

Chemical and Materials Engineering News

Fall 2017 Edition



Eric Aston
Department
Chair

LETTER FROM THE CHAIR

Dear Alumni, Students, Friends and Families,

This year, I feel justified in bragging on my colleagues and their long-term trend of success in both teaching and research. While our external supporters—alumni and employers—continue to provide positive feedback on the quality of our students, I had forgotten that our department is also the most productive in our college based on external funding. A quick login to our Office of Sponsored Programs (OSP) revealed that our external grant dollars have exceeded the other engineering Departments each year for a decade, even out-performing some research centers and institutes (including a year or two before the official ChE-MSE merger in 2009—our electronic memories don't reach back very far). We may be a significant stretch away from becoming like a Carnegie highest research activity institution (R1), but we have good evidence of being strong performers in our particular academic neck-o'-the-woods.

As our Assistant Professors continue their startup and development of research programs and course curricula, we look forward to new excitement and collaborative interests in future class offerings coming soon. Our Advisory Board reviewed curricula at comparable institutions last Spring that revealed some ways we might improve and prepare for changing needs in the global job market, and we've already made some small steps in that arena. The tensions between teaching and research duties are akin to those stressors between maintaining general curricula in breadth (ChE or MSE) versus a more specified focus area in depth—number and kind of both ChE and MSE electives, e.g., biological, nuclear, etc. We must serve the College, satisfy ABET, and dream to include our particular expertise as special flavors to our degree coursework.

This year's graduating class is again larger than average. Though we all enjoy research, all of us indeed thrive on student interactions. I hope you enjoy reading the highlights of our student-centered activities. Thank you for taking the time to be a part of our programs!

-Eric Aston

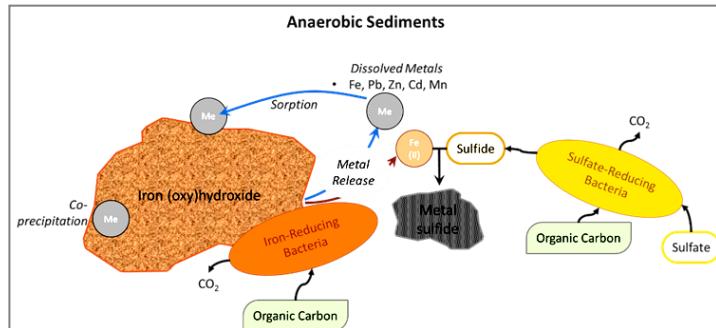
Please update your contact information with us at che@uidaho.edu or mse@uidaho.edu.

RESEARCH HIGHLIGHTS—FACULTY

Dr. Matt Bernards is receiving an “International Young Scientist Award” from the Chinese National Natural Science Foundation (their version of the NSF). This award was based on submission and evaluation of a proposed project on “Nonthrombogenic Polyampholyte Polymers as a Novel Drug Eluting Stent Coating” with collaboration in China. He will work with one of the top ChE programs in China at Zhejiang University. The award includes two years of funding (350,000 Chinese Yuan or ~\$52.7k) but is not a grant by UI standards because all of the money goes to the host institution. However, it does provide Matt access to funded graduate students, research and supplies for his students in China, and travel for his visit. He will work with his collaborator to have Chinese students visit UI for a portion of the project, or have a UI graduate student study abroad for a few months.

Dr. James Moberly hosted a Visiting Scholar over the summer—Dr. Mausumi Mukhopadhyay, Associate Professor, SVNIT, Surat, India—to work on a joint project with Dr. Jeff Langman in Geological Sciences.

Drs. Moberly and Langman are also working on another project in the Coeur d'Alene, Idaho area which has a rich history of mining with a legacy of heavy metal contamination. Due to the efforts of multiple agencies (EPA, IDEQ, and Coeur d'Alene Tribe), the concentration of dissolved metals, chiefly zinc, in the Coeur d'Alene River and Lake Coeur d'Alene (LCdA) is expected to decrease considerably in the near future. This is a great step toward cleaning up the LCdA basin; however, these dissolved metals may have been masking a substantial nutrient issue in LCdA that could manifest with increased phototrophic bioproductivity (potentially toxic algae and cyanobacteria), eutrophication (low oxygen conditions), and potentially increased metal release from lakebed sediments. It is thought that iron-reducing bacteria (IRB) are the principal drivers of metal release under anaerobic conditions. Alternatively, alteration of the redox conditions and influx of carbon in the upper layer sediments to reducing conditions that favor sulfate-reducing bacteria (SRB) may sequester metals via insoluble metal sulfides. The interplay between these anaerobic microbial metabolisms are



thought to control metal fate and transport but contributions from each are unknown. Our research group, composed of James Moberly (CME), Jeff Langman (Geology), Frank Wilhelm (Limnology), and Andrew Child (Post-doc), is using modern geochemical, metagenomic, and molecular biological techniques to study how these two metabolic guilds (IRB & SRB) react under anaerobic and carbon-rich conditions. We are leveraging the resources and lab space from the Lake Social Ecological Systems (LaSES) Lab in Coeur d'Alene where the majority of work occurs. The project is funded in part by Idaho EPSCoR Managing Idaho's Landscapes for Ecosystem Services (MILES) program, Idaho Water Resources Research Institute (IWRI) which funds most of the supplies and salary for Andrew. Additionally James had three undergraduate students located at the LaSES Lab over the summer and funded from UI Office of Undergraduate Research, MILES, and Idaho INBRE (IDeA Network of Biomedical Research Excellence) programs. All three were current or future ChE students. Other externally-funded projects include a passive treatment system to remove heavy metals from acid rock drainage with Dr. Langman funded by the Office of Surface Mining Reclamation and Enforcement and improving separation and recovery of rare earth elements by microorganisms funded by the National Science Foundation with Soumya Srivastava. In total two graduate, six undergraduate, and one high school student worked in the Moberly Labs this past summer.

Current faculty research activity includes:

- ◆ Dr. Gautam Kumar—Seed grant \$11,915.
- ◆ Dr. Indrajit Charit and Dr. Samrat Choudhury—DOE NEUP Metallic Fuel, expires in 2019, \$640,000.
- ◆ Dr. Batric Pesic—DOE NEUP Advanced Electrochemical Separations, expires in 2018, \$340,000.
- ◆ Dr. Mark Roll—Diamondoid Block Copolymers, expires in 2018, \$110,000.
- ◆ Dr. Vivek Utgikar—DOE NEUP Off-Gas Treatment, expires in 2017, \$625,437.
- ◆ Dr. Soumya Srivastava and Dr. James Moberly—NSF EAGER Hyper-Accumulate Metals, expires 2018, \$212,000.
- ◆ Dr. Matt Bernards—DOD Segmental Bone Defect Construction, expires 2018, \$238,275.
- ◆ Dr. Soumya Srivastava Electrophoresis Annual Meeting Expires 2018, \$6000.
- ◆ Dr. Krishnan Raja—DOE NEUP Electrochemical Behavior, \$636,741.
- ◆ Dr. Dean Edwards—ONR AUV Field Sensor Network, expires 2019, \$368,717. Third award on topic, for total \$818,717.
- ◆ Dr. Vivek Utgikar—USNRC Engineering Faculty Development, Expires 2019, \$434,048.
- ◆ Award amount totals: \$3,623,133

STUDENT RESEARCH AND HIGHLIGHTS

We had 12 undergraduate students who were awarded research grants through The Office of Undergraduate Research, (OUR). OUR grants are up to \$1000 for project materials and/or travel. The recipients were Sam Wolfe (now an MS student), Amanda Vu (Honors grant), Nicholas Ayers, Emily Tesnolidek, Shiela Briggs, Lillian Malloy, Kyle Hubbell, Lorraine Mottishaw, Nathan Myers (all ChE's), Ian Ehrsam and Sean Instasi (both MSE and now MS students), and Abigael Ilesanmi. (Biochemistry major working with Dr. Srivastava).

This summer, the OUR also had a 10-week program of full-time student work on faculty-mentored projects, called SURF awards. We had two students who received this award Brian Beatty (with Aston) and Kasey Peach (with Moberly).

Khari Amos (ChE & MSE) and Cortney Hudson (ChE.) received MURI (Miles Undergraduate Research and Internship) awards.

Study Abroad - Six of our undergraduates were admitted to the program for the 2017-18 academic year. Alicante, Spain, 2 ChE, fall; Dublin, Ireland, 1 ChE, 1 MSE, both a full year; Florianopolis, Brazil, 1 ChE, fall; Prague, Czech Republic, 1 ChE, fall.

DEFENSE TITLES:

Robert Blair M.S. MSE, Extending the Life of Concrete Structures Using Glycerol as a Nanoviscosity Modifier: Protection of Reinforcement Steel by Reducing Chloride Transport

Bennett Carv, M.S. ChE, Characterizing Biosorption of Lanthanides to Cupriavidus Necator

Kai Coldsnow, M.S. ChE, Capture of Radioactive Iodine and Krypton from Nuclear Off-gas Streams with a Novel Sorbent

Jakraphan Ninlachart RTN, M.S. MetE, Electrochemical Investigation on Environmental Degradation of Magnesium Rare Earth Alloys

Rachel Peterson, M.S. ChE, Thermal Management of a High Efficiency Electrical Energy Conversion Unit

Anumat Sittih, M.S. MetE, Microstructure and Mechanical Properties of Friction Stir Welded Kanthal APMTTM

Steven Sitler, Ph.D. MSE, Electrochemical and High Temperature Characterizations of Hafnium and Zirconium Diboride Solid Solutions with Different Additives

EXPECTED TO GRADUATE

B.S. Ch.E.	Eric Karl Haakenson	Andrea C. Mansfeld
Hussain J. M. Aljasim	Quenton Heath	Forrest Garret Miller
Abdullah A. I. Alnaifah	Nigel E. Hebbeln	Amanda D. Murdock
Abdulaziz S. K. Alotaibi	Aaron D. Hope	Nathan G. Myers
Maichen M. Carnes	Cortney Hudson	Sam J. Nordquist
Jonathan R. Counts	Leif Krapas	Joseph Pengilly
Neale F. Ellison	John H. Lyons	Logan A. Petersen
Preston Goodall	Lillian S. Malloy	Eric W. I. Pitman

WERC & STUDENT PAPER NIGHT**Task 1 Open task – CuSO₄ Hoof Bath Recovery** 2nd Place

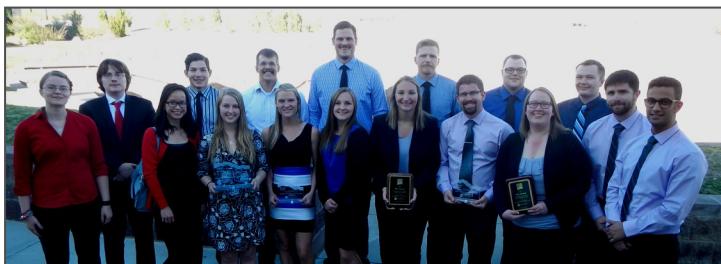
Zachary Beaman, Jacob Bonwell, Emily Tesnolidek, Elli Tindall, Sam Wolfe

Task 2 Solar Distill ARD (Acid rock Drainage water purification)

2nd Place and 1st place PEER judging
Alyssa Ertel, Talal Hamadah, Jesse Hinshaw, Erin Johnson, Nathan Myers

Task 3 Mine Tailings dust (suppression of dust) – no awards

Forrest Garret Miller, Lorraine Mottishaw, Amanda Vu

Task 4 The Internet of Science Things (remote environmental sensor with phone app) 1st Place and 1st place PEER judging
Taylor Davis, Kyle Hubbell, Brett McKinnon, Tyler Songstad (CS)

Front row L-R: Lorraine Mottishaw, Amanda Vu, Taylor Davis, Elli Tindall, Emily Tesnolidek, Alyssa Ertel, Jesse Hinshaw, Erin Johnson, Talal Hamadah

Back row L-R: F. Garret Miller, Sam Wolfe, Zachary Beaman, Jacob Bonwell, Brett McKinnon, Kyle Hubbell, Tyler Songstad (CS), Nathan Myers

Student Paper Night of the ASM Inland Empire Chapter - April 2017

Sponsored by Hi-Rel Laboratories Inc. Spokane, WA

Advisor: Mark Roll mroll@uidaho.edu

Spark Plasma Sintering of Mechanically Alloyed Iron Alloys

Sean M. Instasi, Arnab Kundu, Indrajit Charit

High Temperature Creep Behavior of Alloy 709

Martin Taylor, Harrison Pugesek, Jose Ramirez, Indrajit Charit, Gabriel Potirniche, Robert Stephens

Coal Power 2.0

James Zillinger, Steven Sitler, Raja Krishnan, Indrajit Charit

Martin Taylor—1st Place in Electron Microscopy photo contest and 3rd Place in Presentations

Margaret Fitzgerald—2nd Place in Optical Microscopy and 2nd Place in Artistic Image



L to R: James Zillinger, Sean Instasi, Martin Taylor, Margaret Fitzgerald

**THANK YOU, THANK YOU, THANK YOU
to all of our donors!
You have given an immeasurable gift.**

**OUTSTANDING
SENIORS
2016-17**

ChE—
Zachary Beaman



MSE—
Sean Instasi

Benjamin Plaster
Keely S. Snow
Judah D. Stelck
Mih N. Q. Tran
Trang (Amanda) Vu
Phillip A. Walters
Erin K. Wheless
Jack Williams

M.S. Ch.E.
Bennett Carv
Kai Coldsnow
Rachel Peterson
B.S. M.S.E.
Margaret Fitzgerald
Alen Korjenic

Sanjeet Shrestha
Thomas Thuneman
M.S. Met.E.
Jakraphan Ninlachart Rtn
Anumat Sittih
Ph.D. M.S.E.
Steven Sitler

Jackie Martinez, Chemical Engineering, Grand Challenge Scholar
Project Title: Development of Blood-Brain Barrier Nonfouling Materials

Jackie Martinez strives to be inspiration for first-generation hispanic students.

In Jackie Martinez's hometown, many kids don't graduate from high school, let alone go to college. The number of people living below the poverty level in Milton-Freewater, Oregon, is more than double the national average, and there's too great a need for young adults to immediately enter the workforce and help their family. Often, the only job option is laboring in the agricultural industry in northeast Oregon's Walla Walla Valley. Last summer, Martinez got to walk away from her job thinning trees in an apple orchard for the first time since she was old enough to get a paycheck.

Martinez had a better offer.

Last fall, the sophomore chemical engineering student at the University of Idaho was named a winner of the Grand Challenge Scholars Program Pitch Event. The prize gave Martinez the opportunity to participate in paid research in U of I's College of Engineering, working alongside chemical engineering Assistant Professor Matthew Bernards. The research involved studying the development of materials that can break through the blood-brain barrier and deliver drugs with potentially life-saving effects. Martinez's father always talked about being an engineer, a passion he never achieved professionally. Instead, he worked two jobs — one as a crew boss in the fields and another as a night janitor at a bank. When he came to the U.S. as a young teen, he went to work in agriculture to support his younger siblings.

"He always told us, make sure you get your high school diploma," Martinez said. "Both my parents always pushed higher education on me."

Martinez enrolled at Walla Walla Community College in 2014. Despite being in the top 10 percent academically, she never felt confident as a student.

"I just didn't feel smart or like I could do many things because of the background I came from and because my parents didn't go to school," she said. "Growing up, they hardly helped us with our homework because they didn't know how. They barely spoke English." Martinez's advisor encouraged her to continue her education. In 2016, she applied to U of I intent on pursuing an engineering degree. Martinez enrolled in the Grand Challenge Scholars Program shortly after coming to campus.

The challenges — related to sustainability, health, security and the joy of living — "really went along with my reason for pursuing higher education to help people out," Martinez said. She said a lack of health care and access to affordable medicine are particular problems in her community.

For the Grand Challenge Pitch Event, held each fall for students participating in the program, Bernards suggested Martinez design a nanoscale delivery system for getting drugs through the blood-brain barrier. After winning, Martinez began working on a material for carrying medicine that's both small enough to pass through the barrier and has a non-fouling surface, which means it won't adsorb proteins before or during passage. Such proteins prove challenging to treatment, as the immune system detects and attacks them, preventing drugs from reaching the brain.

Recently, Martinez developed a fiber from a polyampholyte polymer solution using an airbrush spray. As she continues her research in upcoming semesters, Martinez hopes this material will eventually be able to deliver drugs through the barrier. Her end goal is to make the delivery system water insoluble, nontoxic and replete with tunable mechanical properties to control the drug release.

If successful, Martinez's creation could treat patients with brain tumors, Alzheimer's or epilepsy. Of equal importance to Martinez is that the treatment is affordable.

"That's one of my biggest motivators," she said. "I want to give back to my Hispanic community. Seeing what their needs are and how they can't get certain things because they're too expensive or because they don't have health insurance or the resources — it's very sad."

Giving Back to the Community

A second component of the grand challenges program is service learning, and Martinez is using her research to engage with high schoolers in the local area. She used part of her winnings to purchase a headset capable of reading the brain's signals, and is especially interested in understanding the brain patterns of patients with epilepsy to reverse engineer the effects of seizures.

Martinez and Assistant Professor Gautam Kumar are meeting with students in physics and computer science classes at Moscow High School, showing them the possibilities of the headset's brain-computer interface, which allows people to control devices and applications with their mind.

The students have been tasked with designing an application, such as a video game or robot, that can be paired with the headset. Martinez is using it to record the patterns of each student's brainwaves as they watch certain behaviors, like a character in a video game jumping or a robot raising its hand. The headset records this data, which Martinez will then translate into code for computer commands. Once complete, students who have trained with the headset should be able to control the device they've designed through their thoughts. "I'm hoping these kids will be so interested in the things we can do with science that they pursue a STEM degree," Martinez said. "But most importantly, I want them to see me, an undergraduate student, doing these things so they know they can also do this."

Martinez is also excited to use her success to inspire students from underrepresented backgrounds in her hometown.

"A lot of kids don't know they're able to go into higher education. I want them to see a familiar face showing them that we may be from a really small town and may not have a lot of money, but we can still do these really great things," she said. "There's so many people out there rooting for them to go into higher education."

Article by Kate Keenan, College of Engineering

Jackie was granted another Grand Challenge award this year, as the College of Engineering held their second annual Grand Challenge Scholar pitch. There were three recipients from our Department .

Mark Currier — Materials Science Engineering: Make Solar Energy Economical (Dr. Tom Bitterwolf, Chemistry)

Jackie Martinez-Alvarez — Chemical Engineering & Chemistry: Reverse Engineer the Brain (Drs. Bernards & Kumar)

L. Nicole Yu — Chemical Engineering, Biochemistry & Chemistry: Engineer Better Medicines (Dr. Bernards)



University of Idaho

Chemical & Materials Engineering

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<http://www.uidaho.edu/engr/cme>



FBN200

2017 Academy of Engineers Inductees



James R. Arnold

B.S., Metallurgical Engineering, University of Idaho, 1975
M.S., Engineering Management, University of Missouri-Rolla, 1980



Candis S. Claiborn

B.S., Chemical Engineering, University of Idaho, 1980
Ph.D., Chemical Engineering, North Carolina State University, 1991



D. Mark Durcan

B.S., Chemical Engineering, Rice University, 1983
M.S., Chemical Engineering, Rice University, 1984



Yogendra N. Sarin

B.S., Chemical Engineering, HBTI, Kampur, India, 1968
M.S., Oil, Gas, Petro Chemical Engineering, Milan, Italy, 1971
M.S., Chemical and Materials Engineering, University of Idaho, 1976



Patrick R. Taylor

B.S., Metallurgical Engineering, University of Idaho, 1974
B.S., Math, University of Idaho, 1974
Ph.D., Metallurgical Engineering, Colorado School of Mines, 1978