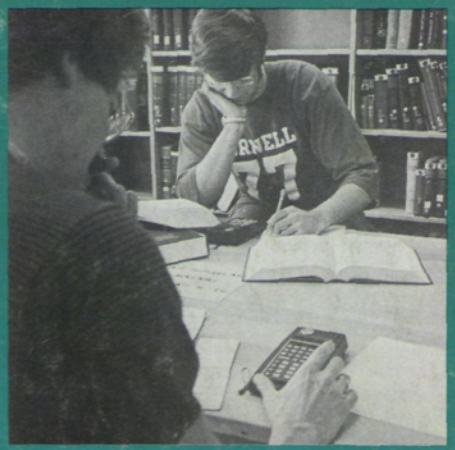
ENGINEERING

CORNELL QUARTERLY



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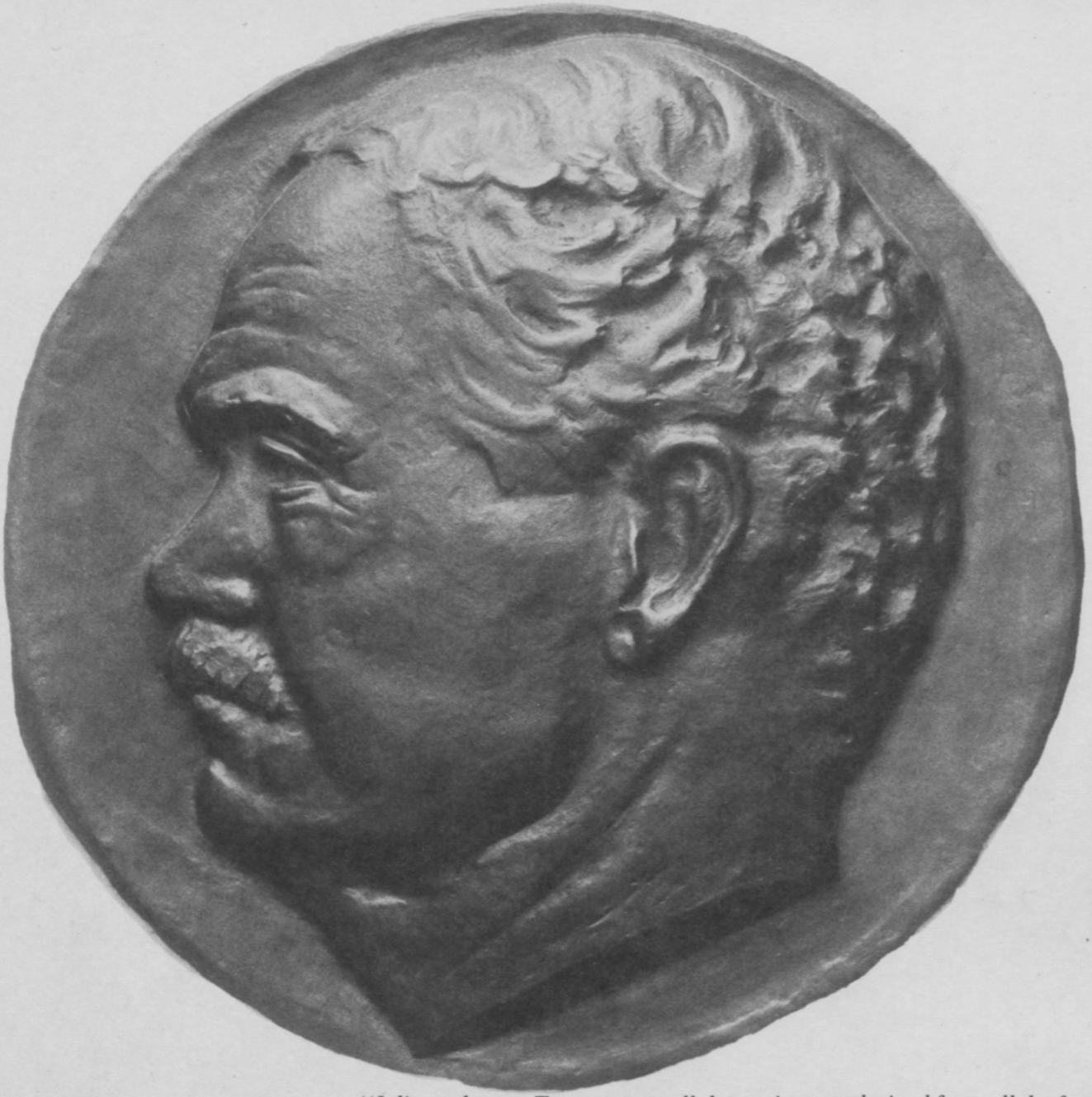
PAYING FOR HIGHER EDUCATION



"I direct that my Trustees pay all the net income derived from all the foregoing trusts . . . annually and in perpetuity and forever to the Cornell University, at Ithaca, N.Y., an educational institution for the purpose of creating and maintaining free scholarship or scholarships for the education of young men as engineers . . ."

— from the will of John McMullen

IN THIS ISSUE

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FINANCIAL AID PACKAGES:

Survival Kits For Students And Colleges Today

by Gladys McConkey

Financial aid has become a new watchword for students, parents, and college administrators. For many students, it means the possibility of going to the college of their choice. For many institutions, it is equally crucial: the financial aid structure on which enrollments are based today is keeping private colleges and universities alive.

At private institutions like Cornell, financial aid now comes in "packages" designed to enable any accepted student to meet the total costs of attendance. These packages often contain a number of items. A typical Cornell engineering undergraduate, for example, is apt to finance his or her education with a combination of state, federal, or privately funded scholarships or grants, a Cornell scholarship, one or more government-backed loans from lending agencies or the University, and part-time and summer jobs, in addition to whatever help parents can provide. Scholarships, as the only direct grants in financial aid packages, are key components, and they have undergone a basic change under the current system. The traditional idea of scholarships won for exceptional achievement or promise has given way to the concept of scholarships awarded mostly, though not exclusively, on the basis of need.

Rising educational costs and the new modes of paying for them have raised many issues. The specific contents of financial aid packages, and who qualifies for what benefits, are urgent matters to many prospective students and their families. How a given institution is faring under the current financial circumstances concerns administrators, faculty, alumni, and students. The effects of present and future financial arrangements on enrollment patterns, and what the implications are for private education and for society and its various segments, are questions of vital importance to the whole society.

FINANCIAL AID FOR CORNELL UNDERGRADUATES

Almost half the applicants to Cornell now qualify for some degree of financial aid. As at most schools, the amount that is provided varies according to the resources of the student and the family. Some applicants may be judged ineligible for any help, but some undergraduates qualify for as much as $6,000 a year in financial aid. The components of average financial aid packages for students in Cornell's endowed colleges are shown in Figure 1.

Determining how much aid should be offered is obviously a complicated and difficult task. Most schools use standardized methods of assessment to try to ensure fairness and consistency in evaluation procedures from school to school. Cornell uses such a method (see the insert on the following pages), and has entered into agreements with the other Ivy League schools and the Massachusetts Institute of Technology so that there are no differences in the amount of financial contribution expected from a given family. What can vary are the relative amounts of scholarship aid (direct grants) and self-help (loans and jobs).

Most College of Engineering applicants are awarded scholarships that are designated specifically for engineering students, but they are eligible also for general Cornell scholarships, including the especially desirable Cornell National Scholarships granted to outstanding applicants. Special grants are available for students transferring from two-year community colleges, and for minority students under the University's so-called COSEP (Committee on Special Educational Projects) program. Candidates

Figure 1. The average budgets of freshmen entering Cornell endowed colleges with financial aid packages have the various components shown. This diagram is based on data of the Office of Scholarships and Financial Aid and information from the Office of Engineering Admissions. Total costs do not include travel expenses. Except for total cost, the points are interpolated for 1970-71, since detailed figures are not available for that year.

The percentage of scholarship aid has remained relatively stable. The percentage of the loan portion also showed little change through 1973-74, although the absolute amount of indebtedness was increasing. In 1974-75 there was a decline in both percentage and average amount of loan, largely because of the introduction of New York State Tuition Assistance Program grants.

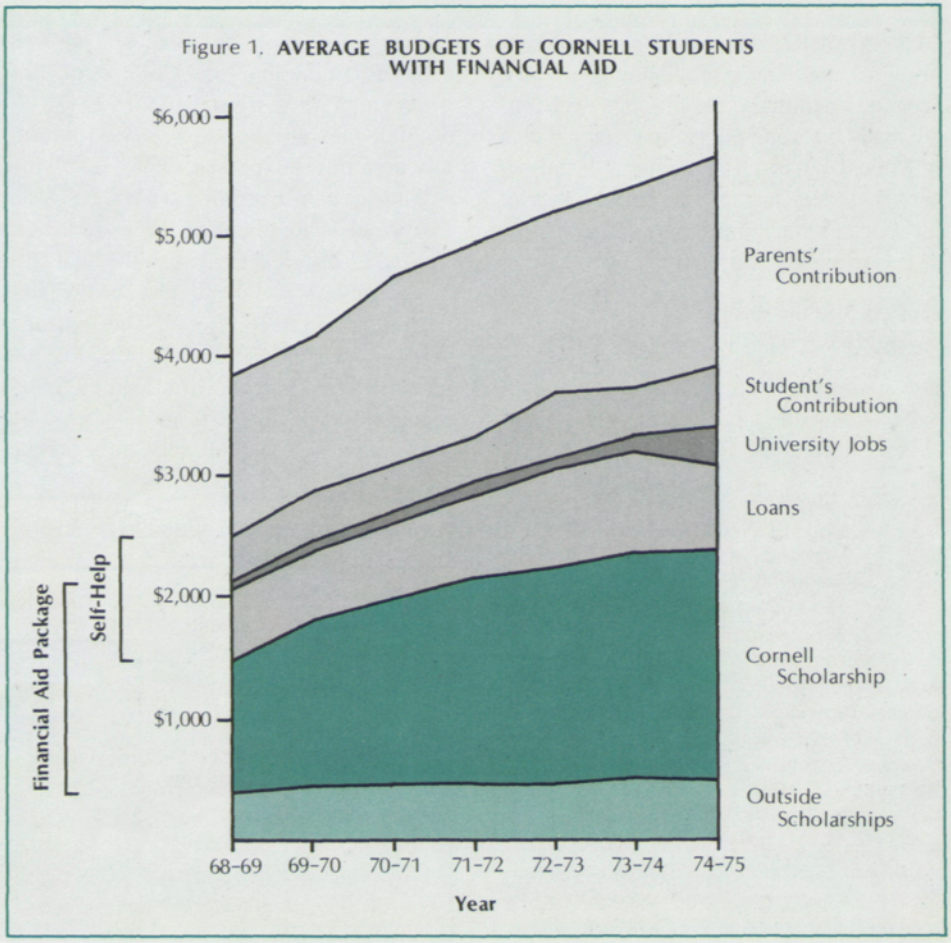
do not apply for specific scholarships; grants are awarded in the ways judged most appropriate by the financial aid staff.

The total amount of Cornell-administered scholarship money available for engineering students is about $1.75 million a year. The largest single source—a special boon to the College—is the John McMullen Scholarship Fund, which provides more than $1 million annually to help support more than six hundred undergraduates at a time. Engineering scholarship funds also come from other endowments, often established as memorials, and as grants from some industrial organizations. In addition to the scholarship money, some $600,000 in loans and jobs are assigned.

COMPARATIVE COSTS AT PUBLIC AND PRIVATE INSTITUTIONS

In spite of the availability of scholarships, it is often assumed that publicly supported institutions are less expensive for individual students to attend than private schools. A simple comparison of the total annual cost of attending an endowed college at Cornell—about $6,300 in 1975-76—with that of around $4,000 in total costs for a

(continued on page 6)



How the Financial Aid Package Is Assembled

At the Cornell College of Engineering, admissions and financial planning are two separate operations. Admissions decisions are made first, and then a financial aid plan is worked out if this is requested. An accepted student has an excellent chance of receiving as much financial assistance as he or she requires.

TOTAL COST − FAMILY CONTRIBUTION = GROSS NEED

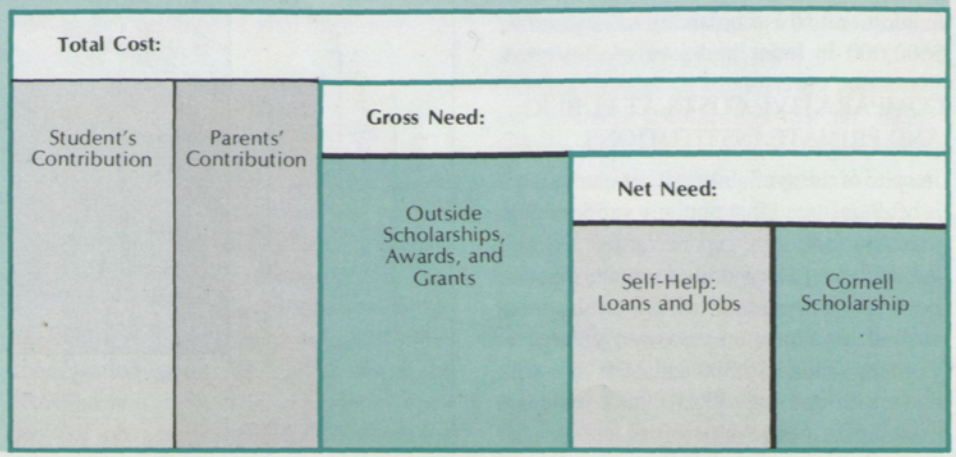
The starting point for the plan is the estimated figure for total annual expense, including tuition and fees, room and board, and personal expenses. For the endowed colleges (including the College of Engineering) this figure for 1975-76 is $6,300, plus an allowance toward unusually high travel expenses.

The first step in arriving at a budget for an individual is to calculate the *gross need*. This is the difference between the total cost and the amount that the student and the family is expected to contribute. The student's share is currently set at $500 a year. The parents fill out a Parents' Confidential Statement, which is supplied and analyzed by the College Scholarship Service, a private organization. Using the information given on this form (including data not only on income but on other assets, unusual expenses, and the number of college-age and other dependent children), the Service establishes a dollar amount expected as the parental contribution. Roughly half the applicants to Cornell endowed colleges are considered capable of meeting all expenses.

GROSS NEED − OUTSIDE GRANTS = NET NEED

Next the College financial aid staff calculates the *net need* by deducting non-

The gross budget for the annual expenses of a Cornell undergraduate engineering student. The total cost *(estimated at $6,300 for 1975-76) includes tuition and fees, books, living expenses, and some travel allowance. The* gross need *is the difference between total cost and the amount expected to be contributed by the student ($500 from savings or summer job earnings) and the parents (a variable amount established by analysis of information supplied on the Parents' Confidential Statement). The* net need *is calculated by subtracting scholarships, awards, or grants from sources other than Cornell. Net need is met by a combination of scholarship, loans, and sometimes jobs. The proportions of the various components vary according to the need and, to a lesser degree, scholastic merit.*



The process of arranging a financial aid package was explained by David C. Johnson (left) and Donald G. Dickason, who have both served the College of Engineering as director of admissions. Since this article went to press, Dickason, who has been an assistant dean and director of student personnel at the College, has been appointed dean of admissions and financial aid for the University, and Johnson has assumed the post of assistant dean and director of student personnel in the engineering college.

University scholarships, awards, and grants from the gross need figure. New York State residents, for example, are eligible for grants from the recently established New York State Tuition Assistance Program; these are scaled according to parents' income, and may be as high as $1,500 a year. Also deducted are any awards the student may have received from other sources. These might include a $250 New York State Regents Scholarship, which is granted on the basis of a competitive examination administered in the high schools; or a National Merit Scholarship, which is granted on a competitive basis but scaled according to such factors as college cost and family income, and may amount to as much as $1,500. A sum available to all full-time students with demonstrated need is the federally funded Basic Educational Opportunity Grant, which ranges from $50 to $800.

After all these awards and scholarship funds are subtracted from the gross need, the remainder, the *net need*, is the amount Cornell anticipates meeting through the financial aid package. This sum comprises a grant (scholarship) and self-help (loans and sometimes jobs).

There are three major sources for loans, all subsidized, federally guaranteed, and readily accessible: (1) *National Direct Student Loans*, which are federally funded and administered through the colleges. Repayment at a 3 percent interest rate begins nine months after graduation. (2) *The Guaranteed Interest Loan Program,* based on federal and state funds. In New York State, loans under this program are administered by the New York Higher Education Assistance Corporation and made available through authorized lending agencies such as banks. (3) *Federally Insured Student Loans,* made by Cornell University. Generally, students can qualify for (2) and (3) regardless of family income, but the interest rates may vary considerably, to a maximum of 7 percent. Repayment begins nine to twelve months after graduation. Cornell engineering applicants are advised by the financial aid office about what loans they qualify for, and how to apply.

Many students are offered on-campus jobs—some of which are federally subsidized—for a maximum of fifteen hours of work a week. An attempt is made to place the student in a job related to his or her academic interests or special skills.

CORNELL SCHOLARSHIPS FOR ENGINEERING STUDENTS

The remaining component of the financial aid package is a Cornell scholarship, which may have a value from a few hundred to several thousand dollars a year. Scholarship recipients generally retain their awards throughout the undergraduate years, provided that they maintain acceptable academic standing. The amount may be adjusted if financial need changes.

The most numerous of these scholarships are those provided by the John McMullen Scholarship Fund. These are awarded on the basis of merit as well as need. The monetary value is calculated as the difference between net need and one of three levels of self-help: a McMullen Dean's Scholarship, the most valuable, is accompanied by an $800 annual loan; an Incentive Scholarship is accompanied by a $1,200 loan; and a College Award is supplemented by a $1,500 loan. Other scholarship funds are distributed similarly.

In offering scholarships, the College follows a policy of full-need financial aid: no award is made unless a package can be provided to equal the total calculated need.

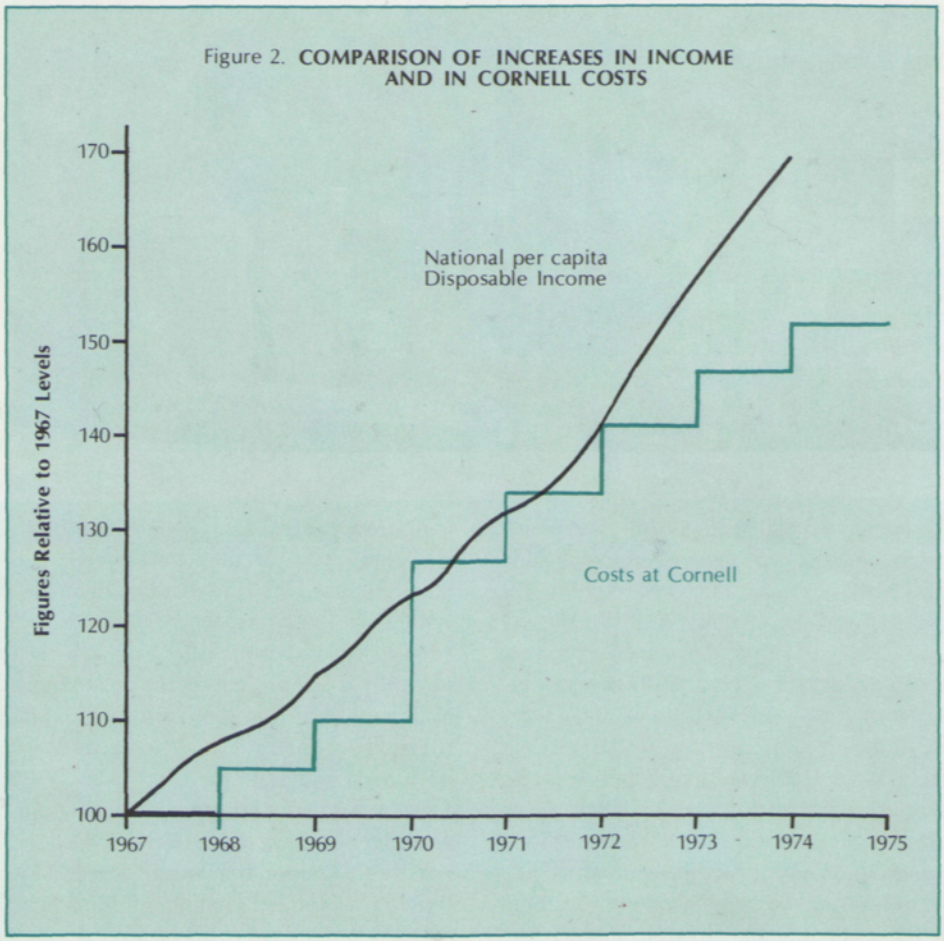


Figure 2. The cost of attending an endowed college at Cornell has generally lagged behind economic indicators such as per capita personal disposable income. (Source: a study by W. Donald Cooke, vice president for research, Cornell University.)

state college, or perhaps $600 for tuition at a community college, does make public education seem much more financially accessible. But whether or not these differences are real or significant depends on the circumstances.

A few generalizations can be attempted. For relatively high income families who are deemed able to pay the full cost or a large share of it, the savings achieved by attendance at a public institution are real. For low income families who qualify for substantial financial aid which may cover expenses over and above tuition, it might even be cheaper to attend a private school. For those in between, in the so-called middle income levels, there are so many variables it is almost impossible to generalize.

Many myths have grown up around the financial aid situation. One that Cornell engineering admissions director David C. Johnson would like to explode is the prevalent notion that $15,000 in gross annual income is the cut-off point for financial aid. Actually, the basis on which aid is offered depends on many things besides income. These include the number of other college-age or younger children; the family's assets and commitments; and any unusual medical or other expenses. For Cornell engineering students now receiving financial aid, even the *mean* figure for gross parental income is considerably higher than $15,000, and Johnson expects it to come out close to $20,000 next year. A number of students from families with incomes considerably higher than this receive sizable financial aid awards. Many families incorrectly assume that they are ineligible for help.

Another common misconception is that the out-of-pocket cost for attendance at a private institution is rising out of proportion to family income. Actually, the overall total for college educational expenses is, if anything, lagging behind increases in national economic indicators (see Figure 2). And the total amount of family contribution expected according to the standard College Scholarship Service criteria has in fact declined in the past several years (see Table I).

Johnson's advice to parents and students is to get all the financial facts before they make their decisions. The only sure way to do this is to file an application for financial aid along with the admission application. Once a candidate is admitted (a matter completely independent of economic con-

siderations), an analysis is made and a financial aid package is offered if the student qualifies for one. "It costs only four dollars to apply for financial aid," Johnson pointed out, "and it lets the family know exactly where it stands."

THE INFLUENCE OF FINANCIAL AID ON COLLEGE CHOICES

How do students decide where to apply and go to college? Costs are important, but they are by no means the only or even the major consideration. A recent study by Richard R. Spies, *The Future of Private Colleges* (Princeton University, 1973) indicates, for example, that students with high ability tend to apply to those institutions whose admissions standards best match their qualifications, with little regard for tuition levels. Often this means that private schools are the ones the best qualified students apply to.

Decisions about where to apply are only one aspect of the selection process, of course; ultimately the student must make a choice among the schools that have offered admission. How do finances affect this decision? Cornell studies of applicants admitted by Cornell who elected to go elsewhere have shown that by far the largest fraction went to other private institutions rather than to public schools. Moreover, those who cited financial considerations as the major reason for their choice were a minority: in 1974 the figures were 18 percent for Cornell as a whole and 22 percent for engineering, continuing a steady decline since the early 1970s.

Nevertheless, Engineering Dean Edmund T. Cranch is concerned about the significant number of potential students who do make their final choice on the basis of "surprisingly small financial margins, perhaps only a few hundred dollars." This is "obviously questionable from a long-term perspective," he said; "students ought to base their decisions on academic parameters." But he believes that the quality of financial aid, and particularly the amount of scholarship that can be offered, does make a difference.

Table I

TRENDS IN AMOUNTS EXPECTED AS PARENTS' CONTRIBUTION

The figures pertain to typical families with two children, according to criteria of the College Scholarship Service.

Income Before Taxes	1966-67	1972-73	1973-74	1975-76
$10,000	1,520	960	819	100
12,000	2,080	1,400	1,265	460
14,000	2,720	1,920	1,720	820
16,000	3,390	2,590	2,290	1,180
18,000	4,150	3,390	2,990	1,590
20,000		4,210	3,842	2,100
22,000		5,020	4,632	2,740
24,000		5,810	5,424	3,510
26,000		6,580	6,288	4,280
28,000				5,030
30,000				5,760
32,000				6,460

PRIVATE INSTITUTIONS IN TODAY'S COLLEGE MARKET

Financial problems are felt not only by individuals, but also by institutions, particularly the private ones. Indeed, the future of private education in the United States in the face of rising costs is at stake. This is a matter of concern to the Cornell College of Engineering, since it is among the privately endowed colleges of the University.

According to Dean Cranch, a competition for able students does exist. "Private schools have generally been the high quality ones," he commented, "but their uniqueness, always under pressure, is especially so at the present time as public institutions work to improve their programs. State subsidies have made possible a marked rise in the educational quality of public institutions over the past twenty years."

The special advantages that private universities continue to offer, Cranch said, include limitations on the size of enrollment and therefore a greater amount of individual attention to students. Also, the diversity of a university like Cornell, as compared with the more restricted programs of a technical school, plays a very important part in the education of specialists such as engineers, whose activities are expanding in scope and becoming more complex and interrelated with other disciplines. The presence of other professional schools, the richness of the available curricula, including offerings of an outstanding liberal arts college, and the opportunity for contact with persons of many different interests and outlooks are very real assets. In the case of Cornell, there is also the asset of an attractive scholarly environment and physical setting, derived in part from its development and traditions as an independent institution.

The essential fact is that students and schools are interdependent in terms of good education. The institution must be able to keep up an optimum enrollment level of able students in order to ensure both economic and academic health. As Cranch expressed it, "The ability of a school to maintain high quality programs depends on its ability to enroll good students." From the student's point of view, cost and quality of education are the important considerations that must be weighed.

"What can vary are the relative amounts of scholarship aid (direct grants) and self-help (loans and jobs)."

The comparatively large amount of scholarship money that has been available for Cornell engineering students over the years has almost certainly been one reason the College has been able to maintain its usual level of enrollment and its high academic standards despite a marked national decline in numbers of engineering applications. Still, there is need for more scholarship resources. The income from existing scholarship endowments goes less far these days. Also, the College is capable of expanding its undergraduate enrollment by fifty or sixty students, Cranch said, and "probably could do so if that number of qualified applicants were offered a competitive amount of scholarship aid."

The possibility of awarding some scholarship aid on the basis of merit gives a private school a decided advantage in attracting able students. At the Cornell engineering college, Cranch pointed out, merit still enters into the picture, even though scholarships are primarily need-based. The College's McMullen Scholarships, for example, are awarded at several levels, so that outstanding applicants can receive more scholarship aid and carry smaller loans to meet their expenses. In fact, Cranch said, a general trend toward a return to more merit-based scholarship grants may be developing in colleges and universities around the country. Federal financial aid policies, now under review, may also allow for more consideration of merit, though how this might be accomplished is unresolved.

SOCIAL IMPLICATIONS OF RISING COLLEGE COSTS

The necessity of providing financial aid in response to increasing educational costs gives rise to a number of socially significant questions. The views expressed are sometimes conflicting. One hears that private schools are not doing enough to increase their proportions of low income students or, conversely, that they are favoring these students by providing more liberal financial aid. Some observers advocate that tuitions be lowered, somehow, in order to ease the financial problems of middle and low income students. Others point out that this would actually favor the wealthiest segments of society, since they would be contributing less than they do now (even full

Table II

FAMILY INCOME DISTRIBUTION OF STUDENTS AT CORNELL AND AT ALL U.S. COLLEGES AND UNIVERSITIES

Cornell figures are for students entering the endowed colleges. Source for the national data is the American Council on Education.

Range of Family Income (Dollars)	1973-74 Cornell (%)	1973-74 All Institutions (%)	1974-75 Cornell (%)	1974-75 All Institutions (%)
0-5,999	2	7	3	5
6,000-14,999	16	44	18	37
15,000-24,999	31	29	28	33
25,000 and above	51	20	51	25

tuition covers only about half the educational cost in many private institutions); and that instead, both tuition and financial aid should be increased.

There is a widespread feeling that students from middle income families are being squeezed out of private schools. According to this idea, high costs are creating a trend toward enrollments with disproportionate numbers of the rich, who can afford the bills, and the poor, who qualify for more financial aid. Especially handicapped, it is argued, are students whose parents feel unable or are unwilling to assume the level of support that financial aid plans require of them. There is criticism of the criteria used by organizations such as the College Scholarship Service in arriving at figures for expected family contributions, on the grounds that they impose an unfair burden on middle income families and, in addition, penalize frugality by considering savings set aside for college education as assets, and debts incurred by spending as liabilities.

What about Cornell? Have recent financial developments changed the proportions of students from different economic levels?

The University has a disproportionate number of applicants (and therefore matriculants) from high income families (see Table II), but this is nothing new, and it is not due to financial factors alone. Part of the explanation lies in the findings of a recent study by the College Entrance Examination Board, which showed a direct relation between average family income and students' Scholastic Aptitude Test (SAT) scores; regardless of what the reasons for this correlation might be or, for that matter, how well the tests indicate potential ability, this circumstance fosters a socio-economic imbalance in enrollments at schools with high academic standards. An important fact in this regard is that whatever the causes, the existing socio-economic distribution of students at Cornell has profound economic significance for the University. While a shift in enrollments toward the lower income levels might appear to be more socially equitable, it would create an impossible financial situation if the University tried to continue, without more outside help, a policy of providing full need-based financial aid for all students.

There are no available statistics that show directly whether the number of Cornell students from middle income families has been decreasing, but there is indirect evidence that it has not significantly. Data collected by the American Council on Education show that nationally there has been only a small decline in recent years in the percentage of students from middle income groups who attend private institutions. A 1971 Cornell study showed that the acceptance rate by admitted applicants was essentially the same regardless of the level of financial aid offered.

As Cornell Vice President W. Donald Cooke has summarized the situation, "the effects of tuition are very complex and the impact on the economic mix is not straightforward." Although individuals may be feeling an economic pinch, he said, no special trends in enrollment appear to be operating.

A CONTINUING ROLE OF ENGINEERING EDUCATION

The possible effect of enrollment trends on the traditional and potential social functions of engineering education is a matter of special concern. In the opinion of Dean Cranch, there is no question that engineering is still serving its historic role of providing increased access to higher economic and professional status. Because they are technologically based, industrial and governmental organizations offer engineering graduates not only technical employment opportunities, but also access to important management positions. Students who enroll in engineering at Cornell continue to come from a wide range of social and economic backgrounds, Cranch said.

A rather recent development, nationally and at Cornell, has been the extension of opportunities in engineering to significant numbers of women and members of minority groups. As recently as nine or ten years ago, only one or two women a year enrolled in engineering at Cornell; this fall they will

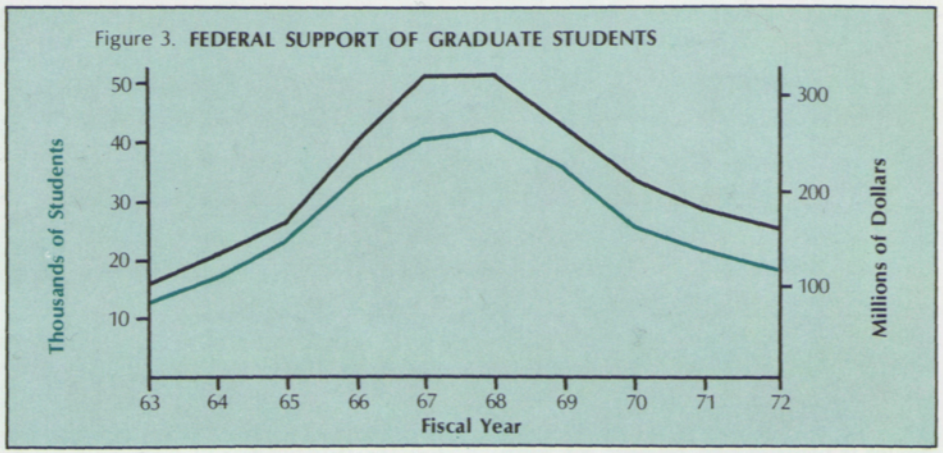


Figure 3. Federal support of graduate students in the form of fellowships and traineeships is shown, for the period 1963 to 1972. These figures represent the stipends applicable to those studying in engineering and applied science fields. Both the numbers of students who received fellowships or traineeships and the total amounts spent are shown. (Source: data of the Interagency Committee on Education.)

constitute about 12 percent of the freshman class. The number of students from ethnic and racial minorities has been rising steadily also; this fall it is expected to reach about 8 percent of the entering class. (There have also been increases in the proportions of women and minority students enrolled at Cornell as a whole.)

The increased enrollment in engineering curricula of students from minority backgrounds is largely owing to the greatly expanded efforts of engineering colleges and also professional organizations such as the National Academy of Engineering and the Engineers' Council for Professional Development. The Cornell engineering college, for example, has developed a program to recruit minority students and to provide special academic and counseling help when this is needed. As director of admissions and later as assistant dean, Donald G. Dickason has had a major role in the development of this program, and he has also worked extensively with the National Academy in its effort.

The chief limiting factor in the expansion of minority-student enrollment is financial aid. At Cornell, for example, funds for scholarships for these students come mostly through the University's COSEP program, and, as admission director Johnson explained, "When the money runs out, the admissions stop."

THE NEED FOR SUPPORT OF GRADUATE STUDENTS

An increasingly urgent need is for financial support for graduate education, which is much more expensive than undergraduate education, since it requires more specialized and creative faculties and more extensive library and laboratory resources.

Not very long ago, virtually all graduate students in the sciences and in engineering received full or nearly full support, usually in the form of teaching or research fellowships or assistantships. Now, however, as federal funding has diminished and university and industrial budgets have been tightened, many graduate students are having financial difficulty. An indication of the seriousness of the problem is given in Figure 3, which shows numbers and dollar values of federal fellowships and traineeships for the years 1963 to 1972. An additional need at Cornell is funding for students in the professional Master of Engineering degree program, who have much less opportunity for support than those enrolled in the traditional research-oriented Master of Science and Doctor of Philosophy degree programs. According to Dean Cranch, it may soon become necessary to extend some of the financial aid policies developed for undergraduates to cover first-year graduate students.

A deficiency in graduate support is serious from the standpoint of the universities because a critical size of enrollment in the various scientific and engineering disciplines is necessary in order to maintain a high level of research activity and graduate education. As Dean Cranch expressed it, "The inability of an institution to support graduate students strikes at the heart of its ability to maintain scholarly vigor." A particular difficulty for private universities is that subsidy of tuition and fees in publicly supported institutions gives them a tremendous advantage in attracting good graduate students. "Indeed," Cranch said, "if this differential continues over long periods of time, it can only result in a decline of graduate education in private universities."

The problem is serious also in terms of national welfare. Cornell President Dale R.

Corson, in a talk to the Association of American Universities a few years ago, pointed out that "our investment in the future, notably through education and research, is taking a back seat. Graduate education has emerged at the very bottom of the priority list." And yet, he said, "our most creative minds are a resource we can hardly afford to waste, and . . . the educational process must be able to accommodate them. We are doing poorly at solving the combined institutional- technological problems of achieving a better and more humane society . . . Intellect—educated, creative intellect—should be at the highest premium in our history."

MEETING FINANCIAL PROBLEMS NOW AND IN THE LONG TERM

The fundamental questions about financial aid are where the needed funds should come from and how they should be disbursed. Should there be more public support of higher education and, if so, should federal, state, or local governments assume responsibility? Should there be more public aid to individuals and, if so, how much should be provided as grants and how much as loans? Should private schools receive more support from public funds, either directly or indirectly through aid to students?

An especially relevant point was made by John R. Silber, president of Boston University, in a recent article in the *Atlantic*. He argues that all education in the United States is actually public, since "private" institutions are "open to the public, serve public needs, and are gravely influenced by public deliberations." Despite lower tuition rates, education is not less expensive at state-owned institutions; in fact, Silber states, the total average cost per student, nationwide, in 1973-74 was some $600 higher in the state sector than in the independent sector. Existing independent institutions are a significant public asset, for "whenever an independent college or university educates a resident of its state, that state's taxpayers are saved whatever it would have cost to educate that student in a state school." Subsidizing the expenses of needy students at existing independent schools would end up costing taxpayers considerably less than establishing and operating public colleges for them.

One sure conclusion is that long-range solutions to the problems of financing higher education will require some far-reaching decisions. "We will arrive at an equilibrium," Dean Cranch has said, "only when a national policy is established—when some consensus is reached about the numbers of people the nation should attempt to educate in what ways, and how financial support should be allocated. Certainly in the area of engineering," he said, "national resources must be made available to support national objectives." He believes that there is need for a dual program of subsidy to institutions, partially in terms of program support, and partially as financial aid extended directly to students.

In the meantime, private schools must rely on whatever financial resources are or can be made available. At the Cornell College of Engineering, scholarships, always a significant factor in the educational program, are more important now than ever before.

Gladys McConkey, editor of ENGINEERING: Cornell Quarterly *and other College of Engineering publications, has worked in experimental science and in writing and editing for many years.*

Her experience at Cornell, beginning in 1956, has included research work in the laboratory of the late Peter J. W. Debye, Nobel laureate in chemistry, and scientific editing for a research group in biochemistry. Previously she worked as a chemist in the research laboratory of the Standard Oil Company of Ohio, as a research assistant in the School of Medicine at the State University of Iowa, and as public relations director and journalism instructor at Morehead (Kentucky) State University.

She holds the B.S. degree in chemistry from Western Reserve University and the M.S. in biochemistry from Iowa. She is an author of a book on chemical physics, in addition to articles in scientific and educational publications.

COMING TO CORNELL ON A SCHOLARSHIP

Profiles of Some Engineering Students

About half the undergraduates in the Cornell College of Engineering qualify for financial aid, and a large share of them hold University scholarships. The following brief sketches of a sampling of the 1974-75 scholarship recipients reveal the importance of financial aid to many students, the many ways in which they meet their overall expenses, and the part scholarships often play in attracting able students.

■ *Don Dube,* who was a junior this year in applied and engineering physics, plans to study nuclear engineering in graduate school after he completes his undergraduate program. He applied for freshman admission to Cornell, he says, because he knew of its good reputation, but he didn't really believe he could manage financially until he received notification of a scholarship award. The next day he and his parents took off for Cornell from their home in Biddeford, Maine, and "fell in love with the campus." Don's McMullen Scholarship from Cornell is supplemented by a newspaper delivery boy's scholarship, one from the Disabled American Veterans, and one from a professional engineers' society, among others, and he has been able to meet expenses without parental assistance. In spite of a College Scholarship Service analysis to the contrary, Don feels that his parents really cannot afford to help, and besides, he says, "I want to be able to say I have gone through college on my own." He may take out a loan next year, but so far has managed with the help of summer work and jobs at his fraternity house. He earned partial room and board waiting on table and serving as treasurer. Don is active in extracurricular activities as well as academic ones: he has been an elected member of the University Senate, and this year was president of his fraternity.

Dube

■ *Fred Hajjar* finished his undergraduate program in mechanical engineering this spring, after transferring from Berkshire Community College in Pittsfield, Massachusetts, his home town. He attended Community College Days, held annually at the Cornell College of Engineering, and liked what he saw, but his main reason for choosing Cornell was an adequate financial aid package. "Otherwise," he says, "I

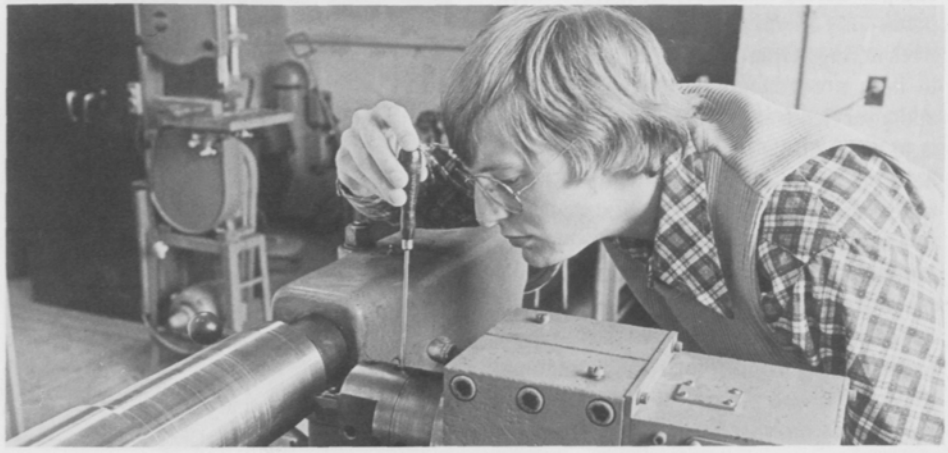
Hajjar

would have gone to the state university, like everybody else." His scholarship covered almost the full tuition costs; loans averaging $900 a year, summer jobs (including one in his area of interest at General Electric last summer), and a little help from his family took care of the remaining expenses. Fred's professional interest is in machine design. For his senior project, he worked with a group of students, mostly Master of Engineering degree candidates, on the Mars Rover project. He plans on going to graduate school, perhaps in the Cornell M.Eng. program.

■ *Scott Ruberl* began his college studies at the State University of New York at Farmingdale, partly to be able to continue work on a race car he designed and built in a partner's automobile repair garage on Long Island. The car, entered in the C Sports Car Racing division, broke the track record everywhere it was raced, and won the national championship in its class. After it was sold, Scott felt free to continue his engineering education elsewhere, and transferred to Cornell as a junior. Here he carried a double major, in industrial engineering and operations research (with a number of mechanical engineering elective courses) and in business (at the Graduate School of Business and Public Administration), and although he accepted a job with the Westinghouse Electric Corporation after graduating this spring, he may return to Cornell at some future time to complete the work for the degree of Master of Business Administration. He plans to make his career in the nuclear energy industry, a field he was introduced to during previous summer work with Westinghouse. Scott's expenses at Cornell were covered largely by a New York State Regents Scholarship and a McMullen Scholarship from the College.

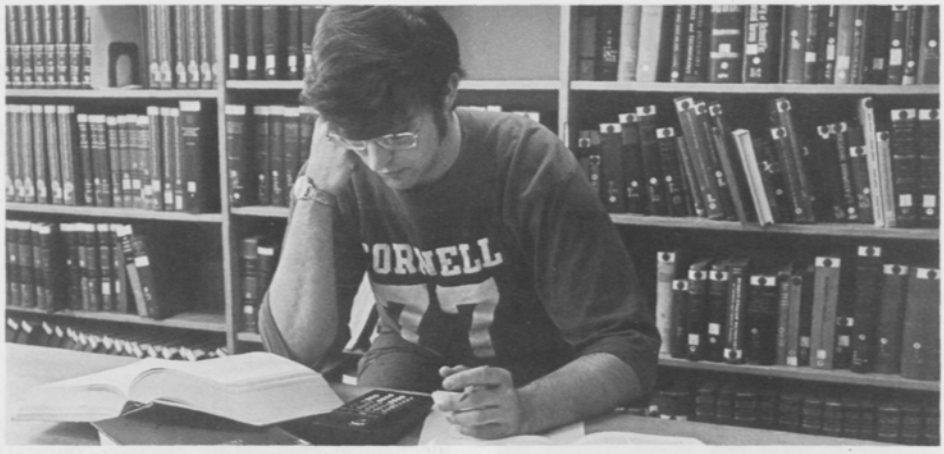
Ruberl

Ruberl

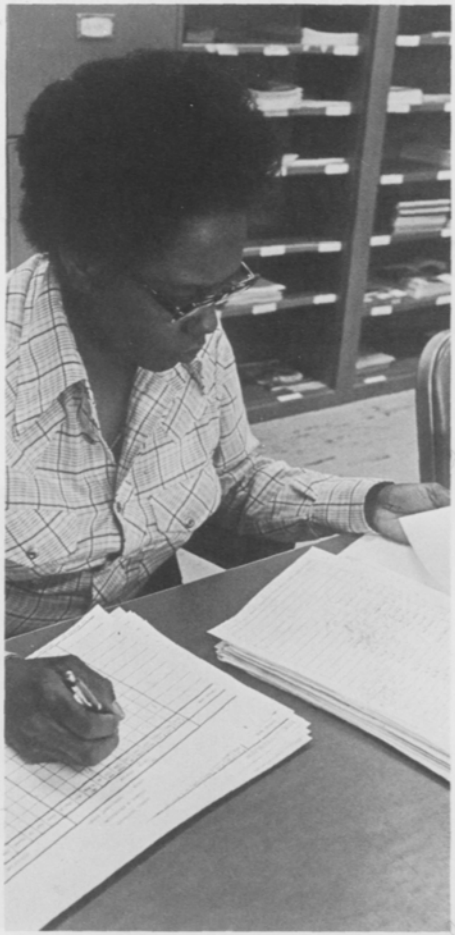


■ *Willie M. Webb* had already worked for ten years before she started college as an independent student. As a data process worker in New York City, she became curious about how computers work and so enrolled for part-time instruction in a training program offered at the RCA Institute. When she learned that tuition is free at Bronx Community College, she decided to begin work for an academic degree; and after earning her A.A. degree at Bronx Community, she entered Cornell last fall as a transfer student in electrical engineering. Her financial aid package includes a General Electric Minority Engineering Scholarship and a $600 annual loan from the University, and she earns extra spending money with a part-time job at the engineering placement office. She started that job as a volunteer between semesters, mostly to keep busy; she was staying on campus during intersession, since Cornell is her only home at the present time. She lives at Sage Graduate Center and belongs to both a coeducational social fraternity and a service fraternity. Willie's ambition is to teach at the junior college level, "to help students like myself who have the necessary drive but not the resources to go to a school like Cornell." She feels that a community college is an excellent starting place for students who may have a weak academic background, particularly in mathematics; by the time they graduate, they can be well prepared for college-level work at a four-year institution.

Utic



Webb

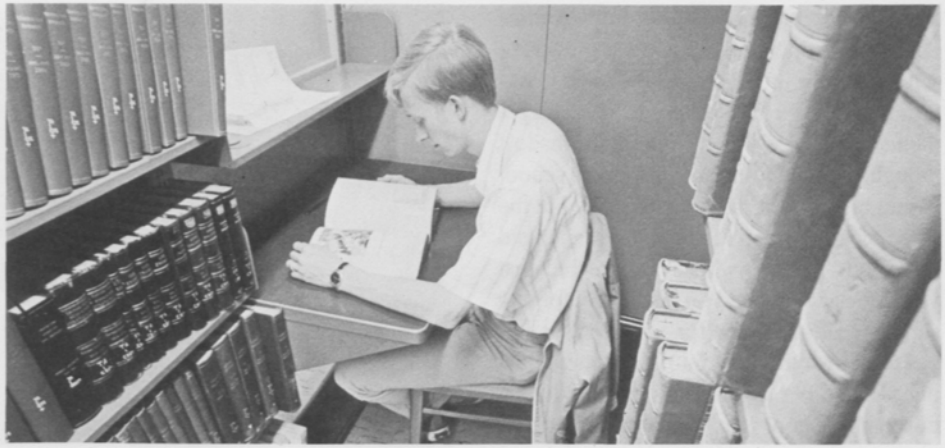


■ *Bill Utic,* a sophomore from Green Bay, Wisconsin, is preparing for a career in city planning and decided to study engineering because some professional city planners he talked with said that people with a technical background are urgently needed on planning staffs. Bill feels that a haphazard and primarily economic approach to urban development must not continue, and that knowledgeable planning can achieve results both practical and environmentally acceptable. He chose Cornell for his undergraduate education because of its quality and the financial aid that was offered. "I wouldn't be here if it weren't for my scholarship," says Bill, one of seven children in his family. With a loan guaranteed by the State of Wisconsin and the proceeds of summer jobs with the power company in his home area, he is meeting his expenses without parental help. His only complaint is that he feels he must be too conscious of grades because of the necessity of maintaining a high scholastic average in order to keep a high level of scholarship support. Bill was chosen for one of the Cornell National Scholarships, which are awarded to especially promising students with well-rounded interests and activities. He serves

as a Boy Scout leader in Ithaca, as president of the Cornell chapter of the national service fraternity Alpha Phi Omega, and as treasurer of his social fraternity, and he is active in the Catholic community on campus.

■ *Steve Lee,* a Cornell National Scholar from Butte, Montana, came here to college because he wanted to attend a school that had both a good curriculum in aerospace engineering and a Navy ROTC program. He was also intrigued by the prospect of experiencing living in another part of the country. Steve has had a continuing interest in space flight, beginning with model rocket launches in his back yard, and he hopes some day to be a member of a research team on a space shuttle. As a junior in the College of Engineering, he is pursuing an individualized College Program with a major in engineering science and applied physics and a minor in astronomy, and he plans to go on to study astronomy or space science in graduate school. Steve's scholarship made it feasible to come here, he says; although the total costs for Cornell sounded high at first, actually "it is cheaper for me to go here than to the state university at home, even with the extra travel expenses." The self-help part of his financial aid package has included a part-time job in the College admissions office, and he earns some spending money taking pictures of weddings on weekends. Also, he has held summer jobs at home each year. For two summers he worked in an open pit copper mine as a carpenter and dump truck operator. Last summer, with two years of engineering education to his credit, he got a job in the electronics laboratory of the Montana Power Company, where he built and tested circuit boards as part of a project to automate hydroelectric plants.

Lee

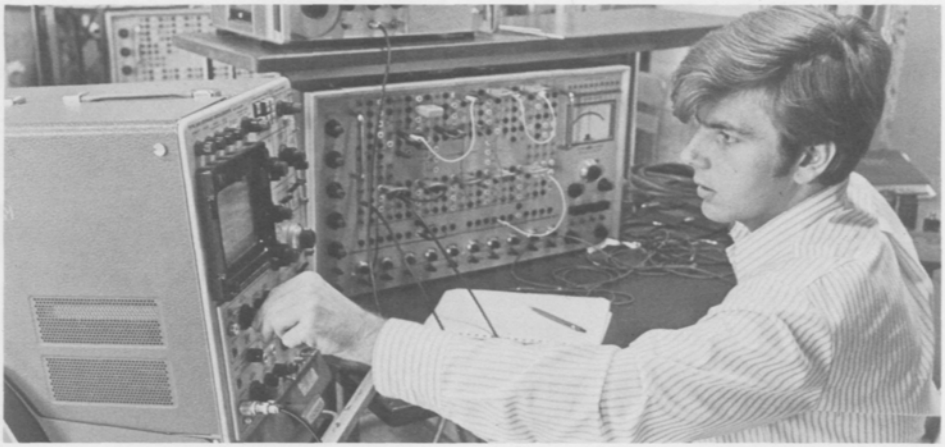


Hickey

■ *Eileen Hickey,* who will enter the field program in electrical engineering as a junior this fall, is preparing for a career in the design of musical instruments and chose engineering as an appropriate college curriculum because "it builds the ability to solve problems." Her father has a business in Rochester, New York, in the repair of pipe organs, and Eileen plans to join him and expand the activities to include modification of a variety of instruments, particularly wind instruments, many of which "have not undergone any development for a hundred years." Eileen is one of nine children in the family, so there is no possibility of parental help in paying for college. Most of her expenses are covered by a New York State Regents Scholarship and an Edward P. Burrell Scholarship (intended primarily for women) from the College of Engineering. For the balance of her costs she depends on loans, summer jobs (this summer she is a lifeguard in Rochester), and, during the school year, a job in the dining room at Sage Graduate Center near the engineering campus as a payroll clerk and occasionally as a short order cook. She is active in the Cornell chapter of the Society of Women Engineers.

■ *Randy Kern,* a sophomore from Akron, Ohio, wanted to attend a good engineering school with a broad curriclum as preparation for a career in corporation management, and he settled on Cornell. He hadn't thought that attending an Ivy League school would be a real possibility, he says, but the offer of a substantial scholarship changed his mind. Randy, whose father died last year, does not depend on his family for any support. He provides for some of his expenses by running the family business during the summer months (his brother does it during the school year), and works at it "six to seven days a week, twelve to eighteen hours a day." Randy got a good start in preparing for a business career while he was still in high school by participating in the Junior Achievement Program sponsored by representatives of business and industry. He helped set up and run a "youth business" each of three years; one year his group manufactured and marketed chess sets made of nuts and bolts, and one year their product was personalized match books. Randy was selected as the organization's national Vice President for Manufacturing in 1972, and the following year he was named Outstanding Area Young Businessman and achieved second place in the national competition.

Kern



Bass

■ *Ray Bass,* a COSEP student from Jamaica, New York, was honored last spring as one of the first recipients of the College's Meredith C. Gourdine Awards for outstanding minority students in engineering. (Gourdine, a black, is an alumnus and a member of the Engineering College Council.) Ray became interested in studying engineering as a result of attending a Science Honors Program for New York City high school students, which was held on Saturdays at Columbia University under the sponsorship of the National Science Foundation. He learned of study opportunities at several Eastern schools, and chose Cornell because of the "good engineering curriculum, the advantages of enrolling at a diverse university rather than a technical school, and the small-town setting." Scholarship support (from a New York State Regents Scholarship and a Cornell COSEP scholarship) was an important factor in making it possible for him to attend. He has met the balance of his college expenses with a loan from the New York State Higher Education Assistance Corporation, with earnings from on-campus jobs in the engineering admissions office and the University Office of Computer Services, and with income from jobs under the Engineering Cooperative Program. Ray completed his baccalaureate degree in industrial engineering and operations research this spring, and next year will complete work, begun during his upperclass years, for a Master of Business Administration degree. His career goal is to work for a major corporation in the area of quantitative managerial models for market, scheduling, or financial planning.

McMULLEN

by Donald F. Berth

McMullen.

It is a name with special meaning for thousands of Cornell engineering alumni. Over the past fifty years, more than 10,000 students have benefitted from the munificence of John McMullen, whose bequest to Cornell provided an engineering scholarship fund that is the University's largest income-producing endowment.

Who was this man? Why was he interested in Cornell? What motivated him to leave the bulk of his estate to provide engineering scholarships? And what has been the impact of his gift on the development of the College of Engineering and its alumni body?

The essentials of the story are simple and impressive. John McMullen was a Connecticut carpenter, born of Irish immigrant parents, who founded a dredging business in the 1880s and went on to build an enterprise that made him a millionaire. He had no children, and although he never went to college and apparently never set foot in Ithaca, he made Cornell University the chief beneficiary of his estate. Income from stock in the Atlantic, Gulf & Pacific Company of New York (AG&P), of which McMullen owned a majority interest, was to accrue to the University through a perpetual trust, and the proceeds were to be used for "scholarships for the education of young men as engineers."

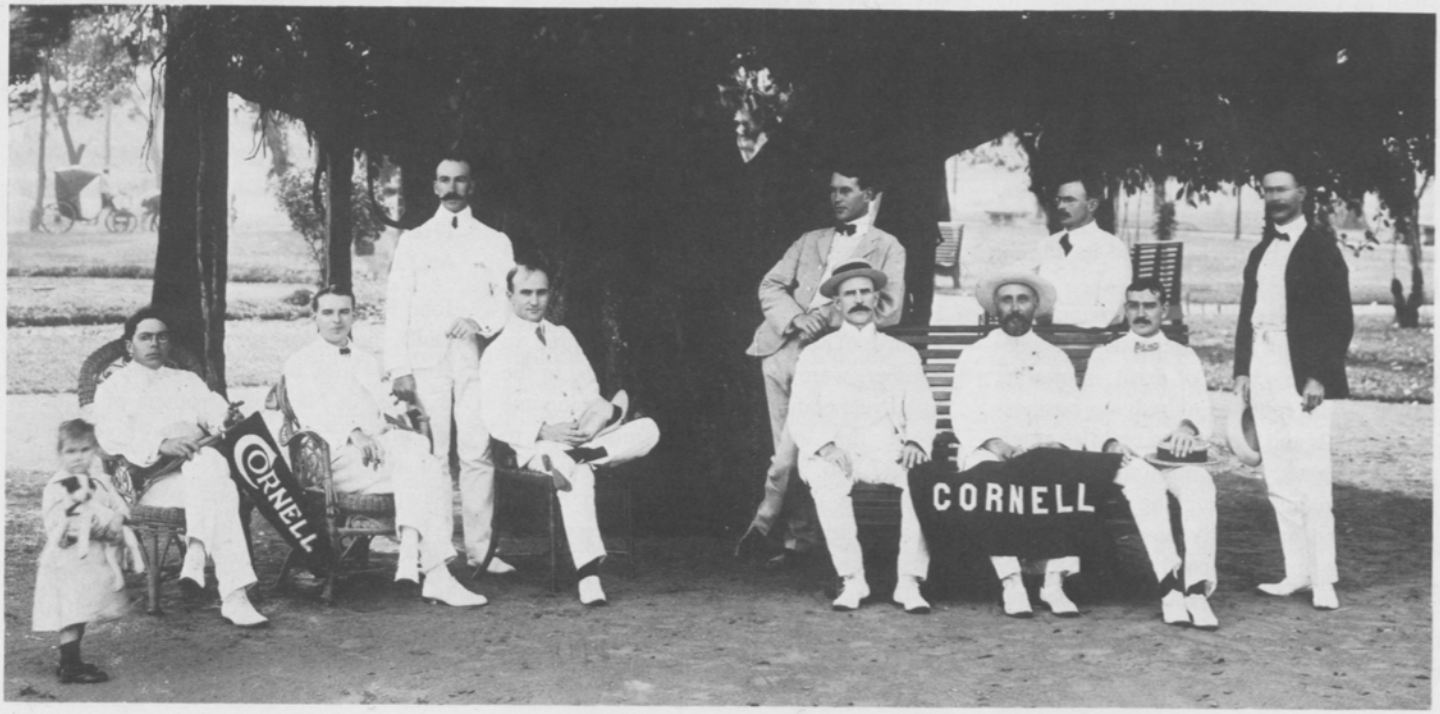
The McMullen bequest has grown through investments made by the University as well as through annual monies received from the trust, and income has been divided between scholarship payments and additions to the McMullen Scholarship Endowment that was established at the outset. The endowment today has a market value in excess of $15 million, representing almost 8 percent of the University's total endowment funds for the endowed colleges in Ithaca. Over the past fifty years, a total of $13,389,910 has been distributed as scholarships. The first scholarships, three in number, were awarded in 1925-26. In the fiscal year ending in June 1974, the income from the endowment amounted to $1,247,796, a sum which provided about two-thirds of *all* the scholarship money awarded by Cornell to its engineering undergraduates.

The roster of engineering alumni who held "McMullens" reads like an international Who's Who of business, industry, government, and education. This enormous gift has provided the means to put Cornell within the reach of thousands of young men who otherwise might not have been able to afford to attend the University. It also has helped draw to Cornell some of the most promising prospective engineers; for many years alumni across the country actively sought candidates for the competitive and highly regarded McMullen Scholarships. And beyond any doubt, the McMullen fund has enabled the University to sustain the quality and numbers of students enrolled in its various engineering programs.

THE SUCCESS STORY OF A CONNECTICUT YANKEE

John McMullen was born on October 16, 1848, near Norwalk, Connecticut. As a youth he took up carpentry, and for a time worked for Norcross Brothers of Worcester, Massachusetts, a company noted for the construction of many of the renowned Newport, Rhode Island estates and Fifth Avenue townhouses in New York City. In 1876, at the age of twenty-eight, he moved to San Francisco and set up a small shop. "John McMullen, the Live Carpenter" the shop sign read.

In about 1880, McMullen began to


CORNELL
CORNELL

Left above: Employees of the Atlantic, Gulf and Pacific Company of Manila held a New Year's Eve reception for John McMullen at the office on December 31, 1904. McMullen is at the far end of the table. At the near end, with glass raised, is Hermann Krüsi, president of the Manila company.

Left below: Hermann Krüsi appears with a Cornell banner toward the right of this 1905 photograph, taken in the Philippines. The Atlantic, Gulf and Pacific Company of Manila built the harbor and port area of that city, and today is one of the largest in its field in Southeast Asia, according to members of the Krüsi family.

(These pictures were loaned by LeRoy Krusi, son of Hermann.)

specalize in the building of wooden truss bridges, and in 1884 he founded the San Francisco Bridge Company in partnership with Hermann Krüsi, one of four 1882 civil engineering graduates of Cornell. The principal work of the company became dredging, an activity with which McMullen was associated for the rest of his life. It may be of some interest that one of McMullen's California friends was David Starr Jordan, first president of Stanford University, a member of Cornell's first four-year class in 1871, and one of the two persons (the other was Cornell's first president, Andrew D. White) ever awarded honorary doctorates by the University.

In 1899 the San Francisco Bridge Company joined with several other firms to form the Atlantic, Gulf & Pacific Dredging Company, specialists in hydraulic dredging of rivers and harbors, and the new organization set up offices in New York City. The other companies in the amalgam were the Puget Sound Bridge and Dredging Company, the British Columbia Bridge and Dredging Company, the San Francisco Dredging Company, and the Atlantic, Gulf and Pacific Company of Manila. (This latter division built the harbor at Manila in the Philippines.) The president of the newly organized company was McMullen, who remained active in the firm until his death in 1921 at the age of seventy-two. The initial vice president was Krüsi.

An assessment of John McMullen as a businessman is found in a 1921 letter to Harold Flack, executive secretary of the Cornellian Council (now the Cornell Alumni Association), from Stuart L. Peebles, a Cornell engineer (C.E. '11) and an employee of AG&P. Peebles wrote: "Mr. McMullen was a very honest, frank spoken man—accustomed to have his way. He was a good salesman with a commanding personality and figure."

The most colorful description of John McMullen that we have found comes from a speech to McMullen scholars made at Cornell in 1938 by DeWitt Barlow, who later became president of AG&P (see p. 21 for pictures taken on that occasion). McMullen, he said:

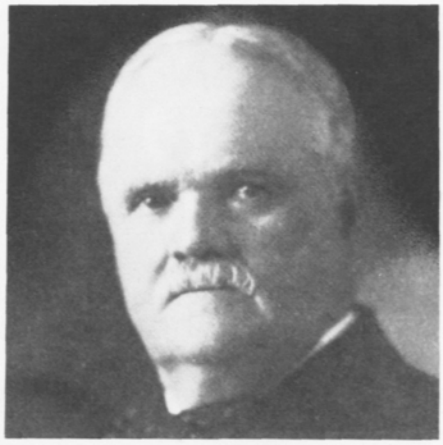
> was a very impressive person, a huge, forthright man, sometimes of violent temper, with virtually no formal education and no engineering training, but with outstanding ability as a leader and organizer of men. He was a man of few intimates, though genial; extremely self-reliant and with no sense of humor. He admired the arts, but without appreciation, and had no use for conventional thinking. He believed in educating only those persons of exceptional ability, and would have favored unlimited opportunity for the best minds, to the limit of their capacities.

One may speculate about why McMullen, who had such a great interest in engineering all his life, did not study to become a professional engineer. Probably his family's situation as recent immigrants—most likely as a result of the potato famine in Ireland—was a factor. Also, engineers of the day were largely self-made men. In the pre-Civil War era, only Rensselaer Polytechnic Institute, founded in 1824, offered civil engineering programs. At the end of the Civil War, when McMullen was seventeen years old, many of the institutions offering engineering (for example, Cornell, Lehigh, and Worcester) were just being founded.

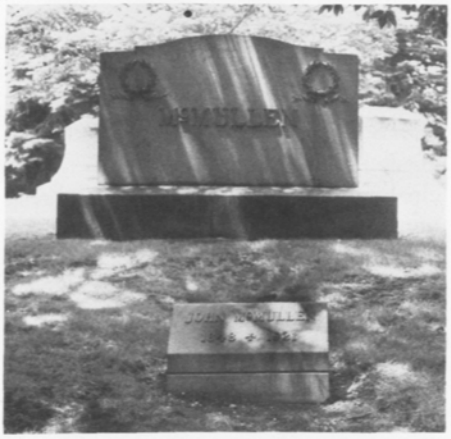
A LEGACY FOR THE EDUCATION OF ENGINEERS

By the time John McMullen wrote his will, his wife had died, and his next of kin were nieces and nephews. (Mrs. Laura G. Hughes, a niece, cared for him during his last years at the McMullen residence in South Norwalk, Connecticut). Worth something in excess of a million, he had to consider the disposition of his estate, which was largely stock in the dredging company. And here another Cornellian, Justin duPratt White, evidently had an influence.

White was a member of the firm of White



Left: This photograph of John McMullen appeared in 1936 and 1967 historic pamphlets about the Norwalk (Connecticut) Hospital. McMullen, who spent the last sixteen years of his life in that community, was president of the Norwalk Hospital Association from 1915 until his death; during his presidency, the hospital site was acquired and the first building of the current complex was constructed. In reporting his death on August 29, 1921, the Norwalk Hour *ran a page one story with the headline, "Norwalk Lost Big Man in McMullen / Judah Island Resident Really Made New Norwalk Hospital Possible." (Photo courtesy of the director of community relations of the Norwalk Hospital.) Below: The McMullen gravesite is in Riverside Cemetery in Norwalk.*



& Case, legal counsel for AG&P, and a member of Cornell's Board of Trustees. In a 1936 letter to Chester T. Reed, M.E. '03, of the Worcester firm of Reed & Prince Manufacturing Company, he wrote: "I used to talk with John McMullen at considerable length about educational affairs and particularly the education of engineers. He was always interested in the education of young men for that profession." White commented later in the same letter that he had nothing to do with drawing McMullen's will, which was done by the New York law firm of Porter & Taylor. His correspondent, Reed, was chairman of one of the regional McMullen Scholarship Committees formed to promote the candidacy of promising young men as McMullen scholars.

That same year, White also wrote to Charles Bostwick, University comptroller, that ". . . it was during the Endowment Campaign (1915) that I developed his (i.e., McMullen's) interest in the University . . . of course, I had always talked endowments, but he from the beginning had the assistance of students in mind." He went on to quote, from a letter he had received from McMullen:

> I would be very proud to have this business, with which I have struggled for substantially thirty-five years, go on in a blaze of glory, and Cornell get all the benefit of it.

Cornell came very close to never knowing the name McMullen, however. It was only eight days after his will had been drawn, signed, and witnessd that John McMullen was dead. Although the will was contested by relatives, his lucidity up to the time of death was proven in court, and Cornell was confirmed as the major beneficiary of the estate.

THE TRUST FOR CORNELL AND ITS PROVISIONS

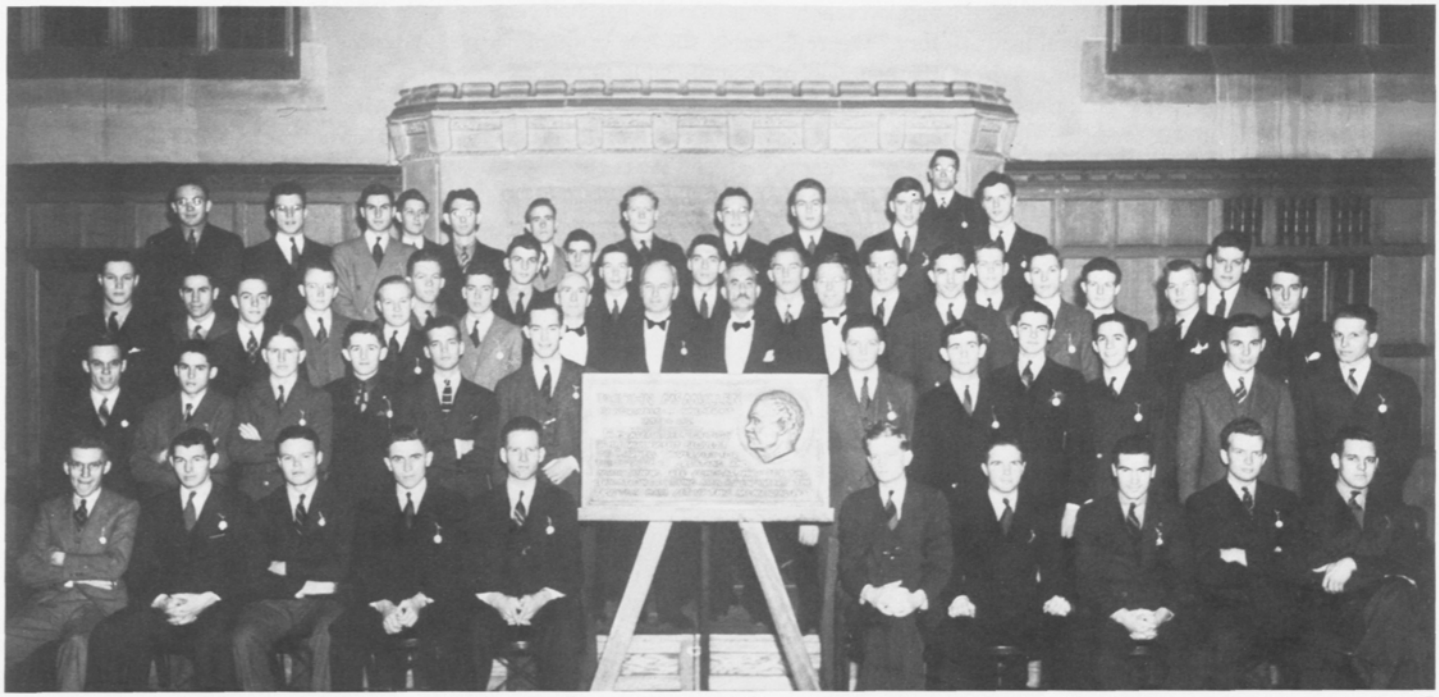
What did John McMullen's will provide Cornell?

A testamentary trust established in the State of Connecticut consisted of about 15,000 shares of stock in AG&P, with a value of slightly over one million dollars. Cornell's share of the trust was approximately 67 percent at that time; nieces and nephews were the beneficiaries of the balance. The terms of the trust further provided that as these beneficiaries reached

Right above: McMullen scholars from Midwest District 12 were among those who attended the 1938 presentation of a plaque (now hanging in Carpenter Hall) honoring John McMullen. Three have been identified: center to right, Robert K. Finn, now professor of chemical engineering at Cornell; William E. Fischer; and Charles W. Lake, Jr., now a member of Cornell's Engineering College Council (see the more recent photo on p. 26).

Right below: Among the group assembled in the Memorial Room of Willard Straight Hall are (in bow ties behind the plaque): Dexter S. Kimball, then dean of engineering, emeritus; Edmund Ezra Day, president of the University; DeWitt Barlow, president of AG&P; and S. C. Hollister, dean of engineering.


TO JOHN McMULLEN
OF NORWALK · CONNECTICUT
1848 – 1921
IN GRATEFUL RECOGNITION
OF HIS MUNIFICENT BEQUEST
TO CORNELL UNIVERSITY FOR
THE PURPOSE OF CREATING AND
MAINTAINING FREE SCHOLARSHIPS FOR THE
EDUCATION OF YOUNG MEN AS ENGINEERS THE
TRUSTEES HAVE SET UP THIS MEMORIAL·1937



"Over the past fifty years, a total of $13,389,910 has been distributed as scholarships."

stipulated ages or died, their shares would revert to Cornell; the University is now almost the sole beneficiary.

The trust was established to exist in perpetuity, but since its revenue depended on the fortunes of its sole source of income, AG&P, Cornell's income from the trust has depended largely on the performance of the company. The business has fallen on hard times in recent years. Yet during the tough years of the depression, its performance was excellent and enabled Cornell to extend its scholarship program at a time of great need. A 1931 letter from Cornell President Livingston Farrand to the treasurer of AG&P, Hamilton E. Shaver, reminds us of that sad depression era:

> In all my academic life I have never known a situation where so many splendid and promising young men are being forced to break into or drop their education solely because of lack of sufficient funds to keep body and soul together . . . The McMullen Scholarships which have been built up through the generous bequest of Mr. McMullen . . . have done more to relieve the situation in that College (Engineering) than any other factor.

Ever since the trust was first established, some of the income has been used to build up the John McMullen Endowment; income from this has been used exclusively to support scholarships over this past half century. The remarkable success in building the endowment is attributable to two factors: the continuing successful performance of AG&P for the first four decades of the fifty-year period, and the sound investment practices of the University.

KRÜSI AND WHITE: CORNELL AMBASSADORS

Two weeks after McMullen's death, a comment about his interest in Cornell was made by the only known Cornellian then employed by AG&P, Stuart L. Peebles. In the letter quoted above, Peebles wrote:

> Mr. McMullen worked into contracting, starting first as a carpenter out in California, later incorporating as the San Francisco Bridge Company and enlarging until about 15 years ago he came east and later sold the Pacific Coast end of the firm to several of his associates. Mr. Krüsi, a Cornell engineer now retired and living in California, still holds a considerable minority interest in Atlantic, Gulf & Pacific. White & Case have been the attorneys for AG&P for about three years and I presume that Mr. White has met Mr. McMullen occasionally but I do not know that he has influenced him in this matter.

Krüsi and White. These two Cornellians, it would appear, made the difference: Krüsi for his performance as an engineer working closely with McMullen for three decades; White as a legal counselor to AG&P and in his role as a Cornell trustee.

Krüsi, probably the first Cornellian among McMullen's associates, was born in Worcester, Massachusetts, in 1858 and grew up in Oswego, New York. He attended the Oswego Normal School (now part of the State University of New York), where his father was on the faculty, before coming to Cornell to study civil engineering. All we know of his Cornell experience

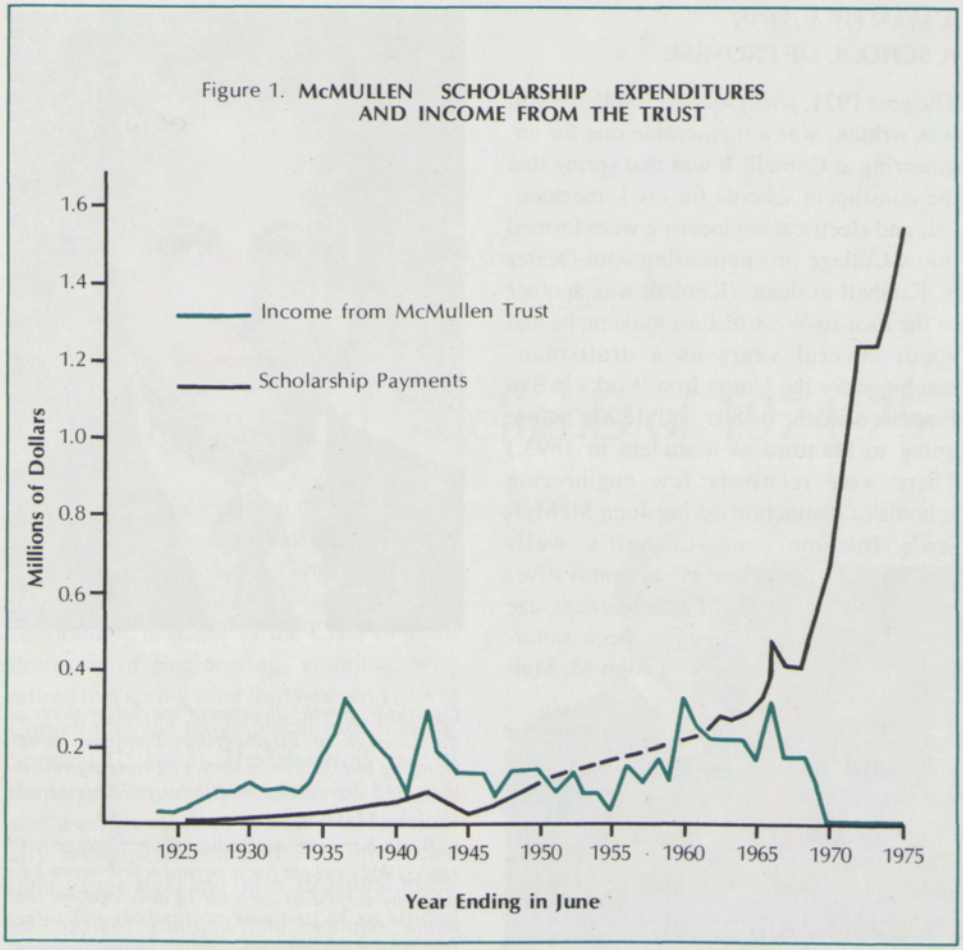


Figure 1. These data on scholarship payments and distributions from the McMullen trust over the past half century show that in recent years income from the trust fell off to zero as scholarship payments increased dramatically. The company has recently been sold, and once net proceeds from the sale have been distributed, the trust presumably will be dissolved.

Revenue for the scholarships now comes exclusively from the McMullen Scholarship Endowment, which was established by the University in 1924 and has grown to a current market value of more than $15 million through income from the trust and investment profits. In 1970 the endowment assets were incorporated into the University's investment "pool," and income (which had kept pace, roughly, with the scholarship payments) rose appreciably to a current annual level of about $1.27 million (see Table I). Educational costs have increased even faster, however, and in the last four years McMullen money has been supplemented from other Cornell endowment funds for the first time since the original bequest was made.

Table I
PURCHASING POWER OF THE McMULLEN SCHOLARSHIP ENDOWMENT

Year Ending in June	Net Income from Endowment	Cornell Tuition and Fees	Equivalent in Full Tuition Scholarships
1971	$1,061,300	$2,600	408
1972	1,158,223	2,800	413
1973	1,186,144	3,000	395
1974	1,221,796	3,180	384
1975	1,270,000*	3,430	370*

*Estimated

Table I. Although net income from the McMullen Scholarship Endowment has been rising in the last five years, costs for tuition and fees have increased faster, and since 1972 the income has been less than the amount spent.

The figures for full scholarship equivalents were obtained by dividing net income by tuition and fees. Actually, the funds are dispersed mostly as partial tuition coverage for many more students. This coming year, for example, approximately 645 students will hold McMullen Scholarships; these will include an expected 277 freshmen, about 43 percent of the class.

is that he was elected vice president of his senior class. After founding the San Francisco Bridge Company with McMullen, Krüsi became the first president of the Atlantic, Gulf and Pacific Company of Manila. After returning from the Philippines in 1907, he became president of AG&P until his retirement in 1910. He died in 1940 in Alameda, California. A son, LeRoy, is still living in that state; a great granddaughter, Jean Krusi, is now at Cornell as a graduate student in botany.

White was a member of one of the most prestigious Wall Street legal firms of the time; its clients included J. P. Morgan & Company, Bankers Trust Company, and the First National Bank of New York. He became a member of the Cornell Board of Trustees in 1913, and was elected vice chairman in 1924 and chairman in 1939, shortly before his death. While on the Board, he was a member of the committee that chose Livingston Farrand as Cornell's fourth president in 1921, and chairman of the committee that selected Edmund Ezra Day as the University's fifth president in 1937. He was also instrumental in effecting the merger of the New York Hospital and the Cornell Medical College in 1927.

A MAN OF VISION, A SCHOOL OF PROMISE

The year 1921, when John McMullen's will was written, was a memorable one for engineering at Cornell. It was that spring that the constituent schools for civil, mechanical, and electrical engineering were formed into a College of Engineering with Dexter S. Kimball as dean. (Kimball was another of the East-to-West-to-East movers; he had spent several years as a draftsman-machinist for the Union Iron Works in San Francisco in the 1880s and 1890s before going to Stanford as a student in 1893.) There were relatively few engineering schools of distinction during John McMullen's lifetime, and Cornell's well-established reputation as an innovative, pioneering institution of considerable size seems in retrospect to have been tailor-made for the preferences of John McMullen.

In personally providing the means for substantial support of thousands of outstanding Cornell engineers—at least a third of all the alumni of the College—John McMullen made a contribution unmatched in all of engineering education. A bold man with a bold vision, he would be proud of what his beneficence has accomplished and will continue to accomplish for Cornell engineering. It's not a bad record for a man who never attended a class at Cornell or, for that matter, anywhere else.

Donald F. Berth, director of special projects at the College of Engineering, combines long-standing interests in history, engineering education, and entrepreneurial industry in his article on John McMullen.

Berth has been a member of the College staff since 1962, except for a period a few years ago when he served as director of development and public relations at Hampshire College. He began at Cornell as an administrative assistant to Dale Corson, then dean of engineering and now president of the University; and subsequently he served as director of college relations and as initial director of the Engineering Advising and Counseling Center. He founded ENGINEERING: Cornell Quarterly *in 1966 and was its editor through 1971. At the College he participates also in the teaching, educational development, and engineering cooperative programs.*

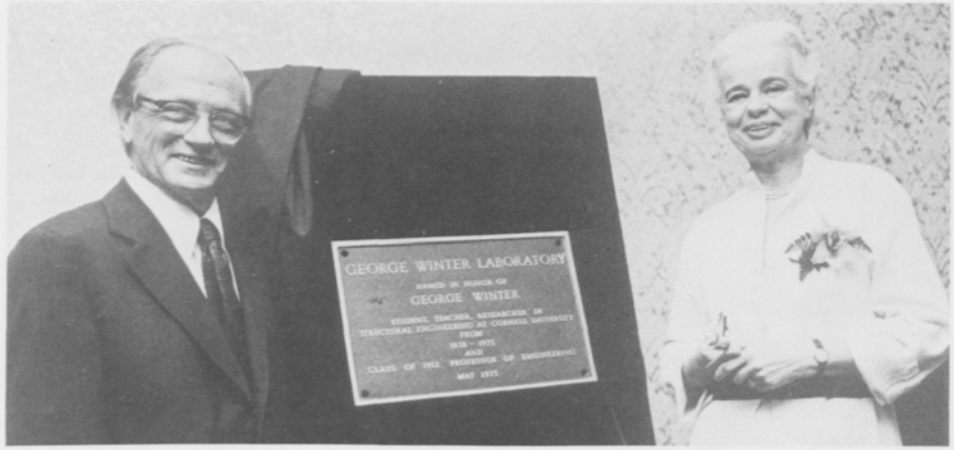
He has served as a consultant in development, publications, and educational innovation to several institutions, including the School of Engineering at the University of Massachusetts at Amherst, the Thayer School of Engineering at Dartmouth, and Worcester Polytechnic Institute, where he earned B.Ch.E. and M.Ch.E. degrees.

VANTAGE

Highlights and Sidelights of 1974-75

■ Among special events at the College this year, one of the most pleasurable was the dedication of the structural engineering test bay in Thurston Hall as the George Winter Laboratory, in honor of the Class of 1912 Professor of Engineering, emeritus, who retired this spring after thirty-seven years at Cornell (see the biographical sketch in the Spring 1975 issue). The laboratory, one of the largest university facilities of its kind, was used for much of Winter's internationally recognized research in cold-formed light-gauge steel and other structural materials. The dedication was part of an all-day program on May 10, attended by some 120 persons. These included present and former colleagues, students, and associates from all over the country. Also presented was a volume of Winter's collected papers, published by the College.

Participants included Cornell physics professor Hans Bethe; S. C. Hollister, who was dean of engineering at Cornell when Winter arrived; Professor T. V. Galambos of Washington University; George F. Leyh, associate technical director of the Concrete Reinforced Steel Institute; William G. Kirkland, vice president of the American Iron and Steel Institute; and Ivan M. Viest of the Bethlehem Steel Company.



Above: Anne Winter joined her husband at the presentation of the plaque for the laboratory. It was unveiled by Dale R. Corson, president of the University and former dean of engineering.

Right: Among the guests was Victor Weisskopf (at right), emeritus Massachusetts Institute of Technology professor, who has been a friend of George Winter since their high school days in Austria. Winter's first paper, an astronomical observation, was written with Weisskopf and published when both were sixteen years old. As recounted by Professor Floyd O. Slate in the forward to the collected volume of Winter's papers, "The two friends had stayed up all one summer night in the mountains near Salzburg counting meteors with the aid of a telescope given George by his parents."

■ Winner of the $1,000 Excellence in Engineering Teaching award for 1975 was Dennis G. Shepherd, professor of mechanical and aerospace engineering. He won the award in 1968 also, and is the only faculty member to receive the honor a second time.

Sponsors of the award are the Cornell Society of Engineers, an alumni group, and the Cornell chapter of Tau Beta Pi, student honorary society. The recipient is chosen on the basis of nominations by students.

Shepherd, a specialist in thermal power, fluid mechanics, and turbomachinery, has been a member of the faculty for twenty-seven years, including seven as director of the Sibley School of Mechanical Engineering. He was educated at the University of Michigan, and spent thirteen years in industrial work in England and Canada before coming to Cornell. His previous honors have included a Guggenheim Fellowship and a Senior Visiting Fellowship of the Organization for European Economic Cooperation.

Below: Presenting the prize to Professor Shepherd at the annual meeting of the Cornell Society of Engineers is Michael Bandler, president. The selection of the award winner was announced earlier at the annual Tau Beta Pi banquet.

Bueche

■ Named chairman of the Engineering College Council this spring was Arthur M. Bueche, vice president for research and development of the General Electric Company. Bueche directs General Electric's Research and Development Center in Schenectady, New York, and also has responsibility for monitoring the company's total research and development effort.

He received the B.S. degree in chemistry from the University of Michigan in 1943 and the Ph.D. in physical chemistry from Cornell in 1947. He assumed his present position in 1965.

Bueche is a member of the National Academy of Sciences and the National Academy of Engineering; a fellow of the American Physical Society; and a member and former director of the American Chemical Society. He is a member of advisory committees to the National Science Foundation, the National Research Council, the National Bureau of Standards, the Governors' Council on Science and Technology, and the Air Force.

He is active in academic affairs at Harvard College, the Massachusetts Institute of Technology, Rensselaer Polytechnic Institute, and the Union University medical college, and he holds honorary degrees from five institutions.

■ Outgoing chairman of the Engineering College Council, Charles W. Lake, Jr., was honored by the College with an Engineering Award presented during the spring Council meeting by Professor Andrew Schultz, Jr., who was dean of the College at the time of Lake's appointment to the Council in 1964.

Lake is chairman and president of the Chicago firm of R. R. Donnelley and Sons, commercial printers, which he joined in 1946. He became vice president in 1954 and president in 1964.

He has been a member of the University's Board of Trustees since 1973, and has been active in Cornell alumni affairs in Chicago. He is also a member of the Citizens' Board of the University of Chicago, the Business Advisory Council of the Graduate School of Business at Northwestern University, and the Visiting Committee of the Divinity School of the University of Chicago. He is a director of the Northern Trust Company of Chicago and a member of a number of professional and civic organizations.

He received the B.S. degree in administrative engineering from Cornell in 1941 and the M.B.A. from the University of Chicago in 1949.

Lake

■ A Rhodes Scholarship climaxed the undergraduate career of Ken Brown '74 of Colorado Springs, and he has now completed his first year at Oxford University. A top mechanical and aerospace engineering student here (with a grade-point average of 3.96), Ken was also stroke on the varsity crew and earned a place on the U.S. team which won the top grand final in the 1974 European Rowing Championships. While a senior here, he received the first Jack S. Fair Award as the outstanding Cornell engineering student-athlete.

Right: Ken Brown, at left, is shown with head coach Douglas Neil and Don Flagg '74.

■ A portrait of Leroy R. Grumman, a member of the Class of 1916 and a longtime benefactor of the University, was presented by his daughter, Mrs. Ellis L. Phillips, Jr., at a Commencement Day breakfast on campus. The portrait was hung in Grumman Hall on the Engineering Quadrangle. Grumman, founder of the Grumman Aircraft Engineering Corporation, is a trustee emeritus of the University and a Presidential Councillor. Funds for the construction of Grumman Hall and for the Graduate School of Aerospace Engineering have been among his many contributions to Cornell.

Right above: On hand for the presentation were (left to right): Kathryn Noel Phillips, Grumman's granddaughter, who received a Cornell A.B. degree that day; Mrs. Ellis L. Phillips, Jr.; and Mrs. Grumman. (Ellis L. Phillips, Sr., was the donor of funds for Phillips Hall.)

Right: Shown on the steps of Grumman Hall are (left to right): Dale R. Corson, president of the University; Mrs. Corson; Mrs. S. C. Hollister; S. C. Hollister, dean of engineering at the time Grumman Hall was built; Miss Phillips; Mrs. Phillips; Mrs. Grumman; Dean of Engineering Edmund T. Cranch; Mrs. Deane Malott; Deane Malott, president emeritus of the University; and E. L. Resler, Jr., director of the Sibley School of Mechanical and Aerospace Engineering.

■ Among award winners at the College this spring is *ENGINEERING: Cornell Quarterly*, which received two national honors: an Exceptional Achievement Award for coverage of public affairs, from *Newsweek* Magazine and the Council for Advancement and Support of Education (CASE); and an Award of Merit for excellence in magazine publishing from CASE. The *Newsweek* award was for the issues on "Planning for Energy R&D" (Volume 9, Number 1) and on "Engineering in Developing Nations" (Volume 9, Number 3). They were discussed as a case study at the national meeting of CASE in July.

The Quarterly has won a total of nine national awards within the past four years. These include a 1973 Top Ten Magazine Award from the American Alumni Council (AAC). In 1974 the *Quarterly* received from the same organization a Publication of Distinction Award and a Special Citation for "writing and editing on difficult scientific subjects."

The magazine received Special Citations for excellence in 1972 and 1973 from the American College Public Relations Association, and Graphic Arts Competition Awards from the Printing Industries of America, Inc., in 1972 and 1974.

■ The Cornell student chapter of the American Institute of Chemical Engineers received an Award of Merit from the Society this spring for its 1973-74 program. President Stephen Glick accepted. James F. Stevenson was honored as one of two outstanding counselors nationwide.

Above: The award was announced at the December meeting of the Society in Washington, D.C. Attending from Cornell were (left to right): Professor Kenneth B. Bischoff; Professor Stevenson; Frank Sherman '76; Dan Teichman '76; Richard Krieg '75; Marice Lada '76; and (front row) Harvey Hirsch '76; Neal Zislin '75; and Frank Herschkowitz '75.

■ David F. (Red) Powers, shop supervisor in Hollister Hall, was honored upon his retirement after forty years of service to the College at a reception in Carpenter Hall this spring.

Below: Three former deans and the present dean of engineering, all in office during Powers' years of employment, were among those attending. Left to right: S. C. Hollister, professor of civil engineering, emeritus; Dale R. Corson, now president of the University; Mrs. Powers; Powers; Dean Edmund T. Cranch ("He was Eddie when I first knew him and he's still Eddie to me," Powers commented); and Andrew Schultz, Jr., professor of operations research.

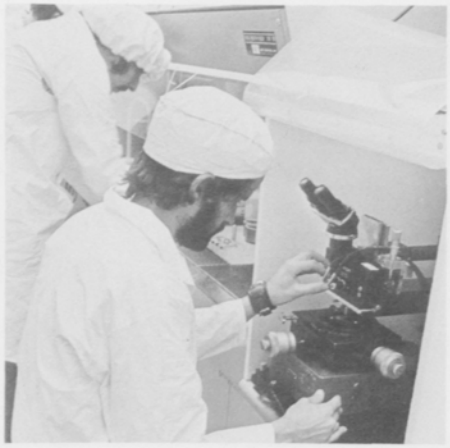
■ A new clean-room facility for crystal growth and semiconductor processing was installed this year in the School of Electrical Engineering in Phillips Hall. A major contributor to the $200,000 renovation project was the International Business Machines Corporation. Others included Motorola, Inc., Hughes Aircraft Corporation, International Telephone and Telegraph Company, Varian Associates, Raytheon Company, and the New York State Science and Technology Foundation. A number of industrial organizations contributed equipment.

The three laboratories in the 3,200-square-foot area have humidity and temperature control and filtered air. Entry is through air locks, by persons wearing special clean-room apparel. The facility is used for both instruction and research.

The laboratory was of particular interest to delegates to the fifth Cornell-sponsored Conference on Active Semiconductor Devices for Microwaves and Integrated Optics, held on campus August 19-21.

Right: Members of a class in integrated circuit technology used the facility during the spring term.

Below: The laboratory provides equipment for growing crystals.



Left: The research facilities are used for research in semiconductor devices by some thirty graduate students and six professors: G. Conrad Dalman, Lester F. Eastman, Charles A. Lee, Jeffrey Frey, Joseph M. Ballantyne, and Chung L. Tang.

■ An attraction for the local community this spring was the Alternative Energy Exposition held on campus May 9 and 10 by the Center for Alternative Energy, a recently organized group consisting largely of engineering students. Electric wind generators and solar heating units were among the devices constructed by the members and exhibited on the Arts Quad. The Exposition also included demonstrations, workshops, and discussions on solar and wind energy, wood as an energy source, methane generation, and organic vegetable production and storage. The Center grew out of a study of solar energy conducted last year by a small group of students. Since January it has had a headquarters in Anabel Taylor Hall, and conducts research, operates a library, holds regular meetings and seminars, and publishes a newsletter.

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1. A Savonius rotor, a vertical windmill, was one of the exhibits. It was constructed with about thirty hours of work from an old oil drum and other parts costing a total of about $30. The builders claimed that this windmill, characterized by low speed and high torque, is suitable for such jobs as pumping water and grinding grain.

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2. A sailwing wind electric generator with a capacity of 2,800 watts of continuous power in a 20 mph wind, cost about $200 to build and required about 150 hours of work. The device features a pole that can be raised and lowered, and parts include an old car differential. It will use a storage battery to store energy. In an average 10 mph wind, the generator produces about 350 watts, sufficient to supply 27 percent of the electricity used by the average American family.

3. A solar hot water heater produced water with a temperature of 160° during the demonstration. The black-painted collector panels are constructed of glass. Parts, including copper tubing and insulation, cost about $121 and the construction took about thirty hours of work.

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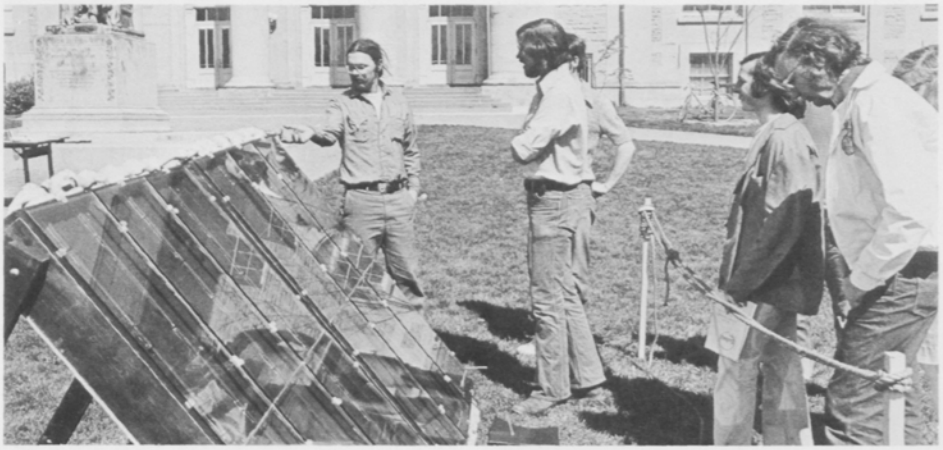

■ At Cornell, 1974-75 seemed to be "Women's Year" in engineering, climaxed by a national conference on "Women in Engineering—Beyond Recruitment" June 22-25. An earlier event, in February, was the second annual conference on women engineers for students and prospective students. Also, the College offered an experimental course for women (see the following pages).

1. More than one hundred prospective women engineers attended the February conference on "The Woman Engineer: Student and Professional." Featured was a panel discussion with women engineers from industry as members. The conference was jointly sponsored by the College and the Cornell chapter of the Society of Women Engineers, with the support from Corning Glass Works and the Martin-Marietta Aerospace Corporation.

2. Among the speakers at the June conference was Engin Inel Holmstrom of the policy analysis service of the American Council on Education. The conference attracted eighty-five delegates–sixty women and men educators from engineering schools across the country, fifteen industry representatives, and ten women students.

3. Members of a working session on academic problems were, left to right: Dena Skalka of Bell Telephone Laboratories; Christine Roysdon, student from Lehigh University; Carol Hall, postdoctoral associate in chemistry at Cornell; Helen O'Bannon, associate dean of engineering at Carnegie-Mellon University; Ann Stenbeck, engineering college staff member at the Universtiy of Michigan; and Mildred Dresselhaus, professor of electrical engineering at the Massachusetts Institute of Technology.

4. Participants included (left to right): Robert E. Gardner, director of advising and counseling at the Cornell College of Engineering; Marilyn Landis Sessions, Cornell graduate and materials engineer at E. I. duPont de Nemours and Company; Malcolm S. Burton, associate dean of the Cornell College of Engineering; and William Simeral, vice president at DuPont. Cornell staff members who organized the conference were Gardner, David C. Johnson, and Mary Diederich Ott. Industry sponsors were DuPont and the General Motors Corporation.

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Catching Up With the Boys

■Sixteen women engineering students who participated this spring term in an experimental one-credit-hour course in basic laboratory skills were the envy of many of their classmates, including men. The course was conceived and organized by Basic Studies and advising and counseling staff members (Associate Dean Malcolm Burton, Research Associate Mary Ott, and Advising and Counseling Director Robert Gardner), who felt that women students frequently are handicapped by a lack of engineering-oriented activity as they are growing up and would gain confidence in their laboratory work through practical experience. As Mary Ott explained, under the usual conditions of an 8-to-1 ratio of men to women in engineering classes, the women often accept help from their male classmates, whom they tend to regard as more experienced.

The class was taught by Tom and Carol Hall, who hold postdoctoral appointments in materials science and engineering and in chemical physics, respectively, and by Burton, Ott, and Gardner. Instruction began with absolute basics such as how to drive a screw, and continued through welding and the use of heavy shop equipment. During the evening laboratory sessions, the students designed and made items such as lamps and candlesticks, performing all operations including woodworking, metalworking, and electrical wiring. One evening they learned to use an oscilloscope, thus gaining an edge on most other beginning engineering students. ''Not many boys know how to do specialized operations, either,'' one of the women remarked. ''It's in the simple things that girls feel deficient.''

The chief problem with the course, according to Dean Burton, is its popularity. How and whether it can be continued or expanded is under study. The evening these pictures were taken, the class was receiving instruction in brazing and welding.

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1. Dean Burton demonstrates brazing techniques.

2. Cindy Loerch cools the joint she has successfully brazed.

3. Marise Lada tries her hand at oxy-acetylene welding under the supervision of instructors Mary Ott (left) and Carol Hall.

4. Instructor Tom Hall watches Pamela Errett do a job of silver soldering with a Bernzamatic torch.

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5. Practice in arc welding (in the background) and in welding with the oxy-acetylene torch proceed simultaneously.

6 and 7. Before and after: Dean Burton gives advice as Kathy Scanlon prepares to use a Bernzamatic torch for silver soldering; success! ("I used to watch my father do things like this," Kathy said, "but he never offered to teach me how. It never occurred to him that I might want to learn; in fact, it never occurred to me either.")

8 and 9. Jan Sun makes an initial attempt to weld with the oxy-acetylene torch, and is pleased with the results.

FACULTY PUBLICATIONS

The following publications and conference papers by faculty members and graduate students of the Cornell College of Engineering were published or presented during the period November 1974 through January 1975. Earlier publications inadvertently omitted from previous listings are included here with the date in parentheses. The names of Cornell personnel are in italics.

■ AGRICULTURAL ENGINEERING

Irwin, L.H. 1974. Transportation and national development. *ENGINEERING: Cornell Quarterly* 9(3):20-26.

Levine, G. 1974. Cornell's activity in tropical water management. *ENGINEERING: Cornell Quarterly* 9(3):35-40.

Loehr, R. C. (1974). Recycling of agricultural wastes. Discussion led at 23rd Annual Meeting of the Agricultural Research Institute, 14-16 October 1974, in Washington, D.C.

Reitsma, S. R.; Scott, N. R.; and *Shepardson, E. S.* 1974. Dynamic Responses of the Dairy Cow's Teat. Paper read at Meeting of the American Society of Agricultural Engineers, 10-13 December 1974, in Chicago, Illinois.

Scott, N. R., and *van Tienhoven, A.* 1974. Amines and body temperature. *American Journal of Physiology* 227(6):1399-1405.

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■ APPLIED AND ENGINEERING PHYSICS

Gilad, P.; Kusse, B. R.; and *Lockner, T. R.* 1974. Trapping of Intense Relativistic Electron Beams in Toroidal Geometry. Paper read at American Physical Society Conference, Plasma Physics Division, 4-7 November 1974, in Albuquerque, New Mexico.

Golovchenko, J. A.; *Batterman, B.W.*; and Brown, W. L. 1974. Observation of internal x-ray wave fields during Bragg diffraction with an application to impurity lattice location. *Physical Review B* 10:4239-4243.

Leiderer, P., and *Webb, W. W.* 1974. Scattering from ^{3}He-^{4}He Mixtures near the Tricritical Point. Paper read at International Conference on Light Scattering Studies of Motion in Molecular Systems, 16-20 December 1974, in Verbier, Switzerland.

Lewis, A.; Spoonhower, J.; Bogomolni, R. A.; Lozier, R.; and Stoeckenius, W. 1974. Tunable laser resonance Raman spectroscopy of bacteriorhodopsin. I. *Proceedings of the National Academy of Sciences (U.S.A.)* 71:4462-4464.

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Webb, W. W.; Herbert, T. J.; and *Elson, E. L.* 1974. Diffusive Transport in Lipid Bilayer Membranes: Measurement by Fluorescence Correlation Spectrosocopy. Paper read at International Conference on Light Scattering Studies of Motion in Molecular Systems, 16-20 December 1974, in Verbier, Switzerland.

Webb, W. W., and Johnson, D. H. 1974. Determination of the Strain Rate Spectrum of Turbulent Pipe Flow by Light Scattering from Anisotropic Probe Particles. Paper read at International Conference on Light Scattering Studies of Motion in Molecular Systems, 16-20 December 1974, in Verbier, Switzerland.

■ CHEMICAL ENGINEERING

Anderson, J. L. 1974. Momentum Transport by Electroosmosis in Submicron Capillaries. Paper read at 67th Annual Meeting of the American Institute of Chemical Engineers, 1-5 December 1974, in Washington, D.C.

Anderson, J. L., and *Malone, D. M.* 1974. Mechanism of osmotic flow in porous membranes. *Biophysical Journal* 14(11):957-982.

Naldi, L. J., and *Hedrick, J. E.* 1974. Marketing costs for chemical products. *Sales Management* 113(9):39-45.

Pendergrass, J., and *Scheele, G. F.* 1974. Rapid Coalescence of Liquid Drops at a Liquid-Liquid Interface. Paper read at 67th Annual Meeting of the American Institute of Chemical Engineers, 1-5 December 1974, in Washington, D.C.

Rodriguez, F. 1974. Lecture demonstrations of drag reduction. *Engineering Education* 65:245-246.

Shuler, M. L., and *Pimentel, D.* 1974. The Energy Requirement for the Production of Corn. Paper read at 67th Annual Meeting of the American Institute of Chemical Engineers, 1-5 December 1974, in Washington, D.C.

■ CIVIL AND ENVIRONMENTAL ENGINEERING

Belcher, D. J., and *Liang, T.* 1974. Airphoto interpretation and remote sensing: international aids in land and resource planning. *ENGINEERING: Cornell Quarterly* 9(3):27-34.

Bereano, P. L. 1974. Environmental Law. Paper read at Environmental Planning Conference, 9-13 December 1974, at Drexel University, Philadelphia, Pennsylvania.

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Brutsaert, W. 1975. Evaporation from water surfaces. In *Interfacial transfer processes in water resources*. Water Resources and Environmental Engineering report no. 75-1, pp. 99-114. Buffalo: State University of New York.

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Galwardi, E.; *Behn, V. C.*; Humenick, M.; Malina, J.; and Gloyna, E. 1974. *Recovery of usable energy from treatment of municipal wastewaters*. Report no. CRWR-116, Center for Research in Water Resources, Environmental Health Engineering, University of Texas at Austin, for the Texas Water Quality Board.

Larrabee, R. D.; Billington, D. P.; and *Abel, J. A.* 1974. Thermal loading of thin shell concrete cooling towers. *Proceedings of the ASCE, Journal of the Structural Division* 100(ST12):2367-2383.

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