SCIENCE
The Key to Education

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By

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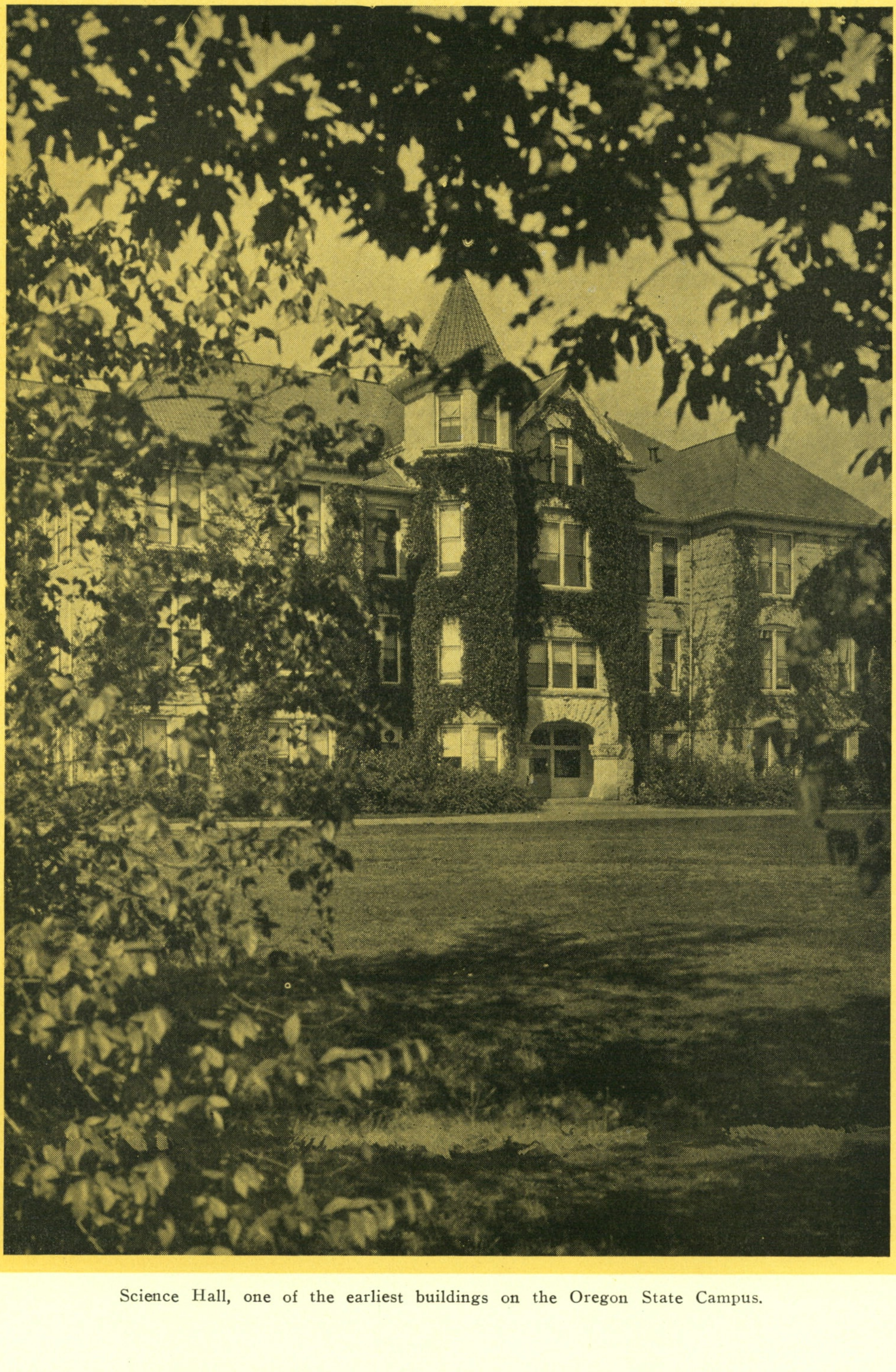
Cover design by Victor Beals

Oregon State
Agricultural College
Corvallis, Oregon



Science Hall, one of the earliest buildings on the Oregon State Campus.

THE rise of America to industrial and financial supremacy among the nations of the world has been coincident with the development and use of power. This in turn has been largely the result of the increasing importance of science in education. Harnessing the forces of nature and vastly multiplying the effectiveness of man, both individually and collectively, invention and machinery as developed today have been the product of scientific experimentation, of laboratory investigation based upon inductive reasoning.

A man today, aided by machinery, can accomplish many times what was possible two generations ago. Where formerly three men could cradle and shock only two acres of wheat in a day, three men under modern methods—the combine harvester, farm tractor and motor truck—can not only harvest, but can thresh and deliver to market two miles away, forty-five acres of wheat a day. An acre of wheat once represented sixty hours of man's labor; it now represents but ten.

Through the use of machinery, every workman in America is backed by $5\frac{1}{2}$ horse-power of energy, whereas the English workman has but $2\frac{1}{2}$, the German $1\frac{1}{2}$, and the Italian 1 horse-power. On the farm, as a result of the application of power and scientific methods, the American produces 12 tons of cereals compared to $1\frac{1}{2}$ tons for the rest of the world.

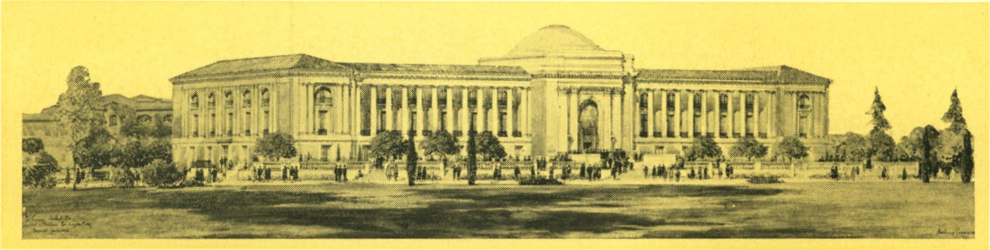
The United States, as a consequence, is the wealthiest nation in the world. The annual income of the people of the United States rose from about 28 billion in 1910 to 74 billion in 1920 and to nearly 90 billion in 1926. With only 7 percent of the world's population, America has 33 percent of the wealth, 50 percent of the gold money, and 50 percent of the surplus income.

This remarkable development rests upon an educational foundation. The industrial, commercial and financial supremacy of the United States, everywhere acknowledged in Europe, is almost invariably ascribed, in fact, not simply to her natural resources nor even to her mass production but to superior technical training and scientific research. To European observers America's industrial progress is the external manifestation of a national zeal for education and training.

The object of public education in America, of course, is not primarily to develop wealth but citizenship. To quote the words of Senator Morrill, author of the congressional act establishing the land-grant colleges, the object of these institutions is to provide an education that "shall prove useful in building up a great nation—great in its resources of wealth and power, but greatest of all in the aggregate of its intelligence and virtue." The evidence that the land-grant colleges have proved useful in building up a nation great in wealth and power confronts the world on every hand. That they have the resources also for helping to build up a nation "greatest of all in the aggregate of intelligence and virtue" is clearly indicated in the pages of this booklet.

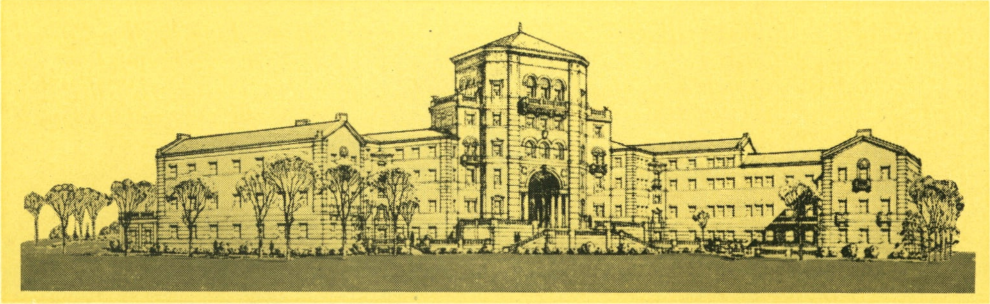
W. J. Kerr

President of the College.



The Memorial Union, which will be opened in the fall of 1928. Financed by gifts from students, alumni, faculty and friends.

The outstanding feature of educational progress during the last quarter of a century has been the bringing of the scientific method into education. The application of scientific principles to the lighting and ventilation of school buildings, the careful study of the laws of learning as bases for methods of instruction, the standardization and use of tests for measuring the results of teaching, and for the classification of pupils; all these have found a definite place in educational administration and procedure since the opening of the present century. Scientific devices and scientifically developed methods are matters of daily use in schoolrooms throughout the land.—C. A. Howard, Superintendent of Public Instruction, in an address on "The Scientific Point of View."



The new Men's Dormitory, ready for occupancy in the fall of 1928. Financed through bonds to be paid for from proceeds of operation.

Science the Key to Education

JUST as science in industry has unlocked new doors of exploration and achievement, so in education it has been the key to new depths of interest and fresh realms of research. It has helped to vitalize, layer by layer, all the strata of the field of education, as it has gradually penetrated downward from the research laboratory to the elementary school. Less than a century has elapsed since education took even a casual glance at the stranger knocking at her doors. Less than half that time has elapsed since colleges began to mass their curricula firmly upon the foundation of the natural sciences. Yet today these sciences are universally recognized as fundamental, and no field of education is so cloistered or remote that it has not felt some vague stirring, at least, of the effect of the scientific method.

> Science—
> Pilot of industry,
> Conqueror of disease,
> Multiplier of the harvest,
> Explorer of the Universe,
> Revealer of nature's laws,
> Eternal guide to truth.—
>
> *Dedicatory inscription of the new Academy of Science Building at Washington, D.C.*

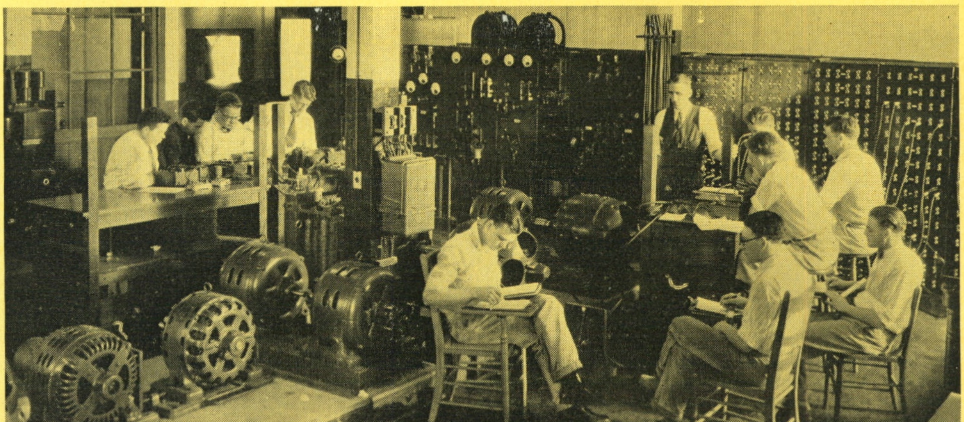
For the scientific method is the method of observation, experiment, and computation. It does not exclude speculation, imagination or even faith. Indeed, imagination and faith have played a large part in the progress of scientific discovery. "In every creative physicist," declares Michael Pupin, one of the greatest and most productive of contemporary physicists, "there is the poet and the metaphysicist." But the true scientist uses his dreams and speculations, his intuitions, not as authorities but as guides. He tests these in the light of facts, the largest number possible. By inductive reasoning he proceeds carefully from these facts to others analogous or implied — from the known to the unknown. He is the true seeker, not trying to substantiate a preconceived theory; but searching for the unalterable laws of the universe. What he observes he submits to experiment; the results of experiment he subjects to calculation, and only when the three tests of observation, experiment and computation repeatedly bring the same result does he accept confirmation.

This process of arriving at results —searching for facts and through a succession of related facts reaching fresh conclusions—has a tonic effect on thinking. Because of the possibility of tangible results, it awakens incentive to study. It promotes an immediate respect for truth. For one of the chief advantages of the study of science, to use the language of Huxley, is its effect upon the learner through "the inculcation of veracity of thought."

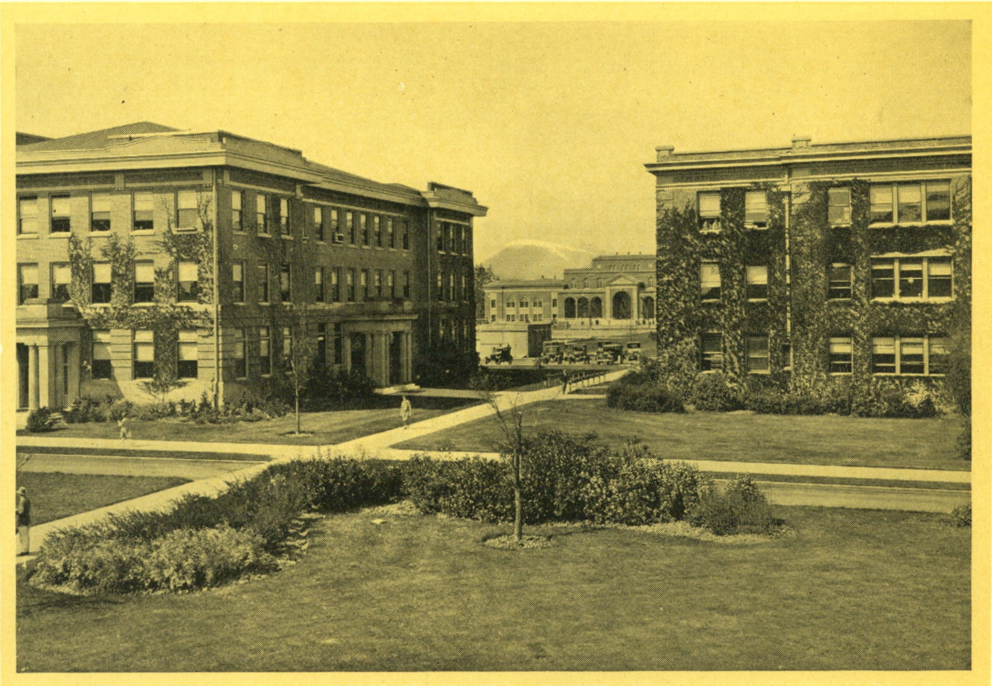
The Laboratory Linked to the Public

"Laboratories are required, and, though an artist without a studio, or an evangelist without a church, might conceivably find under the blue dome of heaven a substitute, a scientific man without a laboratory is in most branches a misnomer."
—Dr. Frederick Soddy, in Science and Life.

SCIENCE, successfully applied to industry, has taught the leaders of the business world as well as the leaders of higher education, that a closer understanding between the two will help to insure not only greater effectiveness of college graduates in industry but also greater efficiency of industry. The American Council on Education has been striving to bring about such an understanding in the interest of adjusting individuals to their work and developing experts. The American Management Association, which joined the Council in the fall of 1927, is helping to promote cooperation between industry and the colleges and to solve their common problem of personnel training. As a result of this cooperative movement, we have the selective training schools of the General Electric Company, the Westinghouse Company, the Bethlehem Steel Corporation, the Pacific Telephone and Telegraph Company, and similar engineering training courses, all of which annually select students from Oregon State. The Pacific Loggers Congress has also taken initial steps to establish between the lumber interests and western schools of forestry a similar cooperative program for building up a closer alliance. This is a distinctly new resource evolved by science for insuring a more practical service on the part of college graduates, with corresponding assurance of success. It is an immense advantage to the college man in helping him to make vocational adjustments.



Electrical laboratory tests. Tests of a scientific nature are made for the purpose of observing and explaining the performance of electrical machinery.



Looking west from the Library, between Agriculture and Dairy halls, past the Women's Building toward Mount Chintimini.

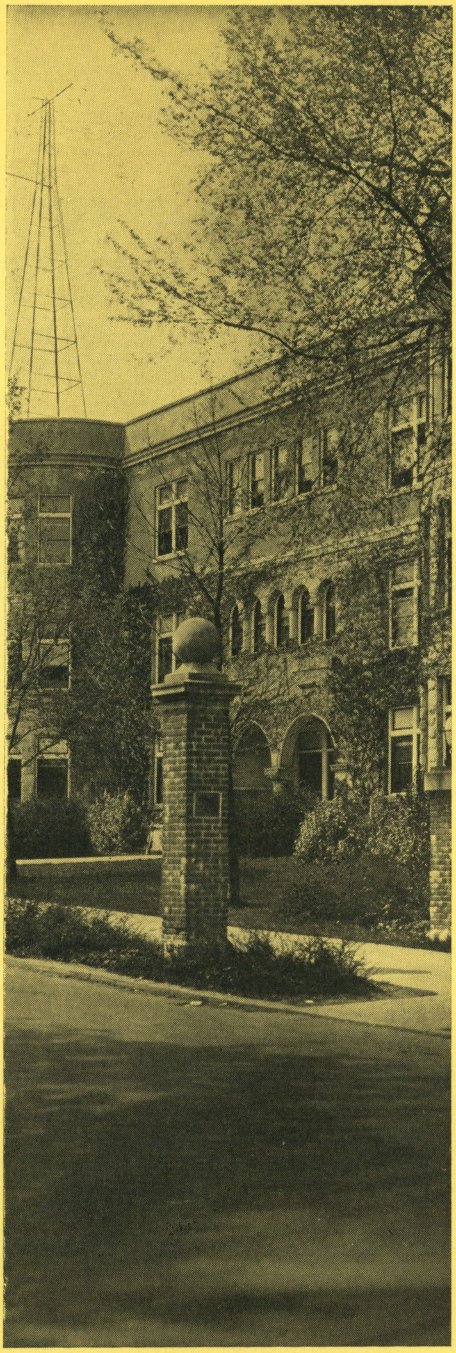
Science Unlocks the Doors of Tomorrow

"The power of prophecy is the best test of a new knowledge."—Michael Pupin, in The New Reformation.

SCIENCE is now so securely fortified by reliable data and manned by trained investigators that it is already beginning to bring the future under its rein. Until recently this was hardly possible. A century ago there was but an occasional investigator, solitary, working on his own resources, with only the most desultory contact with what had gone before; today there is an unorganized army of research workers, backed by the most august and responsible scientific associations, whose accumulated stores of information are available to all inquirers, and supported by adequate funds provided by private endowment or by state and federal appropriations.

So comprehensive and so responsible has scientific investigation become, that a working knowledge of the future is a possible and practical thing. Science, in its observation of the laws of causation, has rapidly reached the stage where it can offer forecasts of the future as confidently and as accurately as it can chronicle the happenings of the past. In other words, it prophesies.

Any science of today, in fact, that is



Apperson Hall.

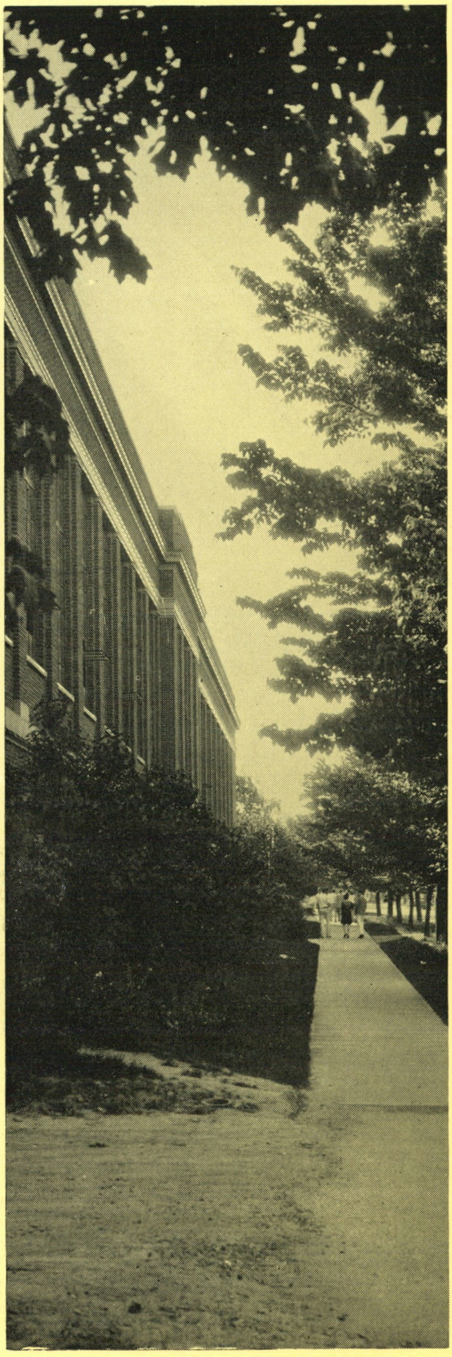
worthy of that distinguished name, is capable of predicting the future. The Entomologist knows the life-history of the crop enemies of his particular field; he knows the general behavior of crops under the soil and weather conditions of his field; and he knows the special poisons, preventive measures and precautions best calculated to kill the insect pest and foster the growing crop. So he prophesies. And in the great majority of cases, the man who heeds the prophecy is the one who raises the crop, while his incredulous or shiftless neighbor harvests nothing but husks and insect enemies. The Horticulturist—familiar with the laws of plant breeding, with its persistent tendency to transmit hereditary characters, but with its variations, "sports," and reversions—can cross and recross varieties of plants that he desires to modify, and even take short cuts by way of selections, and still quite confidently predict the resulting fruit or flower, though his hybrid plant may be many years in coming into blossom or bearing. The Animal Husbandman, scientifically trained in the principles of breeding, and expert through experience in determining the prepotency of his animals, as well as the dominant characters he wishes to transmit, rigidly keeps in view the ideal he would ultimately establish, and works with security, albeit with indomitable patience, toward the goal that is the fulfillment of his prophecy—a superior and distinctive type of animal.

The responsibility of forecasting such as this gives to the student of science a serious sense of the importance of his job. He becomes an authority whose responsibility extends beyond the present to the future. Upon his judgment may depend not only the destinies of a great industry but human life itself. Nothing short of absolute integrity can measure up to this momentous obligation.

Dr. C. W. Crampton, organizer of an important health-service clinic, a modern phase of medicine, tells of the age-old tendency of men to seek to know their future. Formerly they applied for information from the sooth-sayers, palmists, crystal gazers and their kind. But today, with the marvelous results of preventive medicine and corrective surgery chronicled daily in the press, they consult the physician; for medicine has developed a new phase, prophecy. Dr. Crampton confidently makes this arresting statement:

> "By means wholly scientific, physicians are able to read the record of the past, assay the evidence of the present, and forecast the future. What is more, the physician is increasingly able to deliver with his prophecy a constructive guide, designed to defeat the dangers and increase the prospects of realizing the brightest possibilities of the future."

And thus throughout the realm of science, prophecy is the test of integrity. The astronomer foretells with mathematical precision the recurrences of eclipses and comets. The soil analyst, bringing to his aid the sciences of physics, chemistry, and bacteriology, prescribes the fertilizer, as well as the sort of treatment, that will bring definite results with specified crops and cropping practices. The Agricultural Chemist, having analyzed the most desirable type of cured hops and thus determined the constituents necessary to perfection, studies the processes of curing, as well as the time and method of harvesting hops, and from these data, together with his acquaintance with the soil and climate, prescribes the program for arriving at the coveted goal. The science that cannot predict results, in fact, is frankly open to suspicion.



The Engineering Laboratory

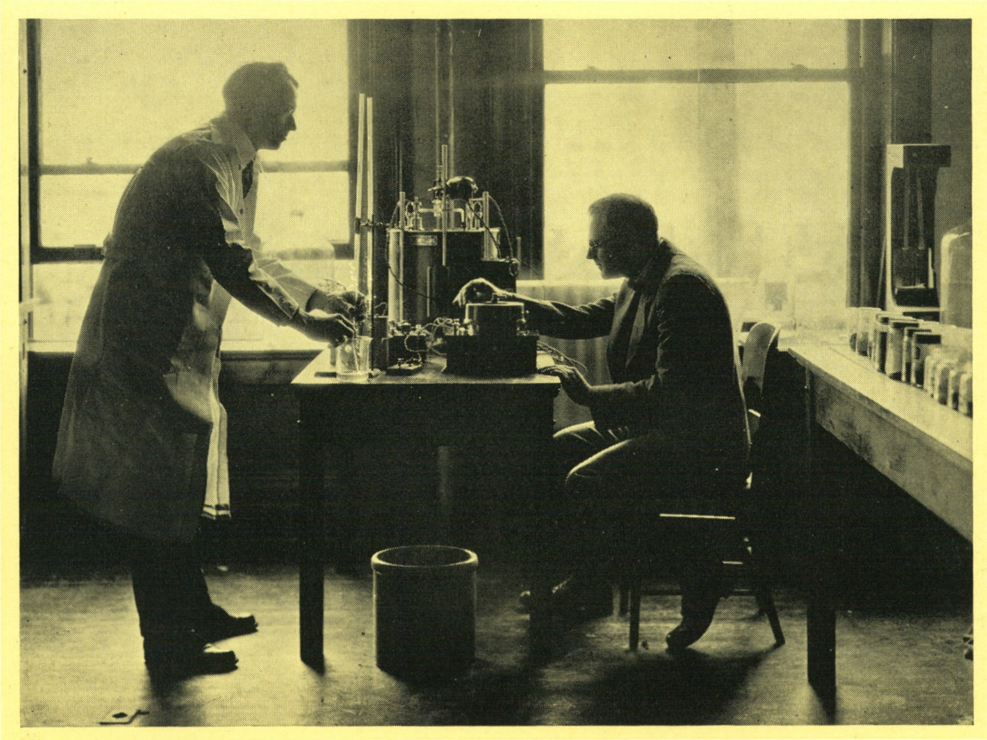
Agriculture

For the student trained in scientific agriculture two highways lead forward from commencement. One leads to the farm with its rich reward of a free, independent, active life in the open—the other to the office, the teacher's desk, the research laboratory, the factory and many similar opportunities. The one can be followed only by those who possess land and the necessary capital to operate it, the other must be followed by those who lack land or capital. Both afford opportunity for using science—the key that has opened new doors for the student throughout his college course—to discover new resources in the soil, to develop new and more profitable products, and to fulfill a finer and higher function in all the relations of life.—A. B. Cordley, Dean of the School of Agriculture.

THE college of agriculture, along with the college of engineering, is where science first showed its peculiar power in American education. No age-old traditions shackled or directed the work of these institutions when the states first began to found them following the enabling act of 1862. They had to pioneer their own way, and science was their touchstone and talisman as well as key. It fired the creative imagination of many young men who have since been leading factors in developing the destinies of the land-grant colleges, the most progressive element in modern higher education. For the ideal of the land-grant colleges, science in service—science testing accepted standards and searching for natural law—has ushered in a new era in higher education, the results of which upon the citizenship and industries of the country have combined to force the United States into a position of industrial and commercial leadership among the nations.

A class in landscape architecture inspecting the different specimens of trees and shrubs on the campus, of which there are several hundred.

Agriculture Hall.



Soil scientists using the new apparatus for measuring the conductivity of soil solutions from which are determined the concentration of ions in soil solutions or soil extracts.

The part played by the land-grant colleges in this movement that has placed scientific research at the heart of American industry and recognized scientific studies as the foundation of modern education, was sketched briefly in The Trail Blazers* as follows:

For the chief factor in this whole movement, naturally enough, is the agricultural college. In cooperation with the Federal Department of Agriculture, it has been in the past, what it must become in still larger measure hereafter, the leader in the improvement of unused lands, in the utilization and conservation of natural resources, in the rejuvenation of worn-out soils, in the production of more varied and more abundant crops, in the distribution and marketing of products, and in the enrichment of the whole range of life on the land. This involves a wide field of effort and enlists the services of all the sciences. It was just such a field, however, that the conception of the founder of the land-grant colleges had in view. For Justin Smith Morrill, the American path breaker for a nationally endowed industrial education, and one of the greatest beneficiaries of agriculture that the nation has ever known—next to the author of the national homestead bill, probably the greatest—conceived these institutions not merely as trade schools, nor yet as exclusively agricultural colleges, but —in his own words—as "National Colleges for the advancement of general scientific and industrial education." In the fulfillment of this broad function, especially after the establishment of the auxiliary experiment stations, the colleges devoted themselves from the start to the promotion of agriculture and the dissemination of con-

*Bulletin No. 200, Oregon State Agricultural College, 1915, by Edwin T. Reed.

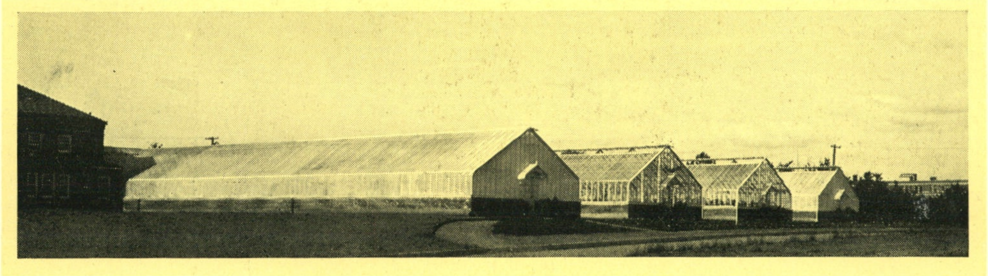
structive agricultural information. They were the first agencies in America to systematize crop rotation for soil building; first to restore worn-out soils by the use of nitrogen-gathering legumes; first to employ seed selection on a large scale for the improvement of plant varieties and crop yields; first to hybridize and top-graft selected fruit varieties with a view to the general betterment of horticulture; and first to demonstrate the value of scientific dairying and livestock breeding. They have taken the initiative in the destruction of insect pests, in the prevention, eradication, or abatement of crop and fruit diseases, and in the correction of the evils incident to defective or excessive irrigation. They have led the way, through comprehensive campaigns of extension, demonstration, and farm cooperation, for the spread of constructive agriculture to every county and every community in their respective states. The agricultural colleges, in short, have been the most dynamic and immediate forces in the past half century in restoring old types of agriculture to a profitable basis; in opening up new and more reliable sources of farm production; and in mutually relating agriculture, on the one hand, and science and industry, on the other, in such a way as to broaden and energize the whole industrial situation.

Oregon State's School of Agriculture, one of the outstanding agricultural colleges of the entire country, is rich in the sciences that have built progress into agriculture and made the American farmer the most productive in the world. A mere enumeration of the curricula leading to degrees tells a

The New Poultry Building.

striking story of the breadth of college training afforded by this great school. Fourteen divisions offer curricula leading to both baccalaureate and master's degrees, with a choice of twenty majors. All departments are provided with suitable laboratories and equipment to give thorough scientific training, with experiments, field demonstrations and objective illustrations.

In cooperation with the school of Vocational Education the school of Agriculture conducts a curriculum in agricultural education preparing students for Smith-Hughes positions in high schools; and in cooperation with the school of Commerce it shares in the important work of agricultural economics. In both these fields the purposeful student, armed with a thorough scientific training, is confronted with challenging problems to be attacked, and with opportunities for service, with corresponding reward, scarcely paralleled in America today.



The new range of greenhouses with administration unit at left.

Typical laboratory scenes in some of the basic sciences

Basic Arts and Sciences

The School of Basic Arts and Sciences insures that no gap shall exist between the basic fundamental training in the arts and sciences and the specialized technical work of the students. Students are not pre-engineering, pre-agriculture, pre-home economics, or what not. From the time they enter the institution they are identified by registration and association with the vocation that attracted them to the College for training. But from the beginning the student of engineering, forestry, commerce, or home economics takes non-technical work, basic work, in an organization which safeguards the scientific integrity of his course at the same time that it gives due regard to his vocational and technical aim. Education is more than technical training, but in this coordination of basic and technical work, science is made the key to education, inlocking the twin doors of technical achievement and intelligent living.—M. Ellwood Smith, Dean of the School of Basic Arts and Sciences.

DR. ARTHUR D. LITTLE, President of the University of Michigan, in The Fifth Estate, utters an aphorism that is pertinent to the theme of this section; namely, "wealth is the product of brains, and labor is productive only as it is guided by intelligence." Some such principle as this actuated the development of the school of basic arts and sciences in an institution dedicated to "a liberal and practical education." For industry depends upon trained intelligence, intelligence trained for the practical application of science and the arts to the work of the world.

The School of Basic Arts and Sciences is precisely what the name implies, an instructional unit offering training in fundamental arts, crafts, and sciences for specific application in the various vocations for which the institution affords preparation. But the technical expert to be successful must also be human. Foundation work for technical success must include opportunities for that broader education without which technical training today is but a tool without a handle. Particularly noteworthy, therefore, is the provision for this work made at the College, that it may fulfill its functions as a land-grant college in affording "a liberal and larger education . . . to those much needing higher instruction for the world's business, for the industrial pursuits and professions of life."*

The fundamental dependence of engineering upon the sciences of mathematics, physics, and chemistry is an accepted fact. In the same way the dependence of agriculture upon bacteriology in the development of plant life; of entomology in pest control; of botany in the breeding and safeguarding of crops and vegetation; and of zoology in the development of animal husbandry, is elemental to scientific progress.

Habits of intelligence and wholesome reading, some knowledge of world affairs, past and present, and some ability to see one's vocation in a true perspective to life—these are as essential to technical education as are formulae and data. The School of Basic Arts and Sciences therefore affords instruction in such fields—twelve departments—and aims to do it in a thoroughly stimulating and constructive way.

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*Justin S. Morrill, author of the land-grant College Acts 1862 and 1890.

Commerce Hall, seat of the School of Commerce and the President's Office.

Commerce

Three things differentiate business today from that of only a generation ago (1) Rapidity of change in methods and facilities, (2) Magnitude of business enterprises, (3) Complexity of organization and a high degree of specialization. As a consequence, old methods of doing business are being constantly superceded by modern methods worked out through scientific research. A wider background of both science and culture is demanded in business. Knowledge of economics, sociology, history, government, psychology, the natural sciences, the various arts of expression, as well as of the technique of commerce, is essential to this new type of business leadership. The School of Commerce endeavors to combine basic training with the various technical arts of business. But above all, it aims to train each student in the field within which he can be of greatest service to society and achieve the greatest personal success.—J. A. Bexell, Dean of the School of Commerce.

COMMERCE moves with colossal strides. The early immigrants to Oregon consumed six months in making the overland journey from Chicago to Portland. A touring automobile does it now in six to ten days. The transcontinental trains make it in less than three days—70 hours, and will reduce this to 66 hours in May. The airplane does it in scarcely more than twenty hours. Communication over the same distance—by telegraph, telephone or radio—is almost instantaneous. To save 27 miles of travel over the great divide of the Rockies a transcontinental railroad system builds the Moffat tunnel, six miles long, at a cost of 18 million dollars. This gives the index of modern business.

Thomas D. Murphy, world traveler, in "Oregon the Picturesque," said of Oregon highways in 1917, "There is as yet little well-improved road in the state; a few pieces of macadam about Portland and down the Willamette Valley—much of it broken and rough—and the wonderful new Columbia River Highway comprising about all of it at this time. . . . Oregon roads generally are desperately bad and are likely to remain so for some time." This was little more than ten years ago.

In this brief interval Oregon, essentially a virgin state, has spent one hundred and ten million dollars on state highways alone. In addition, approximately three and a quarter million dollars is spent annually in developing the market road system. Oregon now has considerably more than thirteen hundred miles of paved roads, including a highway traversing the entire length of the state, and another essentially as good running east and west from the ocean to Idaho. Nearly two thousand miles of engineered roads, surfaced with rock and gravel, of which nearly 1,000 miles are oiled, now supplement the paved highways. Altogether the state has approximately 50,000 miles of public roads. This system of highways, added to the development of the railroads and harbors, has given Oregon a wonderful commercial impetus. It is one of the finest transportation systems in the world.

The development of electric power, the expansion of the lumber industry, the establishment of manufactories for paper, furniture, building materials, fruit and vegetable products, and other facilities for utilizing the state's vast natural resources, together with the improvement of overseas commerce, have all helped to put new life into the veins of Oregon industry.

All this industrial awakening makes its demands upon higher education. The economist, the accountant, the business organizer, are all called upon to analyze the new problems and help direct the new movements. Change is the one thing certain in the wide competitions of the business world. The man who is quick to anticipate the change and adjust himself to it, is the one who reaps the reward. The School of Commerce has always been alert to sense these changes and to offer a constructive program to meet them. Its graduates are imbued with a spirit of alert, studious interest in the problems of the hour.

Modern commercial training is scientific training. This applies to broad basic education in economics, sociology, law, and political science, as well as to technical training in accounting, finance, and secretarial studies. It applies to advertising, for instance. "Research in present-day advertising," says the head of the work in advertising and selling, "is of two kinds, empirical and scientific. The empirical is unreliable. In pursuing the scientific method, the procedure should be the same as that in any other science; it should start from the inside and not from the outside. First there should be observation of facts, then comparison, then generalization, and finally putting the conclusion to a test. Advertising research, in short, takes into consideration the product, the people to whom it is to be sold, and the publicity."

Training in business--and there is a business side to all the vocations and the professions of life—offers opportunities as wide and as high as any field of endeavor today, as worthy of intensive, scientific study, as fruitful of the largest rewards and the highest satisfactions.

The Home Economics Building, looking toward Dairy Hall and the College Library.

Chemical Engineering

Oregon has natural chemical resources to provide the raw material for some of her greatest industries. The deposit of sodium carbonate in Summer Lake alone is of prodigious value; it awaits commercial development. Our sawmills are having increasing difficulty in making use of their waste; they need the help of the chemical engineer. The Pacific Northwest has more than a third of all the water-power in the United States; the time will come when this power will be devoted to gigantic electrochemical industries. Science, through education, holds the key to this development.—Dr. Floyd E. Rowland, Professor of Chemical Engineering.

THE beauty of science as an exact study is well illustrated by chemistry. As long as discovery in chemistry was left to accident, progress was fickle and slow. The alchemists and quacks leeched the public. Gradually the realization that exact knowledge, coupled with imagination, was responsible for the discoveries that mark the great epochs of human history, gave rise to genuine scientific research. Progress was amazingly quickened. Thus, while thousands of years elapsed during which man was discovering the chemical reactions called fire, the reactions that produced copper and tin from their ores, giving rise to the bronze age, and the still greater chemical process, the production of crude iron, within the short space of only fifty years some of the most revolutionary discoveries of all time have been made. Their effect has been tremendously stimulating to the thought and freedom of the race.

In agriculture, for instance, where plants, like animals, are chemical machines whose source of energy is primarily the photo-chemical energy of sunlight, what an amazing development has marked the past fifty years! The contribution of chemistry to the dairy industry, through a knowledge of milk alone, is one of the most inspiring chapters in human progress.

In industry, where upwards of 75 billions of dollars is now invested in this country in enterprises that are more or less dependent upon chemical products, the steel business is a good example of our reliance on chemistry. For the usefulness of steel depends upon its chemical composition. Small amounts of certain impurities ruin it. Certain substances, on the other hand, vastly improve it. Hence the chemist in his laboratory is the real magician of the Age of Steel.

Chemistry in medicine is acknowledged by the greatest physicians and surgeons of the age as responsible for some of the most successful advances in the prevention and cure of disease.

The effect of these amazing contributions of chemical science to the progress of our times is not lost on the student in the laboratory. He realizes that he can be a part of a vital agency for good. His sense of responsibility is correspondingly quickened. He knows that faithful and painstaking work in chemistry may lead in the end to discoveries of momentous importance. Hence he lays his foundation wide and deep that he may build a superstructure of specialization high and fine. Many Oregon State graduates in chemistry have done distinguished work in the graduate schools of other institutions. Many occupy strategic positions in industry.

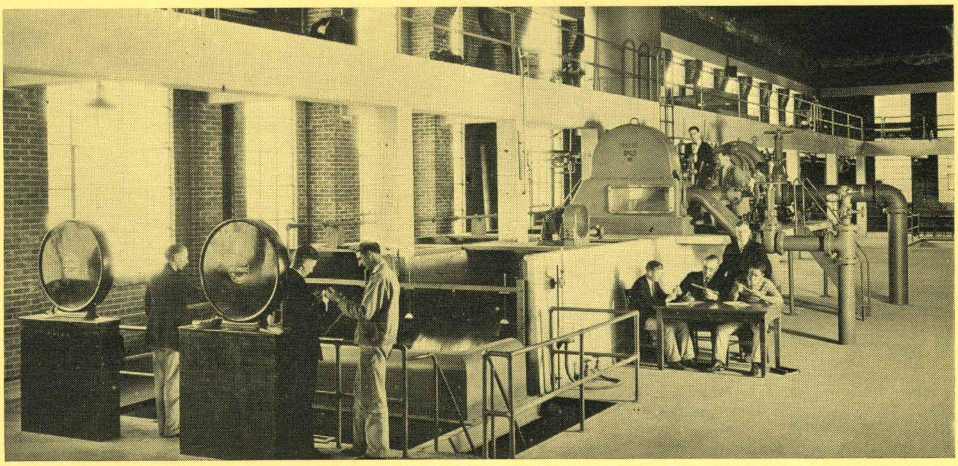
Horticultural Products and Agricultural Engineering Buildings.

Engineering

There are two general classes of higher education—one that can be adapted to the individual tastes and abilities, and the other to which the individual must adapt himself. The former is frequently called collegiate or academic and the latter professional or vocational. One may take the collegiate type of training and with a proper selection of major courses and electives quite satisfactorily adapt it to his particular tastes and abilities. The professional training, however, is a training in which he who succeeds must adjust himself to the requirements and standards of the profession. It is necessary, therefore, that one who desires to succeed in a profession should be potentially adapted to it.—H. S. Rogers, Dean of the School of Engineering in Bulletin 435, Oregon State Agricultural College, Shall I Choose Engineering?

SCIENCE has been the key to much of modern engineering progress; and the scientific method — observation, experiment and calculation — has been the method of organized engineering from the beginning. In the history of higher education in America, in fact, the engineering schools were first to employ scientific research and to put their faith in the natural sciences as the basis of educational development. The rewards in progress have been correspondingly great. Up to about fifty years ago, for instance, the metal industry was all art and no science. Now science makes a vast contribution to the metal industries. It is largely due to science, in fact, working through engineering, that the metal industry has progressed more in the past fifty years than in all preceding history.

Training in engineering has been subjected to the most searching and scientific examination during the past eight or ten years. The Society for the

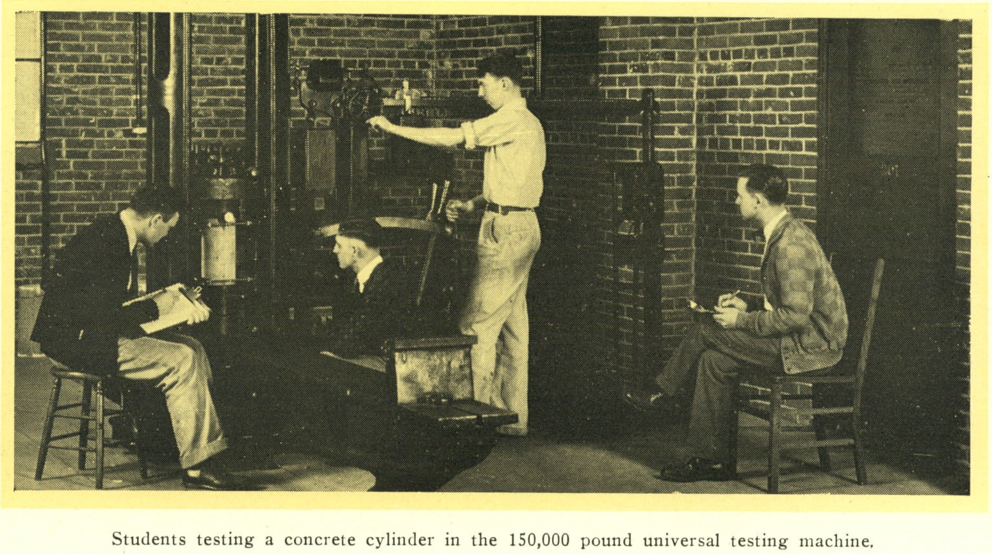


Civil engineering students making an efficiency test upon a Pelton impulse wheel in the Engineering Laboratory.

Promotion of Engineering Education has made exhaustive tests to determine the value of every element that enters into engineering education. Definite conclusions, based upon a valuable mass of information, have helped to determine the objectives, as well as the content, of engineering curricula. All the evidence goes to show that competent training in engineering develops, first of all, the scientific attitude. Graduates by the thousands testified that the habits and ideals developed by their engineering training were: first, accuracy and thoroughness; second, initiative and originality; third, diligence; fourth, integrity and dependability; and finally capacity for leadership.

By this same method of careful research, the purpose of engineering education has been found to be not so much to impart to the student technical knowledge as to furnish him a scientific training that will enable him to think his way clearly and accurately through a problem. Such training involves instruction in (1) the mastery of those fundamental sciences and principles upon which the practice of engineering depends, such as mathematics, physics, chemistry, drawing, etc., (2) the application of scientific methods, calculations and processes to problems within the various fields of engineering, and (3) acquaintance with standard practices and current processes of the engineering profession.

The student who completes the usual four to six years of engineering training leading to the baccalaureate or master's degree is thus admirably fitted to cope with the complex problems that confront our mechanical age. Baccalaureate and master's degrees are offered the student at Oregon State through the following departments of the School of Engineering and Mechanic Arts: Civil Engineering, with senior option in Highway Engineering, Electrical Engineering, Industrial Arts, and Mechanical Engineering. Mechanics and Materials, a service department, provides certain basic instruction for all other departments of the School of Engineering.



Students testing a concrete cylinder in the 150,000 pound universal testing machine.

Forestry

The forester, on every hand, is confronted with a need for scientific knowledge and for the aid of science. He must know the laws of plant life. He must know how to classify his soils; for trees, fruits and grains have their peculiar soil requirements. He must know tree botany, without which he cannot know his trees. He must know the laws governing the strength of wood materials, for upon this knowledge rests the adaptation of the finished product to man's use. In fact, from the planting of the tree to the harvesting of the crop, science meets the forester at every turn.—G. W. Peavy, Dean of the School of Forestry.

THE forest was the refuge and shelter of primitive man. It was his hunting ground and his temple. The fruits and nuts that grew on its trees and the birds and animals that sought its enveloping shade gave him food. Its towering trunks and overhanging branches gave him protection against the storm and from the glare of the sun and the bite of the frost. As he emerged from the primitive and became successively a herdsman, a husbandman, and a tradesman, his immediate contact with the forest and dependence upon it gradually waned. But it never faded entirely from memory. Centuries of habit had made it dear to him as home. He reverts to it, as to a healing shrine, for adventure and inspiration.

Honoring Regent B. F. Irvine.

Advancing civilization waged war on the forests. It drove them out of the level valleys and plains that the plow might cut its fruitful furrow. It felled them along the shore lines and the river harbors that wharves might be built and open trading posts established. Alexander Hall tells how the mammoth trees at Astoria were destroyed in 1811—colossal trunks, painfully cut off with elemental tools by those first settlers, but unable to fall because of the close standing giants about them until many were severed, and then, when felled, of no value to the settlers whatever—a useless encumbrance, too huge to handle, that must be got rid of by the slow process of burning. Only then could the smaller trees, such as they could manage, be brought down from the hills and built into a fort.

Thus have the giant trees been wasted and laid low. Except for the Pacific Northwest, most of the vast virgin forests of America have disappeared. Even here, where twenty percent of the nation's standing timber is still massed in magnificent units, the harvest is fast and formidable. In Oregon alone it is progressing at the rate of 100,000 acres a year. These astounding figures, moreover, are bound to be inflated by demands that must follow depletion elsewhere.

But the harvest is steadily becoming scientific. Conservation is coming into its own. Reforestation is an accepted policy with the lumberman of foresight. The trained forester is displacing the merely experienced woodsman. As a consequence, Oregon, along with the rest of the Pacific Northwest, seems assured of an enduring forest asset—the last, on a grand scale, in America.

Here a great School of Forestry—with adequate classrooms and laboratories, timber areas for field work and research, reforestation plantings, a convenient arboretum, modern logging and milling operations, and a faculty imbued with both the love of the forest and the spirit of research—is striving by scientific education to preserve to Oregon a perpetual and profitable industry, the logging and lumber business, and along with it the invaluable resource of a great natural reserve of trees. With vast mountain areas, comprising more than twenty million acres, good for nothing else but to grow trees, this is a feasible and worthy objective in Oregon. "The glamor of Robin Hood days is gone," writes Dean Peavy in *The Forest Cruise,* "but the forest of the present is just as refreshing, just as enticing and just as romantic as it was in the days when the merry men with their staves and stout yew bows roamed Sherwood Forest."

Mechanic Arts Group on Monroe Street.

Margaret Snell Hall from Women's Building.

The modern forester is a trained specialist who lines up with the engineer and other professional technicians. To the youth physically fit, fond of the open, clear in his spense of duty and responsibility, and able to relish occasional solitude, the field offers refreshing opportunities. So does the closely allied work of the logging engineer and the lumber specialist.

Military Science and Tactics

Senator Morrill and President Lincoln, who were chiefly responsible for the Congressional Act of 1862 establishing the land-grant colleges, were both earnest advocates of military training as an element of their instruction. Senator Nelson, who was chiefly responsible for adding to the support of these institutions in 1907, commended the citizenship training of their curricula, "where literary, ethical, scientific, industrial, and military training are blended into a strong, sensible, inspirational scheme of education." Into this scheme of education the R. O. T. C. of today fits its modern training.—Colonel G. W. Moses, Commandant of Cadets.

SCIENCE received an impetus during the World War never before equalled in a given period of time. Engineering, aviation, chemistry, physics, sanitation, and even psychology, especially as applied to personnel management, all experienced an impulse that tremendously advanced their service to society.

Training in military science and tactics, as a consequence, has experienced a very radical change since the war. Theoretical training, based on the fundamental sciences, has largely replaced the former emphasis on drill. The work of the Reserve Officers' Training Corps now concerns itself chiefly with the solution of problems in field work, tactical situations, engineering, physical training, morale, organization, and leadership.

Four branches of training are offered at the College: Infantry, Cavalry, Engineers, and Field Artillery. A major curriculum leading to the bachelor's degree in Military Science and Tactics affords excellent training in general engineering.

The Armory.

Home Economics

Surely and widely have the doors of education opened to women—how surely and widely science is witness. For the larger opportunities of women have been coincident with the development of science in education and industry. Through the doorway of modern education, rich in scientific knowledge, woman has come into a fuller and more definite conception of her work and worth in human society, particularly as it deals with the development and training of childhood and youth, the feeding and clothing of the family, and the maintenance of a physical and spiritual retreat for the workers of the world—the home, the nation's real foundation.—Ava B. Milam, Dean of the School of Home Economics.

MODERN women, especially those who are responsible for a home, are closer to the realities of human life than men. They need, and are finding, the aids that science can give to help make life more secure, more congenial, and more inspiring. In the newer education, science, instead of being the repellent, obnoxious thing that it was to the clinging vine of an earlier generation, is the talisman of the independent woman of today. It is more, indeed: it is her handmaiden.

Good nutrition is the foundation of good health. Science has introduced the modern woman into a new world of nutrition, with its balance between the food elements, its principles of selection and preparation, and its vitamins. Organization of institutions, budgeting of time and money, simplicity and beauty of surroundings, distinction, economy and charm in dress, and the development of child life into alert, harmonious youth are all elements of a progressive course in home economics, to which science makes its indispensable contribution.

Women trained in home economics find many avenues of service open to them—leading, not infrequently, to the highest executive positions, such as the Women's Joint Congressional Committee and similar organizations for fostering the welfare of women and the home. Many teach, leading young people toward desires and habits of wholesome living. Still others serve the public as managers of cafeterias, tearooms and hotel dining-rooms, adding to the health and comfort of the world through well-prepared food attractively served. Along with these are the dietitians, institution specialists, and food demonstrators. Others become interior decorators and art-shop women who point the way to convenience, comfort, and beauty in the home. Still others turn to social service work, helping the indigent and the unfortunate

By means of animal experiments showing the need for adequate diet the results of deficiencies of calcium, vitamins, etc., are forcibly demonstrated.

to make the most of their environment. Their studies in nutrition, health, child care, etc., make for success in this work. Add to these various callings the extension worker in home economics, the research worker, recently reinforced by the Federal Purnell appropriations, and the journalist who specializes in women's departments for newspapers and magazines, and the field for the woman trained in home economics becomes almost as wide as modern life itself.

Thus, a study of home economics equips a girl for intelligent and happy living and at the same time for earning her own way.

A common quality is found in all women trained in home economics no matter what their walk or work in life. They are adaptable. Somehow, whatever their environment, they find their niche of helpfulness. These women feel that they can serve the world and themselves better for having had a scientific training in home economics. It provides them a means of self-support through various avenues of women's work, and at the same time equips them for establishing and managing their own homes when the time arrives.

A tea room located on the third floor of the home economics building provides actual practice for students majoring in institutional management. Noon meals are served regularly and special dinner parties and banquets cared for. Campus dormitories and cafeteria also are used for this training.

Mining

Since the beginning of the metal-using industrial era science has been the foundation of Mining Engineering education. A few years ago, without a scientific training, one could produce metals in small quantities from ores containing native material. Today no mining or allied industry can prosper unless it is conducted on the highest scientific plane, whether it be the producing end, the fabrication portion, or the business section of the industry. During the last fifty years the use of metals has increased many fold. Each year we are compelled to produce more and purer metal from lower grade and more complex ores. The secret of success is our ability to apply science to our industry, the most efficiently managed industry of all time.—Charles E. Newton, Dean of the School of Mines.

THE sensations attending the "gold craze" and mining romances of the past are inclined to inflate the importance of mining in earlier days and to dwarf it today. "The days of '49" in California, "Cripple Creek," "The Klondike" and similar phrases are quick to conjure up impressions of prodigious wealth obtained from mining. Yet the mining operations of today are vastly more productive of essential wealth and far more reliable as a factor in industrial progress than they ever were in the past.

But they are radically different, as a rule. They are no longer based on chance discovery, personal adventure, individual initiative, or personal persistence. They are primarily commercial projects. They do not depend for backing upon vague inflaming rumors, but on scientific surveys, conducted by geologists and mining engineers. They are as definitely founded on commercial surveys as on mineralogical analyses. For the modern mining project, as a rule, is first of all a feasible industrial enterprise.

There are exceptions, of course—isolated instances of individual successes that exemplify the old type of adventurous mining. But for each of these successes there are scores of tragic and tatterdemalion failures. It is the long and crooked trail of these many failures, and many fakes—strewn with the wreckage of lost fortunes and of blasted human lives—that has helped to arm the geologist or mining engineer with an uncompromising frankness to back up the accuracy of his honest findings. Formerly, perhaps, when tests were less exact, this confident frankness could hardly have been justified. But science today not only justifies but demands that the mining expert speak with authority.

The mining and metallurgical industries of the modern world are far more imposing in their greatness and importance than those of the past. They are supplemented by enormous mechanical, industrial, and commercial organizations. Their markets are world wide. They are absolutely essential to the maintenance of the modern industrial system on which we depend. The place of the mining engineer, therefore, is more secure today than ever before. His field of operations is constantly broadening and calling for scientifically trained men.

The School of Mines offers to its students the opportunity of training for the right start in the work of mining engineering through three major curricula, Geology, Mining and Metallurgy.

The Mines Building in early spring.


The Pharmacy Building.

Pharmacy

The method of the pharmacist is the method of science, which permits no guesswork. The scientific method involves two things: knowing what you want to do, and knowing how to do it best. Both call for education—intensive, specialized education. A man may guess correctly once, or even twice, but only the man with the proper training will be consistently right. He must know he is right. A pharmacist can afford to take no chances. He must know he is right, and such exact knowledge comes only from scientific education.—Adolph Ziefle, Dean of the School of Pharmacy.

THE pharmacist, by reason of his versatility as a student of the problems of the human body, the sanitation and comfort of the home, and the well being of our cities and their collective health, has come to be a very important factor in our community life. Everybody knows his influence in this field. He has also come to be a much more important factor in his contributions to science. But very few are aware of his work in this significant realm.

The science of pharmacy as a branch of pharmacology has done much in the past three centuries to dissipate the old superstitions of the alchemists, and the humbugs of magicians who treated diseases with all sorts of weird concoctions. It has helped, step by step, through discovery and trial, to establish the authenticity of natural drugs. During the past generation especially it has added immensely to exact knowledge of medicines. Scarcely a day has passed without some new discovery of this kind. Merely to enumerate the new drug substances that have been added to medical science since 1900 would make a good-sized encyclopedia. Many of these discoveries have been so significant that they have helped to clean up vast areas of the world formerly given over to ravaging diseases. Many have contributed to some of the most constructive movements for conserving health. "To pharmacology" writes a contemporary scientist "must go largely the credit for most of our knowledge of the vitamins, those substances necessary to body growth and to the prevention of various diseases."

All this background of discovery, applied to the everyday life of the world, stirs the zeal of the student in the classroom. It awakens his sense of obligation. It impresses upon him the need for absolute accuracy and painstaking thoroughness. It makes of his laboratory a shrine of useful service.

Society, knowing the value of the pharmacist, has demanded that he shall be well prepared for his work. He must be licensed by the State Board of Pharmacy. But in Oregon, among other progressive states, he must be a graduate of an accredited college of pharmacy before he can be accepted for examination as a candidate for registered pharmacist. The training afforded in an accredited college, in short, involving both theoretical and laboratory instruction, is now regarded as essential to the thorough preparation of the modern pharmacist.

Oregon State School of Pharmacy has many progressive features that distinguish its work, such as a model drug store, a drug garden, and a drug laboratory.

The College Library, south front.

Vocational Education

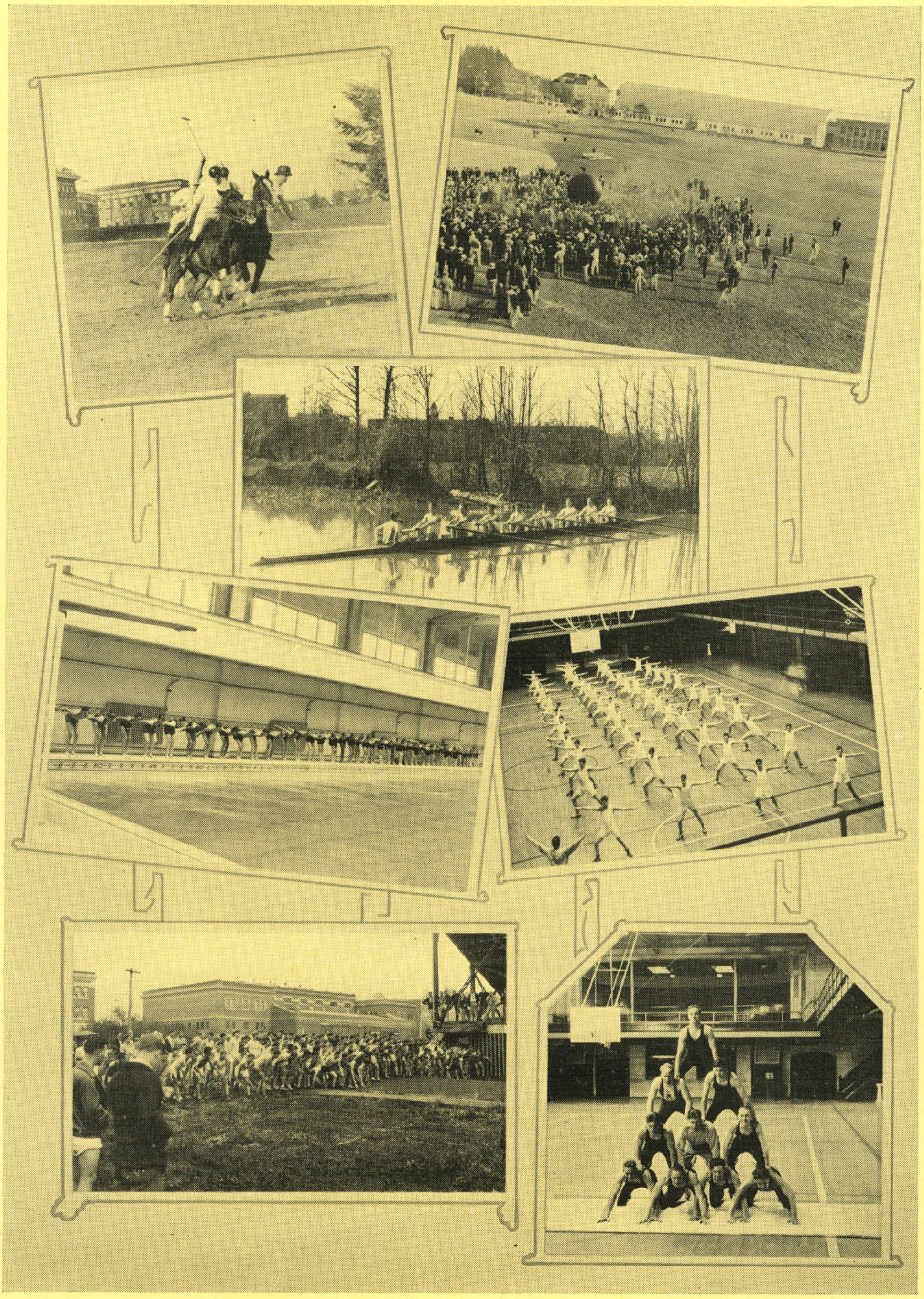
In America we have always believed in education. But only recently, as the scientific attitude toward life has been felt in this field, have we come to analyze the term "education" and carefully define it. The word was once practically synonymous with knowledge. That idea, however, has been all but abandoned, for we have come to understand that knowledge does not always govern conduct. The will then claimed public attention, and education came to include skills and precisions as well as verbal knowledge—we were taught to do with our muscles what we desired to do with our minds. Now, however, education is being made to include the feelings, as well as knowledge and the will, so that our actions may be motivated. Consequently education has come to imply such training as shall guarantee that the student will eventually learn to do better those things that normally he may be expected to do anyway.—J. R. Jewell, Dean of the School of Vocational Education.

SCIENCE has introduced into modern education the means of measuring the results of many phases of school work. Intelligence tests, placement and classification tests, achievement tests, and all the other modern resources of statistics and measurement, have put into the hands of the alert educator fresh means of determining the soundness and constructive value of educational processes. He can test his own work as a whole by a fixed standard or by comparison with that of other educational systems. He can test the individual teacher or pupil.

In the field of vocational education these modern resources have been welcomed and applied as a definite contribution toward the more exact measurement of educational efficiency. At Oregon State, where a program of teacher training has grown up as an essential adjunct of the technical schools, confirmed and assisted by the State Board for Vocational Education, the scientific spirit that pervades the institution as a whole has been clearly in evidence in the field of education.

The School of Vocational Education, in short, manned by a personnel of high scholarship and inquiring spirit, is directing the educational thought and ideals of several hundred students. Some major in vocational education, preparing for teaching or administrative positions demanding a knowledge of a number of vocations, rather than one only. Others major in agriculture, commerce, engineering, or home economics, but pursue their educational work in the School of Vocational Education. Thus the School articulates its work with that of the technical schools in such a way that the training in education, psychology, methods and supervision is provided by the School of Vocational Education, and the technique and subject-matter of the special field of teaching—agriculture, industrial arts, etc.—is provided in the technical school to which it belongs. Scientific instruction is thus assured, under both professional and technical supervision.

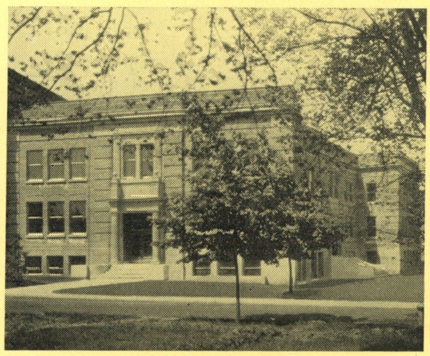
To the end that the teacher of vocational education trained at Oregon State may become the best possible teacher he is capable of being, he is given opportunity to master not only the elements of the subject-matter and technique he will teach in the classroom, but also the professional principles that will give him a broad perspective of his field and a competent grasp of educational problems.



Scientific principles of health and education are back of all the work in physical education and sports at Oregon State.

Miscellaneous

Scholastic Standards. No institution of its type in America has advanced its standards more consistently in the past ten years than Oregon State. It is now regularly accredited by all the leading collegiate rating organizations of the country, including the Association of American Universities, the Northwest Association of Secondary and Higher Schools, the American Association of University Women, the New York Board of Regents, the University of Illinois and others. Devices such as the junior certificate, the grade-point system, freshman week and orientation courses for entering students, all help to maintain high standards of scholarship on the campus.



Physics Building.

Physical Education has been maintained at the College on a high plane of scientific efficiency, and athletic activities reflect this high standard in a spirit of real sportsmanship. The College was one of the first to establish physical education on a broad basis, directed by experts, for the benefit of all students. A scientifically trained staff, superior equipment and almost universal participation of students in intramural sports have combined to give physical education at the College and all phases of athletics an ascendant stride. In competition with all the best institutions of the Pacific Coast the College holds a creditable record in athletics, as well as in forensics and other fields of intercollegiate activity.

Music. A group of artists, trained by distinguished masters and accomplished in their special fields of musical expression, give private instruction to individual students, at moderate tuition charges, provide musical programs for college events, and give instruction, without cost to the participants, to the glee club, madrigal club, band, orchestra, mandolin club, etc. The instruction offered is recognized as of the highest artistic standard.

Industrial Journalism is a service department that renders very practical aid to the various technical fields of study at the College by instructing students in the art of adequate expression through the press. Technicians, competently trained in the elements of news writing, editing, and feature writing, as taught by the department, have proved their efficiency in many fields of specialized service.

Corvallis, the seat of the State College, is a city of 8,000 people situated in the heart of the Willamette Valley, midway between the Cascades on the east and the Coast range and the Pacific ocean on the west. Its surroundings are beautiful and its climate unsurpassed even in the Pacific Northwest. The city has mountain water, sixteen miles of paved streets, superior church and school facilities, excellent hotels, and various civic associations that are functioning for the upbuilding of the community. It is conspicuously a city of homes.

The Men's Gymnasium.

The Idealism of Science

"Inventions grow old and are superceded by other inventions, and being the creations of the constructive schemes of mortal man, are themselves mortal. But the laws which the stars and planets obey and have always obeyed in their paths through the heavens are unchangeable; they never grow old, and therefore are immortal; they are a part of eternal truth. We do not know of any natural processes by which eternal things have been evolved. Their existence is the best philosophic proof that back of all this changeable visible world there is the unchangeable, the eternal divinity."—Michael Pupin, in From Immigrant to Inventor.

NOBODY questions today the work of science in the material realm that has given us mastery of the air and the underseas, prolonged human life, and made vocal communication instantaneous throughout the world. But many are still ignorant of all that science has done to give us an understanding of the human mind, of social relations, and of the development of moral and spiritual ideals. A practical example of the achievements of science in the intellectual realm is found in our present technique of educational and vocational guidance. Yet many are skeptical of its value, though the results of the Committee on Classification of Personnel in the Army, in examining nearly two million American soldiers and following out their careers in service during the World War, are matters of complete official record for all to read. Since the beginning of scientific vocational guidance, in fact, under Dr. Frank Parsons in Boston (first report, 1908) there has been a growing and thoroughly authentic body of scientific principles, tests, analyses, standards and technique that enable the competently trained to give definite and reliable help to young people in discovering those lines of endeavor in which they may find their greatest possibilities for service and happiness. Experience, scientifically recorded and analyzed, is the basis of this valuable counsel.

The interrelation of science and spiritual ideals is being increasingly recognized today. "Science, the fine arts, and religion represent the three fundamental activities of the human soul," writes Michael Pupin in The New Reformation, "and the highest beauty of Christian life consists in a harmonious blending of these three fundamental activities, just as the beauties of human vision consist in a harmonious blending of its three fundamental colors." And the scientist does not hesitate, he points out, to pin his faith on things which are ultra-material provided he knows their actions and reactions.

The creative scientist is essentially reverent as well as imaginative; he comes close enough to the inexorable laws of the universe to realize that science is the food which nourishes not only the material but the spiritual body of man. For he knows that law reigns within the personality as well as without. He knows that "the attempt to amputate the spiritual from the physical world paralyzes both."* And in his search for eternal truth he becomes the true crusader, worthy of the characterization that John Tyndall, himself among the immortals, applied to Michael Faraday in the closing words of his book "Faraday The Discoverer"—

Just and faithful knight of God!

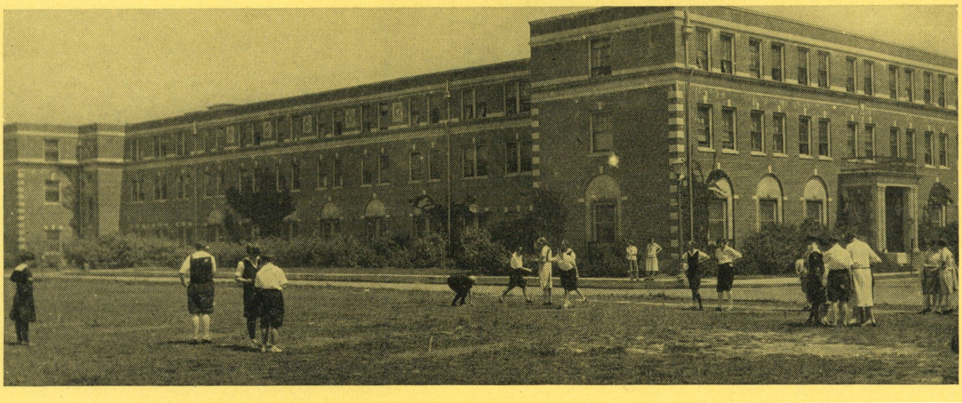
*Dr. Frederick Soddy in Science and Life.

The Women's Building, headquarters of a modern program of physical training for women.

The Women's Building, architecturally beautiful and admirably adapted, through its modern facilities, organization and equipment, for the development of the health and recreational life of the women students.

The ultimate ideal of an institution of scientific learning such as the College is the development of a knighthood of service—expert in technique but "just and faithful" to the highest moral and intellectual standards of the race. For there is a scientific basis for leadership in moral, religious and spiritual fields as well as in the physical conditions of existence. At the College this basis is definitely recognized and fostered by the organized religious agencies of the college community, by the offices of the dean of men and the dean of women, and by the administrative ideals of the entire institution. Psychology, ethics, personnel management, citizenship training, and the scientific treatment of religion thus make their definite contribution through the College toward building up in this country of ours a nation "great in its resources of wealth and power, but greatest of all in the aggregate of its intelligence and virtue."

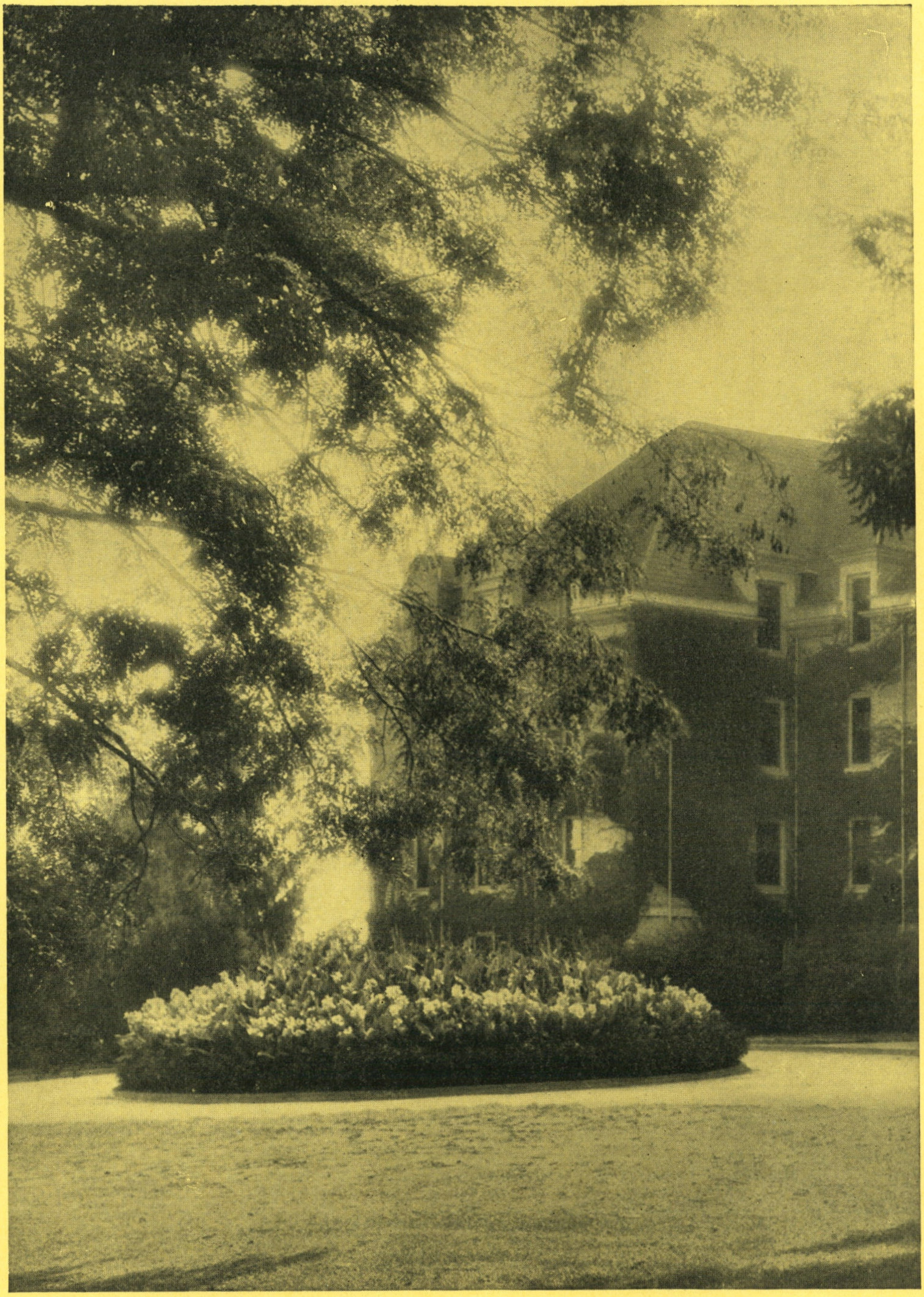
"In fact the most wantonly destructive forces in modern life and the most sordidly commercial, are not in general found in the field of science, nor having anything to do with it. It is literature and art, much more than science, which have been the prey of those influences through which the chief menace to our civilization comes.—Robert A. Milliken, in Science and Modern Life, Atlantic Monthly.



A temporary recreational unit for women west of Margaret Snell Hall. New recreation areas are being developed west of the new Women's Building, which is just south of the area shown.

Alumni Day and Baccalaureate. The alumni lunch on the lawn; President and Mrs. Kerr receive for the graduates; Dr. Weatherford lays the corner stone of the Memorial Union and Dr. Irvine gives the address; the Baccalaureate exercises; an alumni reunion.

Commencement, 1928. The color guard with President Kerr, Dr. Penrose and the Regents; Dr. Poling offering the invocation; the academic procession; the alumni banquet; graduates receiving their diplomas; Dr. Kerr addressing the graduates.



Waldo Hall.

The College in Outline

Resident Instruction

The Degree-Granting Schools and Departments---

The School of Agriculture
The Department of Chemical Engineering
The School of Commerce
The School of Engineering and Mechanic Arts
The School of Forestry
The School of Home Economics
The Department of Military Science and Tactics
The School of Mines
The School of Pharmacy
The School of Vocational Education

The School of Basic Arts and Sciences and other service departments, including Industrial Journalism, Library Practice, Music, and Physical Education, offering work basic and supplemental to the degree curricula.

The Short Sessions, including the Summer Session and the Winter Short Courses.

Research and Experimentation

The Agricultural Experiment Station, including the Home Station at Corvallis and the branch stations at Union, Moro, Hermiston, Talent, Burns, Astoria, and Hood River.

The Engineering Experiment Station.

Graduate Research.

Extension Service

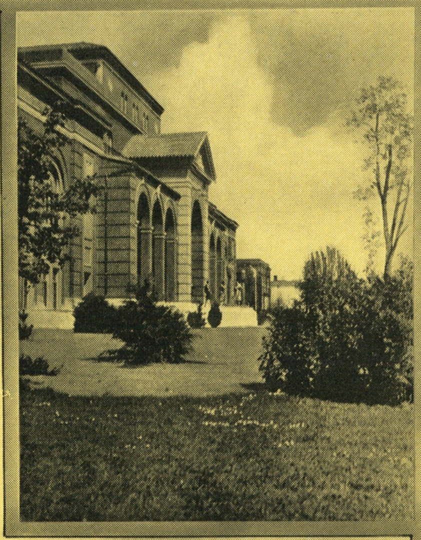
County Agricultural, Home Demonstration, and Boys' and Girls' Club Work.

Extension Specialist Work.

Extension Publications, Lectures, Meetings, Correspondence Study.

For Catalogue and other information address

THE REGISTRAR
OREGON STATE AGRICULTURAL COLLEGE
CORVALLIS, OREGON



The Summer Session at Oregon State affords opportunity for specialized study under the direction of staff experts, supplemented by distinguished educators from other institutions, and offers unusual attractions for a refreshing vacation period, with outings in the neighboring mountains and at the seashore.

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Agricultural College
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CORVALLIS, OREGON

SCIENCE
The Key to Education

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