



**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

**JUST 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 (1/2 time) | J. H. Olson                |
| C. E. Birchenall           | C. A. Petty                |
| H. W. Blanch               | T. W. F. Russell           |
| M. M. Denn                 | S. I. Sandler              |
| B. C. Gates                | G. C. A. Schuit (1/2 time) |
| J. R. Katzer               | J. M. Schultz              |
| R. L. McCullough           | James Wei                  |
| A. B. Metzner              |                            |

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

UNIVERSITY OF KENTUCKY

# DEPARTMENT OF CHEMICAL ENGINEERING

M.S. & Ph.D. Programs  
Including Intensive Study in

## ENERGY ENGINEERING

Energy supply and demand  
Fuel combustion processes  
Coal liquefaction and gasification processes

## AIR POLLUTION CONTROL

Rates and equilibria of atmospheric reactions  
Process and system control, and gas cleaning  
Diffusion, and modelling of urban atmospheres

## WATER POLLUTION CONTROL

Advanced waste treatment and water reclamation  
Design of physical and chemical processes  
Biochemical reactor design

## STIPENDS:

Excellent financial support is available  
in the form of Environmental Protection Agency  
Traineeships, fellowships & assistantships.

## OTHER PROGRAM AREAS:

|                             |                |
|-----------------------------|----------------|
| Electrochemical engineering | Reactor design |
| Process control             | Transport      |



WRITE TO: R.B. Grieves, Chairman  
Dept. of Chemical Engineering  
UNIVERSITY OF KENTUCKY  
LEXINGTON, KENTUCKY 40506

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.

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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

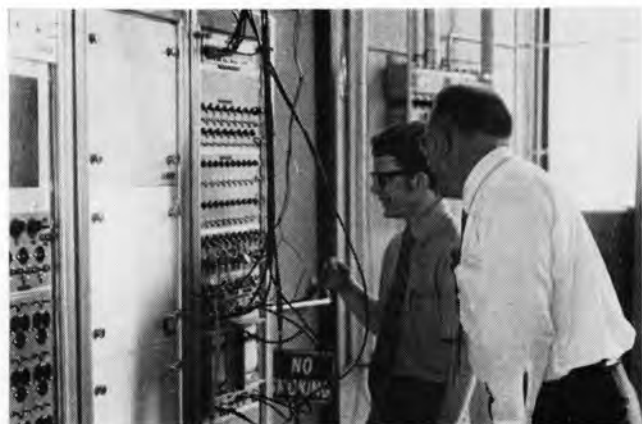
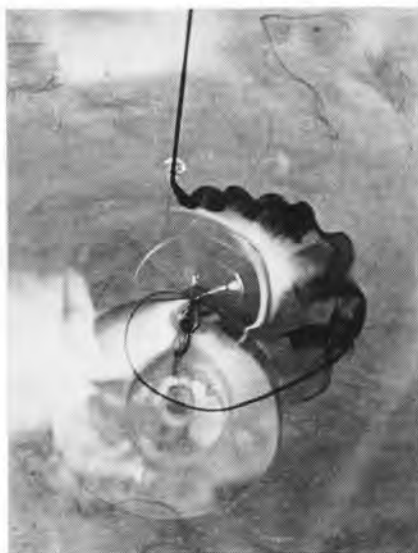


# The university of florida

offers you

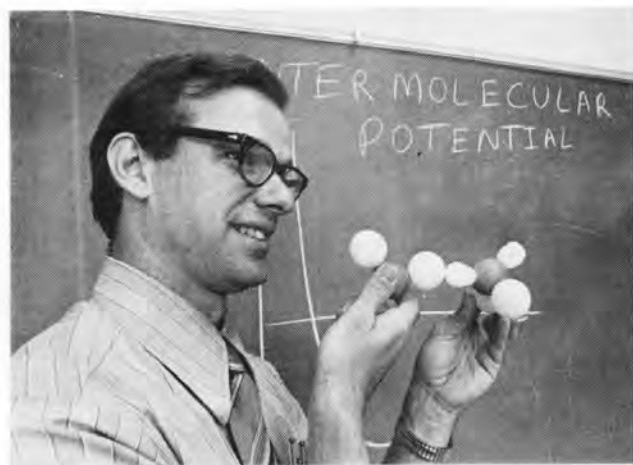
## *Transport Phenomena & Rheology*

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*

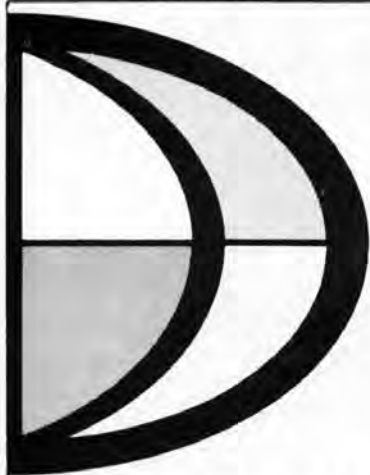
Oxygen being extracted from a substance similar to blood plasma.

*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  
Medicine  
Space**

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.

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

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



**UIC**



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

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

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

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

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

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

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

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

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

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

Process dynamics and control, simulation and process analysis

Kinetics of gas reactions, energy transfer processes, molecular lasers

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

Chemical engineering, bioengineering, membrane transport processes, mathematical modeling

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

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)    | Fluidization (Wheelock)    |
| Biomedical Engineering (Seagrave) | Polymer Kinetics (Abraham) |
| Coal Research (Wheelock)          | Process Chemistry (Burnet) |
| Crystallization (Larson)          | 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.

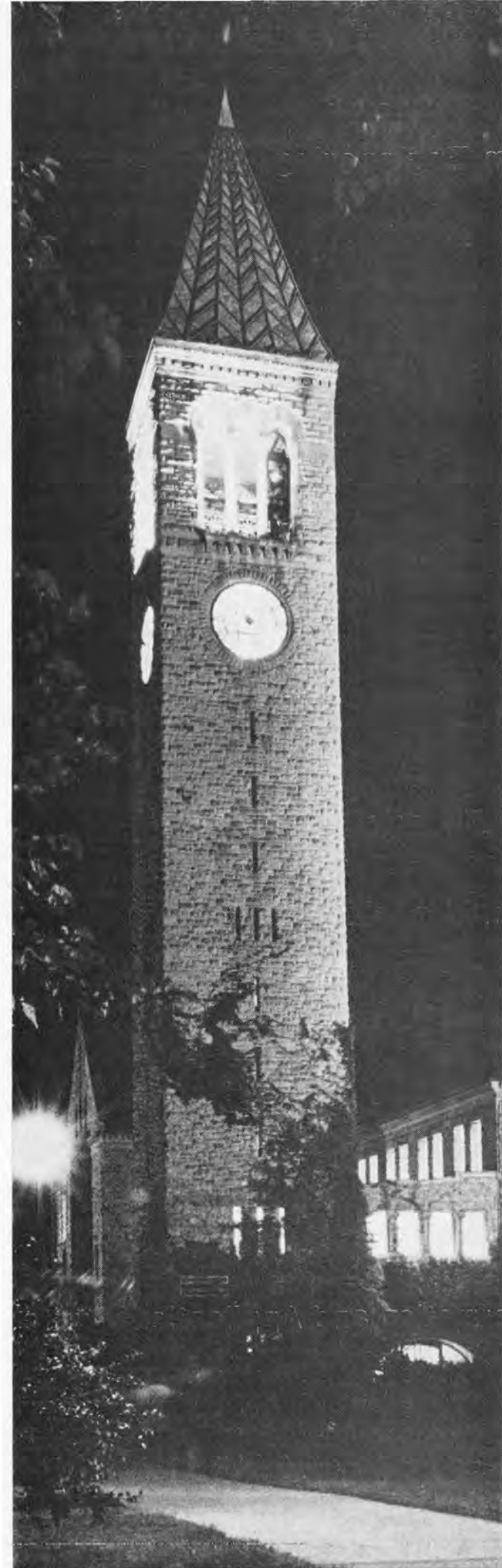
**Robert L. Von Berg, Sc.D.** Liquid-liquid extraction, reaction kinetics, effect of radiation on chemical reactions.

**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

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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.

### **Department of Chemical Engineering**

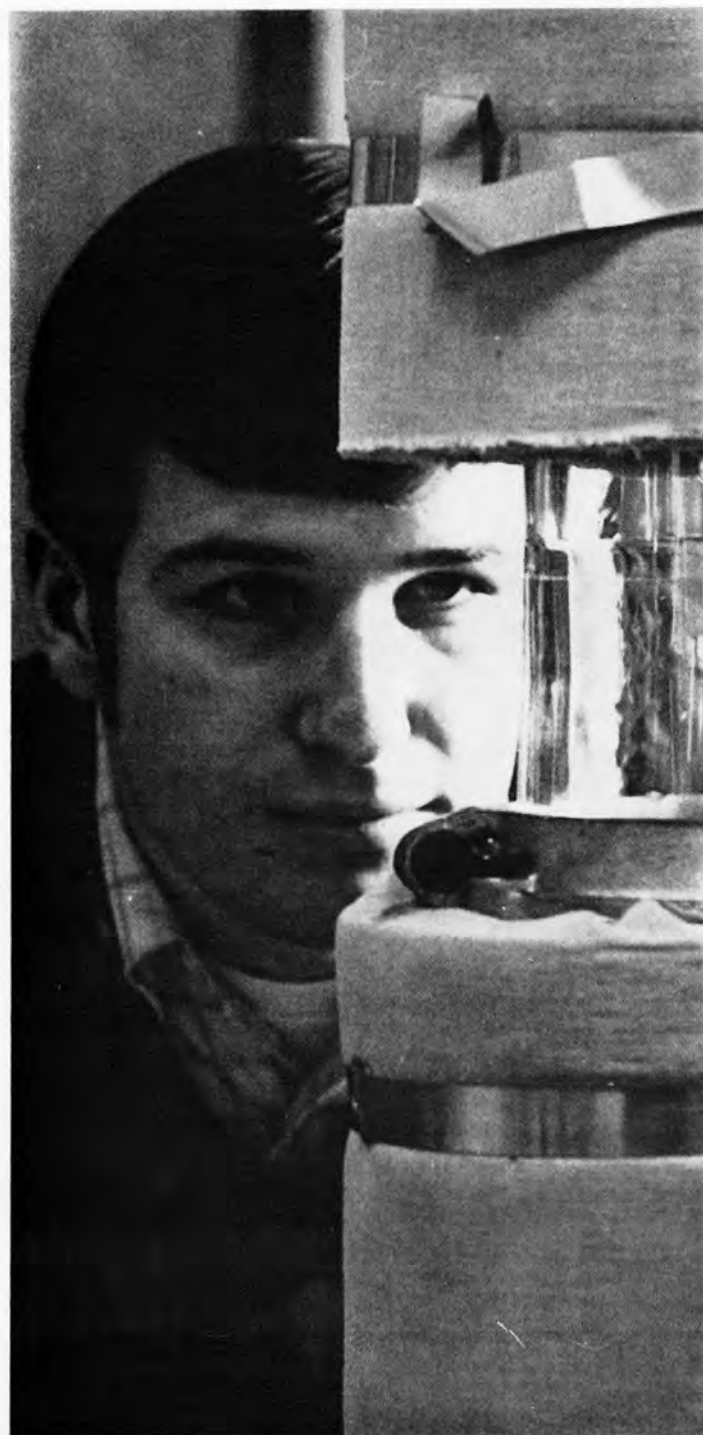
Programs leading to Master's, Engineer and  
Doctor's degrees. Areas of study and research:  
chemical engineering, polymer science and  
engineering, bioengineering and environmental  
studies.

Fellowships and Research Assistantships  
are available.

### **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

# LOOKING



for a  
graduate education  
in  
Chemical Engineering ?

Consider

## **PENN STATE**

**M.S. and Ph.D. Programs Offered  
with Research In**

Separation Processes  
Kinetics and Mass Transfer  
Petroleum Research  
Unit Processes  
Thermodynamic Properties  
Catalysis and Applied Chemistry  
Air Environment  
Bio-Engineering  
Nuclear Technology  
Transport Properties  
Lubrication and Rheology  
And Other Areas

WRITE TO

Prof. Lee C. Eagleton, Head  
160 Chemical Engineering Building  
The Pennsylvania State University  
University Park, Pa. 16802



## 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 under-

graduate 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.**

## 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:

### 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.

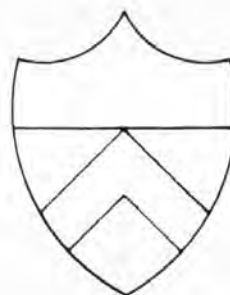
**William B. Russel**—Fluid mechanics, dynamics of colloidal systems.

**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.



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



# RENSSELAER POLYTECHNIC INSTITUTE

offers graduate study programs in Chemical Engineering leading to M.S. and Ph.D. degrees with opportunities for specialization in:

**THERMODYNAMICS  
HEAT TRANSFER  
REACTION KINETICS  
FLUIDIZATION  
ELECTROCHEMICAL DEVICES**

**POLYMER MATERIALS  
POLYMER PROCESSING  
ENVIRONMENTAL ENGINEERING  
PROCESS DYNAMICS  
BIOMEDICAL ENGINEERING**

**Rensselaer Polytechnic Institute**, established in 1824 "for the application of science to the common purposes of life," has grown from a school of engineering and applied science into a technological university, serving some 3500 undergraduates and over 1000 graduate students.

It is located in Troy, New York, about 150 miles north of New York City and 180 miles west of Boston. Troy, Albany, and Schenectady together comprise the heart of New York's Capital District, an upstate metropolitan area of about 600,000 population. These historic cities and the surrounding countryside provide the attractions of both urban and rural life.

Scenic streams, lakes and mountains, including the Hudson River, Lake George, the Green Mountains of Vermont, the Berkshires of Massachusetts, and portions of the Adirondack Forest Preserve, are within easy driving distance, and offer many attractions for those interested in skiing, hiking, boating, hunting, fishing, etc.

**For full details write Mr. R. A. Du Mez, Director of Graduate Admissions, Rensselaer Polytechnic Institute, Troy, New York 12181.**



# 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 chemistry, 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

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## 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.

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## 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

## Graduate Studies in Chemical & Metallurgical Engineering

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## 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

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## 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

## **BRIGHAM YOUNG UNIVERSITY**

### **Chemical Engineering Department M.S. AND Ph.D. PROGRAMS**

#### **Areas of Interest**

Transport/kinetic processes  
Thermodynamics  
(Center for thermochemical studies)  
High pressure technology  
Environmental quality control  
Energy resources  
(Combustion Research Center)  
Nuclear Engineering  
Catalysis  
Fluid Mechanics

#### **Location**

45 miles south of Salt Lake City in scenic Provo at the base of the Wasatch Mountains

#### **Financial Assistance Available**

Fellowships  
Research Assistantships  
Teaching Assistantships  
Scholarships  
Available up to \$6,500/yr.

#### **Faculty**

Dee H. Barker  
Calvin H. Bartholomew  
James J. Christensen  
Ralph L. Coates  
Joseph M. Glassett  
H. Tracy Hall  
Richard W. Hanks

M. Duane Horton  
James F. Jackson  
John L. Oscarson  
Bill J. Pope  
L. Douglas Smoot  
Grant M. Wilson

**FOR INFORMATION CONTACT:  
Dr. Richard W. Hanks  
350G ESTB, Chemical Engineering  
Brigham Young University  
Provo, Utah 84601**



DEPARTMENT OF CHEMICAL ENGINEERING

## **BUCKNELL UNIVERSITY**

LEWISBURG, PENNSYLVANIA 17837

For admission, address

**Dr. Paul H. DeHoff**

**Coordinator of Graduate Studies**

- Graduate degrees granted: Master of Science in Chemical Engineering
- Some courses for graduate credit are available in the evenings.
- Typical research interests of the faculty include the areas of: mass transfer, particularly distillation, solid-liquid, and liquid-liquid extraction; thermodynamics; reaction kinetics; catalyst deactivation; process dynamics and control; metallurgy and the science of materials; mathematical modeling; numerical analysis; statistical analysis.
- Assistantships and scholarships are available.
- For the usual candidate, with a B.S. in Chemical Engineering, the equivalent of thirty semester-hours of graduate credit including a thesis is the requirement for graduation.

# 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

Case Institute of Technology

# CASE WESTERN RESERVE UNIVERSITY

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

## Current Research Topics

Environmental Engineering  
Coal Gasification  
Simulation and Control  
Catalysis and Surface Chemistry

Crystal Growth and Materials  
Engineering Applications of Lasers  
Process Development  
Biomedical Engineering

## General Information

Case Institute of Technology is a privately endowed institution with a tradition of excellence in Engineering and Applied Science since 1880. In 1967 Case Institute and Western Reserve University joined together. The enrollment, endowment and faculty make Case Western Reserve University one of the leading private schools in the country. The modern, urban campus is located in Cleveland's University Circle, an extensive concentration of education, scientific, social and cultural organizations.

For more information, contact: Graduate Student Advisor

Department of Chemical Engineering  
Case Western Reserve University  
Cleveland, Ohio 44106

# CINCINNATI

DEPARTMENT OF CHEMICAL AND NUCLEAR ENGINEERING

M.S. AND PH.D DEGREES



- Major urban educational center
- New, prize-winning laboratory building and facilities—Rhodes Hall
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Inquiries to: Dr. David B. Greenberg, Head  
Dept. of Chemical & Nuclear Engineering  
University of Cincinnati  
Cincinnati, Ohio 45221



# 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, S.S., 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

# the university of connecticut

## faculty

J. P. BELL  
C. O. BENNETT  
M. B. CUTLIP  
A. T. DiBENEDETTO  
G. M. HOWARD  
H. E. KLEI  
R. M. STEPHENSON  
L. F. STUTZMAN  
D. W. SUNDSTROM

## programs

M.S. and Ph.D. programs covering most aspects of Chemical Engineering.

Research projects concentrate in four main areas:

KINETICS AND CATALYSIS  
POLYMERS AND COMPOSITE MATERIALS  
PROCESS DYNAMICS AND CONTROL  
WATER AND AIR POLLUTION CONTROL

**financial aid** — Research and Teaching Assistantships, Fellowships

**location** — Beautiful setting in rural Northeast Connecticut, convenient to Boston, New York, and Northern New England

We would like to tell you much more about the opportunities for an education at UCONN, please write to:

Graduate Admissions Committee  
Department of Chemical Engineering  
The University of Connecticut  
Storrs, Connecticut 06268

## ILLINOIS INSTITUTE OF TECHNOLOGY

CHICAGO, ILLINOIS 60616

**M.S. and Ph.D. programs in Chemical Engineering and Interdisciplinary Areas of Polymer Science, Biochemical and Food Engineering, Gas Engineering, Biomedical Engineering, and Particle Technology.**

### Faculty

|                  |   |
|------------------|---|
| W. M. Langdon    | Environmental Control and Process Design        |
| R. E. Peck       | Heat Transfer and Thermodynamics                |
| B. S. Swanson    | Process Dynamics and Controls                   |
| L. L. Tavlarides | Biochemical Engineering and Reactor Engineering |
| J. S. Vrentas    | Polymer Science and Transport Phenomena         |
| D. T. Wasan      | Mass Transfer and Particle Dynamics             |
| H. Weinstein     | Biomedical Engineering and Reactor Engineering  |

**For inquiries write to: D. T. Wasan, Chairman**

**Chemical Engineering Department  
Illinois Institute of Technology  
10 West 33rd Street  
Chicago, Illinois 60616**

# 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

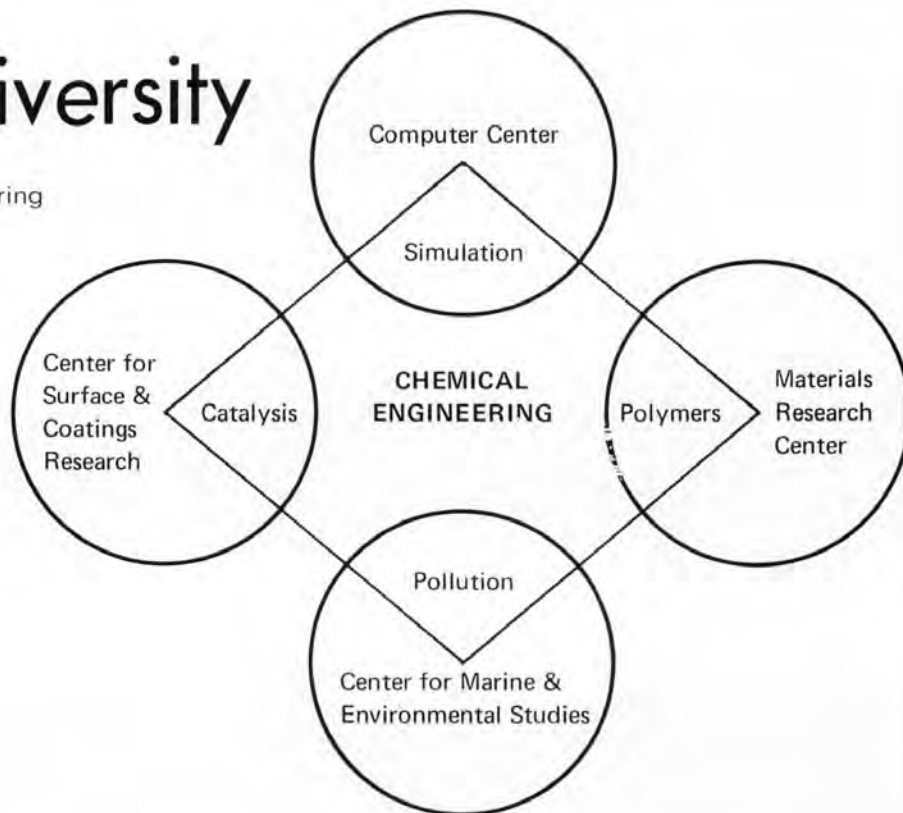
DIFFUSION AND MASS TRANSFER  
 HEAT TRANSFER  
 FLUID MECHANICS  
 THERMODYNAMICS  
 BIOCHEMICAL ENGINEERING  
 PROCESS DYNAMICS AND CONTROL  
 CHEMICAL REACTION ENGINEERING  
 MAGNETOHYDRODYNAMICS  
 SOLID MIXING  
 DESALINATION  
 OPTIMIZATION  
 FLUIDIZATION  
 PHASE EQUILIBRIUM

# 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





Graduate Enrollment — 80

Faculty — 19

- Bioengineering
  - Pollution Control
    - Process Dynamics
      - Computer Control
        - Kinetics and Catalysis
          - Thermodynamics
            - Ecological Modeling
              - Sugar Technology

Write: Chemical Engineering Department  
Louisiana State University  
Baton Rouge, Louisiana 70803

## McMASTER UNIVERSITY

Hamilton, Ontario, Canada  
**M. ENG. & PH.D. PROGRAMS**

### THE FACULTY AND THEIR INTERESTS

|   |   |
|---|---|
| R. B. Anderson (Ph. D., Iowa)                           | Catalysis, Adsorption, Kinetics                           |
| M. H. I. Baird (Ph.D., Cambridge)                       | Oscillatory Flows, Transport Phenomena                    |
| A. Benedek (Ph.D., U. of Washington)                    | Wastewater Treatment, Novel Separation Techniques         |
| J. L. Brash (Ph.D., Glasgow)                            | Polymer Chemistry, Use of Polymers in Medicine            |
| C. M. Crowe (Ph.D., Cambridge)                          | Optimization, Chemical Reaction Engineering, Simulation   |
| I. A. Feuerstein (Ph.D., Massachusetts)                 | Biological Fluid and Mass Transfer                        |
| A. E. Hamielec (Ph.D., Toronto)                         | Polymer Reactor Engineering, Transport Processes          |
| J. W. Hodgins (Ph.D., Toronto)                          | Polymerization, Applied Chemistry                         |
| T. W. Hoffman (Ph.D., McGill)                           | Heat Transfer, Chemical Reaction Engr., Simulation        |
| J. F. MacGregor (Ph.D., Wisconsin)                      | Statistical Methods in Process Analysis, Computer Control |
| K. L. Murphy (Ph.D., Wisconsin)                         | Wastewater Treatment, Physicochemical Separations         |
| L. W. Shemilt (Ph.D., Toronto)                          | Mass Transfer, Corrosion                                  |
| W. J. Snodgrass (Ph.D., U. of N. Carolina, Chapel Hill) | Modelling of Aquatic Systems                              |
| J. Vlachopoulos (D.Sc., Washington U.)                  | Polymer Rheology and Processing, Transport Processes      |
| T. Wairegi (Ph.D., McGill)                              | Fluid Mechanics, (Bubbles, drops and Solid Particles)     |
| D. R. Woods (Ph.D., Wisconsin)                          | Interfacial Phenomena, Particulate Systems                |
| J. D. Wright (Ph.D., Cambridge)                         | Process Simulation and Control, Computer Control          |

**DETAILS OF FINANCIAL ASSISTANCE AND ANNUAL  
RESEARCH REPORT AVAILABLE UPON REQUEST**

**CONTACT: Dr. J. W. Hodgins, Chairman  
Department of Chemical Engineering  
Hamilton, Ontario, Canada L8S 4L7**



# MICHIGAN TECHNOLOGICAL UNIVERSITY



DEPARTMENT OF CHEMISTRY  
AND CHEMICAL ENGINEERING  
HOUGHTON, MICHIGAN 49931

## CHEMICAL ENGINEERING FACULTY

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

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Chairman of the Graduate Committee  
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Ann Arbor, Michigan 48104

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|----------------------------------|---------|---|
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| K. F. Loughlin (Ph.D. U.N.B.)    | . . . . | Molecular sieves  |
| C. Moreland (Ph.D. Birmingham)   | . . . . | Fluid-solid systems, process dynamics                                       |
| D. R. Morris (Ph.D. London)      | . . . . | Electrochemistry, Corrosion   |
| J. J. C. Picot (Ph.D. Minnesota) | . . . . | Transport phenomena in liquid crystals                                      |
| D. M. Ruthven (Ph.D. Cambridge)  | . . . . | Sorption and diffusion in molecular sieves; adsorption separation processes |
| F. R. Steward (Sc.D. M.I.T.)     | . . . . | Combustion, radiation, furnace design and fire science                      |

**For further information write to:**

**D. M. Ruthven  
Department of Chemical Engineering  
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|---------------------|---|
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| D. R. Brutvan       | staged operations                                       |
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| W. N. Gill          | dispersion, reverse osmosis                             |
| R. J. Good          | surface phenomena, adhesion of living cells             |
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| K. M. Kiser         | blood flow, turbulence, pollution in lakes              |
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| E. Ruckenstein      | catalysis, interfacial phenomena, bioengineering        |
| J. Szekely          | process metallurgy, gas-solid and solid-solid reactions |
| T. W. Weber         | process control, dynamics of adsorption                 |
| S. W. Weller        | catalysis, catalytic reactors                           |

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**State University of New York at Buffalo**  
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| Desalination           | Rheology              |

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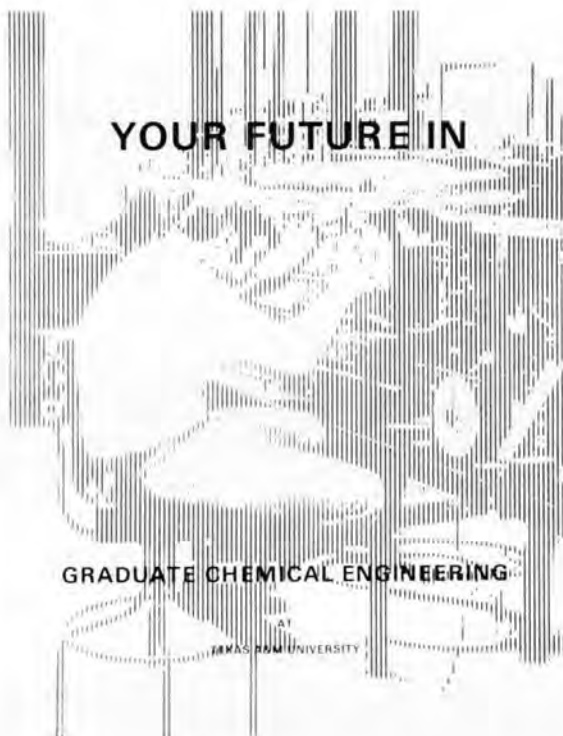
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|  |  |
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WRITE TO: Dr. Henry A. McGee, Jr.  
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Virginia Polytechnic Institute and State University  
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FOR FURTHER INFORMATION on admission and financial aid contact:

Dr. Ralph H. Kummler  
Chairman, Department of Chemical Engineering  
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Department of Chemical Engineering  
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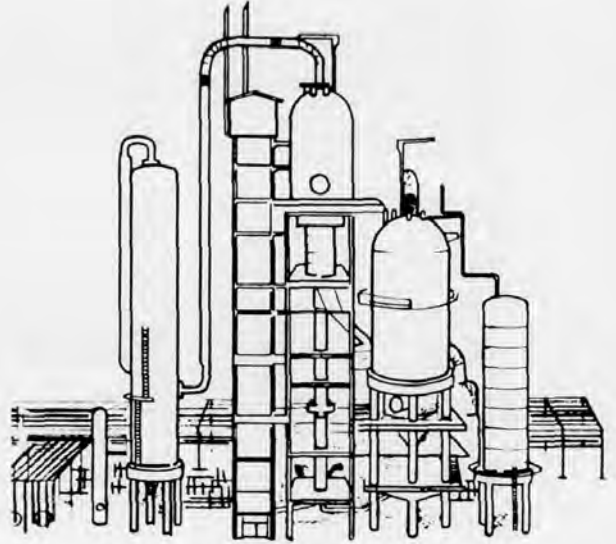
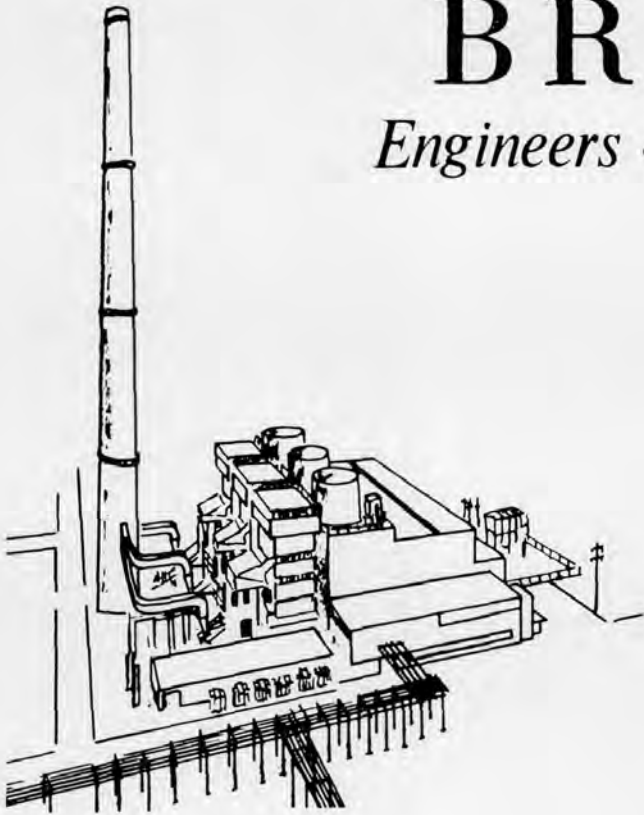
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But providing energy in vast amounts today—and preparing for the greater needs of tomorrow—is a tougher and more challenging problem than ever before.

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.

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