Greetings! I’m pleased to forward to you the latest issue of Diffusion, the newsletter for Oregon State University’s School of Chemical, Biological and Environmental Engineering (CBEE).

In this issue, we welcome new academic and professional faculty for the 2015–16 academic year, and we highlight several major research grants awarded in the School. Student successes at the Fall AIChE Conference in Salt Lake City are featured, along with recent school events and news. Research and industry internships are just one of the ingredients that go into creating our work-ready graduates – read all about eleven of our current juniors and seniors and their varied internship experiences.

My best,

James D. Sweeney
School Head & Kuse Chair
jim.sweeney@oregonstate.edu
NEW FACES

Elain Fu: Assistant Professor

Elain Fu began her tenure-track appointment in the School of Chemical, Biological, and Environmental Engineering at Oregon State University in the fall of 2015. Prior to that, Fu was research faculty in CBEE from 2013 to 2015 and in the Department of Bioengineering at the University of Washington from 2010 to 2013. Fu’s research program is focused on microfluidics-based sensor technology development with the aims of understanding the physics and chemistry of device operation and increasing device performance for field applications. Recent work in her group has been on the development of “paper” devices to enable high performance testing in a simple disposable format that is appropriate for use in even the lowest-resource settings. Global health applications in the areas of human disease diagnosis, veterinary medicine, agriculture, and environmental monitoring are of particular interest to her.

John Cochran: Development Engineer

John Cochran has worked for several different industries in the Corvallis area. He is a graduate of Washington State University as a Chemical Engineer and is also a Registered Professional Engineer in Oregon. Cochran also completed his MBA at Portland State University. He is certified as an Oregon wastewater system operator for both Grade III Collection and Treatment. Cochran loves the various lab work and lab set up that he has been a part of over the years to support industrial research and development. Cochran enjoys spending time with his family when not working.

Anita Hughes: Graduate Program Coordinator

Anita Hughes was raised in Corvallis. She received her BA and MS from OSU. She also received an MBA from Willamette University. Following her MBA she worked as a Market Research Specialist for HP. Hughes was recruited back to work for the MBA program at Willamette and has worked previously for OSU in a similar role. Hughes also served as Registrar at Clatsop Community College in Astoria. Most recently, Hughes was the Associate Registrar and MBA Program Manager at University of Alaska Fairbanks. She spent 5 years in Fairbanks, where she met her husband, also an OSU alum. Hughes loves working with students and their educational goals. She is happy to be back at OSU where she plans become a big supporter of Beaver baseball. Hughes enjoys hanging out with family, beading and quilting, and outdoor activities in her free time.

NEW SPACES

WALLS ARE GOING UP!

Johnson Hall, CBEE’s highly anticipated future Administrative home and primary lab building, is moving along nicely, with an anticipated move-in date of August 2016. Some of the fun features of the new building include heated lobby floors, ambient heated/cooled ceiling tiles, smart HVAC systems that recognize open windows, and more!
LANDMARK NEWS!

MAJOR GRANT AWARDS

NANOTECHNOLOGY ADVANCES

Oregon State University, in partnership with the University of Washington and as part of the Northwest Nanotechnology Infrastructure, has received a $4.5 million, five-year grant from the National Science Foundation for nanoscale science, engineering and technology research. The National Nanotechnology Coordinated Infrastructure is comprised of 16 selected sites, and will allow researchers from academia, government, and industry access to facilities and instrumentation to further nanotechnology innovation and commercialization.

“This winning this NSF grant is evidence that OSU has been making the right investments in our materials research infrastructure, and that we are competitive with the top universities throughout the country,” said Greg Herman, professor of chemical engineering at Oregon State University and Oregon State’s lead on the grant.

(Read more here: http://oregonstate.edu/ua/ncs/archives/2015/oct/nsf-awards-45-million-nanotechnology-grant-osu-partnership)

ADVANCED IMAGING

Oregon State University was awarded an $815,000 “major research instrumentation” grant through the National Science Foundation, part of a $1.2 million package to develop a high-end, 4D imaging system, and establish an Advanced Imaging Facility.

The instrument will provide unique opportunities for conducting high-resolution and high-fidelity three-dimensional imaging of otherwise opaque objects. It can “look inside” objects and “fly through” materials in three-dimensional space, so researchers can study form, character and function at the micron-scale of a variety of materials. There may be applications in environmental, mechanical and civil engineering, as well as geoscience, wood science, zoology, anthropology and agricultural sciences.

“It will be a one-of-a-kind development, and has the capacity to follow processes in time as they take place inside the object of interest,” said Dorthe Wildenschild, a professor of environmental engineering and the grant’s principal investigator. “Among the projects that will be supported by the instrument is research to optimize the trapping of carbon dioxide in subsurface rocks as a climate change mitigation measure.”

(Read more here: http://oregonstate.edu/ua/ncs/archives/2015/oct/nsf-grant-supports-high-end-imaging-instrument-development)

ARPA-E GRANT

Converting Biogas to Liquid Fuels by Low Energy Electrical Corona Discharge Processes

Oregon State University will develop a process that converts methane (the main constituent of biogas) to higher chain hydrocarbons when passed through a corona discharge at close to ambient temperature. This is a radically different approach to carbon–carbon bond formation that could enable the selective conversion of biogas into high value products with energy expenditure similar to that required for thermal processes.

The award to OSU totals $2.25 million. The investigative team includes chemical engineering professors Alexandre Yokichi and Goran Jovanovic, chemical engineering assistant professor Nick AuYeung, and electrical & computer engineering professor Annette von Jouanne.

The U.S. Department of Energy’s Advanced Research Projects Agency – Energy (ARPA-E) funds technologies that show technical promise and potential for commercial impact, but are too early in their research and development for private-sector investment. ARPA-E funds these technologies under focused and open solicitations. The Agency’s 2015 open funding solicitation, also issued in 2009 and 2012, serves as a call to scientists and engineers for transformational technologies outside the scope of ARPA-E’s existing focused programs.

REVOLUTIONIZING ENGINEERING DEPARTMENTS

The OSU School of Chemical, Biological and Environmental Engineering (CBEE) has been selected to participate in the National Science Foundation RED initiative to “revolutionize engineering departments.”

With a five-year, $2 million grant, one of only six of its type in the nation, CBEE plans to substantially change its curriculum to make courses more realistic, consequential, and relevant to the lives of students and embracing of different cultures. The investigative team, led by Jim Sweeney, professor and head of the school, includes Milo Koretsky, OSU chemical engineering professor, Michelle Bothwell, OSU bioengineering associate professor, Devlin Montfort, OSU environmental engineering assistant professor, and Sue Nolen, professor, University of Washington College of Education.

The School plans to develop ways to better incorporate both curricular and real-world experiences. Problem-based learning, cultural inclusion, and consequential work will hopefully improve the student experience and aid retention, recruitment and graduate numbers. Curricular redesign will take place through nine sophomore and junior-level fundamental engineering classes taken by all chemical engineers, bioengineers, and environmental engineers.

“Students will be able to better tie the experience in the classroom to the rest of their lives,” Sweeney said. “Our graduates will be dramatically better prepared to apply their knowledge and skills to whatever unpredictable challenges face our society in the years to come.”

Look for more in-depth reporting on the RED grant and engineering education here at OSU in future Diffusion issues and on our website at cbee.oregonstate.edu
AROUND THE SCHOOL

AICHE ANNUAL STUDENT CONFERENCE, SALT LAKE CITY, UTAH

The CBEE Club students had another outstanding performance at the AICHE Student National Meeting. Held November 6-9, over 1700 students were in attendance from every state and more than a dozen foreign countries. The three co-Presidents, Jenny Green, Ashaen Patel, and Wyatt Self, along with other club officers and volunteers, worked hard to organize the trip and get all the students safely to Salt Lake City and back. It was a long and tiring drive, but everyone returned home safely! The students would like to say THANK YOU to both the College of Engineering and the School of CBEE for their support to attend this meeting.

Undergraduate Poster Competition (326 posters)
The club had nine student presenters in the Poster Competition. Eight of the nine were past Johnson Interns, several in Summer 2015. [See story on page five for more on the Johnson Internship Program.] Many students mention that faculty visit to recruit them for graduate school.

- Student: Anica Neumann  
  Title: Platinum Alloys for Oxidation of Oxalic Acid  
  Advisor: Dr. Plamen Atanassov, New Mexico State University
- Student: Ashaen Patel  
  Title: Density Functional Theory Calculations of CO2 Dissociation on Copper Surfaces  
  Advisor: Dr. Linye Arnadottir, OSU CHE  
  Award: 3rd Place (Computing, Simulation and Process Control I)
- Student: Zia Klocke  
  Title: Behavior of Titanium Dioxide Nanoparticles in the Presence of Common Contaminant Bisphenol A  
  Advisor: Dr. Stacey Harper, OSU ENVE  
  Award: 2nd Place (Environmental Engineering and Science I)
- Student: Khiem Lam  
  Title: Exploring the Microbiome of Cervical Cancer through Transkingdom Networks  
  Advisor: Dr. Andriy Morgun, OSU College of Pharmacy

  - Student: Marisa Thierheimer  
    Title: The Effect of Heat Shock Protein 70 Inhibitors on Platelet Function  
    Advisor: Dr. Owen J.T. McCarty, OHSU
  - Student: Justin Tran  
    Title: Carbon Dioxide Shuttling Thermochemical Storage Using Strontium Carbonate  
    Advisor: Dr. Nick AuYeung, OSU CHE  
    Award: 2nd Place (Fuels, Petrochemicals and Energy II)
  - Student: Jasper Limon  
    Title: Using Pyrolysis to Convert Biomass to Biochar with Heat from On-Site Solar Thermal Energy  
    Advisor: Dr. Nick AuYeung, OSU CHE
  - Student: Sky Jackson  
    Title: The Effects of Post-Annealing on Ferrocryystals  
    Advisor: Dr. David Johnson, U of O
  - Student: Christine Kang  
    Title: Interfacial Adsorption and the Assembly of Gold Nanoparticle Embedded Peptoid Nanosheets  
    Advisor: Dr. Ronald Zuckermann, UC Berkeley  
    Award: 3rd Place (Materials Engineering and Science VII)

National Chem-E-Car Competition
The OSU CBEE Team Tetris placed 12th out of 31 National and International Teams. This was only the second time OSU has had a ChemE Car Team at nationals in the fifteen years of the competition. The car used a hydrogen fuel cell, with an iodine clock reaction for the stopping mechanism.

  - Target Distance: 25.3 m
  - Load: 230ml water
  - Best run: 1.38m from the finish line (actually past the finish line!)

Leader: Wyatt Self; Safety Coordinator: Ashaen Patel; Faculty Advisor: Travis Walker

AS REPORTED BY JENNIFER GREEN AND DR. SKIP ROCHEFORT

FACULTY PROMOTIONS:

STACEY HARPER  was promoted to associate professor with indefinite tenure.

GREG HERMAN  was promoted to professor with indefinite tenure.

ALEXANDRE YOKOCHI  was promoted to professor.

Fall 2015: Largest Incoming CBEE Junior Class Due to Changes in Pro-school Admission Process
In recent years, engineering enrollments at Oregon State have surged, but capacity constraints in upper-level classes have limited the size of the incoming Professional School class of CBEE juniors each year. This fall, with increased support from the University, CBEE was able to admit 233 juniors to “Pro-School”, more than a 50% increase over the prior year.

Senior Dessert Reception
On October 21, engineers and managers from three diverse companies shared career insights and information about their employers to a rapt audience of about fifty, mostly senior, CBEE students. Students heard from bioengineering alums John Baumann (BioE ’02) of Bend Research and Jakson Clark (BioE ’13) of TE Connectivity – Medical, and also from Damon Lechtenberg, Plant Manager from Arclin, Inc. Desserts and networking time followed the talks.

Alumni Homecoming Brunch
On Saturday, October 24th, faculty and CBEE Club members made pancakes and chatted with visiting alums at the annual CBEE Alumni Homecoming Brunch, held in Gleeson Hall. Be sure to join us next fall for this fun chance to reconnect with CBEE, reminiscence and meet our newest students!
Internship experiences are a key element in achieving one of the goals of the OSU School of Chemical, Biological and Environmental Engineering (CBEE) – that students be immediately ready for professional practice upon graduation. Students are encouraged to complete internships while they are enrolled in the engineering program to increase their preparation for work or graduate school.

**“Win-Win”**
The best internship projects are those that provide both real value to the organization (real work) and a challenge to the student (makes them stretch and think). An appropriate degree of supervision and mentorship to the student is necessary to ensure a successful experience, so some degree of pre-planning and supervision is important. Employers usually find that our students are able to work with a high degree of independence.

Hiring an intern can be a great way to contribute to engineering education while also getting some of those back-burner projects completed and leveraging the effectiveness of existing technical personnel.

**Not just juniors and seniors**
Many employers recruit students who have completed their second and third years in the program, however first-year students also seek internships and can definitely provide value in support of an engineering project within an organization. Occasionally our graduate students also look for internships to augment their studies and research.

**Not just summer**
While summer internship positions (mid-June through mid-September) are the most common, some students are available for longer internships during the school year.

**Multiple sources**
Internships come in many “flavors” – research, university, industry, government, co-op, etc. Most students arrange internships directly with employers, with help from CBEE and the OSU Career Development Center. Students find work through employer on-campus recruiting efforts, information sessions, job postings, on-campus interviewing, career fairs, and special events.

**Internship Programs**
Some CBEE students participate in the Multiple Engineering Cooperative Program (MECOP) program, a separate organization which assists in placing engineering interns from OSU and several other Oregon universities into two six-month industry assignments.

For more information about the MECOP Program, see: [meocopinc.org](http://meocopinc.org).

The Pete and Rosalie Johnson Undergraduate Internship Program is a competitive award that is open to students who have successfully completed the two required first-year CBEE courses. The Johnson Internship involves a summer research project at OSU and other academic settings. Previous Johnson Interns can apply for a second summer of support through the program.

For more information about the Johnson Internship Program, see: [cbee.oregonstate.edu/johnson-internship](http://cbee.oregonstate.edu/johnson-internship). For more information about setting up an internship at your organization, please contact CBEE Corporate Relations Manager at lynne.ekstedt@oregonstate.edu.

**Be sure to check out our feature story on pages 6-7 for student summaries of their 2015 internships!**

### A working year with E&J Gallo, NASA and Boeing
Claire Offer arranged for not just one but three internships during a total of 15 months, between her Junior and Senior years! She spent the summer and fall of 2014 at E&J Gallo Winery in Modesto, CA, winter and spring term of 2015 at NASA Kennedy Space Center, FL as a Pathways Intern, and summer of 2015 at The Boeing Company in Everett, WA.

Here’s an excerpt from Claire’s NASA report:

“It’s like drinking from a fire hose.” Nothing better describes trying to learn about NASA, Kennedy Space Center (KSC), Propellants and Life Support, and more in just 19 short weeks. Acronyms, chemical properties, and history are just a few of the things I am still trying to keep straight. In the Propellants and Life Support branch of the Center Operations Directorate, now Spaceport Integration and Services, I contributed as an intern in the liquid oxygen and liquid nitrogen (LOX/LIN) engineer position. As an engineer-in-training, I worked on projects that a LOX/LIN engineer would face daily, monthly, and annually. In addition to purely propellants work, the position allowed me to contribute at Life Support and Propellants North. As my supervisor says, “In this field your knowledge can be as broad or deep as you want.” With such a short time, I began my NASA career by building a broad knowledge base with the hope of continuing to develop an understanding of Propellants and Life Support and delving deeper into specific topics.”

Claire Offer (Senior, ChemE 2016)
CBEE students work for corporations, government agencies and universities; industries include paper products, chemical processing, microelectronics, biofuels, bioengineering, wineries, environmental consulting firms and more.

Rising senior Claire Offer decided to postpone graduation for a year to gain internship experience prior to her senior year. Read Claire’s story on page 5.

To learn more about setting up an internship at your organization, contact Lynn Ekstedt, CBEE Corporate Relations Manager, at lynn.ekstedt@oregonstate.edu.

The following are highlights of a variety of summer 2015 internships completed by CBEE students.

INDUSTRY INTERNSHIPS

INDUSTRY – Columbia Sportswear
Mark Geniza (Junior, ChemE 2017)
My summer internship at the Columbia Sportswear Company in Portland, Oregon was with their Global Innovation Team. I was working with and researching new technologies related to apparel and footwear. This research allowed me to apply a lot of what I had learned in school, and also gave me a preview of what I would be learning in the next couple years. I had fantastic mentors and co-workers with vast amounts of experience at Columbia that helped me to see real and exciting applications of chemical engineering in their business.

INDUSTRY – Hewlett-Packard
Madeline Wilson (Senior, Honors ChemE 2016)
During my internship, I investigated the effects of dynamic surface tension on thermal inkjet printing performance. Surface tension is important in the printing industry because it affects printing speed and ink drop shape. It is also an input parameter for HP’s fluid simulation program used to model ink flow. Because the printing process happens so quickly (around 10 microseconds), HP currently does not have a way to measure dynamic surface tension on this short timescale. My project involved looking for ways to measure dynamic surface tension on this timescale by correlating it to other measurable printing parameters. I appreciated that I was able to choose the direction of my project and conduct my own research. My mentor and manager provided guidance and feedback, but I enjoyed designing my own experiments to gain useful information for myself and my coworkers. In addition to this, I had the opportunity to see how my engineering classes related to real industry problems. I accepted a full-time R&D engineering position at the end of my internship, and I’m excited to continue my work at HP in the future.

INDUSTRY – Boeing
Eric George (Senior, EnvE 2016 – MECOP)
I interned for the Environment, Health and Safety group at Boeing, Renton. My group primarily acted as consultants on many of the larger projects around the plant ensuring that Boeing still complied with wastewater, air, and waste permits. While I was able to assist on projects ranging from greenhouse gas reporting to hazardous waste classification, I primarily worked with the wastewater pretreatment plants at Renton and North Boeing Field (Seattle). Because of the chemicals that enter the water during manufacturing and painting, Boeing has to treat the water before discharging to King County. My main project as an intern was to...
investigate all the influent sources to the wastewater pretreatment plant in Renton. As more 737’s are manufactured, the capacity at the pretreatment plant has to increase. I looked at ways Boeing can decrease water usage around the plant, methods in which grey-water systems can be implemented, and helped determine a schedule at which the treatment plant should be upgraded to accommodate additional flow, a $1,000,000 project.

Networking is very important and Boeing provides you with many avenues and opportunities to get to know other employees, both factory workers and executives. Returning to school definitely required an adjustment period especially when I realized that I would no longer be receiving a paycheck every two weeks. The experience has however helped me in the classes I’ve taken since my first MECOP internship. Because of the experience, I better understand how to incorporate budgeting and scheduling into my work. I also learned that in the work place you’ll be expected to make tough decisions regarding your projects and that it is important to justify each decision so that others can understand your work.

**RESEARCH INTERNSHIPS**

**RESEARCH – Idaho National Lab**
Miranda Raper (Senior, Honors BioE 2016)
As an intern, I was part of a small, collaborative group of scientists that investigated the use of diglycolamides (DGAs) in the separation of actinides and fission products from used nuclear fuel as a way to minimize/recycle nuclear waste. In addition, I worked on a project that analyzed the energy potential of biomass. My research was performed primarily in a mass spectrometry lab where I learned three different techniques: Electro spray Ionization Mass Spectrometry (ESI-MS), Liquid Chromatography Mass Spectrometry (LC-MS) and Gas Chromatography Mass Spectrometry (GC-MS).

This internship enhanced my academic studies because I learned very common analytical chemistry techniques that are commonly used in the biotechnology industry. This opportunity was beneficial for my career as well because it gave me a chance to experience what it was like to work in a national lab, which I had been considering. Lastly, this opportunity allowed me to broaden my knowledge in an area I was not as familiar with (Nuclear Science/Engineering) yet allowed me to exercise the knowledge gained through my Chemistry Minor.

**RESEARCH EXPERIENCES FOR UNDERGRADUATES (REU) – Portland State University Microscopy and Microanalysis**
Shivali Kadam (Junior, Honors ChemE 2018 – MECOP)
This summer, I participated in Portland State University’s Microscopy and Microanalysis REU program. I worked in Dr. Robert Strongin’s lab and my project involved synthesizing a sugar-sensing boronic acid fluorophore and testing its spectroscopic properties. The program ran for eight weeks. In addition to gaining valuable lab experience, this program also allowed me to learn how to use a FIB and attend the 2015 Microscopy and Microanalysis Conference.

**RESEARCH EXPERIENCES FOR UNDERGRADUATES (REU) – Center for Sustainable Materials Chemistry**
Jonathon Lopez (Junior, Honors ChemE 2017)
During Summer 2015, I worked as an intern for the Center for Sustainable Materials Chemistry where I was an Undergraduate Research Intern working under Dr. May Nyman and Dr. Doug Keszler. The Center for Sustainable Materials Chemistry was started and is headquartered at OSU but several other universities have joined the Center, like University of Oregon, Rutgers, University of California Berkeley, and Washington University. My internship experience was unique because I was placed on a team on undergraduates working on one big project with two different areas of work to be done. I was working on the team that characterized the aqueous precursors while the other team created and characterized thin films from those precursors. Working on a team while conducting research was such an enriching experience because I aspire to work in the Research and Development field as a Chemical Engineer so this internship allowed me a great opportunity to experience that now.

**RESEARCH – TWO JOHNSON INTERNSHIPS – with Dr. Nick AuYeung, OSU Assistant Professor of Chemical Engineering**
Jasper Limon (Junior, Honors ChemE 2018 – MECOP)
The Johnson Internship program was an important experience for me. It gave me the chance to see what topics chemical engineers can do research in. I did two internships during the summers of freshman and sophomore year, one in Dr. Alex Yokochi’s Lab and the other in Dr. Nick AuYeung’s Lab. The first summer my project was to design and construct a prototype mini reactor to create a demonstration for what chemical engineers do. The second summer I was on Team Dish, as we call it, creating a parabolic sun concentrator to focus the solar energy for driving a biomass conversion process by pyrolysis. Additionally, being able to work with
Professors helped me get a start on research and I am starting work on my thesis with Dr. AuYeung. The advising has helped me choose a plan to graduate and what to do after graduation. 

Justin Tran (Junior, Honors ChemE 2018 – MECOP)

My Johnson experience showed me what chemical engineering is and what possible fields chemical engineers may work in. This past summer I worked in Dr. Nick AuYeung’s lab researching solar thermochemical energy storage. I focused primarily on the synthesis of the materials used, trying to make them sintering-resistant. Additionally, my first summer in the program, I worked in Dr. David Stuart’s lab at Portland State University. Here, the research was focused on organic synthesis and my project was to find a greener synthesis method for Koser’s reagent.

The Johnson program allowed me to get to know professors in the department as Dr. AuYeung helped guide me over the summer with problems I encountered. Additionally, the Johnson program and research reinforces learning since I was consistently applying concepts from my classes over the summer.

RESEARCH – Monterey Bay Aquarium Research Institute

Wiley Wolfe (Junior, Honors ChemE 2017)

This summer I worked at the Monterey Bay Aquarium Research Institute in central California. I was working on the validation and optimization of a low-cost aquatic carbon dioxide sensor, under the supervision of Dr. Ken Johnson. My time was spent building and deploying the sensor in Elkhorn Slough. It was an incredible opportunity and I highly recommend it to anyone who is interested in the combination of engineering and oceanography.

UPCOMING EVENTS

2016 AICHE SPRING MEETING: APRIL 10–14
This year’s meeting will be held in Houston.

2016 AICHE PACIFIC NORTHWEST STUDENT REGIONAL CONFERENCE: APRIL 15–17
Chemical engineering students from across the region will meet at the University of Washington.

CBEE INDUSTRY ADVISORY BOARD MEETING: MAY 20

COLLEGE OF ENGINEERING UNDERGRADUATE EXPO: MAY 20, 11 am to 4pm
Senior Design Showcase, Lab Tours, Free & Open to the Public.

CBEE GRADUATION CEREMONY: JUNE 10

ABOUT CBEE

The School of Chemical, Biological, and Environmental Engineering (CBEE) at Oregon State University is home to BS undergraduate programs in chemical engineering, bioengineering, and environmental engineering, and graduate programs in chemical engineering and environmental engineering leading to MEng, MS and PhD degrees. The School has 26 full-time faculty, and currently enrolls nearly 1000 undergraduate and 150 graduate students. The School emphasizes the integration of chemical, biological and environmental engineering principles and practice in a student-centered learning environment to provide work-ready graduates and technical solutions for a sustainable future. Research expenditures exceed 6.5 million dollars per year, and current emphasis areas include thin films and nanostructured materials for renewable energy and electronic device applications, bioprocess engineering and biofuels, biomaterials & therapeutics, transport and remediation of contaminants in the subsurface, interaction of nanomaterials with the environment, microtechnology for chemical and energy processing applications, and engineering education research.