Chapter Seven -- The Educational Development, 1863-1918 -- The Liberal and Practical Education of the Industrial Classes"

The leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.--The Land-Grant College Act, 1862

As the semi-centennial year, 1918, drew near, the University became more conscious of its achievements. Steady growth in buildings and enrollment, distinctions coming to the faculty, and vigorous campus life portended that Illinois had gained maturity. For those who could not themselves remember, old grade reminiscences filling many pages of The Alumni quarterly established beyond doubt that there had been remarkable progress in fifty years. Dean Davenport had in 1907 become intrigued by J. B. Turner's part in the land-grant college movement and raised the question whether Turner was not after all the "real author" of the Morrill Act, a question which President James himself attempted to answer in a monograph, The Origins of the Land Grant Act of 1862, the first serious study of the background of the University. A biography of Turner by his daughter, Mary Turner Carril, who had been one of the first women trustees, arose from the same inspiration and appeared in 1911. Both supported the thesis that the movement which had given a new basis to the American state university was the fruit of labors in which Illinois men were the
leaders and that the University of Illinois was to model the arch type among the typical modern state universities. By 1916 death also had drawn attention to the passing of the older University: Peabody and Snyder, 1908; Draper, 1913; Shattuck, 1915; and Burrill, 1916. It was time, as was planned in histories and pageants, to sum up the events of the first half-century.

The essence of Turner's plan had been to raise the commonplace occupations in which ninety-eight per cent of the population made their living to the plane of the learned professions. The theory of industrial education had called for collegiate training of a new and different kind, having the quality of both technical and liberal education, employing "practical" methods to achieve "practical" results, junctures, and suit the "wants and destiny" of the farmers and mechanics for whom he spoke. But Turner, long on philosophy and enthusiasm, had been short on specific applications. The federal act of 1862 and the state act of 1867 were no less a resort to generalities. The federal act leaned on the states for interpretation, and the Illinois law, paraphrasing the terminology, leaned on the federal act as though the purpose was clear. That broad foundations on which a university could be built were adopted, was to the, of Gregory and Willard Flagg. Gregory's taking seriously the idea of a university was a good omen, for the term "industrial university" was loosely conceived and probably not at all in the modern sense except by Turner, and in even his case with certain reservations. Many institutions bore the name and some nourished the hope, but there were no universities in America to suggest the standard when the Illinois Industrial University was conceived and established. It was well too that Gregory discovered for himself as

...
early as 1869 the nature of the German inspirations which were so vaguely represented in the land grant college movement.

Courses in the three suggested groups of instruction under the land grant act were technological, related, and liberal. These were well satisfied by the six departmental groups of agriculture, polytechnics or engineering, chemistry, natural science, trade and commerce, general science and literature, and military, all of which formed the prospectus. Other aspects of the early program gave the foundation the advantage of maximum flexibility, allowing the easy emergence of the worthy and practical. By 1874, at the end of the experimental period, the outline of the courses had survived the test of criticism. Four of the "departments" had already taken the name and some of the forms of colleges: agriculture, engineering, natural science (to which chemistry was added), and literature and science. Grouped under the colleges were ten courses (curricula) called schools: agriculture, horticulture, mechanical engineering, civil engineering, mining engineering, architecture, natural history, chemistry, English and modern languages, and ancient languages. There were two others unrelated to the colleges: commerce and military. Later, in 1873, the School of Domestic Science, the "woman's technology," was added, and in 1876 the art courses were reorganized to form a School of Art and Design. With these additions the curricula considered as part of the University courses reached a total of fourteen, better than twice as many as in the average land grant college at the time. Financial depression forced the suspension of the schools of commerce, horticulture, and domestic science, but those remaining formed the core of the educational structure until the 1876.

There had been other casualties. The elective system under which
the University opened, allowing students to choose their own subject, but that was all but abandoned by 1873, being listed as a possible course but hardly dignified by its designation as Course 0. There was a principle, remaining in the opportunity to choose one of the schools as the field of study, or if grades warranted, to add a fourth class to the three regularly taken each term. Also, during most of Gregory's regency, several non-credit courses which could be taken by anyone. Music, elocution, photography, telegraphy, wood carving, and other informal classes taught irregularly in the 'seventies were open to all who would pay the small fees. Of these, music and elocution were the only ones to gain stability and academic standing.

Graduation without degrees was abandoned in the tenth year. On this experiment one historian of the formative years of the land-grant college was to comment: "Such detached industrialism could not persist." But the granting of the B. S., B. L., and the B. A. did not alter the course structure except to impose an inferior status on commerce, military, and art and design, which were outside of the college organization. Students in these courses were later also classed as specials. Graduation by certificate, which was possible until 1891, became, in the words of Peabody, a kind of "side exit; usually used by those who find it inconvenient, for some reason, to pass out the front door." Degrees, however, were an impetus to the development of graduate study, for which only makeshift individual arrangements had been made after the appearance of the first "resident graduate" in 1889. N. J. Hicker, C. W. Holfe, F. A. Parsons, A. C. Swartz, L. O. Baker, and M. A. Scowell, all teaching
4. BT, '78: 80.
5. Ibid., '88: 207-208.
6. Ibid., '69: 69.
in the University or the preparatory courses, qualified for the bachelor's and advanced degrees in 1878, receiving the first M. Arch., M.S.'s, M.L., and C.E.'s. During the winter of 1879-1880 the faculty systematized the graduate study requirements, demanding an extra year in residence, or three years' systematic and directed study in absentia, and a thesis.

But the curious hope that the University would become the resort of mature men who would leave their fields and shops for its course of study and bring to fit the purposefulness of a modern post-graduate professional clinic and course, was illusory. The program had to be tempered to those who came; the local students whose college ambitions were met by the nearness of the University, those who came for the technologies but who had first to spend a year or more in preparatory classes; and a scattering of various others.

Instructional techniques had concerned Turner and his associates as much as subjects, but their ideas were hazy. It was easier, even for Turner, as late as 1872, to castigate text-books and recitations than to constructive suggestions. Audiences agreed when the speaker questioned the value of knowing the population and exports of Kamchatka or of being able to spell "pthisis" without hesitation. For all the purely negative and the vagueness, the idea was to get away from "book-learning" and to stress observation and practice, to learn by doing. To this movement the industrial university advocates contributed as much as any group. The belief that a manual labor system in some form was essential to the new institutions was the contemporary expression of the idea. Turner himself had no faith in manual labor per se, but for most others the reputed educational value of labor had
7. Faculty Record, Nov. 14, 21, 28, Dec. 5, 1879, June 4, 1880; not pagd.
the supposed advantage of being the only "practical" method which
would not "educate students away from the farm."

A manual labor system requiring two hours' daily service was
accordingly made compulsory in the spring of 1868. Students did
farming, tree planting, and the other odd jobs of campus improvement
for twelve and a half cents an hour. But the glowing anticipation of
happy students learning by their labor did not materialize. Instead
there was grumbling at low wages and endless administrative difficulty.
Even the voluntary system of the fall of 1868 failed. It was popular
only in the machine shop set up by Professor Robinson in 1870 and in
Ricker's wood or architectural shop in 1873, partly because of the in-
geniousness of the shop directors and of the natural interest of farm boys
in machinery.

The main purpose of the shops was educational, but strained fin-
ances imposed the requirement of self-support. Ricker reports that
the only instruction he received when he accepted responsibility for the
wood shop, was from a trustee who told him he was "expected to make the
damned thing pay." When Robinson taught mechanical engineering his
students entered the machine shop as part of their course in the third
year to test the theories of mechanical design, construction, and use.
Ricker had seen the Russian shop system at Vienna in 1873 and soon afterward adapted it to his purpose, requiring his architectural students to
build sample details and sometimes scale models of whole buildings.
After hours and during summers the two shop directors and their better-
trained students turned the shops into manufactories, building wagons,
windmill assemblies, coffee mills, or whatever other order might be
given them. Robinson had a thermometer graduating machine that was fre-
cquently made, and once an automatically directed helioscope was built
for a federal surveying agency. University equipment of all kinds was


built, saving thousands of dollars. The greatest triumph of the shops was a special Corliss-type steam engine which long powered the lathes and grinders, but the class of '78 clock is a close second. It was of novel design by Robinson and one of his protégés, Fred Francis, '78, and while in the west tower of University Hall ran by weights hanging down fully four floors. The clock, later electric motorized, is now in the Illini Union Building cupola.

The shops were interesting in other ways. The display assembled for the Philadelphia centennial exposition of 1876, together with that of the Russian government, was probably responsible for the widespread introduction of the Russian shop principle in America. And although the laboratory principle had independent origins, the shops were examples of the transition from the manual labor theory to the laboratory. The University catalogues, indeed, maintained for some years the distinction between "educational labor" (the laboratory) and "remunerative labor" (the work of the squads.) It would seem that the laboratory was the system for which the manual labor enthusiasts were groping.

Chemistry, the study closest to the laboratory method, and because more than any other subject it was expected to unlock the secrets of agriculture, was given good equipment the first year, and liberal appropriations made possible continual improvement, even to the extent of enabling Professor Stuart to travel to Europe for rare apparatus. The physics laboratory, opened in 1873, was similarly favored. More significant, however, as a methodological development was Burrill's early effort in 1869 to teach botany by laboratory methods and the microscope. His was the first botany laboratory used in regular instruction. Before many more years had passed he taught entomology similarly and introduced non-medical bacteriology, the latter the first instruction of its kind in America. The departments with laboratories were signi-


ficantly the strongest in the early University.

The method did not prove adaptable to agriculture or civil engineering. In the first the classes resorted to the fields, the barns, and the greenhouses, but the unorganized agricultural instruction prevented the development of any characteristic method. The most auspicious beginning was made in the veterinary science classes, for which Dr. H. J. Detmers conducted clinics as early as 1870. Civil engineers went out to the fields with their instruments. In the short-lived School of Commerce, Professor Snyder and his assistant, Fernando Parsons, '75, introduced a novel scheme to demonstrate business procedures. A bank with $200,000 mock capital was set up and each student was given $2,000 in token assets with which to imitate the customs of finance. Had there been a spirit on the campus, the battle of the methods might have been deliciously portrayed, so seriously was Illinois trying to be practical.

"Cabinets" or collections of museum specimens were also much used by the "practical" professor. In some cases more effort was spent in building up natural history collections and mechanical devices than was given to the library. Indeed, it had been supposed by many that the industrial university would supplant books with objects as the sources of its knowledge. Professor Stuart began the collection of minerals, and Taft, who also collected coins, added to it. Peabody's avocation was the butterfly and moth. Emory Cobb, one of the more wealthy trustees, purchased a large number of paleontological casts known as the Ward Collection. Gregory distinguished himself in trading and purchasing items from the foreign exhibitors at the various world fairs he attended. His own field was the fine arts, and he was to be inseparably linked with the Fine Arts Gallery. Burrill went on expeditions and exchanged objects of his searches with other botanists, courting to the far corners

of the state with a band of students in the summer of 1869 and went
with Raft to Honduras and lower Mexico in 1879. Ricker, more phlegmatic, contented himself by patiently accumulating a large file of
architectural photographs, sketches, and drawings.

Most of the objects thus gathered became departmental collections,
but there were also two special museums, natural history and engine-
ing, in large rooms in old University Hall. And lastly there were the
fondly remembered Auzoux papier mache models. The dissectible paper
horse, manikin, and greatly enlarged flowers, fruits, and grains of
the Parisian doctor were widely used in veterinary science, physiology,
agriculture, horticulture, botany, domestic science, and other classes.

But books were still necessary. Lectures were commonly supple-
mented by what early catalogues described as "books of reference" and
the textbook was the basis of most courses. It was difficult to keep
the library abreast of the rapid advance in knowledge when its chief
source of income was no more than the receipts of the matriculation
fees. The want of an adequate scientific literature was itself a handi-
cap. For lack of suitable texts Ricker translated and blueprinted
French and German volumes when there was nothing in English. Baker
was another inveterate user of the blueprints after the blueprint room
was fitted out in 1879. Some twenty to thirty-thousand pages were thus
processed annually in the middle 'eighties. Notebooks, a requirement
in most courses, were full and elaborate; some meticulously scribed
and decorated examples are still extant.

In nothing was there more experimentation than in examinations.
Some of the first finals were conducted as in English schools: a hall
was hired and the public was invited—but not for long. For a time the
students found reason for complaining in too frequent quizzes; then again,

because only the final was given. Probably the greatest extreme to which Illinois ever went was the custom of 1877 requiring the presence of a second professor at the oral part of finals, he being the guarantor of the first examiner's objectivity. Once determined, the final grade for every course was inscribed on the certificate which served as sheepskin until the diplomas signified the attainment of a degree. For the privilege of graduating, however, the fourth-year student also paid dearly with an oration or thesis which he was likely to be called on to deliver or summarize at the commencement exercises. The bachelor's thesis, required in some courses, was not uncommon as late as 1918.

But the mechanics of the educational organization do not tell the real story. The low entrance requirements, the elementary nature of the courses, the comparatively meager equipment and the limited resources lend themselves all too easily to a discouraging picture. The loyalty of the old grads, the Gregorians and those of the 'eighties, was of deeper root than the proficiency of an educational machine. Professor Forbes, who came as late as 1891, found that the inner tone of the University was that of enthusiastic interest in a great new movement of progress and reform in the field of higher education; that the members of the faculty felt themselves privileged and distinguished as joint initiators of this movement; and this spirit, too, I am told, animated the student body so that there was a life, energy, hopefulness, and self-satisfaction which one would not infer at all from the general and physical conditions under which the work was done.... The energy and promise were those of the sprouting seed of a unique new growth; the teachers felt themselves missionaries and exemplars of a new educational gospel; free beyond all precedent to enter upon and cultivate new fields.

Cheerful though they were, the lot of the early professors was anything but easy. Their hours were long, their duties many, and their pay low. The average salary of professors of the highest rank was in 1890 as it
20. Faculty Record, Oct. 12, 1877, I: 256.

had been in 1863, only $2,000, and for ten of the twenty-two years
it had been only $1,800; the full-time instructor's salary at its best
was an average of $1,300, and there were some who had to be content with
$600. Yet devotion to duty was as much a characteristic of the state's
university faculty as it was in the struggling denominational college.

Illinois had no single ideal. Its inspirations were highly eclectic.
Among land grant colleges, first Michigan Agricultural College and later
Cornell, where the aims were more nearly parallel, suggested the standard. The ideals of President Tappan of Michigan, who had found Turner
a kindred spirit, influenced both Gregory and White, Cornell's founder.
Then, when the "University of Illinois" ambition came to the fore, the
students and faculty more commonly looked to Michigan and Wisconsin,
both of which attracted many students from the state of Illinois. But
European influences were also strong. More than a fourth of the fac-
ulty of the Gregory period was trained in Europe or had received a large
part of their technical education there. Gregory himself took every
possible opportunity to spend his summers in Europe. When he could
find no professors of agriculture and architecture to his liking he
took two promising Illinois graduates, Silver and Hicker, to Europe
and installed them in the universities of Halle and Berlin. Never, how-
ever, was Illinois modeled on any one idea. When Miles, the profes-
sor of agriculture in 1875-1876, tried to introduce the Michigan system
in agricultural instruction and to force the rest of the University to
conform to it, it was Miles who left although he was the foremost pro-
fessor of agriculture in his day.

Gregory was himself an unusually able teacher, and like most early
land grant college presidents he chose to teach the "highest" subjects,
mental and moral philosophy, but he also taught history and economics. His were the first books by a faculty member and his proficiencies were sufficient to warrant favorable receptions whether the subject was education, psychology, or economics. The didactic method, in which Gregory excelled, found its antithesis in Burrill, whose classes were from the beginning organized on a system any modern graduate student would recognize. Burrill quickly routed capable students to the laboratory and they shared the honor of publications. Shattuck's classroom methods always excited curiosity. No one understood his grading system, and once he was ensconced in the swivel chair behind his desk he never left it even to spread a problem on the blackboard. But his calculus was letter-perfect. Snyder, who taught German and French, was least the scholar of the three who formed the faculty triumvirate of the first quarter century, but none would deny him an abundance of character and the power to mold it in others. The chair in modern languages, like that of mathematics, was not intended for a prima donna, but rather one who would impart sound, if elementary, proficiencies to young scientists and engineers.

James D. "Jimmie" Crawford, a Williams College graduate, was the master of the School of Ancient Languages and, after Gregory's resignation, the history courses. But with the predominance of engineering students his duties were not heavy, so he also became librarian and secretary of the faculty and for a time in the 'eighties substituted for Peabody as instructor of mental philosophy, a subject which the catalogues stated "requires much maturity of powers, and is therefore confined to the fourth year." Joseph C. Pickard, a Bowdoin graduate, taught English, but composition was not stressed until a new professorship of rhetoric and elocution was established in 1886 and James H.
22. The nature of the courses taught by Gregory is well preserved in notebooks, apparently transcriptions of lectures, of Hector H. Tyndale, '76.

Brownlee was installed. Rhetoric and military drill were thereafter the only inescapable courses.

The early chemistry was an adjunct of agriculture, but even after twenty years it could hardly be said that the connection was profitable to either. Analyses of soils, plants, and agricultural products were conducted in even the most elementary classes but beyond the determination of chemical compositions the objective was obscure. The problems set before the chemistry professors were often curious. As late as 1893 Professor McMurrice, as had his predecessors Stuart and Weber, had to content with demands for an exposition of "The Chemistry of the Hog," and to provide analyses of the fat and lean meat. Not until a special laboratory was opened in the Agricultural Experiment Station did chemistry emerge from its subservient role. But the chemistry taught, regardless of the problem, was sound and the department was considered strong. With little difficulty Arthur W. Palmer, '83, a rare genius who had gone to Germany to study with Meyer at Gottingen and Hoffman at Berlin, and Samuel W. Parr, '84, reoriented the department to its modern aim. There were, oddly, two departments for a time to justify two professors of full rank and the larger appropriations necessary. Palmer was made professor of a department of "pure" chemistry while Parr assumed the "applied" field of chemical engineering.

The natural sciences centered in Burrill and Forbes, though the latter did not come until 1884. Forbes' predecessor, Don Carlos Taft, had been well liked, and had filled the professorship of geology and zoology for eleven years, but aggressive leadership was not among his powers. Forbes' interests were, like Burrill's, in the problems facing farmers and fruitgrowers and other economic interests; economic and ecological zoology were fields in which Forbes placed Illinois among

25. Ibid., '84: 153-165.


27. See S. W. Parr, "Historical Sketch of the Chemistry Department," Circular of Information of the Department of Chemistry (Urbana, 1918), 13-29.

the foremost study centers in America. His monumental studies of the life of the Illinois River were begun in the early 'nineties, and before he turned his attention to other fields it was the best known aquatic habitat in the world. Economic significance of the studies came from the fact that at the time the river was one of the country's major fisheries. But Forbes was no teacher for the dabblers; his influence was felt most by his faculty associates and by advanced students who followed his profession. Easy-going and genial C. W. Rolfe, '72, who inherited the geology courses, was more popular among undergraduates. Rolfe had been a handy man to the University before he centered his interests in geology; he would have found it easier to list the subjects he had not taught rather than those he had.

Mechanical engineering, in which the foundations were laid by Robinson, was successively taught by Peabody, his son Cecil, who came to Illinois from a position in the Imperial Agricultural College of Japan, and Arthur T. Wood, an Annapolitan graduate on leave from the Bureau of Naval Construction. Robinson had also begun the instruction in physics and the course in mining engineering, both of which remained adjuncts of the professorship of mechanical engineering until 1885, when Theodore Comstock, a Cornell graduate whose career had included teaching botany, geology, paleontology, and other subjects, became professor of mining engineering. He had owned and managed mines and an electrical company, and was an explorer. But Comstock, who sought a more active life four years later, one which led him to the presidency of the University of Arizona and further experience in mining ventures, and his successor, Walter J. Baldwin, 1891-1895, found that their students in the mining curriculum could be counted on one hand. Between

1872 and 1811 there were only seven mining graduates, four of them in the class of '97. Physics made its first important progress under S. W. Stratton, '84, who began teaching it in 1880, but development was again arrested two years later when Stratton joined the faculty of the new University of Chicago, one step in a career that included the founding directorship of the U. S. Bureau of Standards and the presidency of Massachusetts Institute of Technology. But Illinois also remembers Stratton for giving the first systematic instruction in electrical engineering, a course organized in 1869-1870.

Both Shattuck and Robinson had taught civil engineering before J. Burditt Web, the first to hold the title of professor of civil engineering, joined the faculty in 1872. The stress on theory and mathematics which characterized Webb's contribution was still to be noticed twenty years later, though the professorship had passed to I. O. Baker, '74, in 1878. "Baker's boys," the G. E. 's were the largest single element in the University enrollment in the eighties and nineties. Many became widely known as outstanding engineers.

Jerome Sondericker, '80, and Arthur Hewell Talbot, '81, became great teachers, the first at Massachusetts Institute of Technology and the second at Illinois. Lincoln Bush, '88, founded an international reputation in solving difficult problems involving railroad bridges and roadbeds. Travelers to this day may be grateful to him for having designed the first "Butterfly" train shed which has replaced most of the great smoke-filled vaults once common to rail terminals. But the precedent for winning honors had already been set by J. A. Ockerson, '75, a specialist in cable control whose work won him decorations from the governments of Germany, Italy, Sweden, France, Belgium, and China in addition to the highest honors of his profession in America.
Ricker's department of architecture, which ranked with M.I.T.'s and Cornell's as the first in America, was not long in becoming the largest. Its growth was steady and sound, reflecting the qualities of its leader. Though Ricker's many duties included responsibility for the administration of the College of Engineering and the design of campus buildings, he was one of the first faculty members to publish a book based on research. By the time this appeared, in 1885, his students had already scattered from coast to coast. C. H. Blackall and J. C. Llewellyn, both '77, were noted practitioners in Boston and Chicago; G. W. Bullard, '82, was beginning a career in the Pacific Northwest. Henry Bacon, who designed the Lincoln Memorial in Washington, and W. A. Boring, who became head of the Columbia University school of architecture, were students during the mid-eighties. In the class of 1890 was J. H. White, who immediately on graduation became the second member of the department and in a lifetime of service to the University as architect left his impression in more than fifty buildings.

But little of the College of Engineering's early success was seen in the College of Agriculture. Illinois conformed to the general experience of the land grant colleges, of which had found a system which could raise the study of agriculture to the collegiate level of their ambitions. The fundamental issue as to whether agriculture was to be taught as a general subject or as one in terms of its component sciences was only compromised. Illinois was indeed more fortunate than most land grant colleges of the narrow agricultural stamp, for the appointment of Professor Morrow in 1876 had put an end to a decade of indirection and wrangling and had introduced a semblance of order.

Morrow normally offered five subjects: elements of agriculture, agricultural engineering and architecture, animal husbandry, rural
31. BT, '94: 76. Baker, Semi-Centennial History... Table 2, p. 52.


34. "John Augustus Oakeson, '75," ibid., 4 (April, 1910), 119-121.
economy, history of agriculture, and sometimes a sixth, rural law. Veterinary science, taught successively by Detmer, Frederick W. Prentice, M.D., and Donald McIntosh, V.S., was a one-year course with terms devoted to physiology and anatomy, medicines, and clinic. Horticulture, under Burrill, was hopefully begun with classes in the elements of horticulture, landscape gardening, floriculture, pomology and forestry, plant houses and management, but the scale was much reduced for lack of students in the 'eighties. In the general course there was little work outside of the classroom, but the horticulture classes devoted an estimated quarter of their time in the green houses and in such work as grafting and pruning. The course outlines were highly creditable; the deficiency was a lack of students and a lack of scientific informational content. Only six per cent of the enrollment was in agriculture during the 1880's and the percentage was declining. But there was also no science of and little science to contemporary agriculture. The sciences on which agriculture is based—botany, chemistry, genetics, and the others—were not enough developed to be of help. Before agriculture could rise, an organized body of information would be necessary.

The record in the accumulation of information was better. Once Burrill had discovered the bacterial origin of the fire-blight of pear trees there were few years in which he did not add some data on plant diseases. He was one of the first, perhaps the first, to recognize the nature of corn smut. Information of this kind gave a basis on which scientific agriculture would rest, but more was needed. The stimulation from the experimentation act (Hatch Act) of 1887 was thus sorely awaited. Among Illinois' early experiments under station auspices was one in which Morrow and his assistants, C. W. McCluer, '84, and F. H. Gardner, '91, proved conclusively that corn hybridization produced sturdier plants and better yield. But in the third year of the Hatch Act's operation the
A group of botanists were enroute to a convention when their train was forced to stop in the midst of a great cornfield. During the wait, some members of the party left the cars to examine the flora along the right-of-way. Gray of Harvard, foremost botanist of his day, saw an example of corn smut and asked if anyone could recognize it, adding, "Burrill, keep your mouth shut!" This story is repeated in most histories of early botany. A. D. Rodgers, American Botany, 1873-1892 (Princeton, 1944), 199.
College of Agriculture for the first time in its history had not a single entering freshman. A plan for a special preparatory course designed to "feed" the college was urged and discussed at length, but instead an equally ailing one-year farmers' short course was recast as a two-year "junior" curriculum. One hardly need note that it failed. Yet before the decade was out Agriculture was in the midst of a rejuvenation which gained for it the reputation of an outstanding college.

This was the older University. The strong personal ties it generated between students and faculty was one of its greatest achievements. With it were associated values which the modern system of specialization has lost, advantageous though the latter proved to be in other ways.

But with the increased demands for broader opportunities and the desire to offer more direct avenues to individual ambitions, the fixed course was giving way in other universities and colleges to a modified elective system. The broadly liberal qualities and the unity of the course system would again be sought, but during the 'eighties the vocationalism for which the land grant colleges had done so much was gaining momentum. Specialization and professional requirements represented forces which were to bring in an era of vocationalism in the liberal background subjects as well as the technologies. That the change (1889-1894) was relatively sudden at Illinois was due less to the conservativeness of the regent than to strained finances. For when the larger appropriations of 1889 and 1891 and the increased federal funds became available, the University hastily grasped at every opportunity to rebuild its educational structure.

The biennium beginning in 1889 saw the increase of the teaching staff of the University from thirty members to forty-three. Half of
The course of the School of English and Modern Languages, while not the most popular, may be used as an illustration.

### First Year

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the new members were in the College of Literature and Science, where
new emphasis was given to Greek, Latin, French, philosophy, psychology,
and pedagogy. There were new curricula not graced with the terminology
of schools in philosophy and pedagogy, electrical engineering, and Latin
and science, the latter a course comparing closely to the standard
liberal arts program of the time. During Burrill's first year as acting
regent a modified elective system was introduced, allowing students
in the College of Literature and Science considerable choice in selecting
subjects. In some engineering and science curricula the system
had no application. Course subjects were numbered and appeared under
departmental listings for the first time in the Catalogue of 1892. With
the new system came a shift accentuated by the adoption of the depart-
mental system administration in the next year. The new faculty appoint-
ments went to specialists. The day of the all-round instructor was passed;
the graduate school-trained man were given the leadership of the depart-
ments. Finally, the supposition that some departments existed only to
serve others closter to the aim of the University was effectively dis-
pelled.

The valedictorian of the class of '95, Milo Smith Ketchum, who be-
came dean of the College of Engineering in 1932, preserved in an auto-
biographical sketch some of the internal contrasts of the University at
the critical year of 1891, when he came as a freshman. His high school
was not accredited, so he had to take the entrance examinations. G. P.
Clinton, '90, an assistant, found Ketchum knew little about botany but
passed him because an engineer would have little need for it. Browneae,
the rhetoric professor, asked a question which he answered himself, told
a hollow joke which drew hearty laughter, and told the candidate he had
passed. It was possible to bluff. But George W. Myers,'88, valedicto-
44. BT, '92: 203-204; '94: 37.

45. Ibid., '92: 204; '94: 19.
orian and holder of a Manich doctorate in mathematics, who gave the
group a stern test, appeared so stern that Ketchum admitted ignorance,
though two years later he startled Professor Shattuck by answering a
final in integral calculus as quickly as the questions were written on
the blackboard. The new men were "tough"; graduate study standards
had made them so.

The newer professors also brought significant changes to the
courses. Studies which, like history, had been unchanged since the
time they were first taught, took their modern form. E. E. Greene
found on his arrival in 1894 that seven term courses were being taught;
a prompt reorganization resulted in new special courses on the Reform-
ation, the Puritan Revolution, the French Revolution, and an undergrad-
uate seminar in American history. Within two years the addition of an
assistant professor made possible a rich complement of ancient and med-
ieval history and two graduate seminars. In the same years Hinley raised
economics from political economy taught in a single term to six distinct
subjects in economics and two in sociology. D. E. Dodge, who came as
professor of English in 1894, introduced specialities in Shakespeare,
Icelandic sagas, and old English legal codes. But it was in the College
of Agriculture that the greatest contrast was to be shown. Davenport
in 1894 refused the title of professor of agriculture, choosing for him-
self the field of animal husbandry and later narrowed his professorial
title to the field of horticulture, the breeding of animals. When he
recount the courses of his college in 1899, more than fifty distinct
specialties were put in, each representing a semester or a year's study
of a subject. No land grant college had attempted anything like this
before, though all were to follow. There is little doubt that during
the early years many individual courses were highly diluted, but the
systematization of agricultural knowledge represented by Davenport's
plan of instruction was one of his more significant contributions to
the development of his science from the inchoate mass of fact and lore
it had been. More or less similar differentiation of subject matters
was going on in every college. Between 1890 and 1900 virtually every
course in the University was recast and reoriented toward new objectives.

Though in keeping with the ambitions of the University, the ex-
pansion of functions which also characterized the 'nineties was mostly
opportunist. The schools of Music, Pharmacy, Medicine, Law, Library
Science, and Dentistry were affiliated or organized with little compre-
hension of the difficulties there would be in integrating them in the
University system. It was not Draper, but the faculty of the College
of Medicine, who resisted further connections with other medical col-
leges, at least one of which had questionable medical principles,
and it would appear that the acceptance of the responsibility of main-
taining a vaccine farm in 1895 to provide state physicians with vaccines
was undertaken without knowing what was involved. The licensing and
regulation of certified public accountants, undertaken in 1903, per-
haps guaranteed that a high standard would be enforced, and encouraged
the prospective CPA to enroll in the newly formed accountancy courses,
but the function was purely regulative.

Behind all this was the idea of service, an idea at the heart of
the justification of the land grant colleges and public university.
During the 'nineties the University reached out as it never had before.
Professor Breckenridge, who came to reorganize the mechanical engineering
department in 1893, reported that his activities in 1898 included
tests of the Champaign cold storage plant, the street railway company's
equipment, and the Illinois Central Railroad's locomotives; that he
was about to make tests of the pumping stations at Aurora and Decatur,
the electric light plant at Bement, and the locomotives of the Big Four
47. ET, '00: 125-135. True, History of Agricultural Education, 240 et seq.

railroad. The chemistry department, under Palmer’s direction, began a survey of the waters of the state in 1895. It was Dean Davenport, however, who was able to develop the service function to its highest degree.

When Davenport came to the campus in 1894 he found the most common complaint against the College of Agriculture was that “it was not doing enough.” The experiment station was engaged in over a hundred and fifty experiments of one kind or another and had issued thirty-three Bulletins in the seven years of its operation, but the demand was for more. Davenport determined to take his college to the people if the people would not come to it. He became, as Morrow had been, a missionary. One of his ablest assistants, Perry G. Holden, the first head of the agronomy department, even became known as “the Apostle of Corn,” though his career at Illinois was brief. A series of annual conferences were organized, one of the first of which was the means of forming a Sugar Beet Growers Association; others followed, among them a Housekeeper’s Conference, first held in 1901. Because the Illinois State Farmers’ Institute, another Davenport organization, wanted it, a member of the college staff investigated the consolidated rural school movement. In April, 1902, soil surveys were begun in conjunction with the Bureau of Soils of the U. S. Department of Agriculture, and in the same year the experiment station began co-operative investigations with individual farmers. Exhibits were commonly prepared for stock shows. An especially significant one, prepared by Professor Humford to demonstrate market classes of beef cattle, was first shown at the St. Louis Exposition, where it won the grand prize. At cattle shows it was the center of greatest interest. Out of ventures of this kind was developed the characteristic extension program. The appointment of Fred R. Rankin in 1901 as institute visitor, the first full-time extension “director,”
51. Mr. Holden recalls that when he came in 1896 there were only sixteen students in agriculture, and "all but three or four of these were mental cripples who had been thrown out of the other classes because they did not have the capacity to carry their studies... There were two lone cows in the dairy department, and not a curry comb on the place." (Memoir, loose-leaf scrapbook, photo-engraved, dated April 10, 1944. Covers the span of Holden's lifetime, to date. Belleville, Mich.)
suggests the degree of organization in an early year. As early as 1902 the Agriculturist, the journal of the student Agricultural Club, complained editorially that the professors were overworked, and blamed "the spirit prevailing in our state to the effect that the Agricultural Faculty is a source from which information or service can be obtained at any time."

It was in the nature of the time to institutionalize each function. The extremes to which the principle of independent organization could be carried were indeed the reason for the reorganization of the state administrative system in 1917, for the legislature had increased its sponsored administrative agencies more than tenfold between 1895 and 1915. When Forbes began his studies of the marine life of the Illinois River at Havana in 1895 a special Biological Experiment Station was established "to represent the University and the state in an important field of scientific investigation; to do its part towards making the people of the state at large acquainted with the state itself; to stimulate and to aid the educational activities of the public schools in respect to the biological subjects and to reform, in some respects, their methods; and to put a foundation of precise and comprehensive knowledge of the system of aquatic life under the practical art of the fish-culturist, especially as this is represented by the operations of the Fish Commissions of our interior states." Having comparable aims were the State Laboratory of Natural History, the State Water Survey, and the State Geological Survey, all of which were state agencies but so much a part of the University that the distinction was mainly a matter of budgets. The agricultural and engineering experiment stations, while neither was entirely analogous, fell into the same category. Each agency had its own research funds, on which it drew for its series of bulle-
55. BT, '02: 122, 265.

56. The Agriculturist, 7 (February, 1902), 76.

tins, circulars, and reports. The effect was the creation of the presumption that the University was the state's scientific service department. This tendency was indeed encouraged during the Draper years.

There were weaknesses, however, which soon became apparent. Dean Davenport notes in his sketch of the reorganization of the College of Agriculture that until the Nelson Act was passed in 1907, providing $25,000 annually for collegiate instruction in agriculture, it seemed likely that the station program of research and extension would smother the college. "The need for and the results of research were more easily understood and of more immediate interest than was the problematical development of instruction," noted the dean. "The situation became serious..." Once the promotional values could be discounted, the issues were seen more clearly. In a presidential address before the convention of the National Association of State Universities in November, 1913, President James confronted an assembly of university presidents with the charge that the state universities, including Illinois, had allowed themselves to be "diverted by one force or another into doing things that we ought not to do--that other organizations of the state ought to be engaged in..." He had no difficulty finding examples: the Water Survey, the inspection and accrediting of high schools, and the library's custom of sending out "loan libraries" to less fortunate communities--a service which had been undertaken in the 'nineties at about the time of the experiment in extramural instruction. James was "aware that some people think our funds will be very greatly increased if we render this kind of service, so that the people get the idea that we are doing a real service for the state, instead of sitting locked up in our own chambers...." But this was not the function of a university. "We should be producing the engineer who will give the advice..., the analyst who will do this analytical service, and not undertake to do it ourselves."
58. Davenport, Rejuvenation of the College of Agriculture, 53.

The problem of organized research and service impinging on the larger one of the general educational development had come to faculty notice before 1904. Fifteen years of effort to build up the liberal arts, an effort begun in 1889 and which was one of the principal considerations in Draper's election to the presidency, had resulted in notable improvement and expansion but little alteration in the lack of balance between the arts and the technologies. The marked expansion of technical research and service functions had enhanced the relative position of the technologies, the requirements of which in terms of liberal arts instruction were elementary. Half the instruction given in the English department, for example, met the requirements of engineering and agriculture and three-fourths the courses taught in 1906 were "first-year" courses. Under these conditions, with funds and energies drained by service courses, there was little prospect of developing advanced liberal arts instruction commensurate to that of the technical vocational studies.

Thus the liberal arts divisions of the University were openly dissatisfied with the administration in 1904; Draper had no more than left the campus when the Senate joined them in reasserting to all the right to research and progress. Among several committees formed to study future development, one inquired into the functions of the University. In April, 1904, the Senate resolved that "the University is an organization for teaching and the advancement of knowledge." As teaching it included the instruction of students in residence, administrative duties, the diffusion of knowledge by correspondence and writing for the public press, the writing of textbooks, lecturing, taking part in educational and professional associations, and giving professional advice. Listed as advancement of knowledge were original investigations, studies in
applications, inventions, creative literary and artistic activities, and the collection of information. That scholarship must be emphasized by the next administration was commonly agreed upon, after a decade marked by an unparalleled expansion of functions. Draper saw this, too, and at the inauguration of President James offered the counsel: "Bring to this University the best scholars who can be procured in any part of the world.... Let the fact be established and let the country come to know that no more truth is likely to be dug out anywhere, and no better instruction provided anywhere, than at the University of Illinois."

Thus came about a new synthesis in the function of the University. The elements were not new; they had been present from the beginning in Turner's plan of 1851, in Gregory's plan of 1867, and in those hopes which led Peabody to win legislative assent to the name University of Illinois. But the forms in which instruction, research, and extension developed after 1890 gave rise to a type of University that was more nearly new than the one which struggled through the years of depression in the 'eighties. Strained finances and the determination to gain status as a college had brought about the setting aside of some of the more distinctive features of the industrial or people's university idea. Their re-emphasis in the 'nineties, together with a new vision of the university ideal, gave rise to the modern University. In the form it took after the twenty years (1889-1909) of reorientation the University of Illinois was a typical example of the American state university. There was reason to believe that it would become one of the best. Under the presidency of James, this distinction was soon accorded to it by the nation's leading educators.
62. Installation of Edmund Janes James... 441.
Guy Stanton Ford, professor of modern European history, 1906-1918, once said that other University presidents commonly greeted President James with congratulations on having assembled so many promising scholars on his faculty—the faculty list in the Illinois Annual Register was their first resource when they planned to add strength to their own faculties.

It would be easy to prove the essential truth of the anecdote. When Minnesota was looking for a dean to revitalize its Graduate School, Ford was secured. Two years later the same university was seeking a dean for its College of Education, and Professor L. D. Coffman was chosen. "His going makes a total of nine Illinois faculty men captured by the Gophers in two years," The Alumni Quarterly noted, "and the hunt is said to be still in progress." One of the nine who preceded Coffman was Solon Justus Buck, research associate of the Illinois Historical Survey, later archivist of the United States. Walter Costella Coffey, '06, professor of sheep husbandry, and C. W. Alvord, professor of history, are others. Deanships at Minnesota were only the first steps for Ford, Coffman, and Coffey; each eventually occupied the Minnesota presidency.

In political science there was a notable succession of "younger men" in Thomas Reed Powell, Walter Fairleigh Dodd, Robert Eugene Cushman, and Pitman Benjamin Potter which carried Illinois' reputation to other institutions. Comparable lists could be drawn for many departments. It was significant, however, that men of this type were not only in the technical fields and the sciences, but also in the arts.

The evolution of the courses of the College of Literature and Arts


may be traced largely through the development of its departments. There were three general landmarks: the adoption of the elective system in 1892, of the semester system in 1899, and of uniform requirements for graduation in 1903. Until the latter year the College had a general course in which the subjects of the first two years were formally outlined and those of the final years were elective. The other course was known as the Specialized Course or Group System, with less opportunity for electives, and calling for a thesis. The requirements adopted in 1903 combined some features of both, with at least eight semester hours' study in each of five groups: English and rhetoric; Ancient and modern languages; Political science, history, and economics; Mathematics, philosophy education, and psychology; and science-astronomy, botany, chemistry, geology, physiology, physics, and zoology. From among the subjects represented, one had to be elected as the major, for at least twenty-four hours' credit. The thesis was optional unless honors were sought.

The course structure of the College of Science was similar, registration in the two colleges being determined mainly by the choice of the major.

The rise of the arts at Illinois, however, is closely associated with the personalities of Deans Kinley and Greene and with the reorganization of the Graduate School. Kinley's aggressive leadership in Literature and Arts during the twelve years 1894-1906 secured financial support and organization, two elements which had been sadly lacking. In the six years that followed, Greene gave the college something of his own spirit of liberality, dignity, and scholarship, and showed the singularly happy ability of being a keen judge of those qualities in the men he selected to teach in his college. Those who knew him per-
66. See Catalog... 1902-1903, 71-77; Announcements, 1904-1905 (Register for 1903-1904), 78-82.
sonally remember a shy bachelor, absent-minded even beyond the pro-
verbial degree, a man utterly without guile whose judgment, never
forced on others, won the highest respect. Both types of leadership
were needed to create an atmosphere so favorable to the purposes of
the college that after more than a generation the period is still
fondly recalled as a golden age.

The Graduate School filled a need of the arts and science de-
partments which Engineering and Agriculture had met in the experiment
station organizations—the opportunity to train students for advanced
research and instruction. The selective principle used in deciding
what departments and professors were to be represented in the Graduate
Faculty stirred many a professor and department head to demonstrate
the higher standards of scholarship and to acquire the equipment which
brought about an early inclusion of their departments. Admission to
the select group was determined by a most careful review of past ac-
accomplishments and opportunities, only agriculture, botany, chemistry,
economics, physics, zoology, engineering, English, modern languages,
classics, history, and mathematics were considered qualified to 67
advance candidates to the doctorate. For worthy students the path
was made easy with a large number of scholarships and fellowships; in
1908 there were seventeen $250 scholarships for master’s degree can-
didates, eight $300 fellowships, two at $400, and three at $500.
Those who planned to teach, either in high schools or colleges, received
special consideration.

For several years the stimulation of better teaching was the most
evident aim of the Graduate School. Its program supplemented that of
the newly formed School of Education, and the development of the Summer
Session, which was mainly for teachers, had an important part. The
summer offerings were improved and made more attractive by bringing in

68. Graduate School, Annual Report, 1907-1908.
distinguished scholars as visiting professors. Scholarships exempting high school teachers from tuition helped to swell the annual enrollment from a little over two hundred, an average between 1901 and 1904, to 502 in 1906, 664 in 1908, and 1,028 in 1915. Education, the social sciences, the languages, and the sciences attracted most of the students, as was planned. Subjects reaching down through the whole public school system were emphasized. As outlined by Kinley in 1905, the idea was to intensify effort first in such subjects as promoted educational interests and citizenship, next in those auxiliary to research and scholarship, and then others as circumstances permitted. This plan was applied on a broad scale. The wisdom of it was apparent within a few years. The effects were cumulative. The dividends were better high school teachers, better student preparation in high schools, and for the University a planned development in fields offering the greatest return.

The first to be expanded was history. Both Draper and James were anxious to have a strong history department, both were interested in state historical activities, one as patron and the other as an active leader. Within ten years the staff recruited by Dean Greene was recognized as one of the ablest in the country. The senior in point of service was C. W. Alford, who had come to the University in 1897 as instructor in the Academy. Among those who were added later, in the upper ranks, were G. S. Ford (1906; to Minnesota, 1913), European history; L. M. Larson (1907), English history; Louis John Pastow (1907, to California, 1911), medieval history; W. S. Robertson (1903), Latin-American history; Albert Howe Lybyer (1913), European history; and Albert Ten Eyck Olmstead (1917; to Chicago, 1929), ancient history. Three of this group—Greene, Larson, and Ford—attained the highest honor of their profession, the presidency of the American Historical Association. But
Greene also found pride in a corps of younger men, instructors and graduate students, who were in the years just before 1912 monopolizing the prizes of the professional competitions.

Alvord's work was probably the most widely known. He discovered, in 1905, in two southern Illinois courthouses rich caches of documents of the state's French colonial period. Two years later he began publishing the selections from these and other documents illustrating state and regional history in a series of volumes known as the Collections of the Illinois State Historical Library. Under Alvord's general supervision members of the department and other historians of the state assembled fourteen volumes of source materials and bibliographic aids. The successful six-volume Centennial History of Illinois was another project which added luster to Alvord's name, as was the founding of the Mississippi Valley Historical Review, of which he became the first editor in 1914.

The work in Garner's department of political science developed along parallel lines. J. A. Fairlie (1909), the department's second member, won an early reputation as an authority on municipal and state government and as editor of The American Political Science Review (1917-1926). J. M. Mathews (1911) came from Princeton to develop the field of national government and international relations. Garner, who became founding editor of the Journal of Criminal Law and Criminology in 1910, was also specializing increasingly in international law, the field in which he was to find fame after the publication of the volumes on International Law in the World War at the close of the war. But it was Fairlie who was most widely known before the war, for on two occasions he had been pressed into service by state governmental agencies to do special work, first a comprehensive survey of the tax structure, and then one of the efficiency of the state's administrative offices. In the field
76. Greene to James, Pres. Corr., 1912-1913.
of local government Fairlie was one of the leaders of the Illinois Municipal League, the first headquarters of which were on the campus.

The fields of linguistics and literature, in which D. H. Carnahan, '96, T. E. Oliver, and E. C. Brooks were already established in 1904, were united in 1906 to attract Gustaf Karsten, a noted German-born and German-trained philologist who published and edited The Journal of English and Germanic Philology, the foremost of its kind in America. Karsten was to establish a center for the study of German culture, to enlarge upon the idea of an American Institute of Germanics which James had established at Northwestern. But Karsten died in 1908, and the departments of German and Romance languages were reconstituted under Julius Goebel, formerly of Johns Hopkins, Leland Stanford, and Harvard, and Raymond Weeks, formerly head of Romance languages at the University of Missouri. At the end of a year Weeks went to Columbia University. Goebel, a widely recognized scholar and leader of German-American cultural groups, was well adapted to carry out the ambitions for a Germanics center, but the plans failed to materialize. However, philology flourished to a degree equalled in few universities, state or private. The library requirements were met by a number of remarkable acquisitions. The Hayne Collection, five thousand items collected by a professor at Gottingen, was purchased in 1909; Karsten's widow gave his library; the Grober Collection, with over 6,300 titles, was acquired from the estate of a former professor of Romance languages at Strasburg. Scandinavian studies were begun by G. T. Flom, who came from the University of Iowa in 1909. J. D. Fitz-Gerald began his career as a student of Spanish literature at Columbia and continued it at Illinois after 1909. Jean Baptiste Beek (1913-1914) and David Simon Blondheim (1915-1917) focused interest on the medieval French song and on French etymology. Leonard Bloomfield, who arrived in 1910 from the University of Cincinnati, rowed

72. Northwestern University, President's Report, 1902-1904 (Evanston, 1904), 11-12. James to Weigl (president, Supreme Council, German Evangelical Church, Germany), Nov. 6, 1912, Pres. Corr., 1912-1913.
widely through many languages and became best known for a grammatical analysis of Tagalog texts. Kenneth McKenzie (1915), who came to head the department, expanded the field of Italian literature.

Greek and Latin, the despised of early years, were joined in a single department of Classics in 1903 under Barton's leadership. Barton (1889) and C. M. Moss (1891), who had led one-man departments of Latin and Greek through the reorganizations of the 'nineties, were joined by W. A. Oldfather and A. S. Pease in 1909, two young men whose research gave the Classics department a reputation far higher than the limited enrollment would suggest. An enviable library was assembled, and in 1911 Pease opened a small museum of Classical Art and Archaeology. A similar museum designed to exhibit the progress of European culture was set up in the same year by N. C. Brooks, the German department's authority on medieval drama. A few years later an oriental museum was begun by Olmstead of the history department. The three collections, which for many years continued to be quite small, were the nuclei of the museum in Lincoln Hall.

The department of English, representing a union of rhetoric headed by T. A. Clark, and English by D. K. Dodge, joined in 1907, was another department picked for special development. No department had to reconcile a wider divergence of circumstances and ambition. The masses which filled its courses were meeting requirements and regarded "rhet" and the elementary survey as chores, though the ambition set for the staff was to stress research in philology and creative writing. Chester Noyes Greenough (1907-1910) made a promising beginning in the achievement of the aim, but Harvard, from whence he came, would not let him stay away; Leland Stanford emulated Harvard in recalling his successor, Raymond M. Alden (1911-1914). The era of Sherman was then ushered in. Besides advancing to the front rank of popular as well as scholarly critics of

literature, Sherman proved himself to be an able administrator and a popular interpreter of James' vision of a people's university in the front rank of scholarship and research. Sherman soon had a following, a coterie which gave Illinois its first taste of a literati. T. H. Guild (1903-1914) in a fruitful decade stimulated interest in drama, and among the studies of philology and literature which emanated from the department those of Jacob Zeitlin are perhaps best known. But others were also to be numbered among the builders of the department: H. G. Paul (1901), who became the special mentor of a large group preparing to teach in high schools; E. C. Baldwin (1901), who traced Biblical origins in English literature; E. W. Scott, '01, the founder of journalism instruction; and others. Harrie Stuart Vedder Jones (1906), Harold Hillebrand, (1914), and Ernest Bernbaum (1916), came to the department later, and among the assistants there were for longer or shorter periods Carl Van Doren, '07, Allan Nevins, '12, and Gerald D. Stopp, '15, one of the first widely known radio drama impresarios. By 1917 forty were teaching the departmental courses and there were four large quasi-departments or divisions: Language and literature, Rhetoric, Speech, and Journalism.

While these were striking developments in the light of past history, the progress of other subjects and departments was also remarkable. The "dismal science" was not so dismal in its enrollment and popularity; by 1914-1915, the year before the organization of the College of Commerce, the department of economics was the core of eight special curricula: a general business course, one for commercial and civic secretaries, banking, insurance, accountancy, commercial teachers, and two in railway administration. Across the college boundary line in Science were the flourishing departments of mathematics, chemistry, botany, and zoology.

E. J. Townsend became head of mathematics and dean of the College
Of these, Rhetoric One had an especially vigorous development under Professor F.W. Scott, who began a weekly conference of the forty or so people who taught the one hundred to one hundred and fifteen sections. Scott's aim was to set up and maintain a uniform grading of themes by the many instructors, some of whom had been giving higher grades than others for work of the same quality. At each session carbon copies of several themes, exactly as written by the students, were given to all instructors, who graded them. Then a record was put on the blackboard of the grades given. They often varied greatly—from A to C or even D on the same theme. Those who had given the highest and lowest grades were called them, and discussion followed. The result of this long series of meetings was that each student, no matter whose section he was in, would get about the same grade as he would if he were in any other section.

Another, and perhaps more important result of these meetings was in relation to the high schools. In Rhetoric One the students were divided into three levels at the end of the first two or three weeks. Those unable to write passable themes who evidently had not the standard or expected high school level were put in "zero" sections and were taught according to their needs, until ready for regular sections. Some did not reach these until the second semester. There were sometimes more than two hundred students (out of the three thousand or more in Rhetoric One) in the zero sections. The flood of criticism from the high schools whose students had been placed in the subnormal sections was met by printing in a special issue of the University's English Bulletin a group of themes showing the minimum quality of composition expected from freshmen. A copy of this Bulletin and a special letter were sent to all the complainants. The response was immediate and appreciative, and the result was early and steady improvement in high school teaching of composition in the state. The plan was also adopted by several universities in neighboring states.
of Science in the same year, 1905. The college had lately reorganized its courses and was ready for expansion. In enrollments the increase was steady. The greater achievement, however, was the filling out of many special fields. In mathematics the five years 1905–1910 saw the addition of twenty-three new courses. The development of graduate study, though previously offered, is attributed to G. A. Miller, who came in 1906. His research and that of Henry Lewis Riets (1903–1918) in statistics; Arthur Robert Grathorne, '08 (whose bachelor's thesis was the first article from Illinois to appear in a mathematical journal, also in statistics); Ernest B. Lytle, '01, in algebra; Ernest Julius Wilczynski (1907–1910); and Arnold Emch (1911), who came from a Swiss cantonal college to fill out the field of geometry—all of these soon gave Illinois an unusual prominence in the literature of mathematics. After 1906 Illinois was one of the "big four" in contributions to mathematical journals. By the end of the period this reputation was further strengthened by R. D. Carmichael (1915), whose field was analysis and theory of numbers, and Arthur Byron Coble (1903), geometer.

In the astronomical adjunct of the department, Joel Stebbings (1903), who came from Lick Observatory, was finding a rich field for investigations in stellar photometry by using photo-sensitive cells invented by Professor Knipp of the Physics department.

When James invited W. A. Noyes to cast his lot with Illinois the president asked him, "Is it possible to build a strong graduate department of chemistry here in the Middle West?" Noyes was willing to try, and he soon discovered that the foundations of the department were strong. The dual headship, which had been shared by Palmer and Parr, was abandoned, though divisions like those in the English department were a logical development that quickly followed. In general inorganic and analytical chemistry there were three leaders: Noyes, C. W. Balke

76. Science, 90 (July 28, 1939), 75.
(1907-1916), whose interests in the rare earths were carried on later by B. Smith Hopkins (1916), and George McPhail Smith (1906). Organic chemistry, the fastest growing field, successively centered in the teaching and research of Richard Sidney Curtiss (1904-1915), C. G. Derick, Ph.D., '10, and Roger Adams, who came from Harvard in 1916. Physical chemistry, the third division, claimed the attention of Azariah Thomas Lincoln (1901-1908), Edward Wight Washburn (1908-1916), who turned his whole attention to ceramics in 1916, and Richard Chase Tolman (1916-1919). In physiological chemistry there were Herbert Sands Grindley, '88, whose primary connections were with the department of animal husbandry, where he was professor of animal nutrition after heading the chemistry department during the interregnum after Palmer's death. In the Water Survey and the division of sanitary chemistry Palmer's successor was Edward Bartow (1905-1920), likewise a holder of a Gottingen doctorate. Farr, who was the chief worker in the chemical engineering division, was concentrating on fuels and conducted his research largely under the auspices of the engineering experiment station. In 1916, when Farr completed his twenty-fifth year as a member of the departmental staff, he paused to note that in 1890 there had been but three members; in the quarter century the number had increased to sixty-two.

Zoology and botany were other departments in the College of Science which, though smaller than chemistry or mathematics, were distinguished in their leadership. Forbes, who had been dean of the college until 1905 and head of the department of zoology until 1909, found his duties as director of the State Laboratory of Natural History increasingly claiming a larger share of his attention. Retaining for himself only the professorship of entomology, Forbes passed zoology on to H. B. Ward, who after 1909 established for Illinois the reputation of being a foremost center in the study of parasitology. The studies of regeneration and genetics, begun in the same year by Charles Zeleny, also represented

78. Van Cleave, An Account of the Development of Zoology... 56.
a new turn of interest, and in 1912 the mature scholarship and reputation of John Sterling Kingsley, who had been since 1892 a noted student of vertebrate zoology at Tufts College, were added. In botany, Burrill turned more and more toward bacteriology while Charles Frederick Hottes, '94, gave emphasis to plant physiology. When Burrill retired in 1912 to devote himself to an ambition to find some way of extending the nitrogen fixing qualities of legumes to other species, his successor was found in William Trelease, another of the great names in American botany. Universities from coast to coast had been for years trying to get Trelease to leave the botanical gardens he had made famous at St. Louis, but without success until James called him to Illinois. Two years later the field of plant pathology, in which Burrill had made his greatest reputation, was turned over to Frank Lincoln Stevens.

The expansion of the collections of the zoology, entomology, and botany departments was one of the more notable pre-war developments. One of the largest gifts was the Bolter Collection of Insects, a well-cared for collection of 120,000 specimens of over 16,000 species which had been assembled by Andreas Bolter of Chicago. Forbes' state laboratory had filed some 330,000 pinned specimens and another 26,000 in vials. The collection of fresh-water mollusca was nearly complete, as were most collections related to the species found in Illinois. In the botany herbarium were about 66,000 mounted specimens of identified fungi there were about 32,000 more. Though the collections were mainly for taxonomic studies, experimental zoology was promoted by the opening of a vivarium in 1916 where colonies of insects and small animals could be studied under controlled conditions. But the most ambitious project of the University in these fields was its participation in the Borup Memorial Crocker Land Arctic Expedition in 1918. Jointly spon-
79. BT, *00: 304-305.

sored by the American Museum of Natural History, the American Geographical Society, and the University, the object of the party was to discover the existence of and to survey "Crocker Land"—some distant mountains Peary believed he had seen in 1906. Walter Elmer Ekblaw, '10, and Maurice Cole Tanquary, '07, were chosen to represent the University, and after suffering the hardships typical of early polar exploration, Illinois' two explorers returned in 1917 with a representative collection of arctic plant and animal life and other information of value to science.

But it was the College of Agriculture which carried farthest the spirit of the land grant college, stated by Dean Davenport to be "the spirit of service through the application of exact knowledge to the ordinary affairs of life." In its contributions to instruction, research, and extension the college virtually became a complete educational system answering almost all the needs which faced farmers and their families. That the college could undertake so broad a program was the result of the vision of its dean, of an able faculty, the liberal aid of the state and federal governments, and the unrivaled support of its constituency.

Nowhere else were the courses over ninety in number so highly particularized. Each of the four departments of the experiment station was larger than all but two stations in the country in 1905. The expansion that followed was unprecedented. In the sixteen years of the James presidency the college faculty increased from 37 to 131, the students from 404 to 1,215, and the budget from somewhat less than $200,000 a year to nearly a million.

To gain enrollment Dean Davenport had at first to adjust the courses to a level suitable for students who came chiefly from rural areas in


83. True, History of Agricultural Education, 240.

84. BT, '06: 113.

85. Sixteen Years at the University of Illinois, 212.
which the high schools were poorly developed. Until about 1910 there were many special students without the University requirement for entrance, and as late as 1909 the Carnegie Foundation implied that only the household science department gave instruction of collegiate grade. But among agricultural colleges comparisons were highly favorable. The condition of the college was determined partly by the opportunities open to graduates in agriculture; as these increased, the standards were raised.

The college program in the fields of instruction, research, and extension was highly developed and institutionalized, but to distinguish its activities by function rather than subject would violate Dean Davenport's most fundamental principle of organization. In spite of pressure put upon him by the federal Department of Agriculture and the custom of other institutions, the dean continued organization by subject to gain the interplay of understanding, stimulation, and inspiration at their best. Nevertheless, certain types of extension activity may be dissociated from a college and station program in its narrowest sense.

The short course and conference were steadily developed after Dean Davenport came in 1894. The mid-winter conference season of a typical early year, 1903, brought about a hundred men to a horticulturists' convention, sixty to the dairymen's, a hundred to the swine breeders', 250 to the corn growers' and stockmen's two-weeks' meeting, and another 250 to a housekeepers' conference. There was also a short course in butter-making. The first farmers' week program, which became the Farm and Home Week, was held in 1901. Youth work was begun in the same year by Fred Rankin, whose other duties are suggested by his title, institute visitor, and the new one he was given in the next year, superintendent of extension. Farm boys became interested in judging corn; a "corn school" for boys

87. BT, '18: 204.
was held as early as 1905, and in the next year A. P. Grout, a member of the Board of Trustees and farm leader, opened a special summer encampment for the same purpose on his farm near Winchester. In the same year the Burlington and Illinois Central Railroads placed "Soil and Seed Specials," demonstration trains, at the disposal of the college, and a little later the household science department outfitted a special car with mechanical appliances and other equipment which was moved about the state. This was the basis of a week's "movable school" of home economics. Lecturers of the household science department alone spoke to seven thousand women at such schools and another fifteen thousand at other meetings in 1915-1916. The year before the Smith-Lever Act went into effect twenty-one out of twenty-five members of the agronomy department took part in one or more kinds of extension activity, attending 234 meetings in sixty-five counties, speaking at institutes and judging at fairs and shows. There was enthusiasm for extension even among the undergraduates of the college: the Agricultural Club sponsored ten trips for eighteen students in 1915-1916. And capping the whole structure was a press service which furnished weekly printed matter, complete with illustrations, to press associations and state newspapers. Almost every rural paper in the state was using the information and some filled special sections.

Out of such activities grew the interest which led to the organization of the DeKalb County Soil Improvement Association and the Kankakee County Soil and Crop Improvement Association in 1912 and the Tazewell County Farm Bureau in 1913, the latter the first county organization of its kind in the country to use the name "farm bureau." The counties and those that followed employed advisors who in effect were liaison agents between the University and the county units. The Smith-Lever Act thus inaugurated no new work but emphasized the demonstrations, the youth's club work, and the county farm bureaus. The act added some

89. *Illinois Agriculturist*, 10 (April, 1906), 266.


93. Assistant Director, Extension Service, Memorandum, Feb. 11, 1943.

$80,000 annually to the agricultural budget and was administered through a special department, the Extension Service, under the direction of Walter F. Handschin, '13, of the department of animal husbandry who was given the title of vice-director.

In the number of years it claimed uninterrupted attention, the soil survey was the foremost project of the experiment station. The reports, usually issued by counties, began appearing within a few years after the inception of the survey in 1901. From this and the experiments connected with it arose the "Illinois system of permanent fertility," a doctrine of conservation virtually synonymous with C. G. Hopkins, though the survey itself was largely conducted by Jeremiah George Mosier, '93. Briefly, the assumption was that the soil could be maintained in its highest state of fertility by natural processes if a few basic raw soil-building materials were added when needed. This was the doctrine of "phosphate, limestone, and clover." Hopkins so thoroughly believed in it that he bought a tract of the poorest land in southern Illinois, named it "Poorland Farm," and set about to demonstrate it. He and Dean Davenport also helped organize a company to exploit a Tennessee deposit of phosphate for the benefit of Illinois farmers, but for fear of misinterpretation of their purpose they relinquished their financial interest. Another outgrowth of the survey was the selection and development of a series of experimental plots on typical soils where field crops, vegetables, and orchards were variously tested. By 1920 the University owned thirty such fields, twenty-eight of which had been donated for the purpose, and conducted experiments in co-operation with owners on an even larger number. On one such, in Saline County, the agronomy department demonstrated that soils producing crops valued at only $6.52 per acre could be made to produce $12.30 if manure and limestone were added. In Mason County, yields could be improved from $6.88 to $20.02
95. BT, '16: 125-126.

96. See Hopkins, *The Story of the Soil* (Boston, 1911), and essays in *In Memoriam, Cyril George Hopkins* (Urbana, 1922).

97. BT, '08: 266-269.
by adding potassium salts; in McLean County $5 worth of potassium raised the crop values from $18.84 to $29.88. The missing element of nitrogen accounted for the difference between returns of $12.88 and $30.35 from the soil of one field in Yancey County. Lack of available nitrogen had been early discovered to be a general deficiency of Illinois soils. Experiments resulting in the widespread use of leguminous crops were among the most important work done by the department in the years before the first World War.

Horticulturists, headed by J. C. Blair, tested and improved vegetable strains and studied the problems of orchardists. Two of the most widely grown varieties of strawberries commemorate the names of Burrill and Seantor Dunlap. Animal Husbandry was noted for its investigations in animal nutrition. One long series of experiments supervised by H. W. Mumford, the head of the department, concerned the market classes of cattle, sheep, swine, and horses and culminated in a bulletin on meats by Louis Dixon Hall, '99, which set the standard for the national system of meat grading. Another significant experiment in nutrition, aided by funds from the American Meat Packers' Association and supervised by five nationally known nutritionists, was a test of the effects of saltpeter cured meats on human health. Twenty-three boys, the Nutrition Club, commonly called the "poison squad," were subjected for seven months to bacteriological, biochemical, and clinical tests directed by H. S. Grindley. The experiment was voluminously reported in medical, chemical, and bacteriological journals and in Grindley and Ward J. MacNeal's five-volume Studies in Nutrition. The general information gathered was probably as significant as the announced proof that small amounts of nitrates are essentially non-injurious. An unusually large amount of data on normal human physiology and food utilization was assembled.
98. Agriculture at the University of Illinois: A Statement of the Work and Needs of the College of Agriculture and Agricultural Experiment Station (Urbana-Champaign, 1917), 4-6.

99. Ibid., 11.

100. BT, '08: 29, 100, 106, 362-363, 386-387.

The chief emphasis of home economics research was also on foods. Among the more important early experiments were those of Elizabeth Sprague, reported in 1903 and 1907, on the roasting of beef, which introduced the use of the meat thermometer and correlated time and temperature with the age-old descriptions of rare, medium, and well-done. Ruth Wardall, '03, who received the department's first advanced degree, and was Miss Bever's successor in 1921, became a specialist in the uses of yeast, while Nellie E. Goldthwait (1908-1918), the first woman in home economics to give full time to research, investigated the principles of jelling, and issued an important monograph on it in 1911. The department was also active in extension and was among the first—in northern states, the first—to parallel the farm bureau with county home improvement organizations and a system of home advisers.

The growth of the College of Agriculture as an institution of collegiate instruction is easily shown in simple statistics. In the thirty-two years between 1868 and 1900 there had been fifty-three graduates; between 1900 and 1916 there were 943. Of these, sixty-nine per cent were living on farms and were farming in 1917; seventeen per cent were in agricultural education or research; ten per cent in allied occupations; and only four per cent had left agriculture. Dean Davenport informed the legislature in 1917 with confidence: "Nothing is clearer than that the Agricultural College of the University of Illinois is accomplishing the purpose for which it was organized."

Illinois had no less enthusiasm for its College of Engineering when the arts and agriculture attained their full stature. Of the total enrollment at Urbana, the College of Engineering attracted more than half as late as 1910, and though the proportion diminished later, the steady increase continued. Research was not a source of the college's
102. Bevier and Sprague, Roasting of Beef, Agricultural Experiment Station, Circular No. 71 (1908). Sprague and Grindley, A Precise Method of Roasting Beef, University Studies, 41: No. 2 (Urbana, 1907).


104. Agriculture at the University of Illinois.... (1917), 29. The County Home Bureau in Illinois, Agriculture Experiment Station, Circular No. 253 (Urbana, 1922).

More general data on the department’s activities may be found in Department of Household Science, University of Illinois, 1916-17 (Urbana, University of Illinois Bulletin, 13 (May 22, 1918), No. 38.)

105. Agriculture at the University of Illinois.... (1917), 1-2.
reputation until some years after the Engineering Experiment Station was opened in 1893. Tests and investigations in behalf of industries also came late and were unimportant until the 1890's, when the influence of L. P. Breckenridge became apparent. There was a gradual change from the methods of the 'seventies and 'eighties which was less striking than the rise of the College of Agriculture but just as significant in its results. This change had three aspects: the development of engineering laboratories, the tendency toward curricular specialization, and the rise of research as a college function.

Laboratory instruction had lapsed after Robinson left the University in 1878, but was reintroduced in the field of mechanics by Talbot in the late 'eighties, and a hydraulics laboratory, probably the first in the world, was opened in 1893. By 1900 the development of laboratory instruction was unequalled among engineering colleges. Most of the space in the numerous buildings erected between 1894 and 1915 was devoted to laboratories ranging in character from the work tables of physics to the locomotive house in which a full-sized railroad engine could be run at full speed on an ingenious system of rollers. There were also the kilns of the ceramicists. The effects were notable. As early as 1896, using very meager equipment, Henry J. Burt, '96, reported in his bachelor's thesis experiments in the testing of bricks which resulted in a revision of trade standards. In 1913 Dean Goss and Bruce W. Benedict (1911-1927), the shop director, recast the shops into laboratories in which methods were tested scientifically with respect to efficiency and economy.

The trend toward the laboratory was one step in the revision of the engineering courses. New curricula in the early 'nineties in architectural, electrical, and municipal and sanitary engineering were, in the words of Baker, the college historian, the "first signs of the expand-

107. Ibid., 94, 130, 161-167.
ing life of the college. As the content of engineering subjects expanded, a tendency to replace the cultural background courses with technical specialities set in. A revision of the course structure in 1911-1914 had as one of its aims better opportunities to elect cultural courses, but was unsuccessful. In spite of other attempts at liberalization, among them required cultural reading during vacations, the engineering curricula remained the most highly specialized of any at Illinois. Ninety per cent of the graduation requirement had to be met in technical or related courses.

In the period 1900-1918 three new curricula were introduced, the first two in railway engineering and the third in mining engineering. In the ten years before 1905, unusual interest was shown in railway problems. The college had co-operated with the Illinois Central and Big Four railroads in building dynamometer cars and had acquired a special car to test electrical railroad installations. These cars were in use from coast to coast. Seeing an opportunity to capitalize on a potential service to one of the country's largest industries, President James E. Ryan, of his coming proposed the establishment of a school of railway engineering. The school and the department in which its activity centered was organized in 1907, and Edward Charles Schmidt, who had previously taught railway engineering courses in 1899-1903, was recalled from an industrial position to head the department. The appointment as dean of the College of Engineering of W. F. M. Goss, who had made Purdue the foremost center in railway studies, rather emphasized the new field. But the reputation of the department was built by its faculty's research rather than by its students, the number of whom was always small. Many of them were from China, Japan, and South America, for whom the faculty bulletins seemed to have more appeal. To most American students, railway engineering was not a recognized profession, and the pay received was comparatively low.
109. Ibid., 167-175, especially at 173. Senate Minutes, Dec. 16, 1913, 3: 75-79.


Mining engineering, a department and curriculum begun in 1909, was appearing among the University's courses for the fourth time since the 1870's. Hardly had the department been opened, with E. H. Stock as its head, and with a rescue station opened in conjunction with the Geological Survey and the federal Bureau of Mines, when the Cherry mine disaster showed in unmistakable terms the need for better trained mining engineers and for a comprehensive program of training in safety measures. The State legislature soon afterward recast its mining laws and provided liberally for miners' and mechanics' institutes (safety courses) which were placed under the supervision of the University. Board of Trustees. But the mining department remained a small one. Six years later, in 1915, the transfer of ceramics courses from the departments of geology and chemistry added another curriculum to the engineering group. A new department was formed, bringing the number to eleven.

The growing emphasis on research by the Engineering Experiment Station—illustrated may best be suggested by a rapid departmental review. Physics, headed by A. F. Garman, was distinguished by the acoustical studies of F. R. Watson, the development of photoelectric cells by Jakob Kuns, and the alkali vapor detector tubes perfected by C. T. Knipp, the latter two representing notable contributions to the development of electronics. The department of electrical engineering, separated from physics after 1897, brought forth computations of coil inductance by Morgan Brooks, head of the department, 1901-1909, and the discovery by Trygve Yensen, '07, of methods of preparing iron and iron alloys with magnetic properties far superior to anything previously known. Brooks' successor was Ernst Julius Berg (1909-1914), a bluff, hearty Swede who stormed when his juniors and seniors could not read the German literature. He had been a noted industrial consultant and was a stimulating teacher. Berg was in turn succeeded by Ellery Burton Paine, who had come


114. Garman to Kinley, Mar. 12, 1940. File "Contributions Made by the Faculty," Public Information Office.

115. James, in National Association of State Universities, Transactions and Proceedings, 1913, 45-46.
from North Carolina College of Agriculture and Mechanic Arts in 1907. Paine headed the department for thirty-eight years. On his retirement, W. L. Everitt, an authority on radar, from Ohio State University, took charge. Among departmental graduates many made their mark. R. E. Doherty, '09 rose in industrial laboratory work, was at one time known as "successor to Steinmetz," and later turned to the academic life as president of Carnegie Institute of Technology.

I. O. Baker, '74, who had been with the department of civil engineering as student, assistant, and professor since the early seventies, and head since 1879, retired in 1915; but when his successor, Frederick Haynes Newell, irrigation expert and formerly director of the U. S. Reclamation Service, returned to field work five years later, Baker again took charge. As in the earlier period, the department had no lack of students whose later records were distinguished. Merle J. Trees, '07, rose not only to head one of the country's greatest construction companies but also became a great benefactor of the University, giving a large and valuable art collection as well as serving as member and president of both the Board of Trustees and the Alumni Association. E. J. Nehren, '06, became an outstanding editor of engineering publications. C. C. Williams, '07, at one time headed the C. E. department and later became president of Lehigh University. Civil Engineering began the first college attempt at extension activity when Baker in 1913 sponsored the first annual short course in highway engineering, bringing together the state's highway superintendents, road builders, and other officials.

Mechanical engineering, one of the stronger research departments, was after 1898 successively headed by Breckenridge and C. E. Richards, who had built a strong engineering college at the University of Nebraska. When Dean Goss resigned in 1917, Richards was his appointed successor. The lifetime services of G. A. Goodenough, one of the country's fore-

most teachers of thermodynamics, and O. A. Leutwiler, '99, whose field was machine design, began in 1899 and 1903. O. A. Leutwiler, '99, whose once before given the University a president, added its second to the staff in 1913 when it made A. C. Willard assistant professor of heating and ventilation. In the combined departments of municipal and sanitary engineering and theoretical and applied mechanics administered by Talbot the addition of M. L. Enger, '06, in 1907 brought in another future dean. The same year saw the beginning of A. F. Moore's long association with the University and of the investigations in the effects of stresses and strains in materials which brought him and the experiment station much of their reputation.

Architecture was one of the departments of unusual distinction. In early 1912 high honors come to two of its former students, Henry Bacon, who in the 'eighties had received his only collegiate instruction under Ricker, and W. B. Griffin, '99. Bacon was selected as the designer of the Lincoln Memorial in Washington, and Griffin of Canberra, the new capital of Australia. In its instruction, the department placed unusual emphasis on the historical development of its art, a technique possible only with the unusually fine library. By 1917, when the collection was named for Ricker, the holdings included some five thousand volumes, ten thousand lantern slides, and a great mass of illustrative material. Ricker retired in 1910, but not before he had seen the department include five members, one of whom was his own student, J. W. White, '90. One of the most beloved members was N. A. Wells (1899-1919), who had come to decorate the old library and stayed to teach decoration. In 1910-1913 the department was led by Frederick Maynard Mann, who before returning to Minnesota, his alma mater, recast the course in conformity with standards set by the Association of Collegiate Architectural Schools, and later by Loring Harvey Provine, '03. There were already nineteen members on the


120. Baker, Semi-Centennial History... 188.
staff Provine headed in the pre-war period. Sidney Fiske Kimball, the architectural historian, taught for a year, 1912-1913, and left a historical sketch of the department.

By 1920, more than a hundred Bulletins had recorded the results of the investigations conducted by the Engineering Experiment Station. Of these, nearly a fifth dealt with concrete and methods of its reinforcement, representing studies begun by Talbot in the station's first year. Information he and his staff gathered by straining columns and other forms to the breaking point have guided engineers throughout the world. Moore's studies of the "fatigue" or progressive failure of metals when subjected to millions and even a billion jolts, flexures, and strains have similarly been classic experiments. Work in ceramics done by A. V. Bleininger in the early years resulted in discoveries which made usable the large deposits of Illinois clays which had been thought to be of no economic value. A process substituting cheap magnesia for costly tin in glazing was but one of several other economically important contributions.

Another series of experiments dealt with coal, one of Illinois' major industries. Professor Parr of the chemistry department carried on his research largely under the aegis of the station, discovering information on the chemistry of coal, its heating values, and storage, while E. C. Schmidt and the railway engineering department staff studied the use of coal in locomotives. Parr also became deeply interested in developing a process which would permit the coking of low bituminous coals such as abound in Illinois, one of the country's greatest reservoirs of this fuel. By 1916 laboratory results had shown that a low temperature coking process would not only produce coke, a smokeless fuel and essential raw material in ore reduction, but would also produce more volatile compounds than were obtained by the common high temperature
121. Ibid., 215-216.
122. Ibid., 157.
processes. The promise of this discovery was unfortunately not realized; Parr was unable to reproduce the small-scale experiment on a commercial basis.

In much of its research the staff had the co-operation of professional societies and of the state laboratories based on the campus. Active support from industries soon followed. The experiments with coal were first aided by subventions from railroad fuel and engineering associations, and later the Illinois Gas Association and a company interested in distilled byproducts. When the war presented its host of technical problems, the tendency toward co-operation was accelerated. The Engineering Foundation and the National Research Council quickly came to the support of investigations of the materials used in airplane and ship construction, and many other problems. That the College of Engineering was taking its place as a center of basic industrial research was further demonstrated in 1916 when the Association of Manufacturers of Chilled Iron Car Wheels offered funds for experiments testing the design and use of car wheels, and in 1918 when the National Warm-Air Heating and Ventilation Association sponsored studies of the efficiency of warm air heating. Co-operative research of this kind was to become a principal characteristic of station activity after the war.

The growing importance of research brought with it responsibilities which had not been foreseen. Until about 1914 it was believed that the benefits of research would be released to the public without restriction. That there was a larger duty not to be shirked, however, was brought to the attention of the trustees when Parr had the embarrassment of seeing some of his preliminary discoveries in cooking methods patented by an outsider, and when it became evident that commercial organizations were little inclined to develop processes and inventions unprotected by patents. Forced to protect both the discoverer and the public, the trustees adopted a rule in 1918, applying at
123. Ibid., 217-220.

124. C. R. Richards, The Functions of the Engineering Experiment Station of the University of Illinois, Engineering Experiment Station Circular No. 9 (Urbana, 1921), 1, 12-17. BT, '16: 884-885; '20: 3-5.

first only to the Engineering Experiment Station but extended in 1921 to all departments, providing for the patenting of promising developments and the assignment of controlling rights to the University as trustee to assure the maximum public benefit.

Until 1888 the reports of the Board of Trustees were the only formal University-sponsored publication in which research was reported. In that year, however, appeared the first Bulletin and in 1897 the first Circular of the Agricultural Experiment Station, setting a pattern that was commonly followed by the Engineering Experiment Station and other organized research divisions. After five years' discussion, the first issue of a general series, The University Studies, appeared in 1900. The contents were highly miscellaneous; Volume 1 included essays on the evolution of Lincoln's literary style, analyses of Illinois soils, methods of determining the digestibility of meat, and the origins of the Grand Remonstrance. Such a compilation could not be continued indefinitely. Three new series touching the social sciences, biological sciences, and languages and literature were begun between 1912 and 1915, resulting in the discontinuance of the University Studies. There was, however, an obvious need to co-ordinate the processes of publication, and to this end the University Press was established in 1918 after more than five years' agitation. In all, eighteen separate series of bulletins, circulars, and other publications were thus centralized, and provisions were made for the issuance of books. That there was a fertile field for publication was evident, for the faculty was writing an average of fifty books and five hundred articles a year by the end of James' first decade in the presidency. Under the direction of H. E. Cunningham, secretary of the Board of Trustees, editorial excellence as well as scholarship has marked the printed issues bearing the University imprimatur.

127. BT. '14: 596; '18: 747. Sixteen Years at the University of Illinois, 255.

128. Sixteen Years at the University of Illinois, 165.
The relation of research, instruction, and extension in the University was one of the vexing problems of the period which enthusiasm for expansion could not hide. In one college, Agriculture, the budget for research in the experiment station was normally twice and sometimes thrice larger than that of the college. Engineering and the Graduate School also had special funds. There was evidence, however, especially after President James' stimulation of productive scholarship, of a gap between the students and the faculty. The field of a professor's scholarship was often far removed from the courses the enrollment required him to teach. From time to time the Illini complained that teaching was being neglected; one of the highlights of 1916-1917 was the editor's campaign against "frenzied research." But the faculty also had a complaint: that student standards were low. Entrance requirements were steadily raised throughout the University and period. After 1910 mixed enrollments in the Academy and University classes were no longer allowed; there had been flagrant cases of students carrying college work to within a month of graduation before being able to meet the matriculation requirement. The Academy was itself abolished in 1912.

After 1905 several inquiries into the standards of student scholarship. The most notable took place in 1914-1916 and brought in several suggested changes. One result was the extension of examinations from four days to seven and the replacement of percentage grading with the familiar A, B, C, D, letter-grade system. An attempt was made to introduce the proctor system of examinations under the general supervision of the registrar, but student opposition forced the adoption of the honor system and its familiar pledge of honesty. But in other recommendations there was certainty in neither the committee nor the Senate. There was a growing reluctance to make changes. Almost all colleges had reorganized their requirements within the past five years. One new college, Commerce, was formed while the committee dis-

130. Report of Special Senate Committee on Standards of Scholarship in the Student Body (Urbana, 1910), and related correspondence and papers of E. B. Greene, chairman (Illinois Collection).


Discussions were in progress and it was understood that another Education would soon follow, as indeed it did in 1918. By April, 1917, when the colleges were to report the deliberations of their faculties there was a notable lack of interest and a pervading pre-occupation with war adjustments. One of the suggestions considered was to reduce the number of courses in the graduation requirement in favor of more intensive study. Another was to establish junior and senior divisions and to enforce the highest possible standards in the latter.

There was also pressure to co-ordinate research activities into functions, partly for administrative convenience and partly to publicize better the contribution through research. A projected Institute for Research, broad enough to include all research activities sponsored by the University, was discussed in early 1917, but its principal proponent, Kinley, found his general duties too urgent to push the plan in the face of some opposition. For such a reorganization the faculty was not ready. It was no doubt true that the University had become a great "foundation for teaching, research, and service," a phrase often used as the "only adequate" description of the modern land grant college and state university, but the faculty preferred to think in terms of the academic tradition; that a university's prime function must be to elevate the classroom—the community of scholars and students.

Many of the issues faced were in one way or another related to the phenomenal growth of the University. The enrollment had by 1917 increased roughly four times as many students as in the early 1900's when the existing organization was adopted. More than a four-fold increase had taken place in the faculty and the budget. Indeed, the Senate committee on standards of scholarship had viewed the increase of students with some alarm. The committee report, and other attempts
133. Report of Special Senate Committee... 14-20.
134. BT. '10; 204.
to bring about a reorganization, inferred that the institution was at a turning point and that the period of opportunistic expansion was past. But as to size, President James informed the University in the introduction of the semi-centennial history that there need be no fear:

We see a university now in which only a few of the subjects which have stimulated the human intellect and stirred the human heart are made the object of scientific study; then at the centennial anniversary we shall see an immensely larger number of subjects made the object of strictly scientific study and development, so that in every line of human life the largest possible enrichment will be secured...

There is, in fact, no limit to the possible numbers of a university organized on sound democratic self-governing lines; and there is no limit to the contributions to human civilization and welfare which the students of such a university, properly trained for their work as students, properly inspired and led toward higher ideals, properly caring for themselves in a way to secure physical, intellectual and moral health, may be able to make.

With questioning, and with this lofty new expression of an ambition less visionary than Jonathan Baldwin Turner's or of the governor who at James' inauguration had called upon the University to become as many-sided, broad, and diversified as society itself, the University of Illinois closed its first half-century.