

# Washington State University

*Celebrating Fifty Years of Chemical Engineering at the Stroke of the New Millennium*



**Marc VanderSchale and Brian Erickson  
remove CO<sub>2</sub> from air in  
packed-column gas absorber.**

So, what can 50 years of chemical engineering education mean in the context of 2,000 years of calendar time, especially when generated from a relatively small program in the rural town of Pullman, Washington, located in the middle of wheat fields?

Surprisingly, Washington State University's chemical engineering department is a unique example of one of the oldest chemical engineering programs in the country that is still a thriving concern for the university and related industry in today's world. Having evolved from being part of the chemistry department in 1917 into a separate department in 1950, ChemE now focuses on education and research in advanced gas and chemical processing, hazardous material cleanup, and bioengineering.

The department has graduated more than 1,100 students, the majority of whom have taken significant roles in industries such as oil and chemicals, pulp and paper, pharmaceuticals, food, microchip manufacturing, environmental protection, and bioengineering. Alumni can be found in such diverse industries as petroleum refineries, pulp and paper mills, nuclear and synthetic fuel processing facilities, and food processing plants. They are hired by such companies as Dow Chemical, Westinghouse, ARCO, Boeing, Weyerhaeuser, Kaiser Aluminum, Intel, Battelle Pacific Northwest National Labs, as well as other Hanford contractors and smaller companies in the region.

"Graduates from WSU's chemical engineering program are highly marketable," reports Richard Zollars, department chair. "Starting salaries in the mid-\$40,000s are common, as qualified candidates in these fields are highly sought after by industry and agencies."

The small size of the program and connections with industry work in its favor. With about 100 undergraduate, 30 graduate students, and 10 permanent faculty, class sizes of 25-35 afford seminar possibilities

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and close interaction between faculty and students. Because of its select nature, the program attracts students with above-average scholastic standing, and as many as one-third of all those certified in the chemical engineering program are in WSU Honors Program.

Given the above collegiate atmosphere, the faculty, research, industry partnerships, and educational activities take on a distinctive quality and focus.

### **THE UNDERGRADUATE PROGRAM**

The undergraduate curriculum allows for broad education in the sciences and sound basics in the discipline, but with a flexibility that allows students to individualize studies. In the upper-division, after students certify, the following courses provide the basics in chemical engineering:

#### Sophomore Year

ChemE Process Principles; Process Simulation

#### Junior Year

Transport Phenomena; Fluid Mechanics/Heat Transfer; Thermodynamics; Separations; Kinetics

#### Senior Year

Chemical Engineering Lab I and II; Control; Design I and II; Seminar

Another seven or eight electives allow juniors and seniors to customize their focus in bioengineering, environmental, or other allied fields. They also have opportunities for multidisciplinary study and research.

For example, Becky Russell, a recent graduate who knew she wanted a career that impacted people, explains "I decided to make chemical engineering my preparation for medical school. The skills I learned in technical problem solving and biomedical applications have served me well."

Not all is serious study, however. Students are encouraged to join the College Ambassadors group and to participate in the AIChE student chapter or other engineering societies for networking and leadership growth. WSU's student AIChE chapter recently won first prize at its regional conference for proposing a national competition around student-built chemically controlled cars. The group will put this to the test at the national conference in Miami in mid-November (after the deadline for this article). President Wendy Anna and other officers were able to raise funds from industry to defray the cost of several students' travel to Florida for this purpose.

As the nationwide need to recruit and retain engineering students escalates, WSU's chemical engineering department continues to step up its efforts for scholarships and other incentives. "There's a good chance that students will qualify for a scholarship if they achieve a 3.4 GPA or better and show promise while enrolled," reports Zollars. Because of the generous support of alumni and corporations, about one-third of the

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Website at  
<http://www.che.wsu.edu>

### **FACULTY**

**Ivory, Cornelius**  
PhD, 1980: Princeton  
*Bioprocessing, separations,  
modeling*

**Lee, James**  
PhD, 1978: Kentucky  
*Bioprocessing, mixing*

**Liddell, KNona**  
PhD, 1979: Iowa State  
*Hazardous wastes,  
electrodeposition*

**Mahalingham, R.**  
PhD, 1968: Newcastle-Upon-  
Tyne, England  
*Hazardous wastes, shock  
reactions*

**Miller, Reid**  
PhD, 1968, California, Berkeley  
*Thermodynamics*

**Petersen, James**  
PhD, 1979: Iowa State  
*Bioremediation*

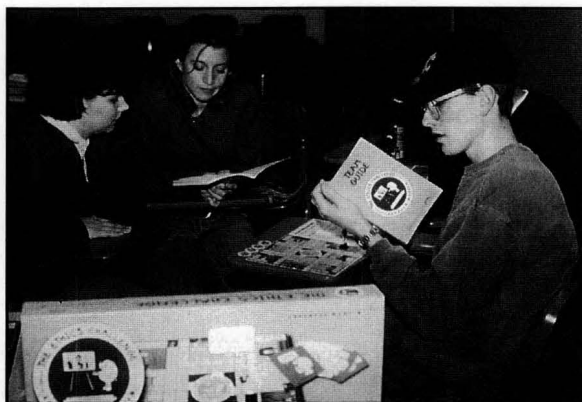
**Peyton, Brent**  
PhD, 1992: Montana State  
*Bioremediation, extremophilic  
bioprocessing*

**Thomson, William**  
PhD, 1969, Idaho  
*Materials, kinetics, catalysis*

**Van Wie, Bernie**  
PhD, 1982, Oklahoma  
*Bioprocessing, biomedical  
engineering*

**Zollars, Richard**  
PhD, 1974, Colorado  
*Colloidal/interfacial phenom-  
ena, reactor engineering*

*Ethics  
are taught in  
one senior class  
by using the  
Dilbert  
Ethics Challenge  
game.  
Teams ponder  
how to handle  
case studies.*



undergraduate students receive some form of financial aid.

With the exception of athletics, chemical engineering's alumni traditionally give the highest per-annum donations of any other unit at WSU.

### **GRADUATE/RESEARCH PROGRAM**

While virtually every undergraduate student who wishes to may get involved in faculty research, the research program is the heart of the graduate program. Currently, more than \$2 million in grant activity is in progress, with healthy prospects for more.

Emphases in bioengineering, environmental restoration, and hydrocarbon processing result in such projects as biotreatment of hazardous contamination, diagnostic medical devices, and converting natural gas to useful products. The current roster of graduate-student research covers such topics as electrodeposition, isoelectric focusing, development of biosensors, protein production in plant cell systems, bioremediation of chlorinated solvents and heavy metals, oxidative coupling of methane, etc.

The Center for Multiphase Environmental Research (CMER), under the direction of Professor James Petersen, conducts interdisciplinary research addressing important environmental problems for industries and government agencies. It seeks opportunities to transfer this technology to industry and, in the process, to educate the next generation of environmental professionals.

CMER faculty are drawn from the civil, environmental, chemical, mechanical, and biological systems engineering departments. The Center and chemical engineering faculty currently play a part in three such projects with large government grants: remediation and recycling of creosote-treated piers at Navy ports and two D.O.E. projects to clean up toxic metals in soils and aquifers.

As a result of her quality work on hazardous waste treatment through CMER, doctoral student Juli Sherwood last year won the university's Harriet Rigas Award from the Association of Faculty Women as WSU's outstanding doctoral woman student, citing her for her research, teaching, and leadership.

Another recent graduate student success story is illustrated by Sherman Xu, who within five years gained both his master's and doctoral degree, valuable research expertise, and a job with the Amoco Research Center in Illinois. His research explored a more productive procedure to convert natural gas to ethylene—the feed stock for many of today's plastics.

### **ABOUT THE UNIVERSITY**

WSU is a land-grant research university dedicated to excellence in undergraduate education. Founded in Pullman in 1890, it has 21,000 students at four campuses, several Learning Centers and other sites throughout the state. WSU's nine colleges and approximate 150 undergraduate majors, along with its distance Extended Degree Programs, can almost "Take You Anywhere You Want to Go!" Pullman's residential campus designates special honors and math-science-engineering residence halls. WSU is one of the most "wired" campuses in the west, with good access to computers and learning labs. Semester classes are scheduled from late August through mid-December, January through mid-May, and at varying summer sessions.

### **ABOUT THE COLLEGE**

The Chemical Engineering Department is part of WSU's College of Engineering and Architecture, which is committed to quality curricula and innovation in learning. Through industry-partnered programs and practical approaches, students prepare for technology-based professions and life-long learning.

Distinguished faculty and alumni network with industries that offer students scholarships, mentoring, internships, and project opportunities. Approximately 120 permanent faculty serve an average of 2,000 undergraduates, who may join more than 20 student clubs or professional societies for fun and extra challenge. Facilities include numerous labs, classrooms, and other learning spaces in seven buildings on the Pullman campus. A modern 100,000 square foot Engineering Teaching and Research Laboratory recently opened and holds state-of-the-art testing and analysis facilities.

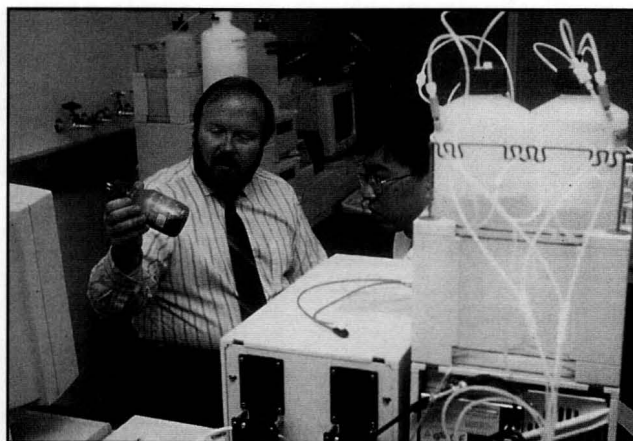
The College assists with tutoring, skills workshops, scholarship applications, orientations, and other special student needs. It also helps recruit and retain individuals from underrepresented groups through the Minority and Women's Engineering Programs.





◀ *O.H. Reaugh Lab dedication: Student Carrie O'Rourke, Chair Dick Zollars, lab director Bill Thomson, WSU President Sam Smith, and alumnus O.H. Reaugh.*

*Reaugh, Thomson, and student Matt Fountain tweak the new equipment. ▼*



▲ *Jim Petersen and graduate student Lin Sha look at grimy creosote being eaten by bacteria and turned into CO<sub>2</sub> in the lab.*



"With my WSU credentials, I found myself very competitive in the job market," says Xu. "I'm grateful to my superior graduate professor who gave me the 'big picture,' and allowed me to find my own answers. His close rapport with industry provided me opportunities to see practical uses of our research."

## FACILITIES

The department's premier research lab—the O.H. Reaugh Oil and Gas Processing Laboratory—was dedicated by its namesake this fall in a ceremony (attended by his family, university leaders, students, industry partners, and friends) that epitomized the momentum that the department's history brings to its future.

Orland Harry Reaugh, a 1933 graduate of the program, became a petroleum engineer and a leader in independent oil production in Oklahoma, Kansas, New Mexico, and Illinois. He has since become a major benefactor of WSU's chemical engineering department, which now has the only such alumni-endowed and -named laboratory within the university. Reaugh provided \$250,000, ARCO another \$50,000, and matching donations are being sought to complete the lab's \$500,000 endowment. The income will ensure a lab that is equipped with state-of-the-art instrumentation.

Lab director William Thomson says the facility "allows us to conduct research that is fast disappearing from the university scene—innovative studies to find less expensive and ecologically friendly ways to add octane to gas, bring natural gas to remote locations, and to create compact, economical hydrogen fuel cells.

More than 9,500 square feet of lab space are located in the

new Engineering Teaching and Research facility containing analytical equipment such as spectrometers, chromatographs fitted with auto-samplers and various detectors, anaerobic incubators, dynamic x-ray diffractometer, laser light scattering, and electrophoresis devices. The George T. Austin endowment for undergraduate lab equipment, augmented by funds from alumnus Gene Voiland, help keep learning technologies current.

Computing equipment and workstations with parallel processing features are provided for all graduate students and researchers. Keeping such quality computing current is always a concern of technical educators, however. Typically, alumni donations help replace one-third of the undergraduate machines every year in the 15-station computing lab. Full-scale commercial versions of Pro Vision, MatLab, Mathematica, MathCAD, spreadsheets, word processors, and other programs are used on these machines.

## INDUSTRY CONNECTIONS

A hallmark of WSU's engineering college is its continuing strong connection to industry. Companies and agencies provide internships, scholarships, collaborative research, and even job exchanges. WSU in turn provides on-site or webbed distance learning, qualified potential hires, and R&D.

One collaborative project is Prof. Bernie Van Wie's work with the Spokane Interdisciplinary Research & Technology Institute and DevTec, an independent industrial partner, to develop and commercialize an automated blood chemistry analyzer. Another collaborative project is Prof. Bill Thomson's work with the Washington Technology Center

and Washington Water Power to refine an efficient fuel cell.

West Coast companies such as ARCO, Boise Cascade, Hanford contractors, SEH America, Kimberly Clarke, and Reynolds Aluminum offer summer jobs and internships (summer plus one semester) to students—and often end up offering them jobs at graduation. They say they are impressed with WSU's students' practical knowledge and leadership experiences outside the classroom.

"Chemical engineers need foundations in science and math, but also in other disciplines that will prepare them to adapt new products into the culture," says Glenn Butler, CEO of the ARCO Refinery at Cherry Point. He and other department advisers urge development of students' skills in communication, presentation, and human relations, in addition to developing a code of ethics and a knowledge of overall business and economic concepts.

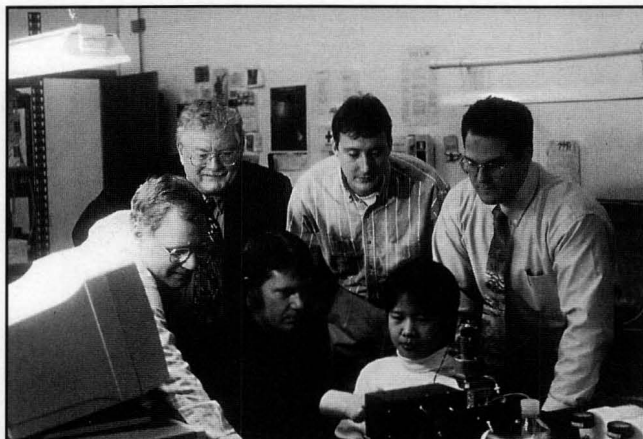
John Wolfe, a 1997 chemical engineering graduate now at ARCO in Anaheim, recently returned to the College's Career Fair—this time as a recruiter! "Basically, my ChemE degree helped to more than double my salary as a science lab technician," says Wolfe. "My internship with ARCO during the summers gave me a foot in the door. And now I have a good job with them solving technically complex problems in oil refining." He's now on the lookout for other potential hires who work well in teams of engineers, scientists, customers, plant operators, managers, lawyers, government regulators, and construction workers.

## OUTREACH

WSU Pullman's program remains fairly stable in size. Many families continue sending new generations as legacies. The department also reaches out to the adult, sometimes mid-career, learner through a companion program at the WSU branch campus in Tri-Cities, with access to Hanford and the Environmental Molecular Science Lab. It generally serves full-time employed engineers, offering after-hour courses so that engineers can upgrade their education or work toward the MSChE. It is one of few evening-based MSChE programs in the country. Many of the courses are taught by PhD chemical engineers who are also employed at the Pacific Northwest National Laboratory.

Tri-Cities student projects or theses usually are done with a committee composed of both WSU regular faculty and

"adjunct" faculty from local industry. Three to five students usually earn the MSChE degree through this program each year. This year's graduates will be Penny Colton (Dissolution Kinetics at the Calcite-Water Interface), Dan Schmitt (10 W Proton Exchange Membrane Fuel Cell Design), Chris Johnson (Microbial Growth Kinetics Using Colloidal Polymer as Substrate), Scott Estey (Thin Film Polydimethylsiloxane Oil Evaporation), and Brad Knutson (Evaluation of Ion Exchange Performance Predictive Tools).



***"Team think" in action. Graduate students, professors, researchers, medical professionals, and commercialization experts work on the automated blood analyzer project.***

To develop interest in engineering at earlier ages, for the past five years chemical engineering faculty has conducted a NSF-funded summer program for secondary school teachers. The goal is to familiarize them with engineering and help them develop modules to teach when they return to their classrooms. All together, more than 65 teachers attended—half from Northwest schools, and others from as far away as Korea, Florida, and Connecticut. Feedback from the participants noted that the experience suc-

ceeded in bringing engineering into their science curriculum. One science teacher developed an engineering-related module that contributed to a portfolio that won her state and national teaching awards.

## FUTURE TRENDS

Academic destinies will depend a great deal on the economic and technological trends transforming higher education today. For instance, the Tri-Cities program will be influenced by down-sizing at Hanford. And, as noted earlier, keeping computer equipment and software current is a major and constant challenge. By the same token, developing distance-learning technologies may allow webbing courses beyond campus sites, which will again revolutionize what we do at universities.

While state appropriations can no longer meet the entire departmental needs, outside grants and private funding is on the rise. The department plans to pursue more endowments similar to the O.H. Reaugh Lab, to stabilize funding bases.

Faculty and student numbers are not expected to change dramatically over the next five years. Expansion of multidisciplinary experiences is anticipated, however, particularly in the wake of the Center for Multiphase Environmental Research's path-finding activities. □