



Aerial photo of Clemson campus.

ChE department

CHE AT CLEMSON

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CLEMSON UNIVERSITY, THE LAND-GRANT institution for the State of South Carolina, is the realization of a long-held dream of its founder—Thomas Green Clemson. Clemson was born in Philadelphia in 1807 and, although the events of his childhood are obscure, it is certain that during his mid-teens Clemson acquired a lifelong interest in science in general and chemistry in particular. By 1826 Clemson was in Paris where he audited lectures of Thénard, Gay-Lussac and DuLong at the Sorbonne, studied in the laboratory of Robiquet, and attended the Royal School of Mines. In 1831 Clemson received an assayer's certificate from the Royal Mint and during the years 1831-39 he developed a profitable business as a consulting and mining engineer in Paris, Philadelphia, and Washington.

While in Washington in 1838 Clemson met Anna Maria Calhoun, the daughter of the South Carolina statesman, John C. Calhoun. By this time

Clemson was a successful engineer and businessman, a world traveler, a linguist and conversationalist, a man interested in science and politics though himself neither scientist nor politician, and one whose hobbies included painting in oils and music-making on the violin. The Calhoun-Clemson marriage took place in November 1838 and subsequently Clemson assumed the management of the Calhoun plantation, Fort Hill, located in the northwest corner of South Carolina. Impressed by the value of proper training for those who farm, Clemson began to consider ways of applying scientific knowledge to agriculture. From 1844 until 1851 Clemson served as chargé d'affaires to Belgium and he took the opportunity of those years in Europe to broaden his study of agriculture.

In 1852 the Clemsons bought a small farm in Prince Georges County, Maryland, where Clemson began testing his ideas on scientific methods of agriculture. He wrote and published extensively on agricultural chemistry; he promoted the establishment of the Maryland Agricultural College (later a part of the University of Maryland); he actively supported passage of the Morrill Act for

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Land-Grant Colleges; he gave, at the Smithsonian Institution, a series of lectures entitled "Chemistry Applied to Agriculture." Following his appointment in 1860 as U.S. Superintendent of Agricultural Affairs, Clemson began developing plans to create a U.S. Department of Agriculture. Those plans and his position as Superintendent had to be abandoned when war broke out in 1861.

In 1866, with both John C. Calhoun and his wife dead, the Fort Hill plantation became the object of legal entanglements that were resolved by holding a public sale. Clemson bought the plantation at that time. Over the last decade of his life Clemson's principal interest was establishing an agricultural college on the Fort Hill plantation. Clemson died in 1888, leaving Fort Hill's 814 acres to the State under the provision that the land become the site of the Clemson Agricultural College of South Carolina. The South Carolina legislature ratified an Act of Acceptance of Clemson's will on December 24, 1888.

DEVELOPMENT OF CLEMSON UNIVERSITY

Construction of college buildings on the Fort Hill plantation was begun in 1890 and in July 1893 the college opened its doors to its first class—446 students. From its inception until 1954, the student body was all male and organized as a corps of cadets.

In the early 1930's the college benefited from the land resettlement policy of Roosevelt's New Deal: the government purchased some 27,469 acres within a ten mile radius of Fort Hill and assigned Clemson College the responsibility of overseeing its revitalization. The entire acreage was deeded to the college in 1954 and the land now serves as an extensive laboratory for the colleges of Agriculture and Forest Resources.

In 1964 the name of the college was formally changed to Clemson University. Today, the university is composed of a graduate school and nine colleges: Agriculture, Architecture, Education, Engineering, Forest and Recreation Resources, Liberal Arts, Nursing, Sciences, and Commerce and Industry. From circa 1970 the university administration has limited total enrollment to about 10,500 students. The university library is housed in an attractive modern building and its holdings number well over one million items, including bound volumes, microfilm, and microfiche. The university computer is an IBM 370/3033 supported by a complete selection of peripheral devices. In addition, the College of Engineering has purchased

two DEC VAX computers: one dedicated to computer graphics, the other to "number crunching" research problems.

No description of Clemson University would be complete without mention of intercollegiate sports. Because of fanatical alumni loyalty and a well-organized athletic fund-raising machine, Clemson has been able to sustain national prominence in several minor sports, especially soccer, baseball, and tennis. As our obligatory comment on football, we note that the legendary John Heisman coached at Clemson from 1900 to 1903 and during that period led the team to its first undefeated season.

DEVELOPMENT OF CHE AT CLEMSON

Chemical engineering was first introduced as a course of study at Clemson in 1917. There was no chemical engineering department or any faculty; the curriculum was drawn from courses in mathematics, physics, chemistry, mechanical engineering, etc. The university catalog for 1920 is the first to show any enrollment in this curriculum—seven students. In the spring of 1923 four of these were the first chemical engineering graduates from Clemson; the attrition rate has changed little since that first class.

The chemical engineering curriculum does not appear in the University Catalogs for the years 1923-1933 but was reintroduced in expanded form

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in 1933 again with no department, courses, or faculty of its own. The catalog attempts to entice students into the curriculum with the following words:

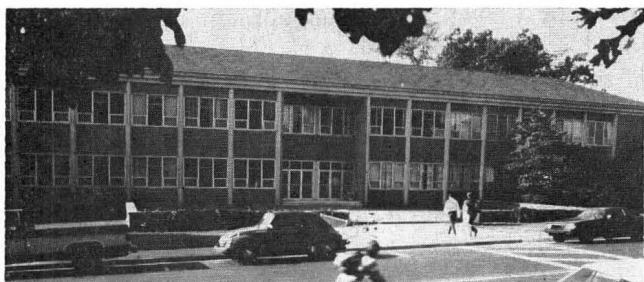
Competition is compelling the industries to abandon rule-of-thumb methods. They are using more and more men trained in the principles of Chemical Engineering—to design their plants and to supervise the operations of various processes.

In 1934 there were 27 students in chemical engineering and the number grew steadily to 81 by 1939. In the 1939 catalog the curriculum no longer appears under the supervision of Engineering but pops up in the Chemistry Department under a

new name, "Chemistry-Engineering," which persevered until 1946.

The 1946 catalog lists the curriculum back under the supervision of Engineering and, for the first time, includes a separate Department of Chemical Engineering with its own courses. The catalog of 1947 indicates two faculty members in the fledgling department: C. E. Stoops, Jr., Professor and Head, and C. E. (Charlie) Littlejohn, Assistant Professor.

In the 1948 catalog Professor Stoops does not appear; rather, the Department Head is listed as Allan Berne-Allen, who remained as Head until 1955. The year 1955 marked something of a turning point in the development of the department: Charlie Littlejohn was the sole faculty member and, hence, Head of the department. The catalog lists sixteen chemical engineering courses, of which eleven were required, and the enrollment stood at 125. It is intriguing to try to imagine Charlie Littlejohn meeting all those courses



Earle Hall, home of the Chemical Engineering Department.

and grading all those papers. In fact, however, Dr. Littlejohn had teaching help from a professor in agriculture who had a Bachelor's degree in chemical engineering.

In January 1956 George Meenaghan joined the faculty and enrollment was 156. In 1958 Chris Alley and Bill Barlage brought the department's faculty complement to four and enrollment had climbed to 184. In 1958 Clemson received a grant of \$1.175 million from the Olin Foundation for construction of a building and purchase of equipment for chemical engineering. Construction was begun in September 1958 and Earle Hall was dedicated at the end of 1959. (Samuel B. Earle was Dean of Engineering from 1933 to 1950 and acting President of Clemson in 1918 and again in 1924-25.) Earle Hall is a 50,000 square-foot facility containing five classrooms, eleven faculty offices, a library, an auditorium, a student

lounge, a seminar room, shop, eight general purpose laboratories, thirteen two-man research laboratories, and a three-level 9,000 square-foot unit operations laboratory. The UO Lab was laid out and equipped under Charlie Littlejohn's direction and has served as a model for similar labs at several other universities. The undergraduate chemical engineering curriculum was first accredited by the Southern Association of the Engineer's Council for Professional Development (ECPD) in 1959.

In 1960 a Master of Science program in chemical engineering was started and in 1962 the PhD program was added. The first PhD in engineering in South Carolina was awarded in 1965 to Jerry A. Caskey, a student under Bill Barlage. Today Dr. Caskey is a member of the Faculty at Rose-Hulman Institute of Technology. Other PhD graduates who are now following academic careers include: Dick Stewart, 1966 (Northeastern); Dan Reneau, 1966 (Louisiana Tech); Dendy Sloan, 1974 (Colorado School of Mines); Gary Mock, 1976 (North Carolina State); Eric Snider, 1978 (Tulsa); David Cooper, 1980 (Central Florida).

In May 1975 Charlie Littlejohn died of cancer. He had taught chemical engineering at Clemson since the founding of the department and had served as Head since 1956. It was his strong personality that molded the attitudes and aspirations of the department—both faculty and students. His philosophy was simple: the department at Clemson exists to provide training in chemical engineering for undergraduates who will follow industrial careers. Charlie was an excellent teacher, that rare individual who inspires diligence, respect, professionalism, and affection in his students. On his death, alumni spontaneously created the C. E. Littlejohn Scholarship Fund to provide support for the education of highly qualified undergraduates in chemical engineering. Industrial gifts were also forthcoming to refurbish a room in Earle Hall as the C. E. Littlejohn Memorial Student Lounge. Since 1975 W. B. (Bill) Barlage, Jr. has served as Head of the department.

CHE AT CLEMSON TODAY

In 1981 the department was composed of 168 freshmen, 89 sophomores, 78 juniors, 90 seniors, 22 graduate students, and a dozen faculty. Freshmen enrollment in the department has increased steadily from 32 in 1972. (The department does teach a course to second semester freshmen.)

Equally dramatic has been the increasing coed enrollment: in the fall of 1981, 30% of the incoming class was female.

The undergraduate curriculum is a strong traditional program requiring 144 semester hours for graduation. Thirty-eight of these are taught in the department. Required courses include stoichiometry, numerical methods, kinetics, process design, process control, transport phenomena, two semesters of thermodynamics, and three semesters of unit operations theory. Communication skills are emphasized in two semesters of unit operations laboratory, a FORTRAN programming course, senior seminar, and junior plant-inspection trips. Furthermore, selected juniors and seniors are invited to join in work on research problems in collaboration with graduate students and faculty.

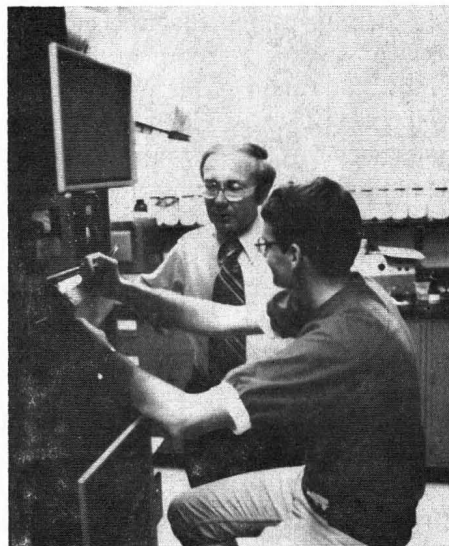
About six years ago an undergraduate cooperative education program was instituted. Under the nurture of Joe Mullins, the department's co-op program has been the most successful of any on campus and co-op students formed one-third of the chemical engineering class of 1981.

Undergraduate chemical engineering students achieve a high degree of camaraderie and identify strongly with the department, both as students and later as alumni. Much of this is due to an extremely active student chapter of the AIChE. Each fall the chapter sponsors a shrimp boil to welcome new and returning students; each spring a pig roast is held to send off the graduating class. During the academic year the chapter holds monthly meetings at which invited speakers present talks on a variety of technical, business, or popular topics. In addition, the chapter holds informal drop-ins throughout the year, organizes tutoring services, sponsors a float in the fall football parade, and makes sporadic trips into the mountains or down the Chatooga River. The chapter has received the Regional Outstanding Student Chapter Award in five of the previous seven years and has been recognized by the national AIChE as an Outstanding Student Chapter in each of the last eight consecutive years.

At the graduate level, the department offers MS and PhD programs to full-time students and a Master of Engineering (ME) program to part-time students. The MS degree requires 24 hours of graduate coursework plus a thesis written on a research project; the ME degree requires 30 hours of coursework plus satisfactory completion of an advanced engineering design problem. In recent years the graduate enrollment has averaged

about twenty students, of which about 20% have been tramontane.

In 1981 two new programs were started with the goal of bolstering graduate student enrollments. One of these is a type of graduate co-op program called the Industrial Residency Program. This program terminates with an MS and functions as follows: On graduation with a BS in chemical engineering in the spring, the new graduate resident selects the company and project upon which he intends to work. The selection is made from projects that participating companies have previously submitted to the department. The student is then assigned a faculty advisor from the department and a project advisor from the company. The student spends the first summer at the company becoming familiar with the project. In the fall the student returns to Clemson and takes two consecutive semesters of graduate courses, completing the 24 semester hour course requirement. The second summer the student returns to the company and works full-time for about seven months completing the research project and writing the thesis. The student is paid by the company at a BS-level rate for the months he is actually working at



Professor Dan Edie with student and INSTRON Rheometer.

the plant. Typically, the salary is prorated over the nominal nineteen months needed to complete the program.

The second new graduate program is an Industrial Fellowship Program in which exceptionally promising students are awarded generous,

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industrially subsidized stipends to pursue full-time graduate study, preferably at the PhD level. Both new programs have already had impact on enrollment; thus, the 1981-82 enrollment of graduate students in the department was twice that of the previous year.

Faculty research interests are divided along traditional lines: F. C. Alley (PhD, North Carolina, 1962), environmental pollution control; W. B. Barlage, Jr. (PhD, North Carolina State, 1960) and D. D. Edie (PhD, Virginia, 1972), rheology and polymer processing; J. N. Beard, Jr. (PhD, LSU, 1971), industrial energy conservation and process control; W. F. Beckwith (PhD, Iowa State, 1963), transport phenomena and kraft-pulping process; R. C. Harshman (PhD, Ohio State, 1951) and R. W. Rice (PhD, Yale, 1972), chemical reaction kinetics and catalysis; C. H. Gooding (PhD, North Carolina State, 1979), separation processes; S. S. Melsheimer (PhD, Tulane, 1969), mass transfer, mathematical modeling, and process control; J. C. Mullins (PhD, Georgia Tech, 1965) and J. M. Haile (PhD, Florida, 1976), thermodynamics and statistical mechanics.

CONCLUDING REMARKS

Sheltered in the southeastern foothills of the Appalachian Mountains, Clemson enjoys a mild, four season climate. The environs of the university provide unlimited opportunities for outdoor recreation, including all types of fresh-water sports, hiking, camping, cross-country running, and hang-gliding. Cultural activities can be pursued in Atlanta—a two hour's drive from Clemson. Furthermore, there is the summer arts festival, Spoleto, held annually in Charlestown, SC. This is an offshoot from Gian-Carlo Menolti's festival held in the Umbrian hill town of Spoleto, Italy, and has evolved into a musical and operatic event of some significance.

The combination of mild climate, moderately priced electrical power, low taxes, and non-unionized labor is attracting important new industry to upstate South Carolina. The cotton mills of the first part of the century have long disappeared from the region and have been replaced with plants producing nylon, polyester, and polypropylene.



Clemson and surroundings.

Today, literally scores of textile mills dot northwest Carolina and eastern Georgia. Moreover, high technology electronic manufacturing companies are moving into the area.

The future of Clemson University also seems particularly promising. The decision of the administration not to expand the student body nor the physical plant during the student boom years of the 1970's seems, in retrospect, to have been a wise decision indeed. The demand for entry into the university, as well as chemical engineering, is higher than ever. Private and industrial support for the university seems to be increasing substantially. In 1981 alone, several important contributions were made to the university: Abney Foundation gave one million dollars for the endowment of a chair in Economics, National Cash Register and Digital Equipment Corporation gave generous research grants to the College of Engineering, and Senator Strom Thurmond donated his public papers to Clemson. Plans are being made for the creation of a Strom Thurmond Center for Excellence in Government and Public Service that will include a library to house Thurmond's papers, a performing arts center, and a continuing education facility.

During its ninety year history Clemson has matured from a local agricultural college to a regional university of some stature. Now, the visions of both the university and its Department of Chemical Engineering are beginning to extend beyond the region to problems and opportunities of national significance. This further maturing process, while not without growing pains, promises to enhance and deepen the educational environment at Clemson University. □