CHAPTER EIGHT

SCIENCE WITH PRACTICE

Methods & Equipment

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If curriculum making was largely an untried adventure, methods of teaching were no less so. In addition to limitation of equipment and shortage of trained personnel, the undertaking was hampered and retarded by certain preconceptions, obsessions, and inhibitions that were inherent in the early industrial movement.

TEACHING COMBINATIONS

Teaching effectiveness, to begin with, was limited by incongruous subject combinations. The presidents—with the exception of Hunt, who seems to have had no teaching duties during his brief term—taught regularly the subjects that were supposedly their specialty and stray courses, theoretical and practical, for which regular provision had not been made. Welch's formal chair during his presidency was designated, successively, psychology and political economy, psychology and philosophy of science, and psychology and sociology, but his actual teaching extended to various other subjects. According to the yearly reports he actually taught, at one time or another, rhetoric, landscape gardening, German, word analysis, Shakespeare, stock breeding, elements of criticism, normal instruction, psychology, geology, political economy, history and philosophy of science, sociology, and history of civilization. Knapp on assuming the presidency had psychology and sociology added to his professorship of practical and experimental agriculture. As an alternate course to the sociology he taught English history. Chamberlain had the curious combination title of "professor of ethics and lecturer on practical

agriculture," and at Welch's death psychology and civics were added. Stanton, along with continuous administrative duties as secretary of the board or acting president, held the dual chair of mathematics and political economy. His teaching record also included English composition, commercial law, and sociology. During his year as acting president in 1881, General Geddes could report instruction in military tactics, freehand drawing, and bookkeeping.

The versatility of the staff often went beyond their title of record; the rule authorizing added service was frequently applied. J. K. Macomber added the librarianship and instruction in elocution and Shakespeare to his main physics department. F. E. L. Beal for a time joined vocation and avocation in his designation of "professor of civil engineering and acting professor of zoology." The humanities—all that was left from the president's offerings—had to be spread widely. Professor Wynn's simple title of professor of English literature received the addition of "science of language" in 1880 and was extended three years later—from the motive of economy rather than of "natural correlation"—to include "English literature, belles lettres, Latin, history and ethics." In whimsical reminiscent vein, in 1906, he recounted his dignities and responsibilities: "I came in, green hand that I was, clothed with the full dignity of a Professorship, being Professor of English Literature, Latin, History, Rhetoric, Grammar, Moral Science, Agricultural Theology, and everything else of a literary character that my Atlas-like shoulders were able to bear. Indeed on the first morning of my arrival Dr. Welch introduced me to the whole body of students, as one who would be responsible for the entire literary side of the curriculum, and for the chapel services on the Sabbath day."

TEXTBOOKS AND TEACHING METHODS

To judge by departmental reports and contemporary and reminiscent judgments of colleagues and students, teaching

methods were in general abreast of the times and in some cases involved notable innovations. An early announcement gave this sensible general statement: "The kind of instruction in these several branches varies with the nature of the subject and the views of the Professor in charge. It is mainly by means of text book and recitation in such subjects as Psychology, Geology, Mathematics, Physiology, Botany, Language, Engineering, and Physics. In Landscape Gardening, Agriculture, Horticulture, and in Veterinary Science, lectures are given. In Chemistry, to the text book and lecture, is added constant practice in the laboratory. In Surveying, in addition to the class-room work, students have frequent practice in the field." As everywhere, teaching effectiveness was hampered by inadequate and poorly adapted texts and books of reference. This was notably the case in the technical fields, where authoritative manuals within undergraduate comprehension were just beginning to appear in the seventies and eighties. Some professors at the College prepared manuals of their own. President Welch contributed a textbook on *The Sentence, a Psychology for Teachers*, and, in 1887, a *Syllabus of Short Histories of the Various Civilizing Forces Whose Progress Constitutes Civilization*—"arranged for the seniors of the Iowa State College of Agriculture and Mechanic Arts" and "printed by authority of the Board of Trustees" (very neatly at the Intelligencer Steam Printing House, Ames, Iowa). Bessey was the author of a pioneer college botany, Professor Stanton wrote a review book in algebra, and Mrs. Welch compiled a model cookbook and a *Manual of Domestic Economy*.

Professor Welch as a student of methodology in the eighties became a full supporter of the topical method (the current pedagogical panacea) as the great solution for organization and presentation of material in any subject. Following the report of the course of study committee in 1885, he introduced the following resolutions seeking to commit the faculty to his conviction: "1. That the prime purpose in education

is to beget in the student the power and habit of independent thinking. 2. That the best methods of instruction in processes that are purely mental supplies indeed abundant stimulant to effort but withholds all unnecessary help and throws the student so far as possible on his own resources. 3. That the topic method in recitation, where the student is left to make a complete statement without interruption is one of the genuine means of accomplishing this important result." The only record of action is that "on motion the resolutions were laid on the table." A report of the debate would be most entertaining if not instructive. In a group with as diverse subject interests and educational backgrounds, agreement on any one method was as unthinkable as that upon the old imponderable, "What knowledge is of the most worth?"

LIBRARY FACILITIES

There was criticism from time to time in student papers and elsewhere of too much lecturing, but without adequate texts the instructor was forced to use that method, while some, as always, could use it with the greatest effectiveness. Library resources, though necessarily inadequate, were for the time relatively good, and the availability for student use was liberal as compared with the older colleges in the East. The report for 1876–77 indicated the resources and aims: "The Library now numbers about six thousand volumes. It is made up almost entirely of new books, purchased since the opening of the College; they are bound in half calf, library style, and substantially covered with strong brown paper. These have all been selected with reference to the wants of the departments, the aim being to build up a working library which shall furnish the students and officers of the College, who are pursuing investigations beyond the ordinary text books, with the best authorities and works of reference. It is not the intention of the College to furnish in its library simply a means of amusement, and while its officers hope to see stu-

dents use the books freely, they expect that such use shall be in all cases with a definite object in view. As the student's stay in college is short, and his time consequently of the greatest value, he cannot afford to waste it in reading worthless books, nor even in desultory reading of good books. It is therefore urged upon students that they lay out for themselves courses of reading and study in the library, under the advice of the Librarian, or of some of the Professors. It is urged further that students make frequent use of the books of reference recommended by the teachers of the various college studies." That the number of volumes was somewhat inflated was indicated by the more specific report for 1880–81 which put the current total not counting duplicates and pamphlets at 4,500. However, lack of numbers, according to this report, was offset by value of the collections: "We have few government reports which usually figure by thousands in the enumeration of libraries. There are not more than a dozen books in the whole lot which could be called 'trash', and they are sent here gratis. The most valuable works in science, agriculture, mechanics, literature, and history, as well as the standard encyclopedias and books of reference, can be found upon our shelves." The initial appropriation of $25,000 supplemented by annual allotments of from $500 to $1,000 down to 1890 was wholly inadequate for supplying needed works of reference and essential sets of scientific periodicals. The collections were early enriched by some substantial gifts. In 1878 Dr. William T. Harris presented a complete set of his *Journal of Speculative Philosophy*. By the bequest of the noted horticulturist, Charles Downing, his professional library was given to the College in 1885.

Library administration was equally restricted. Student assistants were in full charge until the later seventies, when a professor in addition to his regular teaching schedule was given general supervision with two student assistants. J. C. Arthur in 1876 was the first regularly appointed librarian. He

was succeeded in 1879 by J. K. Macomber, who continued until his retirement in 1883. The position then fell to the assistant in mathematics until 1891, when it was joined to the duties of the professor of elocution. During Arthur's service a start was made in installing the Dewey system of classification, but the full classification with Cutter author designation was not completed until 1890. At that time the new librarian, Fanny Thomas, announced the special efforts made to acquaint the student with the resources of the library and to facilitate their use, which indicated an early effort at orientation. "The library work laid down in the College curriculum for the freshman class during the second term is proving to be a marked help to students. It is proposed to make the best methods of reading an important factor in the College course. Besides personal efforts, the library furnishes guides and reader's manuals which have been found most valuable in directing the reader. A course of lectures are prepared for classes on the following subjects: How to use the library, The Classification, The Best General Reference Books and Their Use, The Best Reference Books in Each Department. Students are trained to make their own researches—independent of librarian or professor—and are required to become familiar with the library arrangement. They have unrestricted access to all catalogues, indexes and shelves. The subject catalogue, with the analysis on cards, together with the cross-references shows at once all the library contains on any subject called for."

TEACHING ACHIEVEMENTS

With burdensome schedules, inharmonious combinations, and limited equipment, there were, according to the most creditable reports, notable achievements in teaching. Old graduates without recorded exception recalled the earnestness, piquancy, and thoroughness of Stanton's teaching of the fundamental courses in mathematics. Political economy, too, in

spite of the treatises of his time, was not with him a dismal science, as witness his approach to the history of economic thought: "Students in the senior year are permitted to take advanced work in economic science. Six members of the last class availed themselves of this privilege. A term of solid work (five recitations per week) was given to a study of the historical development of the science. The gradual growth of its leading ideas were traced, and their relation to the perplexing questions of the present shown. It is through such preparatory work that a study of the difficult economic problem of today can best be reached. It is intended hereafter to fully adopt this method." Regardless of the subject there seemed to be general agreement that "Stanty" was a "born teacher." Whatever the differences of opinion regarding Welch's administrative policies there was unanimity regarding his ability and effectiveness in the classroom. His lectures, whether in his special field of psychology, in the social sciences, or in the technical realms of stock breeding and landscape art, never failed to arouse serious interest. In his courses on the philosophy of science and the history of civilization, he anticipated the modern orientation survey. Barrows introduced the seminar method in teaching history, and both Welch and Barrows made use of syllabi.

Wynn brought to his teaching a detached culture that set his work apart and caused him and his lectures to be quoted in student papers and to be remembered with affectionate regard. He apparently gave much conscientious thought to method. After a trial of six years he felt that the special aims in the teaching of English literature in a technical college were "measurably attained." His supplemental title of "professor of the science of language" he sought to justify by presenting to the juniors in the agricultural and ladies' courses the philological controversy of W. D. Whitney and Max Muller, after which the students were "encouraged to draw their own conclusions." One would think that it would have required much

encouragement indeed. But the appeal of the professor was not in a particular method but in his emotional enthusiasm for his subject. Whether understood or not in lecture or sermon, there was no question of the lasting appeal of his personality. At his retirement a substantial purse was given him by alumni headed by Gurdon Wattles. In general science Bessey, Pope, and Hainer were known as strong teachers. Professor Pammel, though less systematic and exacting, had an enthusiasm for his work and an interest in individuals that awakened scholarly interests in some and a personal regard in most.

The technical subjects here as elsewhere involved pioneering in method of subject organization and presentation. The military department found a discouraging task in maintaining training befitting the skill and discipline of the soldier among country boys. The commandants' reports urged the necessity of military discipline, of regular uniforms, and an adequate drill hall. There were shifts in emphasis in the early years. From an elaborate course for all male students the training was made voluntary for a time. Then all but seniors were formed into companies with required uniforms. The only exceptions were for physical disability and, in a few cases, conscientious objection of students or parents. Sham battles, participation in parades and other celebrations, and policing of state fair grounds gave stimulating variety and piquant application of the drill. So attractive did the conduct of the department become that in the eighties the women sought this training as an added opportunity of the new education as well as an evidence of their equal status. They were formed into companies and proved highly efficient in executing the more intricate maneuvers.

In the early days of this, as of other land-grant colleges, there were frequent complaints that professors of engineering and physics had a professional rather than a teaching background and outlook, and that much of their instruction went

"over the students' heads." How much of this complaint was due to inadequate student preparation, especially in higher mathematics, rather than to unsound pedagogy remains a question.

Agriculture and allied fields were even less organized and systematized. Stalker was a highly competent and unusually interesting teacher, though his wide range of subjects prevented any approach to specialization. Budd was not a formal or exacting teacher, but he had an enthusiasm that aroused an interest in horticulture even with the naturally indifferent. Roberts, with a background of thorough academy training and practical experience, combined both effectively when almost literally called from the plow to the desk. His informal lectures and demonstrations were characterized by an appreciative alumnus as a sort of farmers' club. Like all effective science teachers, he was able to interrelate principles and practice.

Knapp's rare skill in combining the teaching of principles with practical applications, which was to place him among the great applied science educators, was already in evidence. Quite in contrast was his successor, Loren P. Smith, whose training and interests were more in general science than in the technical fields and who as an easterner was unfamiliar with western farm methods. Some of his essays into the practical, like his demonstration of harnessing horses, were sources of much amusement to his students. He was regarded as an outsider unconversant with the problems and technique of Iowa agriculture. Such criticisms were not wholly just and fair, as some of his students came later to recognize; the young professor was seriously handicapped by inadequate equipment and the inordinate number and variety of subjects he had to teach.

Domestic economy was a wholly undeveloped field in which the instructor was forced to blaze her way and at the

same time provide the implements and devise the methods. Mrs. Welch supplemented her practical experience by study at the School of Maids in London where she was mistaken by fellow students for a servant in training, with a supposed professional expert in New York City, and by visitation of the leading proprietary schools of cookery. She felt that her subject was especially handicapped by a lack of understanding and appreciation of its nature and importance. There was thus the necessity for effective and striking appeal without the organized information and tried methods essential to that achievement. Her zealous efforts were detailed in her report for 1882–83. "With no text-books, no works of reference, absolutely no thoroughly classified and systematized knowledge to be obtained in this department of instruction, how can this be accomplished? Only by the most persevering study on the part of the teacher, joined to a genuine love of the work and a thorough belief in its importance. She must search through many books for a few items. She must arrange these in proper order. She must try every recipe before bringing it to her classroom, and give to her students not only its materials and method, but as nearly as possible the whys and wherefores of every step. She must know all about food history, the comparative economy of special foods, including not only the first cost, but the amount of nutrient supplied and the lasting quality of such nutrient. She must look up food adulterations. She must give advice as to market supplies both as to price and quality. She must know the parts of a beef animal as well as the butcher who sells them; in short she must post herself thoroughly on all questions concerning every article of food she handles. The food supply of Iowa is abundant in quantity and excellent in quality, but comparatively limited in variety. Beef, pork and poultry, milk, eggs, and the hardier fruits and vegetables compose our staple articles of food. Since variety enters very materially into the question

of digestion and assimilation, it has been my aim to give as great a number of simple methods of preparing and combining as possible. This has also required study and practice. Every hour's work in the college kitchen with my class represents many hours of hard labor in my own study and kitchen."

In the study of general housekeeping there was an attempt to give practical motivation along with a social welfare indoctrination. According to the official report the sophomore class "took notes from lectures on 'Arrangement and Furnishing of the Home,' 'Drainage,' 'Water Supply,' 'Management of help,' 'Care of the Sick,' 'Sewing and Mending,' 'Management of Children,' 'Household Accounts,' 'Care of Health,' 'Courtesy,' 'Hospitality and the Etiquette of Entertaining,' and a variety of kindred topics. They also wrote essays for which I dictated subjects and recommended books of reference which they were to consult and take notes from. The following are some of the topics given them for such essays: 'Education Necessary to the Skilled Cook,' 'My Model Kitchen,' 'Slovenliness a Sin,' 'Economy a Duty,' 'Pure Air a Necessity,' 'My House and Its Situation,' 'My Cleaning Days,' etc., etc." In the introductory lecture of her course for juniors in 1876, Mrs. Welch made a strong plea for the recognition of the social utility of the training, in the College and throughout the state:

"If the Iowa Agricultural College can graduate young ladies with finely cultured minds, with hearts truly refined and womanly, and with a correct notion of a happy home added to a complete preparation for its actual management, it will do a grand work for the World. . . . How great would be the popularity of your Alma Mater, if after graduation you should each go home and astonish your Mother by saying, 'I mean to make a skilled housekeeper. I am going into the kitchen and learn to cook; I shall do the fine ironing or I will make and mind my own clothes. You shall rest, Mother dear, and I will show you what a sound, sensible practical education the Iowa Agricultural College gives earnest young women.' The fame of our College would go abroad to such an extent that appropriations for new dormitories for girls would come rolling in. No legislature could deny our

requests and a cry would come up to us from all the mothers in our state, 'Take my daughter, and mine, and mine.' "

In the late eighties and the nineties Mrs. Owens was stressing primarily the home-making function: "The whole interest and purpose of the present instructor is to secure to the students a knowledge of practical and systematic methods of rendering home a pleasant and healthful abode. . . . The essays prepared by the sophomores and juniors as part of their work in the department, calling for synopsis of subjects taken up in the lecture room during the course, and calling for some originality in matters pertaining to the adaptation of home work to circumstances and individual taste, have, with very few exceptions, shown such intelligence, good judgment, common sense and true womanliness, as promise much for the homes over which they may in the future preside." As in the case of the practice work in shop and on the farm, there was the effort to further the various aims, instructional and otherwise, through the activities of the kitchen and dining hall.

MANUAL LABOR REQUIREMENT

In the establishment and formative development of the A. and M. college, required manual labor was regarded as an essential, distinguishing feature. The full application of this system was a test of the soundness and good faith of any "agricultural college." This requirement, as has been noted, was given a major emphasis in the dedicatory addresses, and in early reports Welch expressed gratification at the successful operation of the system. To many who were doubtful of certain features and policies of the College the labor part was a saving element. In the legislative investigation of 1874 the statement of a recent girl graduate that she had paid her entire way by work at the College and teaching in the winter was received by the senatorial interrogator with "God bless

you and the College"—and the official reporter showed his spontaneous approval in taking the liberty to echo and record, "Amen." "Father" Clarkson of the *State Register* was especially elated over the training of the girls for practical work of the household. Upon the announcement of the cooking requirement in 1877 he wrote: "Good! The day dawns." And in commenting on the exhibit of a model kitchen at the State Fair in 1880, he asserted that Mrs. Welch was "doing more to improve and elevate domestic economy than all other influences in the State . . ." All descriptions of the College during the first two decades gave special emphasis to the practical training for farm and farm home. The President's early reports were not only favorable but enthusiastic, and he even chided a professor for referring to the system as compulsory when the service was sought so eagerly.

DECLINE OF THE SYSTEM

But doubts soon developed. Students were more eager to earn than to learn, and at times their ideas of their earning capacity were unbounded. Welch cited the case of a boy who proposed not only to meet all his expenses but to send something to his family. The organization of the system involved complications. Effective supervision required more time and effort than staff members could devote to it. The squad organization was soon abandoned. The special detail was the service most sought as it provided more certain remuneration and generally more pleasing work. Such assignments were supposedly made strictly on the basis of competence, but there were many complaints of favoritism. The student labor, especially after the early campus and farm developments were completed, could not be carried on economically. The labor periods were too intermittent, and after the early enthusiasm, student application proved too indifferent to carry on the regular farm work promptly and effectively. Most serious of

all for a college, the effort to combine remunerative and educational work was not feasible; as the President confessed, labor that was instructive was impossible to provide in adequate amounts. This brought criticism from the original industrialists. As early as 1873, at the meeting of the State Horticultural Society, Suel Foster complained that the intent of the law in making the labor service educational in character was being defeated. At the same time another prominent member, C. E. Whiting, expressed feelingly his disappointment and disillusionment: "This Agricultural College was with me a cherished pet. I thought of it by day and dreamed of it by night. I went over there and saw it fairly inaugurated with feelings of mingled pride and hope as to its birth and future. I urged our boys and girls to go there to learn what? To wash dishes? to throw dirt out of the big college ditch? to wheel dirt and brick? Surely this was not my idea of the labor of an agricultural school. And yet I am sorry to say that so far a higher educational order of labor has not been inaugurated." Others expressed themselves to the same effect, but no one explained how under the system as they understood it instructive labor could be provided. The failure to solve that problem led to gradual abandonment.

In 1876 a distinction was made between instructive and non-instructive labor, the former was to be performed without compensation. In 1880 the service was maintained only in the freshman year, and four years later the requirement was abrogated. There were protests from the old timers against abandoning the essential and distinctive feature of an agricultural college, but the general recognition of the unworkableness of the old survival from the manual labor school opened the way for more effective methods. The constructive influence in the passing of manual labor as an educational device was the prevalence of the laboratory methods. The formative years of the College's history marked the transition from the instructor-

demonstrational to the student-manipulative experimentation. The College not only kept in step with the main trends of this development in the basic and applied science fields but made certain distinct contributions to it.

THE LABORATORY ARRIVES

Chemical instruction was on an experimental basis from the start, in accord with Eliot's method at M. I. T. But with undue zeal for practical motivation, the young instructor had the students in organic chemistry make bluing, ink, gun powder, and other articles of common manufacture. Dr. Foote thought mistakenly that he was the first in the country to teach organic chemistry by the laboratory method. According to his complacent report, "Sugar was made from sheeting and saw-dust; starch was extracted from potatoes and grain; fruits were analyzed; parchment was made from paper; gun-cotton and collodion from cotton fibre; ether, chloroform, and alcohol, were manufactured, nitro-glycerine was made from glycerine, which had been extracted from fat; hard, soft and transparent soaps were made, etc., etc. Special experiments of considerable interest were performed with the various substances used by bakers to adulterate bread, and with the volatile ethers, some of which are used for flavoring, and others possess remarkable anaesthetic properties." Apparatus was so limited that in the class in quantitative analysis there was but one analytical balance which had been borrowed from the state geological survey and "but a few of the most careful men in the class were allowed to work with it."

The real advance came with an experienced science teacher, Thomas E. Pope, who was surer of his methods and more restrained in his claims. In 1920 Professor Pope wrote of his pioneer work in the department: "When I taught there we labored under many difficulties, lack of equipment, money, and too few instructors, also we had but few books for reference and were far from any library. I believe I was the first to

have students do quantitative work and equip the laboratory with analytical balances, each year I bought at least one expensive piece of apparatus for the use of the students and so was enabled to increase the efficiency and scope of their work, and while I know you have progressed in equipment, teachers, and fame I do not think the students of late years can be more earnest than those I had. I was proud of their work and know it was the splendid showing made [*by*] the students whom I sent to be assistants in chemistry at the Massachusetts Institute of Technology that was the cause of my being called to that institution."

Professor Bennett, writing in modern terms, aimed "to unite more closely the laboratory practice with the class room work. The laboratory practice is manual training, is sense training, and should be the highest mental training. The endeavor is to make this practice the means of making clear the statement of text or lecture. Experiments are not performed for the student, but by the student."

In natural history there was provided at the beginning a "museum" that Bessey later characterized as a "marvelous collection of birds and beasts and insects which some trustees with more zeal than knowledge had squandered hundreds of dollars upon." A visitor remarked that the collection was not an image of anything in heaven or on the earth. A real museum in botany and zoology was collected by Bessey, Beal, and Osborn. In the eighties the College missed getting the extensive Hornaday collection for lack of funds for mounting. The collection of this famous former student went instead to the State University. Bessey's own special contribution to science instruction at the College was in establishing "the first botanical laboratory of the United States for undergraduate instruction." He wrote to W. J. Beal of Michigan in 1877 regarding his experiences: "A college which proposes to keep up with the current must provide botanical and zoological laboratories. The college which does not provide such

laboratories will fall behind the progressive institutions, at least so far as the biological sciences are concerned. A botanical laboratory is just as necessary for the proper teaching of botany, as is a chemical laboratory for chemistry." Osborn was largely responsible for parallel developments in zoology and entomology.

In engineering the civil branch had the direct opportunities of surveying and field work, but the mechanical was dependent in the early years upon a small machine shop, in which the power was provided by a simple Corliss engine run by a student "detailed" for this service. In the eighties testing machines and other laboratory equipment were provided.

Domestic economy made its contribution in 1877 in "the establishment of the first experimental kitchen ever opened in any college" which, as Mrs. Welch observed, was the girls' equivalent of the work shop and the farm. The enthusiastic founder thus described its operation: "Practical instruction is given in bread, biscuit, cake and pastry making; cooking of meats—broiling, roasting, boiling, etc., including beef, mutton, veal, ham, and the dressing and cooking of poultry; the preparation for the table of vegetables, of desserts, and the canning, preserving and pickling of fruits. The teacher remains with the class during all the hours of practice. At each session the cooking of some new dish is carefully taught and the class take notes and assist the teacher. At the next session material is supplied and a certain number detailed to do the same work unassisted. If the material is spoiled, it is paid for by those wasting it and the same work given over until successfully performed. Thus each member of the class becomes in turn responsible for each kind of cooking."

By the eighties the output of the kitchen had apparently reached a degree of standardization, as the instructor reported that throughout the term "bread and yeast are made at every lesson, and it was our good fortune to furnish bread once a week to Professor Bessey's family. You can find out from them the quality of this bread. We also provided some part of their

dinner twice a week for nearly the whole term." By 1889 Mrs. Owens could report that the "results of the laboratory practice in all the classes have been most satisfactory, showing interest, care, and many times culinary skill."

Roberts' informal agricultural teaching involved using "materials at hand" and the making of direct observations. Weeds were gathered for identification, skeletons of farm animals were disintered for anatomical study, crops were observed by walks about the farm, and comparisons made by trips to neighboring farms. Knapp continued the practical observational and demonstrational work believing that agriculture should be taught largely by direct observation and participation in its practices. The college creamery built in 1879 served not only for experimental purposes but as well for undergraduate instruction and practice in the operations of dairy industry.

EARLY RESEARCH

These methods both in the general and technical fields indicated an awareness of what was going on in college teaching and in the development of science. Continued advance both in methods and content was directly dependent upon research programs and activities. From the beginning it was assumed by this, as by other land-grant colleges, that the law authorized experimental work, and it was started in a modest way. The State Horticultural Society was especially concerned to get orchards and forests established. They secured one of their members as the first professor and when he proved not sufficiently active sought others. Their addresses and memorials in turn chided the College for lack of activity and recommended increased appropriations. When their secretary, J. L. Budd, became professor they were especially solicitous. Budd's Russian expedition in 1882 for fruit and shrubs suitable to Iowa climate was financed in part by the society. The venture proved only partially successful, as the Iowa seasons developed the fruit too early and considerable misunder-

standing arose with the society members—an illustration of the complication involved in such outside subsidy.

Botany from the earliest days developed a program of research that was to be systematically extended through the years. Dr. Bessey was a research enthusiast and proceeded at once to the collection of an Iowa flora and at the same time did notable work in fungi and insecticides. His research papers were the first to be published in the college reports. His successor, Dr. Byron Halsted, gave attention to germination tests, the control of fungi, and the development of honey plants. Following these mature scientists the youthful L. H. Pammel began his notable lifetime research in weeds, grasses, and plant pathology. Following his graduation in 1879 Herbert Osborn was beginning his entomological investigations.

Agricultural experimentation was started as soon as the college farm was put in running order. Roberts as farm superintendent made tests of cereals, feeds, and fertilizers; and when he was called to Cornell in 1874 his student successor, Millikan Stalker, continued the field experiments and added others in swine feeding. Knapp, as professor of practical and experimental agriculture, sought to justify the latter part of his title by experiments in dairy and animal husbandry, dairy industry, and farm crops. The experimental creamery of 1879 was a noteworthy innovation. President Welch in the midst of his manifold labors in administration and teaching anticipated research in genetics in publishing studies on the laws of animal breeding. The results of the early investigations were published in the biennial college reports, in the college periodicals, in special bulletins of the departments of agriculture and botany, and, in a number of cases, as bulletins of the United States Department of Agriculture.

AGRICULTURAL EXPERIMENT STATION FOUNDED

With its early emphasis upon research the College was a center of the agitation for federal endowment of experiment

stations. In 1882 Knapp and Bessey drafted a bill that was introduced in Congress by Representative C. C. Carpenter but not reported from committee. The following year at the convention called by Commissioner Loring at the Department of Agriculture the Carpenter bill was endorsed and a committee appointed with Knapp at the head to urge the matter before the committee on agriculture. The bill with some modification was introduced in 1883 by A. J. Holmes, Carpenter's successor in the House. Knapp, then president of the College, issued a circular in support of the bill. The proposed measure was not acceptable to the colleges as it was felt to center too great control in the Department. Furthermore, sufficient interest and support had not been aroused among farmer groups to secure its passage. But the agitation continued and the national convention of 1885 appointed a legislative committee which aided Commissioner Colman in drafting a bill providing for state initiative in experimental programs, which, known as the "Hatch Act," was enacted in 1887. Knapp was a member of the executive committee but not of the legislative committee of this convention, and he doubtless felt that the new bill went too far in the direction of state autonomy. While the Hatch bill was pending, the *Students' Farm Journal*, which generally reflected the Professor's view, argued that the act did not provide adequately for intelligent supervision and uniform methods of work. The future administrative trend, under the influence of the grants-in-aid principle, was to be increasingly in line with Knapp's position. Meanwhile Iowa proceeded to organize on the basis of the original act.

On March 2, 1888, the General Assembly passed an act to establish the station. In anticipation of such action the Board a month previously had accepted the resignation of one of their number, Captain R. P. Speer, and appointed him as director. Speer had been a leader in the State Horticultural Society and according to the *State Register* was "a well educated man

and a thorough general farmer." The committee on the station decided that the work of the College and station staffs should be separate, except for the employment of certain members of the college staff during vacation. The station force was completed by the selection of John Craig as assistant to the director, G. E. Patrick, station chemist, A. A. Crozier, station botanist, and C. G. Gillette, station entomologist. The early experiments of the station were concerned mainly with crops, soils, horticulture, and dairying—the same general problems that had occasioned the pioneer experimental efforts.

THE STAFF AND THE IOWA ACADEMY OF SCIENCE

The interest of the faculty in scientific research was shown no less in active participation in the meetings of regional and national societies in their respective fields and in their contributions to such organizations within the state. On August 27, 1875, a meeting of scientists was held at the State University at which the first Iowa Academy of Science was formed. Among the organizers were Bessey, Macomber, and Dr. Fairchild. Bessey was elected the first president, and Dr. Fairchild, Macomber, Pope, and Beal were among the fellows. The organization proved premature and did not function after 1884. The second and permanent organization was effected at Des Moines on December 27, 1887. Osborn was on the organizing committee, as was Andrews, late of the College; and Crozier, Gillette, and Pammel were prominent in the early meetings. With all their research interest and professional contacts, members of the staff were no less diligent in making popular ones throughout the state by the extension of their light and leading to the solution of the practical problems of their constituency.

FARMERS' INSTITUTES

None of the early land-grant colleges made a more immediate or persistent effort to serve their state. The College was a

pioneer in the forerunner of modern extension, farmers' institutes. In the winter of 1870 President Welch and Professor Roberts held three-day institutes at Cedar Falls, Council Bluffs, Washington, and Muscatine. The President reported enthusiastic gatherings of farmers, and four institutes were arranged for the following winter. A regular program dealing with livestock, dairying, and fruit growing, with opportunities at each session for questions and discussions, was printed with the annual report. The movement continued throughout the pioneer years and was a main influence in keeping the College in touch with the farmers. President Hunt during his brief tenure conceived a plan of extension effort worthy of his promotive imagination. He proposed the holding of county institutes to be led by the best scientific and practical talent that the state afforded, and that these meetings be followed by a yearly state institute to be addressed by national agricultural leaders, such as the commissioner of agriculture and leading land-grant presidents. In addition he planned a system of correspondence courses by which the farmer and his sons might gain instruction at home. The plan was in advance of communication facilities and cooperative consciousness, but it anticipated leading features of a developed extension program. Chamberlain, who had pioneered in institute work in Ohio, was an enthusiast for this service. Under his lead in 1887 the College joined with the State Agricultural Society and the State Horticultural Society in organizing the Iowa Association of Agricultural and Industrial Instruction for encouraging and conducting institutes.

The institute work thus provided an agency for tying up with the State Agricultural Society and the State Horticultural Society. The relations with the latter were especially intimate. The professors of horticulture were active in its program, and other staff members found approaches. Welch explained the aims and difficulties of industrial education and expounded landscape art, Beal spoke on useful birds, Macom-

ber on forests and climate, and even Barrows found a theme in horticulture and education. The relations with the State Agricultural Society were mainly in exhibits at the state fair, and in papers at the annual meetings. In the early seventies the "Agricultural College District Society," nominally composed of the counties of Boone, Hardin, Hamilton, Marshall, Polk, and Story, was really a college institution. The two or three fairs were held in a grove near the campus and the College provided the main exhibits. Welch headed the organization in 1871.

COLLEGE PERIODICALS

As a means of reaching the farmers more widely, official journals were maintained. In 1875 Welch secured control of the *Progressive Farmer* of Cedar Rapids and conducted it largely as a college organ from January, 1875, to August, 1876. The college staff provided the editorial board, which C. F. Clarkson, the agricultural editor of the *Register* termed "the ablest editorial corps of any agricultural paper in the United States." Following the disposal of this journal, *The Producer* was launched at the College in November, 1876, with pretentious prospectus, as an organ for disseminating the findings of the institution in various fields of knowledge of interest to the people of the state. Owing to Welch's ill health the publication was suspended in August, 1877; the subscription list was taken over by the *Western Stock Journal and Farmer*, to which the *Producer's* editorial staff contributed. The next periodical venture was the *College Quarterly*, issued from May, 1878, through November, 1880.

In these publications there was an interchanging of experience, questions were answered, and the new findings made known. Discussions were not wholly in the technical fields. Mrs. Welch conducted a section on household economy and child training, and Professor Stanton discussed the tariff, marketing, and resumption. The program of the college was

explained in an effort to clear up misunderstanding and create a cordial feeling.

OTHER PUBLIC RELATIONS

There were many less systematized contacts. The chemistry department offered to make analyses. The natural sciences sought specimens for their museums. Regardless of threatened law suit and denunciations by interested parties, Professor Macomber carried through the exposure of a lightning rod fake. With the outbreak of pluro-pneumonia in the eighties, Professor Stalker served as state veterinarian with the resulting complications that early regulatory efforts involved. Staff members were in much demand for teacher's institutes, county fairs, and Fourth of July and Memorial Day orations. Professor Stanton was especially popular on such occasions. At a Memorial Day service at Nevada in 1888 President Chamberlain read an extended original poem on "Our Fallen Heroes" which was undoubtedly regarded as a fitting climax to his oration, and the student paper printed four of the seven stanzas.

In private life many of the faculty had farms, often in the neighborhood of the College. These enterprises at times brought relations not always pleasant with the College, rival breeders, and the community. In 1878 at the annual meeting of the State Horticultural Society, Welch complained bitterly at the way in which, under the lax fencing law, a neighbor's cattle trespassed upon his crops, setting property rights at naught.

COMMUNITY RELATIONSHIPS

College community relations were retarded by the geographical situation of the campus, which under the transportation limitations of these years involved a real isolation. During winter storms and spring thaws the country road was wellnigh impassable. Faculty members joined with city business

men in the seventies to provide for regrading, but at best the facilities were most inadequate. The result was that campus dwellers were cut off from the city, and faculty members resident in the city took part in campus life only at a great sacrifice of time and energy. Evening faculty meetings were an especial hardship to this group. In 1880 a faculty committee was appointed to request the Board to provide a college team to convey staff members living in Ames to and from faculty meetings, but there is no record of action on the request.

Transportation of mail, express, and passengers was by bus, the service for which was let at competitive bids. After a decade of agitation a railroad with a steam "dinky" engine was constructed by local capitalists in 1891. The previous year two engineering students had taken for their thesis subject the design of an Ames to Campus electric line—anticipating transportation progress by some seventeen years.

Ames by this period had a growing and aspiring population which in spite of difficulty of communication received a certain cultural uplift as well as material advantage from the location of a growing college in its environs. There was as yet no evidence of the fulfillment of the prophecy of Professor Charles R. Tuttle made in 1876 in his *Illustrated History of the State of Iowa* of "a vast city in which education will become subsidiary." "Ames," wrote a county historian in 1890, "is the most widely known of the towns of Story County, as is well typified in its busy depot, where the North-Western Traveler 'changes cars for all points north, south, east, and west' amid the clang of bells and the snorts of iron-horses, or where the verdant freshmen by scores annually step off the trains and take the modest omnibus out to the beautiful acres of the Agricultural College and Farm, there to spend years in growing into the clear-minded finished graduate, who again takes the modest omnibus to the busy depot and buys a North-Western ticket into the busy World. But while these two streams of travel and

student life pass through Ames, she has also a fixed population of probably 1,600, as the second town in the county. The traveler will not see this unless he leaves the broad and begrimed strip of railway grounds, which divides the town, and, taking a few steps to the north, finds himself on Onondaga, the business street, from which extends north, Douglas Street, the Euclid Avenue of Ames, lined as it is with the finest residences of the place. Here, too, will be found a certain mixture of the civilian and collegian tone typified somewhat in the papers and social life of the Ames Social Club."

CAMPUS DEVELOPMENT

The isolation of the campus emphasized the need for its development not only as an educational, instructional, and experimental plant but as a place of living. The Main building was soon overcrowded both as to rooms and facilities, and temporary outlets were provided in boarding cottages. Serious problems of congestion and sanitation arose. In 1877 after a malaria epidemic had been traced to the sewerage system improperly constructed and inadequately maintained, new pipes were laid, but adequate sanitation was not provided until twenty years later with the construction of a modern disposal plant. Other evidences of modernization were the trial of the first campus telephone in 1878 between the president's office and the physics laboratory, and the installation of electric lights in 1884.

Presidents almost annually stressed the need for more faculty dwellings, and by 1886 eight professors were housed on the campus. The faculty families formed a little community. Their children attended school in a neighboring country school or, later, in the college preparatory department. So convenient and socially desirable was campus dwelling regarded that there was a strong competition for houses when they became vacant. But there were also drawbacks and restrictions, especially when houses were divided. In 1887 a

new professor petitioned the Board to release him from the agreement to occupy half of the farm house, as he and his wife felt that with their large family "life in this house would be uncomfortable and exhausting to an extent that would interfere with my work. It would be better if the worst should happen, that I should toil on in loneliness here, with the family comfortably housed, than that we should all be here in an uncomfortable home." The same professor was also greatly disappointed to find that in all the expansive college domain there was no place provided for his garden for which he had a "very positive taste" evinced by the hope that this area for relaxing labor would be provided even before his domicile was secured. Evidently campus husbandry did not extend beyond cultivation, as a board rule of 1886–87 provided that "no dogs, pigs, or poultry belonging to any professor, or employee, shall be permitted on the College grounds."

No permanent buildings were added to the campus in these years, but the main form of campus landscaping was worked out by President Welch in the early years. This project, designed by planting of native trees and shrubs on a naturalistic basis, was a labor of love with him and provided one of the more constructive and educative labor activities of the early students. In a description of the College in the *Iowa Normal Monthly* in February, 1889, President Chamberlain referred to the campus as "one of the most extensive in the West; a beautiful park where the principles of landscape gardening have been so carefully obeyed as to please the eye and cultivate the taste." The tradition of the location of clumps of trees by the scattering of potatoes or throwing of walnuts seems to be disproved by the precise description of the planning given by Dr. Welch a decade later. The common practice of planting potatoes to break up the sod may have been a basis for the legend. Dr. Welch's account of the making of the campus in a paper read at the meeting of the State Horticultural Society in 1885 sets forth his ideas of institutional

landscaping and has permanent suggestions for campus development.

"The plan, after being carefully devised, was sketched on paper, and stakes driven accordingly where the trees should be set. The holes were dug twenty inches deep and thirty inches in diameter. As the work progressed and the workers grew enthusiastic, they were informally instructed in the following particulars:

"1. Some trees do not take kindly to grouping, because of their peculiar form and foliage, which are too striking to bear repetition.

"2. Those trees only should occupy the same group whose leaves and general outlines, when matured, produce a harmonious effect on the eye. Consequently the group will generally be limited to either the same species, or species that are closely related. For instance, you cannot properly combine on a lawn the weeping willow and the Lombardy poplar, nor the hard maple with the honey-locust.

"3. Great care must be taken at the outset that the completed plan should present no formal repetitions. The entire result should, as the years pass, seem like the product of nature in one of her happiest moods.

"4. Natural beauty never interferes with convenience. No tree should be set where it will obstruct the passage or stand in anybody's way, or intercept the open vista lines through which the eye can reach the more striking features of the distant landscape. The vision may be stifled as well as the breath.

"No invariable rule can be given for the arrangement of trees on extensive lawns, since a variation of surfaces demands a variation of plans, but in general, it may be said that the first settings should extend along the roads and walks, should adorn the buildings, public or private, and crown the elevations wherever found. The humblest dwelling becomes attractive when set against a background of abundant foliage; but care should be taken that close growing trees should not be planted so near as to impede, in any season, the free access to its windows of air and sunlight. This policy may, however, be reversed in respect to surrounding unsightly structures, necessarily attached to every building. All these should be hemmed around by evergreens, whose thick foliage shall hide them wholly from the eye.

"All grouping should be made to answer, as far as possible, two different objects: the one of which is the near effect on the eye when the trees are young, and the other the more remote effect in future years. The first requires a large proportion of quick growing trees, and sets them at shorter distances apart with a view to future thinning with the axe. The second utilizes the slow growing, hardier trees, planted at wider intervals, suitable

to their final size, interspersed, however, with a fast growing variety of kindred form, to be removed whenever crowding should begin."

. . . . . .

"Fifteen years of growth have beautified the college lawn with a variety of tree forms, most of which, I am glad to say, are common ones, for I love common things and common characters whose aspect never varies in any vicissitude of fortune or weather."

PIONEERS IN RESEARCH. *Left to right: Above*—C. E. Bessey, J. L. Budd, L. H. Pammel, and Herbert Osborn. *Below*—Anson Marston, C. F. Curtiss, Wm. H. Stevenson, and William B. Niles.