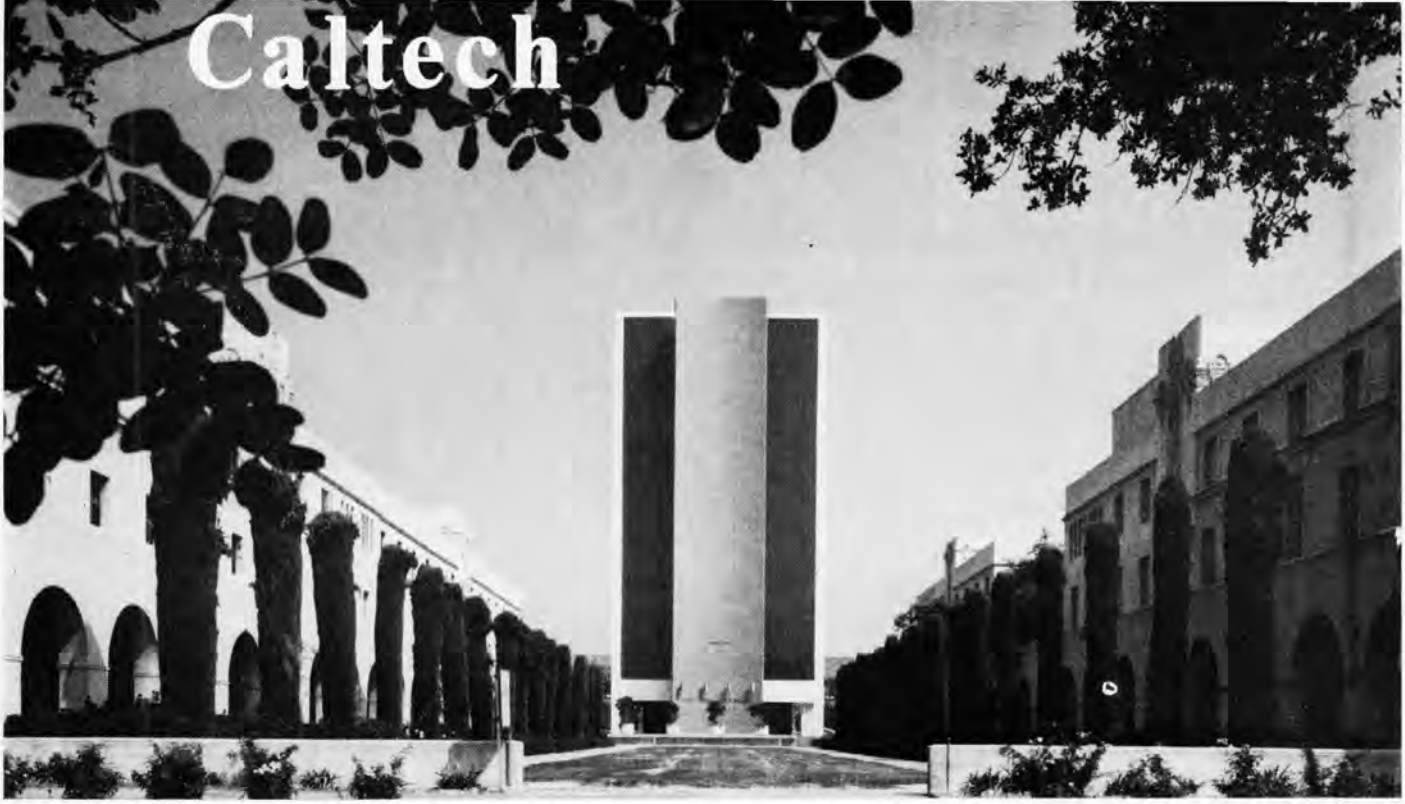



**PROGRAM OF STUDY** Distinctive features of study in chemical engineering at the California Institute of Technology are the creative research atmosphere in which the student finds himself and the strong emphasis on basic chemical, physical, and mathematical disciplines in his program of study. In this way a student can properly prepare himself for a productive career of research, development, or teaching in a rapidly changing and expanding technological society.

A course of study is selected in consultation with one or more of the faculty listed below. Required courses are minimal. The Master of Science degree is normally completed in one academic year and a thesis is not required. A special terminal M.S. option, involving either research or an integrated design project, is a newly added feature to the overall program of graduate study. The Ph.D. degree requires a minimum of three years subsequent to the B.S. degree, consisting of thesis research and further advanced study.

**FINANCIAL ASSISTANCE** Graduate students are supported by fellowship, research assistantship, or teaching assistantship appointments during both the academic year and the summer months. A student may carry a full load of graduate study and research in addition to any assigned assistantship duties. The Institute gives consideration for admission and financial assistance to all qualified applicants regardless of race, religion, or sex.

**APPLICATIONS** Further information and an application form may be obtained by writing

Professor J. H. Seinfeld
Executive Officer for Chemical Engineering
California Institute of Technology
Pasadena, California 91109

It is advisable to submit applications before February 15, 1975.

## FACULTY IN CHEMICAL ENGINEERING

WILLIAM H. CORCORAN, Professor and Vice-President for Institute Relations
Ph.D. (1948), California Institute of Technology
Kinetics and catalysis; plasma chemistry; biomedical engineering; air and water quality.

SHELDON K. FRIEDLANDER, Professor
Ph.D. (1954), University of Illinois
Aerosol chemistry and physics; air pollution; biomedical engineering; interfacial transfer; diffusion and membrane transport.

GEORGE R. GAVALAS, Associate Professor
Ph.D. (1964), University of Minnesota
Applied kinetics and catalysis; process control and optimization; coal gasification.

L. GARY LEAL, Assistant Professor
Ph.D. (1969), Stanford University
Theoretical and experimental fluid mechanics; heat and mass transfer; suspension rheology; mechanics of non-Newtonian fluids.

CORNELIUS J. PINGS, Professor,
Vice-Provost, and Dean of Graduate Studies
Ph.D. (1955), California Institute of Technology
Liquid state physics and chemistry; statistical mechanics.

JOHN H. SEINFELD, Professor,
Executive Officer
Ph.D. (1967), Princeton University
Control and estimation theory; air pollution.

FRED H. SHAIR, Associate Professor
Ph.D. (1963), University of California, Berkeley
Plasma chemistry and physics; tracer studies of various environmental problems.

NICHOLAS W. TSCHOEGL, Professor
Ph.D. (1958), University of New South Wales
Mechanical properties of polymeric materials; theory of viscoelastic behavior; structure-property relations in polymers.

ROBERT W. VAUGHAN, Associate Professor
Ph.D. (1967), University of Illinois
Solid state and surface chemistry.

W. HENRY WEINBERG, Associate Professor
Ph.D. (1970), University of California, Berkeley
Surface chemistry and catalysis.

# UNIVERSITY OF ARIZONA

The chemical engineering department at the University of Arizona is young and dynamic with a fully accredited undergraduate degree program and MS and Ph.D. Graduate Programs. Financial support is available through government grants and contracts, teaching and research assistantships, traineeships, and industrial grants. The faculty assures full opportunity to study in all major areas of chemical engineering.

**THE FACULTY AND THEIR RESEARCH INTERESTS ARE:**

**WILLIAM P. COSART,** Asst. Professor
Ph.D. Oregon State University, 1973
Transpiration Cooling, Heat Transfer in Biological Systems, Blood Processing

**JOSEPH F. GROSS,** Professor
Ph.D., Purdue University, 1956
Boundary Layer Theory, Pharmacokinetics, Fluid Mechanics and Mass Transfer in The Microcirculation, Biorheology

**JOST O.L. WENDT,** Assoc. Professor
Ph.D., Johns Hopkins University, 1968
Combustion Generated Air Pollution, Nitrogen and Sulfur Oxide Abatement, Chemical Kinetics, Thermodynamics Interfacial Phenomena

**RICHARD D. WILLIAMS,** Asst. Professor
Ph.D., Princeton University, 1972
Catalysis, Chemical Reactor Engineering, Energy and Environmental Problems, Kinetics of Heterogenous Reaction—Applications to the Minerals Industry.

**DON H. WHITE,** Professor and Head
Ph.D., Iowa State University, 1949
Polymers Fundamentals and Processes, Solar Energy, Microbial and Enzymatic Processes

**ALAN D. RANDOLPH,** Professor
Ph.D., Iowa State University, 1962
Simulation and Design of Crystallization Processes, Nucleation Phenomena, Particulate Processes, Explosives Initiation Mechanisms

**THOMAS R. REHM,** Professor and Acting Head
Ph.D., University of Washington, 1960
Mass Transfer, Process Instrumentation, Packed Column Distillation, Applied Design

**JAMES WM. WHITE,** Assoc. Professor
Ph.D., University of Wisconsin, 1968
Real-Time Computing, Process Instrumentation and Control, Model Building and Simulation

Tucson has an excellent climate and many recreational opportunities. It is a growing, modern city of 400,000 that retains much of the old Southwestern atmosphere.

**For further information, write to:**

*Dr. J. W. White, Chairman*
*Graduate Study Committee*
*Department of*
*Chemical Engineering*
*University of Arizona*
*Tucson, Arizona 85721*

# UNIVERSITY OF ALBERTA

## EDMONTON, ALBERTA, CANADA

## Graduate Programs in Chemical Engineering

**Financial Aid**

Ph.D. Candidates: up to $5,000/year.
M.Sc. and M.Eng. Candidates: up to $4,000/year.

Commonwealth Scholarships, Industrial Fellowships and limited travel funds are available.

**Costs.**

Tuition: $535/year.
Married students housing rent: $140/month.
Room and board, University Housing: $115/month.

**Ph.D. Degree**

Qualifying examination, minimum of 13 half-year courses, thesis.

**M.Sc. Degree**

5-8 half-year courses, thesis.

**M.Eng. Degree**

10 half-year courses, 4-6 week project.

**Department Size**

12 Professors, 3 Post-doctoral Fellows,
30-40 Graduate Students.

**Applications**

Return postcard or write to:

Chairman
Department of Chemical Engineering
University of Alberta
Edmonton, Alberta, Canada T6G 2E6

**Faculty and Research Interests**

I. G. Dalla Lana, Ph.D. (Minnesota): Kinetics, Heterogeneous Catalysis.

D. G. Fisher, (Chairman), Ph.D. (Michigan): Process Dynamics and Control, Real-Time Computer Applications, Process Design.

A. E. Mather, Ph.D. (Michigan): Phase Equilibria, Fluid Properties at High Pressures, Thermodynamics.

W. Nader, Dr. Phil. (Vienna): Heat Transfer, Air Pollution, Transport Phenomena in Porous Media, Applied Mathematics.

F. D. Otto, Ph.D. (Michigan): Mass Transfer, Computer Design of Separation Processes, Environmental Engineering.

D. Quon, (Associate Dean), Sc.D. (M.I.T.): Applied Mathematics, Optimization, Statistical Decision Theory.

D. B. Robinson, Ph.D. (Michigan): Thermal and Volumetric Properties of Fluids, Phase Equilibria, Thermodynamics.

J. T. Ryan, Ph.D. (Missouri): Process Economics, Energy Economics and Supply.

D. E. Seborg, Ph.D. (Princeton): Process Control, Adaptive Control, Estimation Theory.

F. A. Seyer, Ph.D. (Delaware): Turbulent Flow, Rheology of Complex Fluids.

S. E. Wanke, Ph.D. (California-Davis): Catalysis, Kinetics.

R. K. Wood, Ph.D. (Northwestern): Process Dynamics and Identification, Control of Distillation Columns.

**Department Facilities**

Located in new 8-story Engineering Centre.

Excellent complement of computing and analytical equipment:

—IBM 1800 (real-time) computer
—EAI 590 hybrid computer
—AD 32 analog computer
—IBM 360/67 terminal
—Weissenberg Rheogoniometer
—Infrared spectrophotometer
—Research and industrial gas chromatographs

**The University of Alberta**

One of Canada's largest universities and engineering schools.

Enrollment of 18,000 students.

Co-educational, government-supported, non-denominational.

Five minutes from city centre, overlooking scenic river valley.

**Edmonton**

Fast growing, modern city; population of 440,000.

Resident professional theatre, symphony orchestra, professional sports.

Major chemical and petroleum processing centre.

Within easy driving distance of the Rocky Mountains and Jasper National Park.

# UNIVERSITY OF CALIFORNIA

## BERKELEY, CALIFORNIA

### RESEARCH

ENERGY UTILIZATION

ENVIRONMENTAL

KINETICS AND CATALYSIS

THERMODYNAMICS

ELECTROCHEMICAL ENGINEERING

PROCESS DESIGN
AND DEVELOPMENT

BIOCHEMICAL ENGINEERING

MATERIAL ENGINEERING

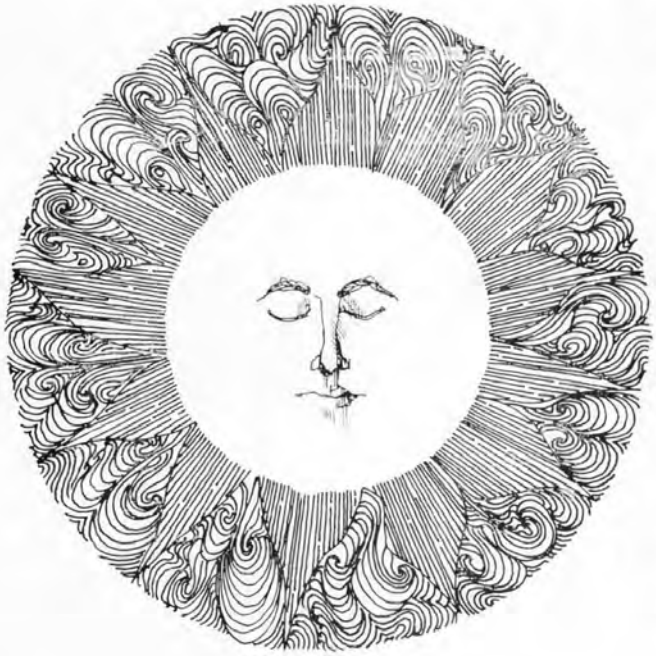
FLUID MECHANICS
AND RHEOLOGY

### FACULTY

Alexis T. Bell
Lee F. Donaghey
Alan S. Foss
Simon L. Goren
Edward A. Grens
Donald N. Hanson
C. Judson King (Chairman)
Scott Lynn
David N. Lyon
Robert P. Merrill
John S. Newman
Eugene E. Petersen
Robert L. Pigford
John M. Prausnitz
Mitchel Shen
Thomas K. Sherwood
Charles W. Tobias
Theodore Vermeulen
Charles R. Wilke
Michael C. Williams

*FOR APPLICATIONS AND FURTHER INFORMATION, WRITE:*

**Department of Chemical Engineering**
**UNIVERSITY OF CALIFORNIA**
**Berkeley, California 94720**



# NEW ENERGY

***Write - Graduate Chemical Engineering***
Carnegie-Mellon University
***Pittsburgh Pennsylvania 15213***

# UNIVERSITY OF DELAWARE

## Newark, Delaware 19711

The University of Delaware awards three graduate degrees for studies and practice in the art and science of chemical engineering:

An M.Ch.E. degree based upon course work and a thesis problem.

An M.Ch.E. degree based upon course work and a period of industrial internship with an experienced senior engineer in the Delaware Valley chemical process industries.

A Ph.D. degree.

The regular faculty are:

Gianni Astarita (½ time)
C. E. Birchenall
H. W. Blanch
M. M. Denn
B. C. Gates
J. R. Katzer
R. L. McCullough
A. B. Metzner
J. H. Olson
C. A. Petty
T. W. F. Russell
S. I. Sandler
G. C. A. Schuit (½ time)
J. M. Schultz
James Wei

The adjunct and research faculty who provide extensive association with industrial practice are:

L. A. DeFrate ..... Heat, mass and momentum transfer
W. H. Manogue ..... Catalysis, reaction engineering
E. L. Mongan, Jr. ..... Design and process evaluation
F. E. Rush, Jr. ..... Mass transfer—distillation, absorption, extraction
R. J. Samuels ..... Polymer science
A. B. Stiles ..... Catalysis
K. F. Wissbrun ..... Polymer engineering

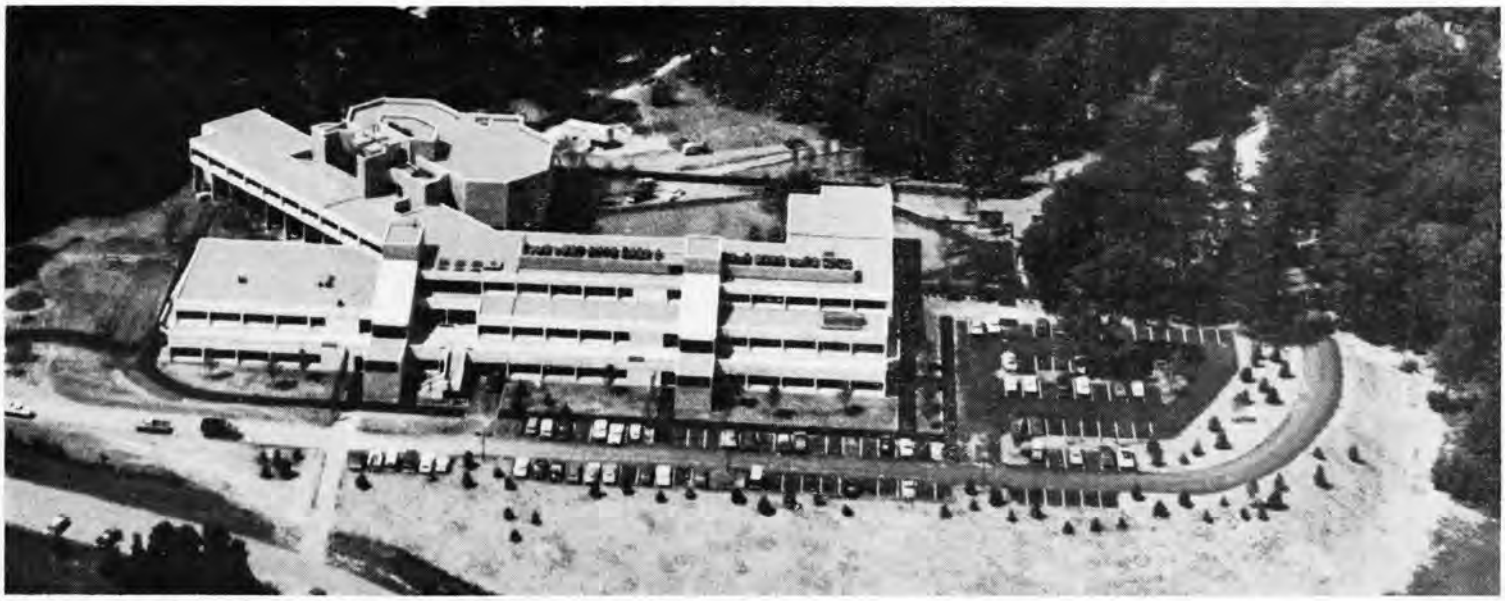
For information and admissions materials contact:

A. B. Metzner, Chairman

DEPARTMENT OF CHEMICAL ENGINEERING

# CLARKSON

## PROGRAMS LEADING TO THE DOCTORAL DEGREE IN CHEMICAL ENGINEERING AND ENGINEERING SCIENCE



On the southern brow of the Hill Campus, Clarkson's massive new Science Center now stands complete, its laboratories, classrooms, and corridors teeming with student activity. The $5.5-million structure is the first educational building to be constructed "on the hill."

## CHEMICAL ENGINEERING FACULTY

**R. J. NUNGE**—Prof. and Chmn. (Ph.D., 1965, Syracuse University) Transport phenomena, multistream forced convection transport processes, structure of pulsating turbulent flow, flow through porous media, atmospheric transport processes, transient dispersion.

**D. T. CHIN**—Assoc. Prof. (Ph.D., 1969, University of Pennsylvania) Electrochemical engineering, transport phenomena, mass transfer at electrodes.

**R. COLE**—Assoc. Prof. and Exec. Officer. (Ph.D., 1966, Clarkson College of Technology) Boiling heat transfer, bubble dynamics, boiling nucleation.

**D. O. COONEY**—Assoc. Prof. (Ph.D., 1966, University of Wisconsin) Mass transfer in fixed beds, biomedical engineering.

**E. J. WOVIS**—Prof. (Ph.D., 1960, University of Washington) Heat transfer and fluid mechanics associated with two-phase flow, convective diffusion, aerosol physics, transport phenomena, Mathematical modeling.

**J. ESTRIN**—Prof. (Ph.D., 1960, Columbia University) Nucleation phenomena, crystallization.

**E. W. GRAHAM**—Assoc. Prof. (Ph.D., 1962, University of California, Berkeley) Chemical reaction kinetics and related theoretical problems, catalysis, fuel cells, air pollution.

**J. L. KATZ**—Assoc. Prof. (Ph.D., 1963, University of Chicago) Homogeneous nucleation of vapors, homogeneous boiling, heterogeneous nucleation, aerosols, nucleation of voids in metals, thermal conductivity of gases.

**R. A. SHAW**—Assoc. Prof. (Ph.D., 1967, Cornell University) Nuclear engineering, reverse osmosis, radioactive tracers, environmental effects of power generation.

**H. L. SHULMAN**—Prof., Dean of Eng. and Vice Pres. of the College. (Ph.D., 1950, University of Pennsylvania) Mass Transfer, packed columns, adsorption of gases, absorption.

**R. S. SUBRAMANIAN**—Asst. Prof. (Ph.D., 1972, Clarkson College of Technology) Heat and mass transfer problems, unsteady convective diffusion—miscible dispersion, chromatographic and other interphase transport systems, fluid mechanics.

**T. J. WARD**—Assoc. Prof. (Ph.D., 1959, Rensselaer Polytechnic Institute) Process control, nuclear engineering, ceramic materials.

**G. R. YOUNGQUIST**—Assoc. Prof. (Ph.D., 1962, University of Illinois) Adsorption, crystallization, diffusion and flow in porous media.

---

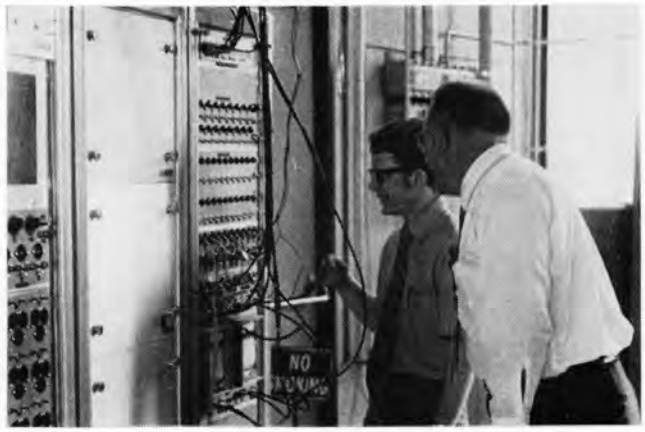
For information concerning Assistantships and Fellowships contact the Graduate School Office, Clarkson College of Technology, Potsdam, New York 13676

CLARKSON COLLEGE OF TECHNOLOGY / POTSDAM, NEW YORK 13676

# The university of florida offers you

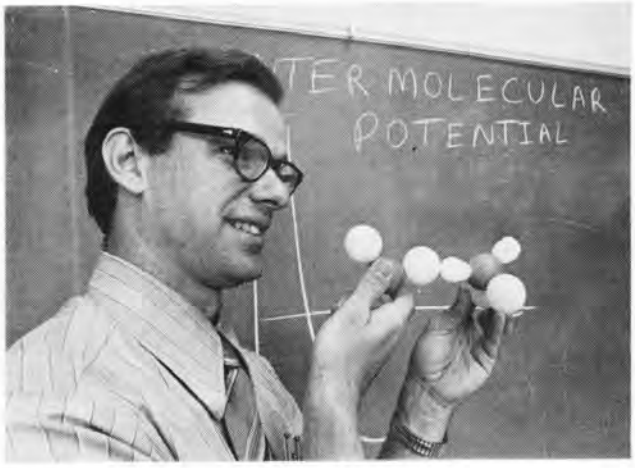
*Transport Phenomena & Rheology*

Drag-reducing polymers greatly modify the familiar bathtub vortex, as studied here by dye injection.



*Optimization & Control*

Part of a computerized distillation control system.




*Thermodynamics & Statistical Mechanics*

Illustrating hydrogen-bonding forces between water molecules.

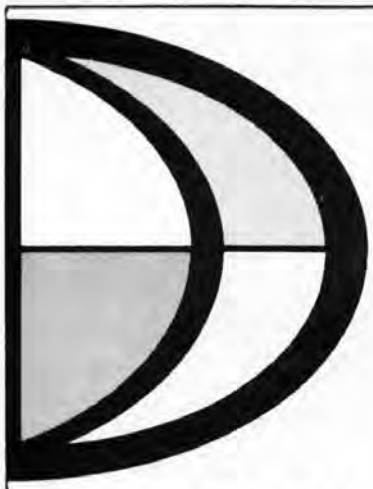
*Biomedical Engineering & Interfacial Phenomena*

Oxygen being extracted from a substance similar to blood plasma.

## and much more...

*A young, dynamic faculty*
*Wide course and program selection*
*Excellent facilities*
*Year-round sports*

*Write to:*
*Dr. John C. Biery, Chairman*
*Department of Chemical Engineering - Room 227*
*University of Florida*
*Gainesville, Florida 32611*



# The Real World of Chemical Engineering

**The University of Houston is located in the midst of the largest complex of chemical and petrochemical activity in the world. This environment provides unequalled opportunities for graduate students in . . . . THE REAL WORLD OF CHEMICAL ENGINEERING.**

## Petrochemical Industry

Houston is the national center for manufacturing, sales, research and design in the petroleum and petrochemical industry. Most of the major oil and petrochemical companies have plants and research installations in the Houston area. The headquarters of many of these organizations are here.

## Medicine

The world - famous Texas Medical Center is located in Houston.

## Space

The NASA Lyndon B. Johnson Space Center is located in the Houston area.

**There is continuous interaction through seminars, courses and research between the faculty and graduate students of this department and the engineers and scientists of this large technical community.**

## Faculty

The research of 14 faculty members encompass a wide range of subjects in chemical engineering. Faculty members are active in the interdisciplinary areas of biomedical, environmental urban and systems engineering.

## Department

The department is one of the fastest growing in the nation. The current enrollment includes 50 seniors and 45 full-time graduate students; a 200% increase in the enrollment over the past 5 years. Research grants and contracts currently in progress exceed 1.2 million dollars.

## Facilities

Over $900,000 of modern research equipment is located in 50,000 square feet of research and office space.

## Financial Aid

Fellowship stipends are available to qualified applicants.

## Houston

The temperate Gulf Coast area with its year-round outdoor weather offers unlimited recreational opportunities. An equal number of cultural opportunities exist in the sixth largest and fastest-growing city in the country. Houston has an outstanding symphony orchestra several theatre companies, fine museums, and a stimulating intellectual community.

INQUIRIES ARE DIRECTED TO:

Head, Graduate Admissions
Department of Chemical Engineering
University of Houston
Houston, Texas 77004

# GRADUATE STUDY AND RESEARCH

# The Department of Energy Engineering

# UNIVERSITY OF ILLINOIS AT CHICAGO CIRCLE

UICC

Graduate Programs in

The Department of Energy Engineering

leading to the degrees of

MASTER OF SCIENCE and

DOCTOR OF PHILOSOPHY

**Faculty and Research Activities in CHEMICAL ENGINEERING**

**David S. Hacker**
**Ph.D., Northwestern University, 1954**
**Associate Professor**

Chemical kinetics; combustion, mass transport phenomena; chemical process design, particulate transport phenomena

**James P. Hartnett**
**Ph.D., University of California at Berkeley, 1954**
**Professor and Head of the Department**

Forced convection, mass transfer cooling, non-Newtonian fluid mechanics and heat transfer

**Larry M. Joseph**
**Ph.D., University of Michigan, 1974**
**Assistant Professor**

Process dynamics and control, simulation and process analysis

**John H. Kiefer**
**Ph.D., Cornell University, 1961**
**Professor**

Kinetics of gas reactions, energy transfer processes, molecular lasers

**G. Ali Mansoori**
**Ph.D., University of Oklahoma, 1969**
**Associate Professor**

Thermodynamics and statistical mechanics of fluids, solids, and solutions; kinetics of liquid reactions, cryobioengineering

**Irving F. Miller**
**Ph.D., University of Michigan, 1960**
**Professor**

Chemical engineering, bioengineering, membrane transport processes, mathematical modeling

**Satish C. Saxena**
**Ph.D., Calcutta University, 1956**
**Professor**

Transport properties of fluids and solids, heat and mass transfer, isotope separation, fixed and fluidized bed combustion

**Stephen Szepe**
**Ph.D., Illinois Institute of Technology, 1966**
**Associate Professor**

Catalysis, chemical reaction engineering, optimization, environmental and pollution problems

The MS program, with its optional thesis, can be completed in one year.

The department invites applications for admission and support from all qualified candidates. Special fellowships are available for minority students. To obtain application forms or to request further information write:


**Professor Harold A. Simon, Chairman**
**The Graduate Committee**
**Department of Energy Engineering**
**University of Illinois at Chicago Circle**
**Box 4348, Chicago, Illinois 60680**


**IOWA STATE UNIVERSITY**

First Land Grant school (1862). Largest College of Engineering west of the Mississippi River and fifth largest in the U.S. Ranks ninth in Ph.D. degrees in Chemical Engineering. Current enrollment of 250 undergraduates and 50 grad students in Chemical Engineering.

**PROGRAMS**

M.S. and Ph.D. degrees. Five year integrated program for M.E.

**FACULTY**

Graduate faculty of 13 in Chemical Engineering having a variety of backgrounds and interests.

**FACILITIES**

New, fully equipped Chemical Engineering building with 50,000 square feet of laboratory, office, and classroom space. Adjacent to computer center and to library. Excellent technical support from Engineering Research Institute and technical service groups. Affiliation with the Ames Laboratory, the only National Laboratory of the U.S. AEC located on a university campus.

**RESEARCH**

International reputation in the following areas:

Biochemical Engineering (Tsao)
Biomedical Engineering (Seagrave)
Coal Research (Wheelock)
Crystallization (Larson)
Fluidization (Wheelock)
Polymer Kinetics (Abraham)
Process Chemistry (Burnet)
Simulation (Burkhart)

Outstanding programs also in electronic instrumentation, computer applications to process control, air and water pollution control, extraction, thermodynamics, kinetics and reaction engineering, liquid metals technology, fluid mechanics and rheology, heat and mass transfer, and interfacial and surface phenomena.

**FINANCIAL AID**

Teaching and research assistantships and industrial fellowships available.

**LOCATION**

Ames, a small city of 40,000 in central Iowa. Site of the Iowa State Center (pictured above), which hosts the annual Ames International Orchestra Festival and athletic events of the Big Eight Conference.

**TO APPLY**

Write to:

George Burnet, Head
Dept. of Chemical Engineering and Nuclear Engineering
Iowa State University of Science and Technology
Ames, Iowa 50010

# UNIVERSITY OF KANSAS

## Department of Chemical and Petroleum Engineering

M.S. and Ph.D. Programs
in
Chemical Engineering
M.S. Program
in
Petroleum Engineering
also
Doctor of Engineering (D.E.)
and
M.S. in Petroleum Management

The Department is the recent recipient of a large state grant for research in the area of Tertiary Oil Recovery to assist the Petroleum Industry.

Financial assistance is
available for Research Assistants
and Teaching Assistants

## Research Areas

**Transport Phenomena**

**Fluid Flow in Porous Media**

**Process Dynamics and Control**
**Water Resources and**
**Environmental Studies**

**Mathematical Modeling of**
**Complex Physical Systems**

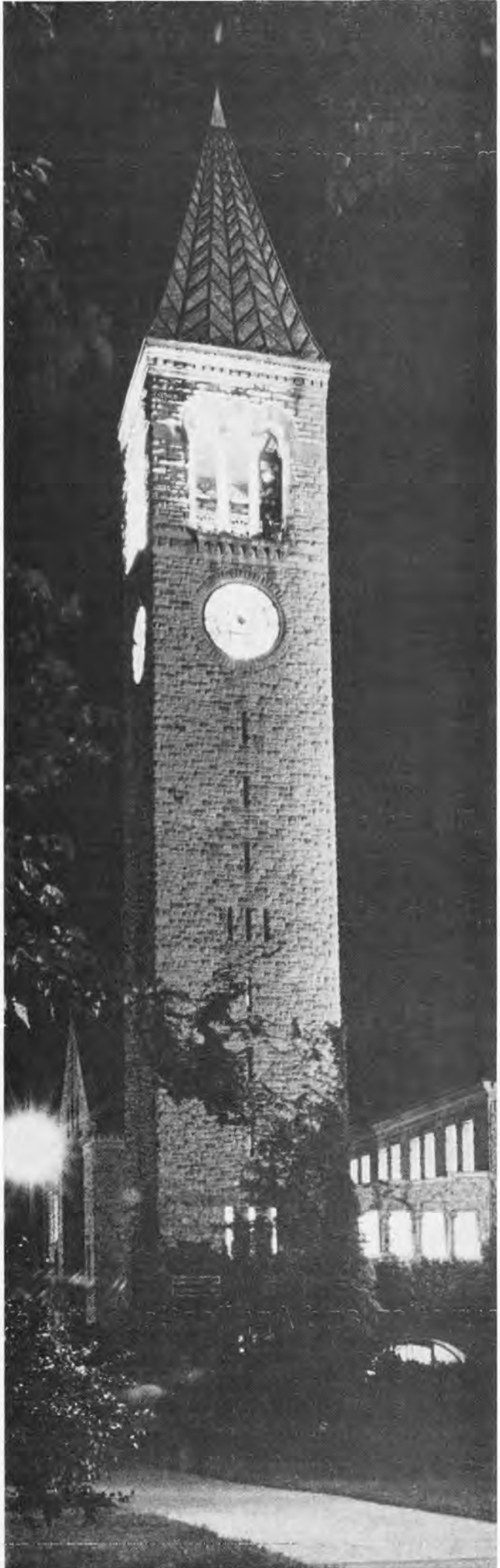
**Reaction Kinetics and**
**Process Design**

**Nucleate Boiling**

**High Pressure, Low Temperature**
**Phase Behavior**

For Information and Applications write:

Floyd W. Prestun, Chairman
Dept. of Chemical and Petroleum Engineering
University of Kansas
Lawrence, Kansas, 66044
Phone (913) UN4-3922



# CORNELL UNIVERSITY

## Graduate Study in Chemical Engineering

Three graduate degree programs in several subject areas are offered in the Field of Chemical Engineering at Cornell University. Students may enter a research-oriented course of study leading to the degrees of Doctor of Philosophy or Master of Science, or may study for the professional degree of Master of Engineering (Chemical). Graduate work may be done in the following subject areas.

**Chemical Engineering (general)**

Thermodynamics; applied mathematics; transport phenomena, including fluid mechanics, heat transfer, and diffusional operations.

**Bioengineering**

Separation and purification of biochemicals; fermentation engineering and related subjects in biochemistry and microbiology; mathematical models of processes in pharmacology and environmental toxicology; artificial organs.

**Chemical Microscopy**

Light and electron microscopy as applied in chemistry and chemical engineering.

**Kinetics and Catalysis**

Homogeneous kinetics; catalysis by solids and enzymes; catalyst deactivation; simultaneous mass transfer and reaction; optimization of reactor design.

**Chemical Processes and Process Control**

Advanced plant design; process development; petroleum refining; chemical engineering economics; process control; related courses in statistics and computer methods.

**Materials Engineering**

Polymeric materials and related course work in chemistry, materials, mechanics, metallurgy, and solid-state physics, biomaterials.

**Nuclear Process Engineering**

Nuclear and reactor engineering and selected courses in applied physics and chemistry.

**Faculty Members and Research Interests**

**John L. Anderson, Ph.D.** Membrane transport, bioengineering.
**Kenneth B. Bischoff, Ph.D.** Medical and microbiological bioengineering, chemical reaction engineering.
**George G. Cocks, Ph.D.** Light and electron microscopy, properties of materials, solid-state chemistry, crystallography.
**Robert K. Finn, Ph.D.** Continuous fermentation, agitation and aeration, processing of biochemicals, electrophoresis, microbial conversion of hydrocarbons.
**Peter Harriott, Ph.D.** Kinetics and catalysis, process control, diffusion in membranes and porous solids.
**J. Eldred Hedrick, Ph.D.** Economic analyses and forecasts, new ventures development.
**Ferdinand Rodriguez, Ph.D.** Polymerization, properties of polymer systems.
**George F. Scheele, Ph.D.** Hydrodynamic stability, coalescence, fluid mechanics of liquid drops and jets, convection-distorted flow fields.
**Michael L. Shuler, Ph.D.**, Biochemical engineering.
**Julian C. Smith, Chem.E.** Conductive transfer processes, heat transfer, mixing, mechanical separations.
**James F. Stevenson, Ph.D.** Chemical engineering applications to biomedical problems; rheology.
**Raymond G. Thorpe, M.Chem.E.** Phase equilibria, fluid flow, kinetics of polymerization.
**Robert L. Von Berg, Sc.D.** Liquid-liquid extraction, reaction kinetics, effect of radiation on chemical reactions.
**Herbert F. Wiegandt, Ph.D.** Crystallization, petroleum processing, saline-water conversion, direct contact heat transfer.
**Charles C. Winding, Ph.D.** Degradation of polymers, polymer compounding, filler-polymer systems, differential thermal analysis.
**Robert York, Sc.D.** Molecular sieves, chemical market analyses, chemical economics, process development, design, and evaluation.

FURTHER INFORMATION. Write to Professor K. B. Bischoff, Olin Hall of Chemical Engineering, Cornell University, Ithaca, New York 14850.

# Massachusetts Institute of Technology

## DEPARTMENT OF CHEMICAL ENGINEERING

- ENVIRONMENTAL QUALITY
- BIOCHEMICAL ENGINEERING
- BIOMEDICAL ENGINEERING
- TRANSPORT PHENOMENA
- CHEMICAL ENGINEERING SYSTEMS
- SURFACE CHEMISTRY AND TECHNOLOGY
- POLYMERS AND MACROMOLECULES
- ENERGY

For decades to come, the chemical engineer will play a central role in fields of national concern. In two areas alone, energy and the environment, society and industry will turn to the chemical engineer for technology and management in finding process related solutions to critical problems. M.I.T. has consistently been a leader in chemical engineering education with a strong working relationship with industry for over a half century. For detailed information, contact Professor Raymond F. Baddour, Head of the Department of Chemical Engineering, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139.

## FACULTY

Raymond F. Baddour
Lawrence B. Evans
Paul J. Flory
Hoyt C. Hottel
John P. Longwell
James E. Mark
Herman P. Meissner
Edward W. Merrill
J. Th. G. Overbeek
J. R. A. Pearson
Robert C. Reid
Adel F. Sarofim
Charles N. Satterfield
Kenneth A. Smith
J. Edward Vivian
Glenn C. Williams
Clark K. Colton
Jack B. Howard
Michael Modell
C. Michael Mohr
James H. Porter
Robert C. Armstrong
Donald B. Anthony
Lloyd A. Clomburg
Robert E. Cohen
Richard G. Donnelly
Samuel M. Fleming
Ronald A. Hites
Jefferson W. Tester

Department of Chemical Engineering

# UNIVERSITY OF MISSOURI — ROLLA

**ROLLA, MISSOURI 65401**

---

Contact Dr. M. R. Strunk, Chairman

Day Programs M.S. and Ph.D. Degrees

---

Established fields of specialization in which research programs are in progress are:

(1) Fluid Turbulence and Drag Reduction Studies —Drs. J. L. Zakin and G. K. Patterson

(2) Electrochemistry and Fuel Cells—Dr. J. W. Johnson

(3) Heat Transfer (Cryogenics) Dr. E. L. Park, Jr.

(4) Mass Transfer Studies—Dr. R. M. Wellek

(5) Structure and Properties of Polymers—Dr. K. G. Mayhan

In addition, research projects are being carried out in the following areas:

(a) Optimization of Chemical Systems—Prof. J. L. Gaddy

(b) Evaporation through non-Wettable Porous Membranes—Dr. M. E. Findley

(c) Multi-component Distillation Efficiencies—Dr. R. C. Waggoner

(d) Gas Permeability Studies—Dr. R. A. Primrose

(e) Separations by Electrodialysis Techniques—Dr. H. H. Grice

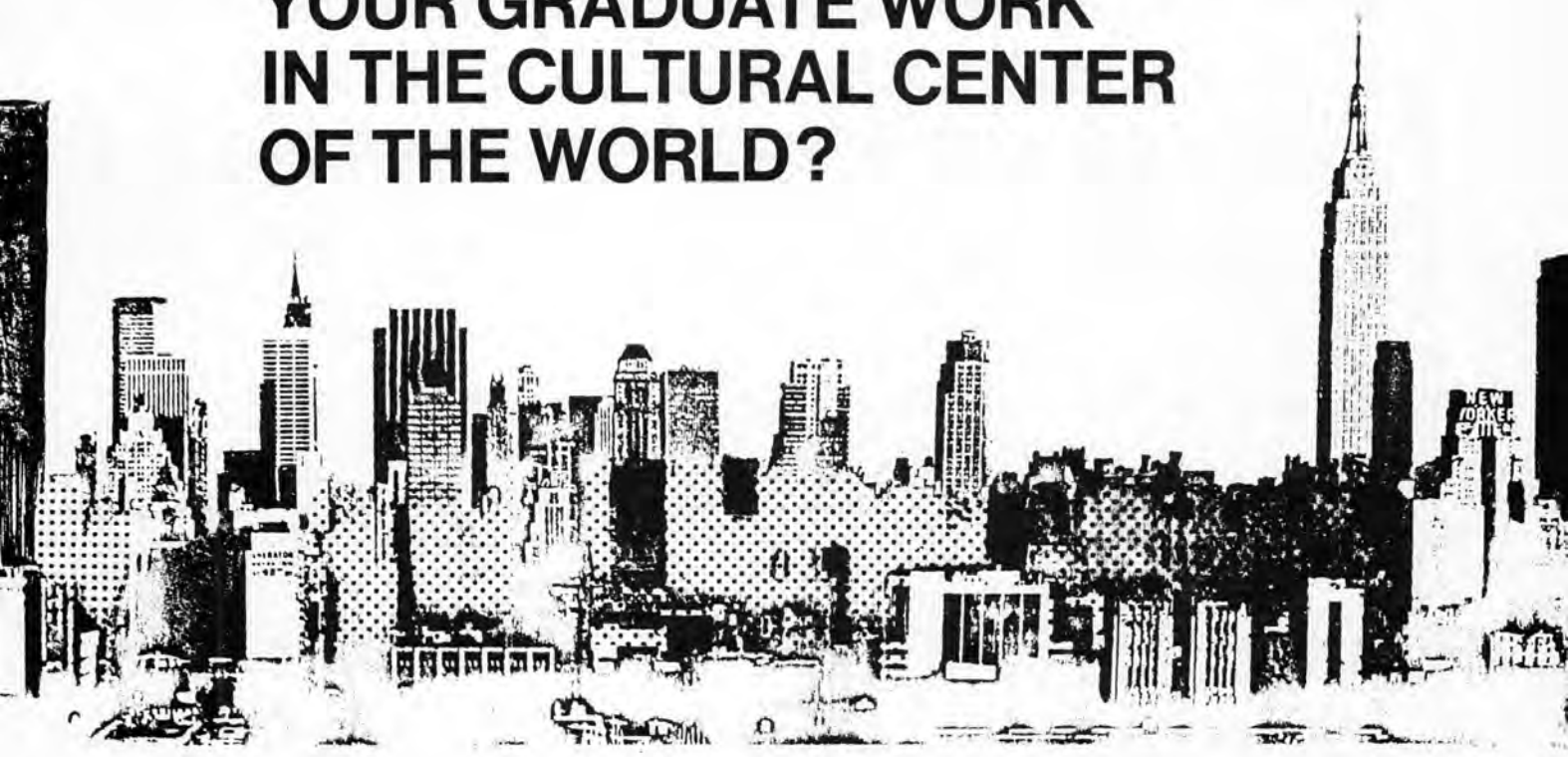
(f) Process Dynamics and Control—Drs. M. E. Findley, R. C. Waggoner, and R. A. Mollenkamp

(g) Transport Properties, Kinetics and enzymes and catalysis—Dr. O. K. Crosser and Dr. B. E. Poling

(h) Thermodynamics, Vapor-Liquid Equilibrium —Dr. D. B. Manley


**Financial aid is obtainable in the form of Graduate and Research Assistantships, and Industrial Fellowships. Aid is also obtainable through the Materials Research Center.**

# HOW WOULD YOU LIKE TO DO YOUR GRADUATE WORK IN THE CULTURAL CENTER OF THE WORLD?



## FACULTY

R. C. Ackerberg
R. F. Benenati
W. Brenner
J. J. Conti
C. D. Han
M. A. Hnatow
R. D. Patel
E. Pearce
E. N. Ziegler

## RESEARCH AREAS

Air Pollution
Catalysis, Kinetics, and Reactors
Fluidization
Fluid Mechanics
Heat and Mass Transfer
Mathematical Modelling
Polymerization Reactions
Process Control
Rheology and Polymer Processing

**Polytechnic Institute of New York**

Formed by the merger of Polytechnic Institute of Brooklyn and New York University School of Engineering and Science.

Fellowships and Research Assistantships are available.

### Department of Chemical Engineering

Programs leading to Master's, Engineer and Doctor's degrees. Areas of study and research: chemical engineering, polymer science and engineering, bioengineering and environmental studies.

### For further information contact

Professor C. D. Han
Head, Department of Chemical Engineering
Polytechnic Institute of New York
333 Jay Street
Brooklyn, New York 11201

# PHILADELPHIA

The cultural advantages and historical assets of a great city, including the incomparable Philadelphia Orchestra are within walking distance of the University. Enthusiasts will find a variety of college and professional sports at hand. A complete range of recreational facilities exists within the city. The Pocono Mountains and the New Jersey shore are within a two hour drive.

# UNIVERSITY OF PENNSYLVANIA

The University of Pennsylvania is an Ivy League School emphasizing scholarly activity and excellence in graduate education. A unique feature of the University is the breadth of medically related activities including those in engineering. In recent years the University has undergone a great expansion of its facilities, including specialized graduate student housing. The Department of Chemical and Biochemical Engineering has attracted national and international attention because of its rapid rise to excellence.

# DEPARTMENT OF CHEMICAL AND BIOCHEMICAL ENGINEERING

The faculty includes two members of the National Academy of Engineering and three recipients of the highest honors awarded by the American Institute of Chemical Engineers. Every staff member is active in graduate and undergraduate teaching, in research, and in professional work. Close faculty association with industry provides expert guidance for the student in research and career planning.

**FACULTY**

Stuart W. Churchill (Michigan)
Elizabeth Dussan V. (Johns Hopkins)
William C. Forsman (Pennsylvania)
David J. Graves (M.I.T.)
A. Norman Hixson (Columbia)
Arthur E. Humphrey (Columbia)
Ronald L. Klaus (R.P.I.)
Mitchell Litt (Columbia)
Alan L. Myers (California)
Melvin C. Molstad (Yale)
Leonard Nanis (Columbia)
Daniel D. Perlmutter (Yale)
John A. Quinn (Princeton)
Warren D. Seider (Michigan)

**RESEARCH SPECIALTIES**

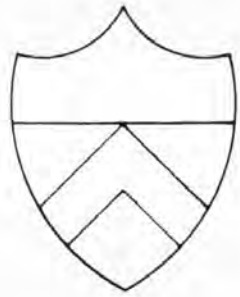
Energy Utilization and Conservation
Enzyme Engineering
Biomedical Engineering
Computer-Aided Design
Chemical Reactor Analysis
Electrochemical Engineering
Environmental and Pollution Control
Polymer Engineering
Process Simulation
Surface Phenomena
Separations Techniques
Biochemical Engineering

**For further information on graduate studies in this dynamic setting, write to:**
**Dr. A. L. Myers, Department of Chemical and Biochemical Engineering,**
**University of Pennsylvania, Philadelphia, Pa. 19174.**

# Princeton University

## Department of Chemical Engineering

Princeton offers two programs of graduate study, one leading to the degree of Master of Science in Engineering, the other to that of Doctor of Philosophy. Students are admitted to either program but the first year is arranged so as to accommodate changes from one to the other without difficulty. Work for the MSE can be completed in one year. Three to four years beyond the baccalaureate is the usual length of study for the PhD. Because of the faculty's varied research interests the incoming student has considerable flexibility in choosing a research topic. Financial support is available in the form of fellowships and research assistantships for the academic year and summer months. For detailed information contact:



Director of Graduate Studies
Department of Chemical Engineering
Princeton University
Princeton, New Jersey 08540

### Faculty

**R. P. Andres**—Molecular beams, intermolecular forces, microparticles, nucleation phenomena.
**R. C. Axtmann**—Fusion reactor technology, environmental studies of fusion and geothermal power, synthetic fuel production.
**R. L. Bratzler**—Bioengineering: cardiovascular transport phenomena, extra corporeal devices.
**John K. Gillham**—Mechanical spectrometry of polymeric solids, synthesis, characterization and pyrolysis of polymers.
**E. F. Johnson**—Fusion reactor technology, molten salts (kinetic and thermodynamic properties, catalysis), process control.
**M. D. Kostin**—Chemical kinetics, bioengineering, transport phenomena, applications of quantum theory.
**Leon Lapidus**—Numerical analysis in chemical engineering, computer-aided design techniques, identification and control of reaction systems.
**Bryce Maxwell**—Shear-induced crystallization of polymers, melt structure recovery, polymer mixing and blending.
**D. F. Ollis**—Heterogeneous and homogeneous catalysis, biochemical engineering.
**William B. Russel**—Fluid mechanics, dynamics of colloidal systems.
**D. A. Saville**—Fluid mechanics, behavior of particulate systems, electrical phenomena in fluids.
**W. R. Schowalter**—Fluid mechanics, rheology.
**N. H. Sweed**—Fixed bed sorption processes, chemical reactor engineering, honeycomb catalysts, coal processing (gasification and liquifaction).
**G. L. Wilkes**—Morphology and properties of block and segmented copolymers, crystallization of polymers, biopolymers and biomaterials.

# Graduate Study in Chemical Engineering at Rice University

**Graduate study in Chemical Engineering at Rice University is offered to qualified students with backgrounds in the fundamental principles of Chemistry, Mathematics, and Physics. The curriculum is aimed at strengthening the student's understanding of these principles and provides a basis for developing in certain areas the necessary proficiency for conducting independent research. A large number of research programs are pursued in various areas of Chemical Engineering and related fields, such as Biomedical Engineering and Polymer Science. A joint program with the Baylor College of Medicine, leading to M.D.-Ph.D. and M.D.-M.S. degrees is also available.**

**The Department has approximately 35 graduate students, predominantly Ph.D. candidates. There are also several post-doctoral fellows and research engineers associated with the various laboratories. Permanent faculty numbers 12, all active in undergraduate and graduate teaching, as well as in research. The high faculty-to-student ratio, outstanding laboratory facilities, and stimulating research projects provide a graduate education environment in keeping with Rice's reputation for academic excellence. The Department is one of the top 15 Chemical Engineering Departments in the U.S., ranked by graduate faculty quality and program effectiveness, according to a recent evaluation by the American Council of Education.**

## MAJOR RESEARCH AREAS

**Thermodynamics and Phase Equilibria**
**Chemical Kinetics and Catalysis**
**Chromatography**
**Optimization, Stability, and Process Control**
**Systems Analysis and Process Dynamics**
**Rheology and Fluid Mechanics**
**Polymer Science**

## BIOMEDICAL ENGINEERING

**Blood Flow and Blood Trauma**
**Blood Pumping Systems**
**Biomaterials**

### Rice University

Rice is a privately endowed, nonsectarian, coeducational university. It occupies an architecturally attractive, tree-shaded campus of 300 acres, located in a fine residential area, 3 miles from the center of Houston. There are approximately 2200 undergraduate and 800 graduate students. The school offers the benefits of a complete university with programs in the various fields of science and the humanities, as well as in engineering. It has an excellent library with extensive holdings. The academic year is from September to May. As there are no summer classes, graduate students have nearly four months for research. The school offers excellent recreational and athletic facilities with a completely equipped gymnasium, and the southern climate makes outdoor sports, such as tennis, golf, and sailing year-round activities.

## FINANCIAL SUPPORT

**Full-time graduate students receive financial support with tuition remission and a tax-free fellowship of $333-400 per month.**

## APPLICATIONS AND INFORMATION

**Address letters of inquiry to:**

Chairman
Department of Chemical Engineering
Rice University
Houston, Texas 77001

### Houston

With a population of nearly two million, Houston is the largest metropolitan, financial, and commercial center in the South and Southwest. It has achieved world-wide recognition through its vast and growing petrochemical complex, the pioneering medical and surgical activities at the Texas Medical Center, and the NASA Manned Spacecraft Center.

Houston is a cosmopolitan city with many cultural and recreational attractions. It has a well-known resident symphony orchestra, an opera, and a ballet company, which perform regularly in the newly constructed Jesse H. Jones Hall. Just east of the Rice campus is Hermann Park with its free zoo, golf course, Planetarium, and Museum of Natural Science. The air-conditioned Astrodome is the home of the Houston Astros and Oilers and the site of many other events.

# THE UNIVERSITY OF SOUTH CAROLINA
## AT COLUMBIA

between the mountains and the sea

Offers the M.S., the M.E. and the Ph.D. in Chemical Engineering. Strong interdisciplinary support in chemstry, physics, mathematics, materials and computer science.

Research and teaching assistantships, and fellowships, are available.

For particulars and application forms write to:

**Dr. M. W. Davis, Jr., Chairman**
**Chemical Engineering Program**
**College of Engineering**
University of South Carolina
Columbia, S. C. 29208

THE CHEMICAL ENGINEERING FACULTY

B. L. Baker, Professor, Ph.D., North Carolina State University, 1955 (Process design, environmental problems, ion transport)

M.W. Davis, Jr., Professor, Ph.D., University of California (Berkeley), 1951 (Kinetics and catalysis, chemical process analysis, solvent extraction, waste treatment)

J. H. Gibbons, Professor, Ph.D., University of Pittsburgh, 1961 (Heat transfer, fluid mechanics)

P. E. Kleinsmith, Assistant Professor, Ph.D., Carnegie-Mellon University, 1972 (Transport phenomena, statistical mechanics)

F. P. Pike, Professor, Ph.D., University of Minnesota, 1949 (Mass transfer in liquid-liquid systems, vapor-liquid equilibria)

J. M. Tarbell, Assistant Professor, Ph.D., University of Delaware, 1974 (Thermodynamics, process dynamics)

# THE UNIVERSITY OF TENNESSEE

# Graduate Studies in Chemical & Metallurgical Engineering

## Programs

Programs for the degrees of Master of Science and Doctor of Philosophy are offered in both Chemical and Metallurgical Engineering. The Master's program may be tailored as a terminal one with emphasis on professional development, or it may serve as preparation for more advanced work leading to the Doctorate. Specialization in Polymer Science and Engineering is available at both levels.

## Faculty

William T. Becker
Donald C. Bogue
Charlie R. Brooks
Edward S. Clark
Oran L. Culberson
John F. Fellers
George C. Frazier
Hsien-Wen Hsu
Homer F. Johnson, Department Head
Stanley H. Jury
Carl D. Lundin
Charles F. Moore
Ben F. Oliver, Professor-in-Charge of Metallurgical Engineering
Joseph J. Perona
Joseph E. Spruiell
E. Eugene Stansbury
James L. White

## Research

Process Dynamics and Control
Sorption Kinetics and Dynamics of Packed Beds
Chromatographic and Ultracentrifuge Studies of Macromolecules
Development and Synthesis of New Engineering Polymers
Fiber and Plastics Processing
Bioengineering
X-Ray Diffraction, Transmission and Scanning Electron Microscopy
Solidification, Zone Refining and Welding
Cryogenic and High Temperature Calorimetry
Flow and Fracture in Metallic and Polymeric Systems
Corrosion
Solid State Kinetics

## Financial Assistance

Sources available include graduate teaching assistantships, research assistantships, and industrial fellowships.

## Knoxville and Surroundings

With a population near 200,000, Knoxville is the trade and industrial center of East Tennessee. In the Knoxville Auditorium-Coliseum and the University theaters, Broadway plays, musical and dramatic artists, and other entertainment events are regularly scheduled. Knoxville has a number of points of historical interest, a symphony orchestra, two art galleries, and a number of museums. Within an hour's drive are many TVA lakes and mountain streams for water sports, the Great Smoky Mountains National Park with the Gatlinburg tourist area, two state parks, and the atomic energy installations at Oak Ridge, including the Museum of Atomic Energy.

## Write

Chemical and Metallurgical Engineering
The University of Tennessee
Knoxville, Tennessee 37916

# CHEMICAL ENGINEERING

**DEGREES: M.S., Ph.D.**

**RESEARCH AREAS INCLUDE:**

- HEAT AND MASS TRANSFER
- REACTION KINETICS AND CATALYSIS
- PROCESS DYNAMICS AND CONTROL
- PROCESS MODELING

**IN:** COAL GASIFICATION, WOOD PYROLYSIS, METHANATION, ECOSYSTEM ANALYSIS, AND THEORETICAL STUDIES

**CONTACT: DR. WILLIAM J. HATCHER, JR., HEAD**
**P. O. Box 6312**
**University, Alabama 35486**

# AUBURN UNIVERSITY

A Land Grant University of Alabama

## GRADUATE STUDY IN CHEMICAL ENGINEERING

M.S. AND PH.D. DEGREES

## CURRENT RESEARCH AREAS:

- LIQUID FUELS FROM COAL
- POROUS MEDIA
- CRYSTAL GROWTH KINETICS
- INDUSTRIAL WASTEWATER TREATMENT
- PROCESS CONTROL
- P-V-T RELATIONS
- SOLIDS-LIQUID SEPARATION
- TRANSPORT PHENOMENA

## Financial Assistance:

**Research and Teaching Assistantships, Industrial Fellowships Are Available**

## For Further Information, Write:

**Head, Chemical Engineering Department**
**Auburn University, Auburn, Alabama 36830**

# UNIVERSITY OF CALIFORNIA, DAVIS

## CHEMICAL ENGINEERING, M.S. AND PH.D. PROGRAMS

**Faculty**

| | |
|---|---|
| R. L. Bell: | Mass Transfer, Bio Medical Engineering |
| R. G. Carbonell | Enzyme Kinetics, Quantum Mechanics |
| A. P. Jackman: | Process Dynamics, Thermal Pollution |
| B. J. McCoy: | Molecular Theory, Transport Processes |
| J. M. Smith: | Water Pollution, Reactor Design |
| S. Whitaker: | Fluid Mechanics, Interfacial Phenomena |

**To Receive Applications for Admission and Financial Aid Write To:**

Graduate Student Advisor
Department of Chemical Engineering
University of California
Davis, California 95616

# UNIVERSITY OF CALIFORNIA
# SANTA BARBARA

## CHEMICAL AND NUCLEAR ENGINEERING

Henri J. Fenech
Owen T. Hanna
Duncan A. Mellichamp
John E. Myers
G. Robert Odette
A. Edward Profio
Robert G. Rinker
Orville C. Sandall

**For information, please write to: Department of Chemical and Nuclear Engineering**
**University of California, Santa Barbara 93106**

# CLEMSON UNIVERSITY

**Chemical Engineering Department**

**M.S. and Doctoral Programs**

**THE FACULTY AND THEIR INTERESTS**

Alley, F. C., Ph.D., U. North Carolina—Air Pollution, Unit Operations
Barlage, W. B., Ph.D., N. C. State—Transfer Processes in Non-Newtonian Fluids
Beard, J. N., Ph.D., L.S.U., Chemical Kinetics, Hybrid Computation
Beckwith, W. F., Ph.D., Iowa State—Transport Phenomena
Edie, D. D., Ph.D., U. Virginia—Polymay
Harshman, R. C., Ph.D., Ohio State—Chemical and Biological Kinetics, Design
Littlejohn, C. E., Ph.D., V.P.I.—Mass Transfer
Melsheimer, SS., Ph.D. Tulane—Process Dynamics, Applied Mathematics
Mullins, J. C., Ph.D., Georgia Tech—Thermodynamics, Adsorption

**FINANCIAL ASSISTANCE**—Fellowships, Assistantships, Traineeships

Contact:

C. E. Littlejohn, Head
Department of Chemical Engineering
Clemson University
Clemson, S. C. 29631

# THE CLEVELAND STATE UNIVERSITY

MASTER OF SCIENCE PROGRAM IN

## CHEMICAL ENGINEERING

**AREAS OF SPECIALIZATION**

**Thermodynamics** **Pollution Control** **Transport Processes**

The program may be designed as terminal or as preparation for further advance study leading to the doctorate at another institution. Financial assistance is available.

**FOR FURTHER INFORMATION, PLEASE CONTACT:**

Department of Chemical Engineering
The Cleveland State University
Euclid Avenue at East 24th Street
Cleveland, Ohio 44115

# Graduate Study in Chemical Engineering
# KANSAS STATE UNIVERSITY

M.S. and Ph.D. programs in Chemical Engineering and Interdisciplinary Areas of Systems Engineering, Food Science, and Environmental Engineering.

**Financial Aid Available**
Up to $5,000 Per Year

**FOR MORE INFORMATION WRITE TO**

Professor B. G. Kyle
Department of Chemical Engineering
Kansas State University
Manhattan, Kansas 66502

**AREAS OF STUDY AND RESEARCH**

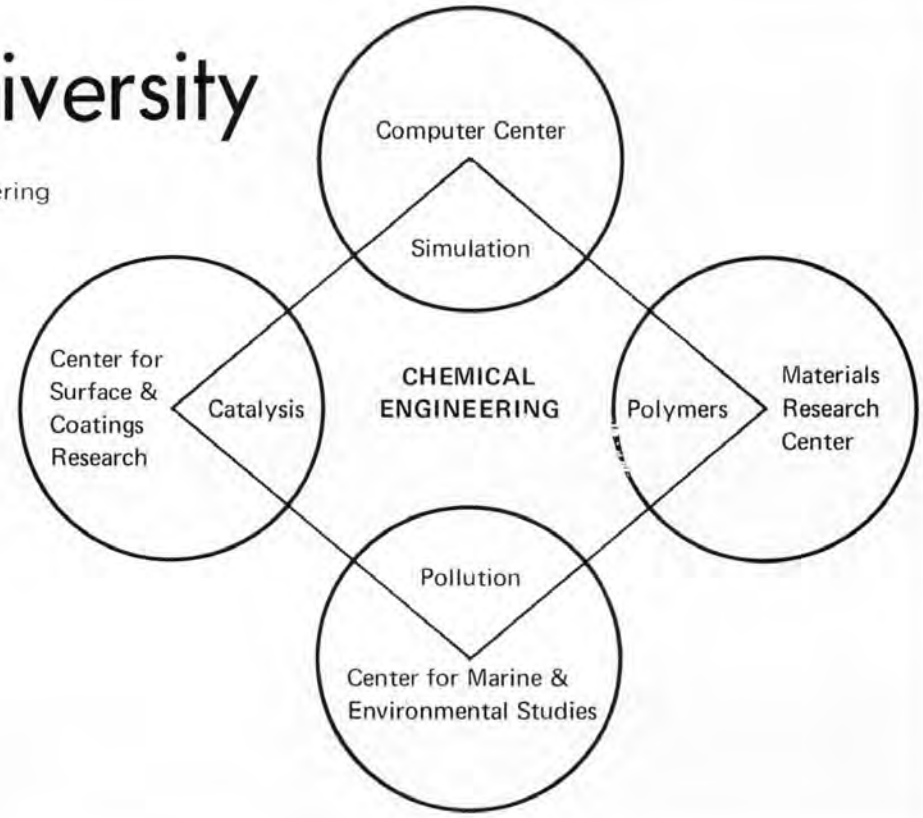
**DIFFUSION AND MASS TRANSFER**
**HEAT TRANSFER**
**FLUID MECHANICS**
**THERMODYNAMICS**
**BIOCHEMICAL ENGINEERING**
**PROCESS DYNAMICS AND CONTROL**
**CHEMICAL REACTION ENGINEERING**
**MAGNETOHYDRODYNAMICS**
**SOLID MIXING**
**DESALINATION**
**OPTIMIZATION**
**FLUIDIZATION**
**PHASE EQUILIBRIUM**

# Lehigh University

Department of Chemical Engineering

M. CHARLES
C. W. CLUMP
R. W. COUGHLIN
A. S. FOUST
W. L. LUYBEN
A. J. McHUGH
G. W. POEHLEIN
W. E. SCHIESSER
L. H. SPERLING
F. P. STEIN
L. A. WENZEL

Bethlehem, Pa. 18015



# MICHIGAN TECHNOLOGICAL UNIVERSITY

## DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING

HOUGHTON, MICHIGAN 49931

CHEMICAL ENGINEERING FACULTY

L. B. HEIN, Ph.D., Department Head

M. W. BREDEKAMP, Ph.D. – Instrumentation, Process Dynamics and Control
E. R. EPPERSON, M.S. – Phase Equilibria
D. W. HUBBARD, Ph.D. – Lake Studies, Mixing Phenomena, Turbulent Flow
J. T. PATTON, Ph.D. – Biosynthesis, Waste Treatment, Petroleum Recovery
A. J. PINTAR, Ph.D. – Energy Conversion, Transport Phenomena, Applied Mathematics
J. M. SKAATES, Ph.D. – Fluid-Solid Reactions, Catalysis, Reactor Design
E. T. WILLIAMS, Ph.D. – Improvement of Pulpwood Yield

DEGREES GRANTED: M.S.

Financial assistance available in the form of Fellowships and Assistantships.

For more information, write to:

DR. L. B. HEIN, Head
Department of Chemistry and Chemical Engineering
MICHIGAN TECHNOLOGICAL UNIVERSITY
HOUGHTON, MICHIGAN 49931

# THE UNIVERSITY OF MICHIGAN

## CHEMICAL ENGINEERING GRADUATE PROGRAMS on the ANN ARBOR CAMPUS

**The University of Michigan awarded its first Chemical Engineering M.S. in 1912 and Ph.D. in 1914. It has moved with the times since and today offers a flexible program of graduate study that allows emphases ranging from fundamentals to design.**

**The Chemical Engineering Department, with 21 faculty members and some 65 graduate students, has opportunities for study and research in areas as diverse as: thermodynamics, reactor design, transport processes, mathematical and numerical methods, optimization, mixing, rheology, materials, bioengineering, electrochemical engineering, production-pipelining-storage of oil and gas, coal processing, and pollution control.**

**The M.S. program may be completed in 10 months and does not require a thesis. The Professional Degree requires thirty-hours beyond the Master's and a professional problem. The Ph.D. program has recently been revamped to expedite entry into a research area as early in the program as possible.**

**For further Information and applications, write:**

Prof. Brice Carnahan
Chairman of the Graduate Committee
The University of Michigan
Department of Chemical Engineering
Ann Arbor, Michigan 48104

# MONASH UNIVERSITY

## CLAYTON, VICTORIA
## DEPARTMENT OF CHEMICAL ENGINEERING
## RESEARCH SCHOLARSHIPS

Applications are invited for Monash University Research Scholarships tenable in the Department of Chemical Engineering. The awards are intended to enable scholars to carry out under supervision, a programme of full-time advanced studies and research which may lead to the degrees of Master of Engineering Science and/or Doctor of Philosophy.

Facilities are available for work in the general fields of:

Solid-gas Thermodynamics and Kinetics
Packed Tubular Reactors
Crystal Nucleation and Growth
Fluidisation
Rheology
Computer Control and Optimisation
Gas Absorption with Reaction
Waste Treatment Engineering
Process Dynamics
Biochemical Engineering
Fluid - Particle Mechanics
Mixing of Liquids
Submerged Combustion

Scholarships carry a tax-free stipend of $A3,050 per annum. Detailed information about the awards and the necessary application forms may be obtained from the Academic Registrar. Technical enquiries should be addressed to the Chairman of Department, Professor O. E. Potter.

**Postal Address: Monash University, Wellington Road, Clayton, Victoria, 3168, Australia.**

# UNIVERSITY OF NEBRASKA

OFFERING GRADUATE STUDY AND RESEARCH LEADING TO THE M.S. OR Ph.D. IN THE AREAS OF:

**Biochemical Engineering**
**Computer Applications**
**Crystallization**
**Food Processing**
**Kinetics**
**Mixing**
**Polymerization**
**Thermodynamics**
**Tray Efficiencies and Dynamics**
**and other areas**

FOR APPLICATIONS AND INFORMATION ON FINANCIAL ASSISTANCE WRITE TO:

**Prof W. A. Scheller, Chairman, Department of Chemical Engineering**
**University of Nebraska, Lincoln, Nebraska 68508**

ENERGY RESOURCE RESEARCH
POLLUTION CONTROL
BIOCHEMICAL ENGINEERING
MEMBRANE TECHNOLOGY
PROCESS DYNAMICS

These are some of the challenging specialties
you can follow in graduate programs
leading to degrees of M.S. in chemical/petroleum engineering
or Ph.D. in chemical engineering.

Graduate Coordinator
Chemical/Petroleum Engineering
University of Pittsburgh
Pittsburgh, Pa. 15261

# University of Pittsburgh

# PURDUE

purdue university

KINETICS

TRANSPORT

SYSTEMS ANALYSIS

THERMODYNAMICS

BIOENGINEERING

ENVIRONMENTAL ENGINEERING

**write to** **Chemical Engineering**
**Purdue University**
**Lafayette, Ind. 47907**

# Queen's University
# Kingston, Ontario, Canada

## Graduate Studies in Chemical Engineering

MSc and PhD Degree Programs

D.W. Bacon PhD (Wisconsin)
H.A. Becker ScD (MIT)
D.H. Bone PhD (London)
S.C. Cho PhD (Princeton)
R.H. Clark PhD (Imperial College)
R.K. Code PhD (Cornell)
J. Downie PhD (Toronto)
J.E. Ellsworth PhD (Princeton)
C.C. Hsu PhD (Texas)
J.D. Raal PhD (Toronto)
T.R. Warriner ScD (Johns Hopkins)
B.W. Wojciechowski PhD (Ottawa)

- Waste Processing
  - water and waste treatment
  - applied microbiology
  - biochemical engineering
- Chemical Reaction Engineering
  - catalysis
  - statistical design
  - polymer studies
- Transport Processes
  - combustion
  - fluid mechanics
  - thermodynamics

Write:
Dr. B. W. Wojciechowski
Department of Chemical Engineering
Queen's University
Kingston, Ontario
Canada

# UNIVERSITY OF ROCHESTER

**ROCHESTER, NEW YORK 14627**

**MS & PhD Programs**

| | |
|---|---|
| T. L. Donaldson | Mass Transfer, Membranes, Enzyme Catalysis |
| R. F. Eisenberg | Inorganic Composites, Physical Metallurgy |
| M. R. Feinberg | Formal Chemical Kinetics, Continuum Mechanics |
| J. R. Ferron | Transport Processes, Applied Mathematics |
| J. C. Friedly | Process Dynamics, Optimal Control & Design |
| R. H. Heist | Nucleation, Atmospheric Chemistry, Solids |
| F. J. M. Horn | Chemical Processing Theory, Applied Mathematics |
| H. R. Osmers | Rheology, Polymers, Biological & Ecological Processes |
| H. J. Palmer | Interfacial Phenomena, Transport Processes |
| H. Saltsburg | Surface & Solid-State Chemistry, Molecular Beams |
| W. D. Smith, Jr. | Kinetics & Reactor Design, Computer Applications |
| G. J. Su | Glass Science & Technology, Thermodynamics |

**For information write: J. R. Ferron, Chairman**

**UNIVERSITY OF WASHINGTON** Department of Chemical Engineering Seattle, Washington 98105
*GRADUATE STUDY BROCHURE AVAILABLE ON REQUEST*

## WASHINGTON UNIVERSITY

### ST. LOUIS, MISSOURI

### GRADUATE STUDY IN CHEMICAL ENGINEERING

Washington University is located on a park-like campus at the St. Louis City limit. Its location offers the cultural and recreational opportunities of a major metropolitan area combined with the convenience of a University surrounded by pleasant residential areas with many apartment houses where single and married graduate students can obtain housing at reasonable rates.

The Department of Chemical Engineering occupies a modern building with well-equipped laboratory facilities for research in a large variety of areas. There is close interaction with the research and engineering staffs of major St. Louis chemical companies and also extensive collaboration with the faculty of the Washington University School of Medicine in the biomedical engineering research activities.

### PRINCIPAL RESEARCH AREAS

- Biomedical Engineering
- Chemical Reaction Engineering
- Environmental Science
- Polymer Science
- Rheology
- Technology Assessment
- Thermodynamics
- Transport Phenomena

**For application forms, a catalog, and a brochure which describes faculty research interests, research projects and financial aid write to:**

**Dr. Eric Weger, Chairman**
**Department of Chemical Engineering**
**Washington University**
**St. Louis, Missouri 63130**

## THE UNIVERSITY OF AKRON

## DEPARTMENT OF CHEMICAL ENGINEERING

AUBURN SCIENCE AND ENGINEERING CENTER

### GRADUATE STUDY AND RESEARCH IN CHEMICAL ENGINEERING

**RESEARCH AREAS:**
- Applied Mathematics
- Biomedical
- Environmental
- Porous Media
- Rheology
- Polymer Processing
- Transport Processes

**FINANCIAL AID:**
- Teaching and Research Assistantship
- Fellowships Available
- Competitive Stipends

**FULL AND PART-TIME ENROLLMENT**

**FOR FURTHER INFORMATION WRITE**
**DEPARTMENT OF**
**CHEMICAL ENGINEERING**
**THE UNIVERSITY OF AKRON**
**AKRON, OHIO 44325**

## THE UNIVERSITY OF BRITISH COLUMBIA

**Department of Chemical Engineering**

Post graduate work is offered leading to the research degrees of M.A.Sc. and Ph.D. or to the non-research degree of M. Eng. The Department has excellent experimental and computing facilities. A wide range of research topics is available. Please write for further information on graduate courses, research projects and financial assistance to:

**Dr. F. E. Murray, Head,**
**Department of Chemical Engineering,**
**University of British Columbia,**
**Vancouver, B.C., Canada**
**V6T 1W5**

## UNIVERSITY OF COLORADO

**CHEMICAL ENGINEERING**
**GRADUATE STUDY**

The Department of Chemical Engineering at the University of Colorado offers excellent opportunities for graduate study and research leading to the Master of Science and Doctor of Philosophy degrees in Chemical Engineering.

Research interests of the faculty include cryogenics, process control, polymer science, catalysis, fluid mechanics, heat transfer, mass transfer, computer aided design, air and water pollution, biomedical engineering, and ecological engineering.

**For application and information, write to:**

**Chairman,** Graduate Committee
Chemical Engineering Department
University of Colorado, Boulder

## UNIVERSITY OF NORTH DAKOTA

**Graduate Study in Chemical Engineering**

**PROGRAM OF STUDY:** Thesis and non-Thesis programs leading to the M.S. degree are available. A full-time student can complete the program in a calender year. Research and Teaching assistantships are available.

**PROJECT LIGNITE:** UND's Chemical Engineering Department is engaged in a major research program under the U.S. Office of Coal Research on conversion of lignite coal to upgraded energy products. A pilot plant is under construction for a coal liquefaction process. Students may participate in project-related thesis problems, or be employed as project workers while taking course work in the department.

**BUREAU OF MINES:** The Department of Chemical Engineering and the U.S. Bureau of Mines Energy Research Laboratory offer a cooperative program of study related to coal technology. Course work is taken at the University and thesis research performed at the Bureau under Bureau staff members. Fellowships are available to U.S. citizens.

**FOR INFORMATION WRITE TO:**

**Dr. Thomas C. Owens, Chairman**
**Chemical Engineering Department**
**University of North Dakota**
**Grand Forks, North Dakota 58201**

## THE UNIVERSITY OF IOWA

**Iowa City**

**M.S. and Ph.D. in Chemical Engineering**

Emphasis on Materials Engineering

Rheology
Transport Processes
Chemo-mechanics
Stress Corrosion
Irreversible Thermodynamics
Membrane Processes
Surface Effects
Reaction Kinetics
Radiation Effects

**Assistantships are available. Write:**

**Chairman**
**Chemical Engineering Program**
**University of Iowa**
**Iowa City, IA 52242**

Do any of these names ring a bell?

**Elzy**
**Fitzgerald**
**Knudsen**
**Levenspiel**
**Meredith**
**Mrazek**
**Wicks**

They're our Department.

We offer advanced study in straight chemical engineering and joint programs with biochemistry, environmental and ocean engineering, etc.

It's exciting here at

**OREGON STATE UNIVERSITY**

Curious? Questions? Write

Dr. Charles E. Wicks
Chemical Engineering Department
Oregon State University
Corvallis, Oregon 97331

## University of Rhode Island
## Graduate Study
## Chemical Engineering MS, PhD
## Nuclear Engineering MS

AREAS OF RESEARCH

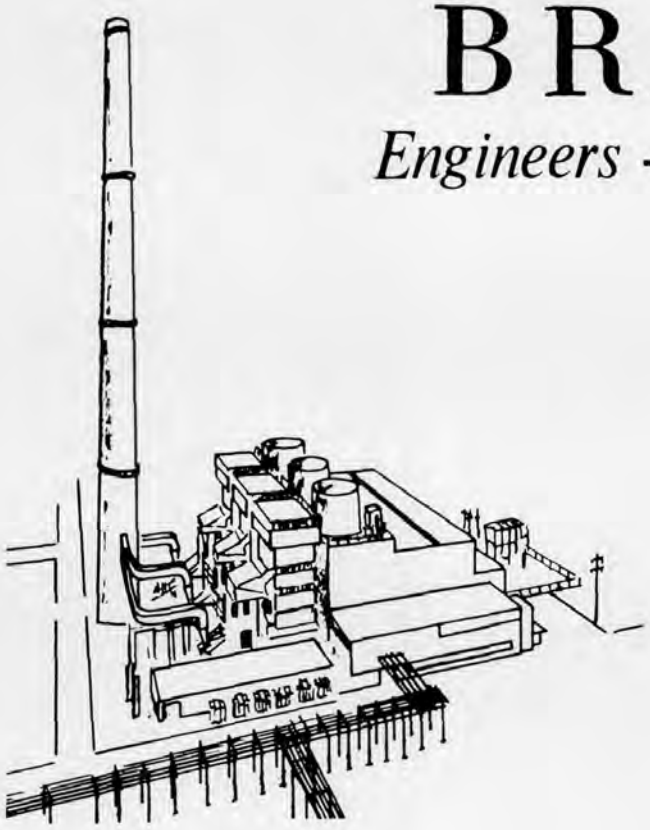
| | |
|---|---|
| Adsorption | Mass Transfer |
| Biochemical Engineering | Materials Engineering |
| Boiling Heat Transfer | Membrane Diffusion |
| Catalysis | Metal Finishing |
| Corrosion | Metal Oxidation |
| Desalination | Metallurgy |
| Dispersion Processes | Nuclear Technology |
| Distillation | Phase Equilibria |
| Fluid Dynamics | Polymers |
| Heat Transfer | Process Dynamics |
| Ion Exchange | Thermodynamics |
| Kinetics | Water Resources |
| Liquid Extraction | X-ray Metallography |

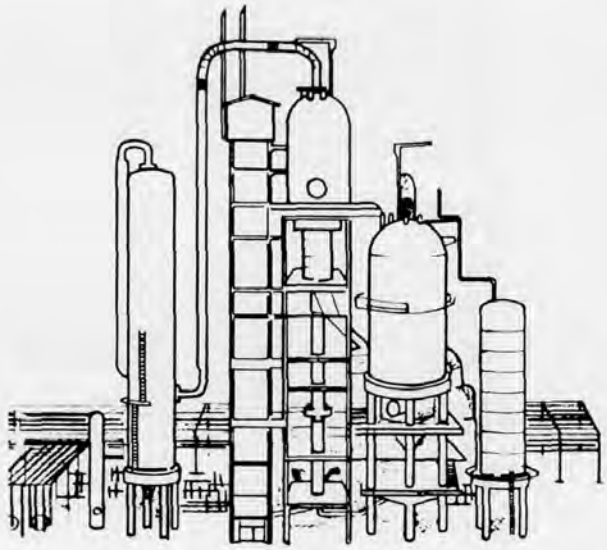
APPLICATIONS

Apply to the Dean of the Graduate School, University of Rhode Island, Kingston, Rhode Island 02881. Applications for financial aid should be received not later than February 15. Appointments will be made about April.

# BRAUN

*Engineers - Constructors*





# engineering for more energy requires new ideas - YOURS

With a background of 65 years of engineering for the process industries, C F Braun & Co occupies a unique ground-floor position in three of the newer energy fields – coal gasification, oil shale processing, and nuclear fuels. Our nuclear projects include plants for fuel fabrication, fuel reprocessing, and power generation. We are also engineering and will construct plants to convert coal and oil shale to clean commercial fuels.

You, as an engineer, recognize that your future job security and shortest route to promotion lie in areas of new industrial technology. You want individual recognition for your ideas. You want to be involved with new concepts. You want to work in a congenial atmosphere with senior engineers who can help you advance rapidly in your career. You want to work in a company that provides the ideal environment for your professional growth. All of these, you will find at Braun.

The rapid growth of our engineering and construction work for the energy-conversion industries has opened many career positions in our Engineering Headquarters at Alhambra, California and in our Eastern Engineering Center at Murray Hill, New Jersey. For more information, please write to C F Braun & Co, Department K, Alhambra, California 91802 or Murray Hill, New Jersey 07974.

AN EQUAL OPPORTUNITY EMPLOYER

# In the energy field, there aren't any easy answers

## which is one very good reason for considering Atlantic Richfield for your career.

It's energy that has created and maintains the fabric of today's civilization. That's basic.

But providing energy in vast amounts today—and preparing for the greater needs of tomorrow—is a tougher and more challenging problem than ever before.

Now, new answers must be found to developing and utilizing energy—and its by-products—if we are to maintain our energy-based standards of living.

We want the best brains we can find to help us arrive at these answers. We want people sensitive to the human and natural environment—and realistic enough to know that preserving both must come from tough, intelligent, dedicated work . . . backed by outstanding resources in capital, research and experience, such as those of Atlantic Richfield.

If tackling such large-scale, significant problems is one of your criteria in selecting a job, join us. We can offer you a career rich in challenge, rich in meaningful work, rich in personal reward.

See our representative on campus or your Placement Director. Should that not be convenient, write J. T. Thornton, Atlantic Richfield Company 515 South Flowers Street, Los Angeles, CA. 90071.

**AtlanticRichfieldCompany**

An equal opportunity employer, M/F.