



ChE department

OREGON STATE UNIVERSITY

Submitted by

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OREGON'S TRADITIONAL COMMITMENT to quality higher education was established in 1868 when Oregon State University (then known as Corvallis College) became qualified under the Morrill Act as a land-grant college. The U.S. Congress defined the purpose of the land-grant schools in these words: "The leading object shall be, without excluding other scientific and classical

studies, to teach such branches of learning as are related to agricultural and the mechanic arts, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." Since its founding, the university has grown in scope and diversity, accepting the challenge of the Morrill Act while seeking to free people's minds from ignorance, prejudice and provincialism and to stimulate instead a lasting attitude of inquiry. Oregon State University is currently recognized as a university composed of schools in which the liberal arts are pursued, together with professional and technological schools which depend chiefly on the sciences and social sciences.

The 400 acre Oregon State University campus, composed of 54 major buildings surrounded by

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expanses of lawns, tall shade trees and flowering shrubs, is located in Corvallis, the heart of the Willamette Valley. This city of 45,000 people is situated between the snow-capped Cascade Mountains which rise to the east and the forested Coast Range to the west, beyond which lie the headland and scenic beaches of the Oregon Coast. These mountains and beaches provide a wide variety of outdoor activities throughout the year. These are balanced by the many cultural events and facilities found on campus. Oregon State offers a quality education in a relaxed, coherent atmosphere within a state that is proud of its leadership role in protecting the environment.

DEPARTMENT ROOTS

INSTRUCTION IN ENGINEERING began on the campus in 1883 with supervision vested in the mathematics department. In 1889, the Engineering Curricula was established involving civil, electrical, mechanical, and mining engineering. The first Chemical Engineering instruction followed the appointment of Professor Floyd Roland in 1914; at that time, Chemical Engineering was a separate school. The first bachelor of science degree in Chemical Engineering was awarded by this academic unit in 1917. After the addition of graduate courses, the first masters degree was granted in 1931 and the first Ph.D. degree in 1946. Chemical Engineering remained a separate school until the reorganization of the State System of Higher Education in 1932, when the school was brought into the School of Engineering. An important milestone in the emergence of the Chemical Engineering Department at Oregon State University was in 1942 when the Department became fully accredited.

Since its birth, the department has grown under the leadership of several outstanding individuals; notably George Gleeson—who later became Dean of the School of Engineering—and Jesse Walton. The Chemical Engineering program now occupies an eminent position in the School of Engineering, enrolling over 270 undergraduates and 35 graduate students. The department has been located in its own building since 1955; this facility makes available over 35000 square feet for

instruction and research.

Flexibility in its academic and research programs continues to be the keystone to the department's development. Rather than adhering to any narrow field of specialization, the department has sought to shift its technical emphasis over the years so that its graduates could meet the challenges of the future, using the most newly developed technology. Due to this philosophy and the accomplishments of the department's faculty



Dr. Kayihan and Brice Dardell using departmental minicomputer in their computer graphics developmental work.

members, chemical engineers have filled several of the university's high administration positions. Currently, the Associate Dean of Engineering and Director of the Experiment Station and the department chairmen of agricultural, chemical and mechanical engineering have Ph.D. degrees in Chemical Engineering. The Associate Dean, Jim Knudsen, is also the national president of the American Institute of Chemical Engineers.

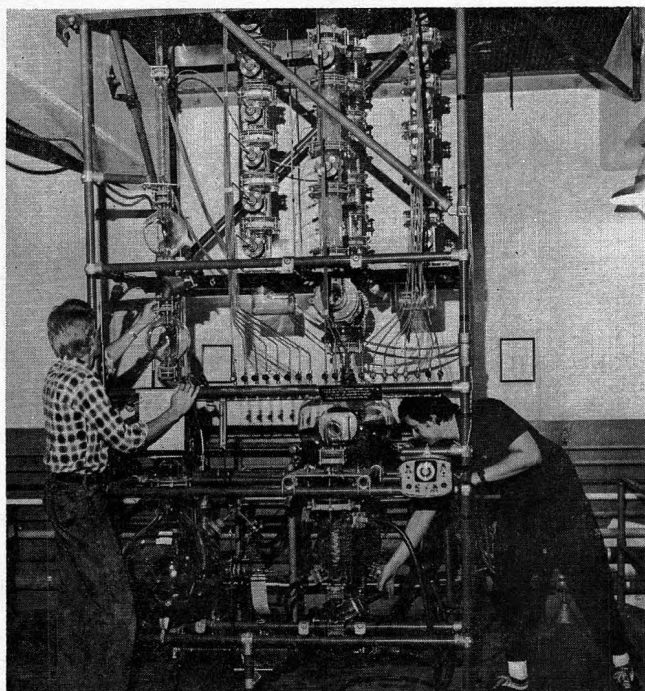
Since our first graduate in 1917, the department has provided the education of several outstanding engineers and scientists who have continued to make important contributions in industrial, governmental, and academic circles. The department is particularly proud of two of our earlier undergraduates who have recently been honored by Oregon State University for their distinguished services to society. Linus Pauling, the only chemical engineer to receive two Nobel prizes

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(one for his contributions in the field of chemistry and one for his efforts toward world peace) and Paul Emmett for his research in surface chemistry and heterogeneous catalysis and the famous B.E.T. theory on adsorption of gases.

THE UNDERGRADUATE PROGRAM

CONSISTENT WITH THE department's policy of technical flexibility and adaptability, the present undergraduate curriculum has been developed to maintain a strong emphasis on the physical and engineering sciences and to provide



Jeff Pitzer and Doug Larsen, seniors, working in the Chemical Engineering Lab.

laboratory and design experiences in solving today's practical engineering problems. A total of 204 term hours is required in the undergraduate curriculum; this includes year sequence courses in the engineering sciences of thermodynamics, transfer and rate processes, mechanics of solids, and electrical fundamentals as well as the more traditional chemical engineering courses of stoichiometry, applied fluid and heat transfer, mass transfer operations, chemical reaction engineering, process dynamics and control, and chemical plant design. Elective courses are available from other departments in specific engineering fields of air pollution, pulp and paper processes and wastewater engineering.

Computers have been an integral part of the

Chemical Engineering curriculum. Freshmen are introduced to our computing facilities with an extensive FORTRAN programming course; this is followed with a computer-aided stoichiometry course. Several of the other undergraduate courses utilize the computer on either a required or optional basis. Students have access to the department's real-time and analog computers as well as the university's computer system using departmental terminals. Every office and classroom has been wired so that the terminals can be made readily accessible.

Also available is the senior project option which typically involves the student in an on-going departmental research project or in the development on new computer methodology. Our faculty believe this "hands on" experience in a specialized field will help motivate the good students and hopefully encourage them to continue their education towards an advanced degree.

Considerable faculty effort is devoted to our undergraduate program. This is evidenced by the textbooks authored by members of our faculty. Octave Levenspiel has written the following texts: "Chemical Reaction Engineering," "Fluidization Engineering," "The Chemical Reactor Minibook," and "The Chemical Reactor Omnibook." Jim Knudsen has co-authored the textbook, "Fluid Dynamics and Heat Transfer," and Charles Wicks has co-authored a textbook with two other Oregon State professors, "Fundamentals of Momentum, Heat and Mass Transfer." Teaching does not take second place to research; this is evidenced by the honors and teaching awards won by our faculty. Octave Levenspiel was honored as an outstanding lecturer by the American Society for Engineering Education. Both Bob Mrazek and Charles Wicks have received the Carter Award for being the most inspirational teachers in the School of Engineering for a given academic year. In 1978, Bob Mrazek was honored by the university with the Elizabeth Ritchey Award as the university's outstanding teacher and advisor. In 1979, Charles Wicks was recognized by the OSU IFC as the outstanding university teacher and Jim Knudsen received the OSU Alumni Award as the most distinguished professor.

THE GRADUATE PROGRAM

THE OREGON STATE Chemical Engineering Department offers programs leading to the M.S. and Ph.D. degree, with either the thesis or non-thesis option available at the master's level. The

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graduate student is provided with a broad selection of courses in all areas fundamental to chemical engineering. Course selection is made by the student in consultation with the graduate student advisor or with the major professor.

An informal academic atmosphere is maintained with opportunity for the graduate students to give and take with the faculty and for joint work with environmental engineering, earth sciences, oceanography, environmental sciences and atmospheric sciences. We believe that science and technology have a responsibility to make this a better world.

The environment of our graduate program also provides a unique opportunity for cultural exchange. We are currently supporting students from over a dozen countries with fellowships, teaching assistantships, and research assistantships.

Our graduate students carry out most of their research work in their own individual laboratories or in the four-story chemical engineering laboratory located in the departmental building. We are fortunate to have the laboratories of the U.S. Bureau of Mines, U.S. Environmental Protection Agency, the OSU Forest Product Research Center, the OSU Marine Science Center, and the OSU Radiation Center nearby where some of our students have conducted their research. These interdisciplinary research projects will continue as the technological problems facing society require increasingly sophisticated solutions.

Beyond their usual interaction with the Oregon State faculty, our graduate students have the opportunity to informally meet with and listen to many visiting professors in our graduate seminars. In recent years, distinguished chemical engineers from the United States and many foreign countries, such as Russia, England, Italy, Australia, Italy, etc., have presented seminars to the OSU faculty and students.

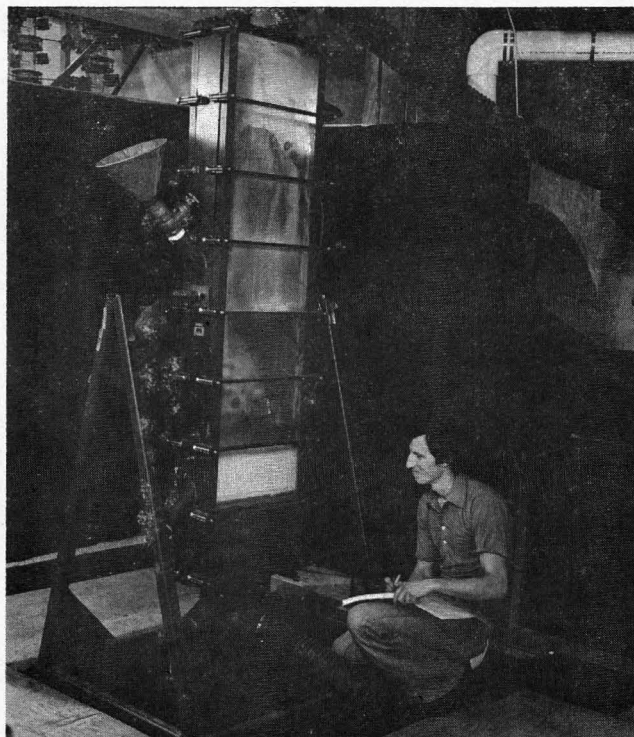
We are a small department, having only seven full-time faculty members. By and large, we are practically oriented, with a desire to make research relevant to the needs of man. And perhaps it is because we live in Oregon that we are concerned

about the environmental impact of what we do. Our research projects include a study to find out how rivers get supersaturated with nitrogen, resulting in the death of migrating salmon, and how coal can be efficiently burned without polluting the atmosphere with sulfur dioxide, as well as the more conventional studies in the areas of heat and mass transfer, mixing, reactor design, corrosion, thermodynamics, process control, systems optimization, fluidization, extractive metallurgy and chemical reaction engineering.

As examples of current research, four of the current research programs are described below:

Fluidization

In 1974, Octave Levenspiel and Tom Fitzgerald were approached by the Electric Power Research Institute (EPRI) with the suggestion of extending the correlations in his text, "Fluidization Engineering," to larger particles and higher velocities which could be used in designing fluidized bed combustors. Large fluidized beds, approximately a square meter in cross section, were constructed to fluidize gravel-sized particles at velocities as high as 4 meters/second in the presence of immersed tube bundles. Specialized instrumentation systems were developed to make



Steve Crane, graduate student, collecting data from one of the four fluidized beds within the department.

A new reactor has been used to study simultaneous mass transfer and reaction between two fluid phases under the direction of Octave Levenspiel. The unique features of this reactor are the uniformity of composition of the two phases and the ability to independently adjust the individual phase resistances to mass transfer.

transient heat transfer and tube stress measurements, and to trace the flow of solids and gas. Parallel heat transfer studies were initiated in the Mechanical Engineering Department by Jim Welty. The research effort in fluidization at OSU has led to comprehensive models for coal burning in atmospheric fluidized bed combustors, for elutriation of particles from high-velocity fluidized beds and for predicting bed to tube heat transfer coefficients. Current fluidized bed combustion research is sponsored by the U.S. Department of Energy, EPRI, Babcock and Wilcox and the Aerospace Corporation.

Control

Saving energy in distillation is a major question in our profession. Ferhan Kayihan is looking into this problem from the controller design aspect. He is using intermediate heat exchangers on a specially designed laboratory column to examine the relative merits of new control strategies.

Because of Bob Mrazek's interest in determining physical properties and applying thermodynamics to metallurgical processing, he is currently involved with the complete instrumentation and computer interfacing of a low-temperature calorimeter. This project will permit computer control and automatic data acquisition and its reduction for measurements over a temperature range of 5 to 300°K.

Heat and Mass Transfer

Under the joint sponsorship of National Science Foundation and Heat Transfer Research Institute, Jim Knudsen has been conducting extensive research on waterside fouling resistance inside condenser tubes. This project has provided fundamental information on fouling characteristics of cooling tower water.

Charles Wicks is looking at cross-current contactors as a means of saving energy in separation processes by reducing the pressure drop required for a specific thru-put and separation. In other mass transfer projects, he has studied the mass transfer of surface gases due to jet streams

plunging into a liquid pool; this study verified the reasons why there were supersaturated nitrogen levels in our rivers and provided the necessary information for optimizing an aeration pond.

A new reactor has been used to study simultaneous mass transfer and reaction between two fluid phases under the direction of Octave Levenspiel. The unique features of this reactor are the uniformity of composition of the two phases and the ability to independently adjust the individual phase resistances to mass transfer. Octave also continues his work in the field of chemical reactor design; his contributions in this special field were recognized by A.I.Ch.E. when he was awarded the 1979 Wilhelm Award.

Combustion

Research in pyrolysis and combustion of wood is the prime interest of Ferhan Kayihan. Pyrolysis converts up to 80% of dry wood into combustible gaseous products. The kinetics of reactions producing various volatile gases become the critical part of any reactor model dealing with the conversion of energy from wood. Experiments under high heating rates have been conducted to identify the kinetic behavior of different wood types. It has been shown that the pyrolysis and combustion phenomena are highly affected by, and in turn alter, the porous structure of wood particles.

Hopefully, the reader will not gain the impression that only work is involved in chemical engineering at Oregon State. If you were to join the faculty and graduate students on one of our weekend jaunts to Octave Levenspiel's beach cabin, you would encounter a spirited volleyball game, chess tournaments and explorations of the aquatic shorelines. Other excursions are taken in the Cascades for cross-country skiing or weekend camping and mountain climbing trips.

For three years, our graduates have remained undefeated in the university intramural soccer league. And whenever Oregon State has a home basketball game, the department building empties as the students forego their studying to root the Beavers on to another victory. □