese, and Austin Ketterhagen

Copper Harbor School Tours the UO Lab



"We're starting them young this year—igniting the passion for chemical engineering with a visit to the Unit Operations Lab," says Scott Wendt, manager of lab facilities in the ChE department. Wendt hosted the entire (one-room) Copper Harbor Elementary School.

Thank You for Supporting Our Students!

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Michigan Tech

Department of Chemical Engineering
203 Chemical Sciences
and Engineering Building

1400 Townsend Drive
Houghton, MI 49931-1295

T: 906-487-3132

F: 906-487-3213

E: cmquestions@mtu.edu

