Frederick Douglass Hall—
houses Liberal Arts Departments and classrooms

HOWARD

There is strong interaction among faculty members across research areas [that] provide three research focal areas . . . transport phenomena in environmental engineering, separation processes, and kinetics and reactor modeling.

JOSEPH N. CANNON, RAMESH C. CHAWLA,
DORIAN ETIENNE*
Howard University
Washington, DC 20059

Howard University is a private, co-educational institution located in Washington, DC. Named for General Oliver Otis Howard, a Civil War hero who helped found the University, it was incorporated in 1867 by an Act of Congress, and its founding mission was to help educate the four million freed slaves and others to whom education had previously been denied.

The University offers degree programs in about two hundred specialties and its four campuses encompass 241 acres. Most of its schools and facilities, including the radio and television stations, a full-service hotel, a hospital, and a number of research centers, are located on its eighty-nine-acre main campus three miles north of the Capitol in the heart of Washington, DC.

Howard's more than 1,200 full-time faculty members are a microcosm of the world population of scholars, and its approximately 12,000 students come from all over the United States and more than one hundred countries.

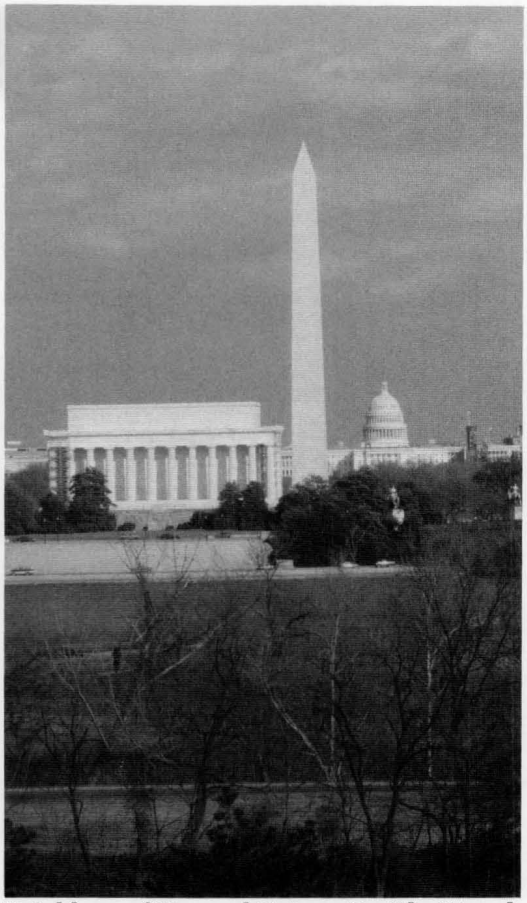
THE SCHOOL OF ENGINEERING

Howard University introduced its engineering programs in 1911 and they were among the first accredited programs in the United States. Historically, Howard has been the nation's major source of minority engineers, particularly African American engineers. Bachelor's and master's degrees are offered in chemical, civil, electrical, and mechanical engineering, and in systems and computer science. The departments of electrical and mechanical engineering also have PhD programs. Each year about 850 undergraduate and 200 graduate

* *Graduate Student in chemical engineering.*

UNIVERSITY

Downing Hall of Engineering: Chemical Engineering Wing on the left.



Neighbors of Howard University: The Lincoln Memorial, the Washington Monument, and the U.S. Capitol building.

students enroll in the various programs offered.

Modern instructional and research laboratories, together with computing facilities, support both student and faculty research pursuits. The Computer Learning and Design Center (CLDC), the school's centralized computing facility, and the Computer Laboratory for Instruction and Design in Engineering (CLIDE), provide a full spectrum of computer resources for faculty and students. These include PCs, HP and DEC VAX minicomputers, Sun Workstations, and access to an Alliant mini-supercomputer. These resources are linked via networks to each other, to the university's IBM 3090 mainframe, and to INTERNET.

Graduate students reviewing laws of motion.

THE CHEMICAL ENGINEERING DEPARTMENT

The Chemical Engineering Department was established in 1969 with the appointment of Dr. Herbert Katz as the Chair and with five students at the sophomore level. Between 1970 and 1972 three more faculty joined the department: Pradeep Deshpande (now at the University of Louisville), Joseph Cannon (current Chair of the department), and Franklin King (now Chair at NCA&T State University). In June 1972, the five original students successfully completed the curriculum and were awarded the first BS degrees granted by the department. Presently, there are six full-time faculty positions (one vacant), one part-time faculty, approximately

one hundred undergraduate students, and twelve MS students.

In 1975 a modern chemical engineering wing was added to the L.K. Downing Hall of Engineering. This facility contains a number of research laboratories, each equipped with state-of-the-art equipment to meet the experimental research needs of the faculty.

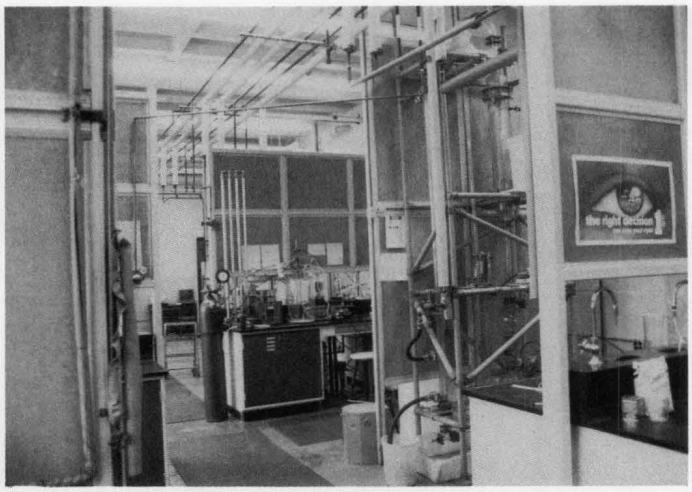
The Fluid and Thermal Engineering Laboratory houses equipment and instrumentation for the measurement of flow and heat transfer. A Laser Anemometry System, a rotational viscometer, along with other instruments enable researchers to measure velocities, map shear-stress patterns, and conduct routine measurements of shear viscosity.

The undergraduate program is structured to provide a broad background in the fundamental areas of chemical engineering, with special attention given to the development of analysis and problem-solving skills.

The Biochemical Engineering Laboratory is equipped to conduct research in microbial fermentation, protein purification, bioremediation, and protein adsorption. Specialized equipment includes an inverted phase contrast photo-capable microscope, automated high-pressure and low-pressure liquid chromatography systems with variable wavelength detection capabilities, full-spectrum scanning spectrophotometry instrumentation, and a microtome.

The Microelectronics Materials Processing Laboratory features two chemical vapor deposition reactors (horizontal and vertical) and a sublimation reactor, all for the growth of silicon carbide and related materials. This laboratory is a part of the NSF-funded Materials Science Research Center of Excellence (MSRCE) located in Downing Hall of Engineering where faculty and students from electrical and chemical engineering, physics, and chemistry carry out interdisciplinary research.

The environmental engineering laboratories have facilities dedicated to analytical instrumentation, microbiology, incineration, water pollution, and air pollution. Jointly shared by the environmental engineering faculty in civil engineering, these laboratories are the focus of several interdisciplinary research projects. All the necessary equipment for the growth, isolation, and analysis of microorganisms is located in the microbiology laboratory. Equipment for studying the kinetics, chemistry, and heat and mass transfer characteristics of high-temperature reactions are available in the Incineration Laboratory. This includes a Shirco infrared incinerator, a liquid/gas combustion unit, and a fluidized bed high-temperature reactor. Howard is one of a handful of academic institutions possessing the incineration facilities capable of studying thermal degradation of waste in all phases—solid, liquid, and gas.



Undergraduate unit operations laboratory.

The EPA-funded Great Lakes and Mid-Atlantic Hazardous Substances Research Center (a consortium of the University of Michigan, Michigan State University, and Howard University) supports cooperative research efforts among chemical engineering and other university faculty. These environmental research programs are in the areas of bioremediation and composting.

UNDERGRADUATE PROGRAM

The undergraduate program is structured to provide a broad background in the fundamental areas of chemical engineering, with special attention given to the development of analysis and problem-solving skills. The breadth of the undergraduate program is intended to prepare students to either enter the chemical engineering profession upon graduation or to successfully continue their education at the graduate level.

The curriculum is particularly strong in providing comprehensive design experience, basic engineering technology in separation processes, and the fundamentals of transport processes. Computer use is integrated throughout the curriculum, with special emphasis on digital simulation and software for analysis and design. Laboratories support undergraduate instruction in momentum, heat, and mass transfer, reaction kinetics, process control, and process design. Electives of-

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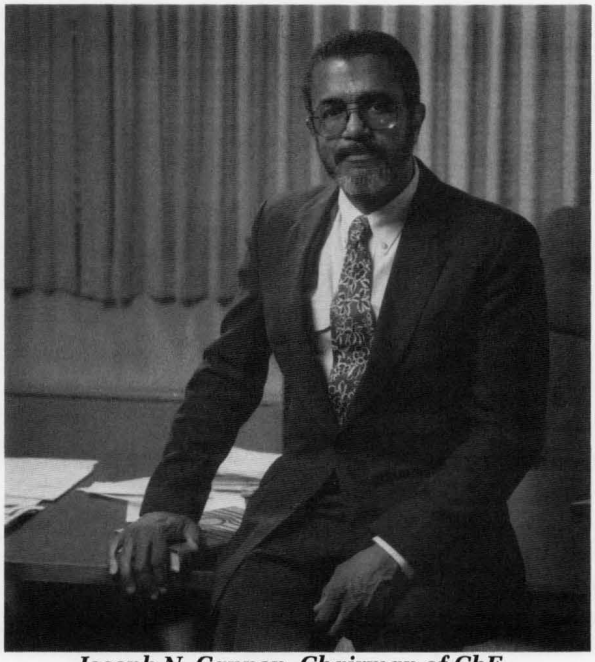

Joseph N. Cannon, Chairman of ChE

TABLE 1
Faculty and Research Areas

Joseph N. Cannon, P.E., Professor and Chair;
PhD, University of Colorado
Transport phenomena in environmental systems, computational fluid mechanics, heat transfer

Ramesh C. Chawla, Professor;
PhD, Wayne State University
Chemical kinetics, separation processes, bioremediation, incineration, environmental engineering

M. Gopala Rao, Professor;
PhD, University of Washington, Seattle
Separation processes, energy systems, radioactive waste management

Mobolaji E. Aluko, Associate Professor;
PhD., University of California, Santa Barbara
Process control, mathematical methods, reactor modeling, crystallization, microelectronic materials processing

John P. Tharakan, Assistant Professor;
PhD., University of California, San Diego
Reactor design and bioprocess engineering, protein separations, protein adsorption, biological hazardous waste treatment

Robert J. Lutz, Visiting Professor;
PhD., University of Pennsylvania
Hemodynamics, intra-arterial drug delivery

Herbert M. Katz, Professor Emeritus;
PhD., University of Cincinnati
Environmental engineering

fered by the department include: polymer engineering, biomedical engineering fundamentals, bioprocess engineering, processing of electronic materials, transport phenomena, energy systems, and environmental engineering.

Most of the BS graduates have found employment in industry, while about one-third of them have gone on to pursue advanced degrees in chemical engineering, environmental engineering, business, or other professional areas such as medicine, law, and dentistry.

GRADUATE PROGRAM

The goal of our Master's program is to provide the necessary academic experiences to prepare students for challenging and responsible careers as practitioners and administrators in the chemical engineering profession and for the numerous other opportunities associated with this level of achievement. The program is intended to extend the student's training in the mainstream areas of chemical engineering at an advanced level, with sufficient in-depth study of a selected area and involving both formal course work and a thesis research project.

The instructional program is based on core courses in thermodynamics, transport phenomena, reaction kinetics, advanced engineering mathematics, and elective courses related to the student's area of specialization. Graduate theses are generally based on faculty research.

FACULTY AND RESEARCH FOCUS

Since ours is a small department, there is a great opportunity for interaction among students and faculty. Students feel comfortable visiting faculty at any time to seek advice or assistance on matters related to their courses, their research, or personal well-being. There is also strong interaction among faculty members across research areas. These interactions provide three research focal areas for the department: transport phenomena in environmental engineering, separation processes, and kinetics and reactor modeling. Table 1 lists the research interests of each faculty member.

Mobolaji Aluko's research is in three specific areas: experimental analyses and numerical modeling of gas-phase deposition reactors for semiconductor materials; solution crystallization of ceramic materials; and control of nonlinear chemical systems. Recent MS theses projects have focused on the analysis of mixed-suspension mixed-product removal (MSMPR) crystallizers and on the design of heterogeneous catalytic reactors.

In addition, he directs the Engineering Coalition of Schools

for Excellence in Education and Leadership (ECSEL) program at Howard. This coalition consists of seven universities funded by NSF to seek fundamental changes in engineering education through active student involvement in learning and by incorporating interactive, open-ended teaching approaches. During the 1992-93 academic year he is spending a sabbatical leave at two coalition schools—the University of Washington, Seattle, and the University of Maryland, College Park.

In his spare time, he plays tennis, ping-pong, and chess, and he is one-half of the 1991-92 Howard University Tennis Doubles' Championship team. He is always ready to argue politics and religion.

Joseph Cannon's research focuses on transport phenomena with applications in environmental engineering. He is currently studying the movement of hazardous organics in soil and has both experimental and numerical work underway. He is also interested in the cooling of electronic equipment containing printed circuit boards. One of his students has just completed a thesis on the numerical analysis of conjugate heat transfer in electronic packages.

For over twenty years, Joe has been known to frequently challenge a student to a one-on-one basketball game. It appears as though "Father Time" has caught up with him, however, and he has recently started taking tennis lessons. He also enjoys pocket billiards and chess.

Ramesh C. Chawla's research combines the application of the principles of mass transfer and kinetics to environmental systems. He has been involved in an on-going EPA-funded research program in hazardous waste treatment using physical and chemical techniques such as soil washing, adsorption, acid protonation, and biodegradation of hazardous wastes using indigenous microorganisms cultured from the contaminated sites. He has also been studying the combined technique of surfactant-assisted biodegradation of hazardous wastes. His projects on thermal treatment of hazardous wastes deal with the assessment of organic emission and heat and mass transfer limitations in incineration.

Ramesh loves to discuss politics and sports with his colleagues and students. He is the faculty advisor for the AIChE Student Chapter and frequently conducts some of the chapter meetings with students while bowling at the University Center.

Gopala Rao has been very active in the areas of adsorption and ion exchange separation processes, radioactive waste management, and alternative process energy systems. His current research, funded by the Office of Civilian Radioactive Management (DOE), concentrates on sorption equilibrium measurements of binary and ternary ionic systems of radionuclides (such as cobalt, nickel, strontium, cesium, and lead) in aqueous phases and on single and mixtures of minerals such as clinoptilolite, montmorillonite, and goethite. These efforts are in support of the Yucca Mountain Site Characterization Project being conducted at the Los Alamos National Laboratory and the Sandia National Laboratory.

Gopala is an avid swimmer and jogger. Whenever he is out of town for a meeting or a conference, he can be found after hours on the jogging trails around his hotel.

John Tharakan's protein separation research focuses on the effects of such parameters as ligand distribution, resin structure, and flow configuration on process efficiency. He has carried out cell culture research to investigate the fundamental physicochemical parameters at the microenvironmental level that affect cell viability and productivity in novel bioreactor configurations for large-scale cell culture. His bioremediation research focuses on the synergistic effects of pathways and cofactors utilized by individual and consortia of microbes in the biodegradation of toxic wastes.

John enjoys discussing politics and is especially interested in the interactions of science, technology, and culture. He is a member of the local Chapter of Science for the People. When not involved with class or lab work, he can usually be found cooking in the kitchen.

Robert Lutz has been studying methods of intra-arterial drug delivery to achieve high concentrations of an anticancer drug at the tumor site while maintaining subtoxic levels at other sensitive sites in the remainder of the body. He is investigating catheter design and infusion methods that minimize nonuniform drug distribution.

Bob has been teaching and participating in research at Howard for the past twelve years. When not working at NIH or Howard, he can be found playing basketball or golfing or participating in any other sport for which the weather is suitable.

Howard University has come a long way since its inception in 1867 with the mission of educating freed slaves. Today it successfully conducts the daily business of educating young people anxious to and capable of making significant contributions in many ways and in many areas. We are proud of our graduates and look forward to the educational and societal challenges of the future. ❐