

Vol. 7 No. 90

July, 1926

MINNESOTA CHATS



For a Better
Minnesota

Published Monthly by the University of Minnesota, Minneapolis. Entered as second-class matter at the Minneapolis, Minn., post office. Acceptance for mailing at special rate of postage provided for in section 1103, Act of Oct. 3, 1917, authorized May 26, 1923.

Foreword

JUST as truly as Minnesota from her mines, fields, and herds supplies an important part of the world's markets with iron, wheat, and butter, do her scholars and research workers in the University of Minnesota send into the current of world thought many striking additions to the sum total of knowledge and accumulated scientific fact.

AMONG the members of the University faculty are many who year by year make contributions that draw attention to Minnesota in all of the world centers where scholarship is prized and furthered, as well as in the hundreds of important educational institutions in the United States and Canada.

IN its State University Minnesota maintains an institution which represents more than any other in the state, the people's willingness to be of service and to contribute to the world's general welfare and to the advancement of knowledge and civilization. Furthermore, the people of Minnesota are enabled to give this service at practically no cost to themselves, inasmuch as the University each year pays its cost many times over through its functions of educating young people, preparing teachers, training men and women in the professions, and serving Minnesotans through its projects in engineering, agriculture, geology, municipal and state government, school management, care of the indigent sick, extension work, and the like.

IN its current issue MINNESOTA CHATS is presenting three articles that describe a striking research in plant life, another in geology, and an important experiment in high school management. These things are typical of many others that are in progress on the campus at all times.

THE EDITOR

Sweden's Future King Visits the University

The Address of President Lotus D. Coffman during the Public Ceremonies

THIS vast audience meets today in high convocation to extend greetings to the distinguished guests of the University of Minnesota. The arrangements for this great meeting and for the entertainment of the royal visitors at the University were made by a general committee consisting of the Swedish Memorial Committee, whose chairman is Professor A. A. Stomberg; the John Ericsson Committee, whose chairman is Mr. Edgar L. Mattson; and the University Committee on Public Functions. The University wishes to extend grateful acknowledgment to these and their associates for their co-operation and assistance in planning for this meeting.

It seems peculiarly fitting that the respect and admiration of the people of this state and of this University in particular should be shown in a public way to the Crown Prince and the Crown Princess of Sweden and to the great country they represent. Tens of thousands of Swedish immigrants have established their homes in this state and thousands of their children and grandchildren have attended the University of Minnesota. A deep and abiding affection for the homeland, for its adventurous spirit, its traditions, its high regard for law and for the cultivation of the arts and sciences, survives in them and lives in their children. The United States as well as the state is cemented to the Swedish nation by a heavy debt of gratitude and an enduring friendship.

For a century and a half a bond of common interest and mutual esteem and respect has existed between Sweden and the United States. Sweden was the second of the great world powers to recognize the independence of the United States. From that time to the present moment this country has maintained close and amicable political and cultural relations with Sweden. The pervasive spirit of democracy which early found expression and still flour-

ishes, the early recognition of a free and universal system of education and the general spirit of progress pervading Sweden, long ago established an enduring kinship with our own country.

One of the guarantees of civil liberty which many hitherto thought indigenous to American soil, is that the children of all men shall enjoy as nearly free and equal educational privileges as it is possible for us to provide. Long before this principle became a part of the American philosophy, it had existed in spirit in Sweden. As early as the seventeenth century the people in many parts of Sweden were able to read. In 1686 definite regulations with reference to elementary education as a state concern were made. The priests were directed to proceed with all diligence to teach the boys and girls to learn to read. A certain amount of knowledge was required for permission to marry. The immediate result of the regulations issued at the close of the seventeenth century was a wider dissemination of the ability to read; the remote result was that the ability to read served as a leaven for more than a hundred years for the widespread increase of knowledge and the encouragement and promotion of popular education.

In 1842 Sweden promulgated her first elementary education statute which made education compulsory by requiring at least one school with a teacher of recognized competence in each parish. From that time education both general and special, has prospered in Sweden. A school system has been established, which, from the standpoint of organization, qualifications of teachers, progressive ideas, and results attained, has served as a brilliant example, worthy of emulation in many respects, by the rest of the civilized world. The effectiveness of the Swedish system of elementary education is revealed by the fact that the percentage of

illiteracy is one tenth of one per cent, perhaps the lowest in all the world.

THE universities and technical schools of Sweden take high rank. Men of achievement and of recognized scholarship, trained in these institutions, are members of the faculty of the University of Minnesota. Young scholars of great promise now on our faculty are being urged to attend some of the higher institutions of learning in Sweden, for the reason that the ablest and best scholars of the world in certain special fields are found in these universities.

By the annual Nobel prizes, Sweden seeks to serve the cause of world peace and the universal brotherhood of man, and it rewards and gives new impetus to scientific and literary achievements wherever they may be found. How fortunate it is that some nation has recognized that the benefits of science and literature belong to all mankind, that they should be rewarded without reference to national boundaries or racial lines, and that the stimulation of men of the finest minds and rarest skills to pursue their researches represents the surest way to promote human progress.

The state of Minnesota and the University of Minnesota have profited greatly by the standards of excellence and the educational achievements of Sweden, for the simple reason that this state has a larger population of Swedish descent than any other state in the United States. Here it is possible for one in certain localities to travel for forty or more miles and find none but Swedish homes. At the last census the total number of our people born in Sweden was 112,117 and, of course, their descendants may be multiplied by hundreds of thousands. The contribution which these people have made to the building of this commonwealth constitutes an impressive chapter in its history.

There is a peculiar fitness in the visit of Their Royal Highnesses, the Crown Prince and the Crown Princess, to the University of Minnesota, partly because of their keen interest in the sciences and the humanities, but more especially because the University of Minnesota has a larger contingent of students of Swedish descent than any other higher institution of

learning outside of Sweden. Approximately 2,000 of our students are of Swedish extraction.

The permeating influence of the fatherland is shown in the presence of the Scandinavian Department in the University, offering instruction in Swedish and Norwegian. This department was established nearly a half century ago.

THE Library of the University of Minnesota is undoubtedly the best equipped in the matter of books, periodicals, and records in the field of Swedish literature, philology, and history of any library in America.

There remains only a need for a great museum of culture, emphasizing especially the Scandinavian, presenting in concrete form the story of progress, depicting the life and visualizing the accomplishments of these great nations, to make complete the contribution of this institution through its educational channels to multitudes who are unfamiliar with these alluring chapters of history and who are not likely to have the privilege of returning to their homelands for this inspiration and knowledge.

Thousands of students of Swedish descent have enjoyed the privileges of higher education at this University. It is a matter of profound regret that I cannot upon this occasion name those Swedish students who have achieved national, and in some cases, international, distinction. It cannot be done; the list is too long. They have become professors of the various sciences and arts, doctors of dentistry and of medicine, industrial chemists, social service workers, journalists, dramatic and literary critics, lawyers, public officers, judges of higher courts, governors, actors, authors, missionaries, and clergymen. No field of worthy human endeavor has been left untouched by them. Science has unlocked her doors and literature has been embellished through their efforts. The crafts and professions have felt and have yielded to the stimulating ethics of these trained leaders.

The University of Minnesota is proud of her Swedish heritage and she is proud of the opportunity that has been afforded her to train thousands of Swedish youth for the life of the adopted country of their fathers and for

leadership in their chosen professions. The University glories in the achievements of her Swedish sons and daughters. She feels that her ideals at their best will be safe in their hands, for their ancestors for centuries have been thoughtful of their obligations and attentive to their responsibilities. The heritage of statesmanship, of courage, and of idealism which has characterized the national life of Sweden, her children have brought as a rich heritage to the plains of Minnesota. The schools and colleges of this state have felt, and still continue to feel, the quiet, intelligent, and persistent support of the possessors of this heritage. Education for centuries has been, and still is, a major interest of this people.

IT is my belief that we here today take as great pride in the cultural interests and educational achievements of our most distinguished guest as we do in his statesmanship. We dare to believe that his statesmanship and royalty have both been enriched by the fact that he has been trained in the elementary schools and the universities of his own country and that he has maintained an unflagging interest in the supreme values of education.

We come to this meeting mingling the high hopes and dreams that characterize the spirit of America with those of the progressive and far-seeing races that have made the Northwest their home, resolved to build on the superstructures of state and school which these hardy pioneers founded here, still nobler and greater structures if that may be.

We come more especially to pay our respects to our distinguished guests from Sweden who honor us with their presence upon this occasion. Their visit here will do much to increase the good will and regard we already bear their native land and to bind us closer to them in bonds of esteem and affection. We are particularly moved by the presence of the Crown Prince at a University function because by training, experience, and inclination, he represents the idealism, the purposes, and the ambitions of a great university whose fundamental purpose is that of serving mankind better and better with each succeeding generation.

Finally we come that East may join with West, and West with East, in enhancing the spirit of good will, amity, and concord that should exist among the nations of the earth.

Charting the World for Its Deposits of Metals

A Bird's-Eye View of All Mines Reveals the Law of Deposition

STUDIES conducted over a series of years by Dr. W. H. Emmons, head of the Department of Geology at the University of Minnesota, have led him to advance such interesting new theories regarding the deposition of minerals and ores and the relationship of ore deposits to the formation of the earth's surface that he has been asked to explain them in papers before the Society of Economic Geology next December, and in February before the American Institute of Mining and Metallurgical Engineers, meeting in New York. These are the two principal American bodies dealing with the more practical as well as the scientific aspects of geology.

To arrive at his conclusions Dr. Emmons has spent years familiarizing himself in detail with the geological formations of the entire world on the assumption that a picture of the mineral deposits over the face of the globe would enable him, through generalizations, to arrive at the laws that govern the formation of mineral deposits and explain both the place and the condition in which they may be found. It is this law which he now believes he has found. His intent is, however, not to state it as a theory but to present the facts revealed by his world-wide study with the hope that these facts will speak for themselves and establish his discovery as accepted geologic law.

As is true of nearly all scientific work, parts of Dr. Emmons' theory have been known and partially accepted for many years, some parts for half a century. The task on which he is now engaged, however, is that of bringing together such a mass of supporting evidence that these theories and the extension of them which he has made will stand as finally proved.

The Grouping of Metal Deposits

As outlined by himself, his explanation of mineral deposits is as follows:

Mineral veins may be grouped in six classes

depending upon their position with respect to the parent masses of igneous rock that brought in the veins and upon the amount these bodies and their associated veins have been eroded, as ages passed, by running water.

The deposits of these six groups depend upon the environment, and each deposit has a definite relation to the intrusives (or intrusions of igneous rock) and to the other deposits in the region. In some of the groups the ores of different metals are arranged in concentric belts or zones around the parent igneous mass, and these zones are arranged in the same order throughout the world.

The Shields, Bows, and Hinges

He points out, furthermore, that on the earth's surface there are six districts in which the surface has been deformed but little since very early geologic time. These are large areas known as "shields" and lie in Canada, Scandinavia, Eastern Siberia, Western Australia, Central Africa, and Brazil. As these regions have remained geologically unchanged for long ages, one finds in them minerals and metal ores deposited very long ago. Their deposits are deeply eroded so that today they present to the geologist or miner only the roots of veins.

Partly encircling the "shields" in long curves like those of a bow and therefore called the "bow areas," are other districts in which a deforming of the earth's crust took place after the "shields" had reached the fixed state in which they have remained. As the earth's crust wrinkled, mountains were thrust up, back in middle geologic time. Volcanoes spouted out their water and molten lava. Masses of hot rock from inside the earth thrust up towards the surface, bending and creasing it and sometimes breaking through. These are the intrusives. The deposition of minerals and metals accompanied these disturbances.

As one passes still further from the shields

and outside the bow areas, he comes into an area where volcanic action is still strong and where, on that account, the deposition of ore has taken place more recently or is still going on in contemporary geologic time. This area Dr. Emmons calls the earth's "hinge zone." It represents a line on which the surface of the earth has not yet reached fixation. It stretches around the entire world, and it is along this line that most of the volcanic action and the earthquakes that take place nowadays are encountered.

Along the Earthquake Line

The earth's "hinge zone" belts the Pacific Ocean and joins the East Indies with the West Indies along a line stretching through the Himalaya Mountains and the mountains of Persia and Asia Minor into the Balkans, the Carpathians, the Alps, the Apennines, and the Atlas Range of North Africa, thence through the Canary Islands to the West Indies and Central America.

In each of these three groups, the shields, bow areas, and hinge zone area, certain of the six types of ore deposits already mentioned, prevail, according to Dr. Emmons. Thus in the shields are found deposits that have been most deeply eroded because they have lain there since time immemorial. In the bows a great deal of erosion has taken place, for they date back to middle geologic time, but not so much as in the older shields. In the hinge zone the prevailing type of deposit is only slightly eroded, so that at many places the original or parent masses of igneous rock from which the deposited ores came are not even exposed as yet, and their presence is known only through dykes and flows or by the discovery of the lodes themselves or other evidences of volcanism.

World's Deposits As a Background

Dr. Emmons has built up his theory of shields, bows, and hinge zone by taking into joint consideration the recorded mineral deposits and structure of the earth's surface the world over and the widely accepted hypothesis that metals are deposited from the hot waters that flow to the earth's surface from the underground igneous masses that push up towards

the surface from the center of the earth. In previous studies he has pointed out how these waters deposit ore veins in which the minerals and metals vary from top to bottom of the vein. Nearest the bottom are found those minerals which are most readily deposited from hot water, while near the top of a vein are found those that remain longest in solution.

Conversely, in deeply eroded regions, like the shields, there would be little evidence of the minerals deposited near the top of a vein, for all of that would long since have been worn away by the action of water. One would find chiefly the minerals first deposited near the bottom of the vein. In the newer veins, such as those along the hinge zone, would be found series much more nearly complete. The minerals near enough to the surface in these to be discovered by man would probably be those deposited last and near the top of the original vein. Dr. Emmons' studies of deposits the world over bear out all of these assumptions.

Starting as an employee of the United States Geological Survey, Dr. Emmons has familiarized himself with the mineral deposits of the entire world, partly by first-hand contact and partly by studying the reports of geological surveys and of other scientific investigations. All in all, he finds the former method rather more exciting, but the latter more comprehensive.

Personal Visit Not Necessary

This is because the investigator who visits a region personally gets no more than a glimpse of his problem, at best, whereas, nowadays every nation and in this country nearly every state has its own geologic survey. In his office the student can take reports from these organizations and examine at length the results of investigations far more detailed and painstaking than he could possibly find time to make. Even for the districts one visits, the maps and reports enable the student to enlarge his knowledge a hundred-fold.

Dr. Emmons values, nevertheless, the first-hand investigations which led him into New England, the southern Appalachian territory, Tennessee, Georgia, North Carolina, Michigan, Minnesota, Texas, Oklahoma, Colorado, Wyom-

ming, Montana, Arizona, Nevada, and California while he was working for the government. In private practice as an economic geologist he has investigated ore bodies in Mexico, South America, Japan, China, England, France, and Switzerland. And as for the rest of the world, he has studied it over, deposit by deposit, from the records of painstaking scientific investigators. It is as a result of the comprehensive picture of mineral deposits obtained in this way that he has come upon the similarity of their arrangement in regions with a similar geologic history—the shields, bow areas, and hinge zone.

Why Geology Fascinates

At a huge table, occupying more than half of a large room and littered with books, maps, treatises, reprinted speeches, and great, loose-

leaf binders labeled "China," "Australia," "South Africa," and the like, Dr. Emmons explained his interest in geology and the manner in which it has grown on him.

"At first one finds geology interesting as a study of the environment of man," he said. "Then the interest swings more to the environment than to man himself, for the earth has its laws and lessons regardless of man's relation to it. But the third step in my own interest has been a specialization on the things in the earth which are useful to man. This becomes the problem of greatest and most absorbing interest. Except for the air and the sunshine, everything mankind uses comes from or grows upon the earth. The study of economic geology is the study of man's storehouse and of his bank account."

Plant Students May Make Waste Places Bloom

Botanist and Biochemist Seek to Adapt Species to Drouth and Cold

AS long as the world has all of the land needed to produce food for its millions the problem of agricultural expansion is relatively easy. The farmer can seek out a type of land suited to the crop he plans to raise. But such a condition cannot continue forever. Scientists are already foreseeing the time when even the entire world may not provide food enough for all its mouths, and within many individual nations that line has already been passed. Biologists predict the time, not far in the future, when our own country, despite its tremendous reaches, will be forced to employ every jot of skill and technique at its command if it is to raise its own sustenance.

When the wheat land and the corn land, the cotton land and that suited to potatoes has all been put to use, there will still remain tremendous stretches of soil not immediately suitable to any food producing species commonly raised. Then the situation will be changed. Instead of finding a soil and climate to fit the plant, science will have to find the plant to fit the soil and climate. More likely still, and more striking, science will be called upon to develop the plants, or species of plants, that will flourish on areas that would otherwise be fruitless.

The Experiments Begin

Some years ago, perhaps 12 or 15, two young scientists on the staff of the Carnegie Institution for Experimental Evolution at Cold Spring Harbor, Long Island, saw the importance of this need for identifying or developing plant species that would grow in outlawed agricultural areas. They foresaw that we should have to make use of land in the very dry places and the very cold places, at that time in the future when man should have pre-empted all the pleasancess, the warm fertile valleys, and the sunny Edens of the agriculturalist.

One of these two young men who were spending the first years of their scientific lives together at Cold Spring Harbor was a chemist who came also to know biology. The other was a biologist who came also to know chemistry. One has made and directed in the hands of graduate students important researches in the determination of useful plants that can be grown in areas too cold to be productive of the present types of plants; the other's studies have been aimed more especially at discovering species of economic usefulness that can be grown where it is now too dry. And the contrasting parallel between them can be carried still another step, for Ross Aiken Gortner came to Minnesota a number of years ago and became head of the Department of Agricultural Biochemistry, while J. Arthur Harris followed him some years later, in the fall of 1925, to become the new head of the Department of Botany.

Botany has come more and more in recent years to be numbered among the romantic sciences. No corner of the world is too obscure to offer its contribution to the researcher whose interest is purely scientific or to his fellow worker who seeks new plants or new knowledge of plants that will add to mankind's well-being. Among Minnesota's faculty Professor Josephine Tilden has scoured the shores of the South Seas in her studies of the foods on which fishes live, providing, in their turn, food for humanity. Professor F. K. Butters has become recognized as an authority on the plant life of the Selkirk Mountains in western Canada; Professor W. S. Cooper has studied the sand dune plant life of the Pacific Coast and was instrumental in getting the government to set aside the huge Glacier Bay reservation in southern Alaska; Professor C. O. Rosendahl has made important studies of the effects of tree and plant pollens, as in their relationship to hay fever, and with Professor Butters is com-

pleting a guide to the trees and shrubs of Minnesota.

Jungle and Desert Traversed

In his studies of plants that will survive desert conditions Dr. Harris has gone into the jungles of Jamaica and Hawaii, seeking the plants that grow under conditions involving extreme moisture, and into the deserts of Utah and Arizona to study and experiment with plant life under extremely dry conditions. Dr. Gortner, also, has studied in the deserts. And he points out, furthermore, that a study of plant behavior in winter is like a study of them in the desert, because the plant has no moisture available to it during the period of freezing, no matter how many feet of crystalline water in the shape of snow may be piled on top of it or how much frozen water may be resting in the earth near its roots.

Because of the experiments he and his associates in research have made, Dr. Harris can take a plant into the laboratory, study its juices, and tell whether it is likely to survive under desert conditions. And Dr. Gortner, as a result of his studies, also finds in plant juices, though more in the lack of juices, the key to his knowledge of a plant's ability to withstand the extreme winters of a northern climate.

"In desert plants we find a much greater concentration of the soluble substances in the juices than in plants that grow where there is plenty of moisture," says Dr. Harris. "Both drouth resistance and frost resistance can be determined by the chemical characteristics of a plant, and from our knowledge of these things we can predict the value of agricultural varieties grown under such conditions as we have assumed, extreme dryness or severe winter cold. Where the plant juices show an extreme concentration of salts and sugars they are much stronger in their resistance to drouth."

This knowledge has already been put to practical use in the introduction of species of alfalfa, of cotton, and in tree planting in areas once considered too arid to be used.

Contrasting regions such as Arizona for dryness and Hawaii for moisture, one part of the island of Jamaica for moisture and an another part for desert conditions, the Florida

Everglades for extreme moisture and dry shore areas of the same state for drouth were visited by Dr. Harris in his studies of plant adaptability to dryness. In every instance he found that the plant growing where moisture was abundant had a low concentration of salt and sugar in its juices, while for those that grew under desert conditions the concentration was very high.

Freezing Plants in the Desert

The ability to freeze a plant in the Arizona desert where the temperature is seldom below 100 during the day and not so very much lower at night is only one item in the elaborate laboratory technique that must be mastered by the scientist who makes studies like this. Use of a salt mixture based on the same principle employed when salt is put into the ice cream freezer enables the research worker to freeze his plants in the hottest desert and the freezing liberates the juices so that they can be thoroughly extracted by squeezing. The extent of the salt concentration, which is the most important, is then determined by passing an electric current through the juices. The more concentrated the solution, the less is the resistance to electricity. Measurement of the amount of current employed gives a key to the salt concentration.

At Sacaton, Arizona, where Dr. Harris and a number of others have been working summers for several years past on experiments started by the United States Department of Agriculture, a principal study has been to determine just why Egyptian cotton is superior to every other known type for growing where there is little moisture. The layman might say that this cotton came from Egypt, which is dry, and is therefore adapted to arid lands. That is true in a way, but science is thorough and must know why and how it became adapted. For Egyptian cotton was transplanted to that country, both from America and from Asia, and then was retransplanted into the American southwest.

A \$20,000,000 Crop

Its adaptability has furnished one of the most phenomenal successes of American agricultural experiment, for during the war, when

a tough, long-staple cotton was needed for many military purposes, the offspring of a single plant of Egyptian cotton developed by the United States department and chosen from among many thousand other plants yielded in one year a \$20,000,000 crop of cotton in the Salt River Valley of Arizona. This is cited by Dr. Harris as the outstanding example of what may be done by the adaptation of plant species to dry conditions.

In a lecture which Dr. Gortner has delivered at a number of western state universities under the auspices of the Mayo Foundation, he tells, among many other interesting things, how Robert Newton, now head of the Department of Agronomy and Biochemistry at the University of Alberta, when a graduate student at the University of Minnesota, took merely the leaves of six varieties of winter wheat, tested their juices, and predicted the order of their winter hardiness if planted side by side under exactly similar conditions. The six plots were left over winter and the one which he predicted would stand the cold best, did so; his prediction was 100 per cent in fact, for the one he said would be second best, was; so were the third, fourth, fifth, and sixth. Incidentally the wheat which stood the winter best was Minhardi, a variety developed at Minnesota by the plant breeders at the Central Experiment Station.

Dr. Gortner explains this experiment by saying that the percentage of "bound" water in a plant, as opposed to "free" water, determines its resistance to cold and also to drouth. This works in with Dr. Harris' theory, for the plant with a high concentration of salts in its juices, has a low percentage of free water, and probably a large percentage of bound water. The two work on the same problem stated in somewhat different terms.

What "Bound Water" Is

"Bound" water, however, shows the familiar liquid in a new and fascinating situation. It is water that is in such close association with the tremendously small particles of protein or vital tissues in a plant that no ordinary procedure will separate the two.

"A London fog," Dr. Gortner explains, "is

built up on millions of tiny particles floating in the air. The water in the air forms little balls around these minute particles. It piles up and these balls grow larger as a snowball might if rolled on a damp day. In the early morning there may be little fog, but when the factories send out their smoke with its trillions of particles for the water to cling to, the fog becomes more and more dense. In the bodies of plants, similarly, the tiny particles of living substance each form the nucleus for a tiny film of water. When the proportion of water in the form of water films is high in a plant, it resists freezing in cold weather and resists absorption by the sun in very hot weather. It hangs on to its plant. And plants of that type are the safe ones in cold and drouth."

He cites as an example the prickly pear cactus, with a high percentage of water bound to colloidal particles. It resists a year of drouth in the desert. Similarly Minhardi wheat, presumably because the bound water does not freeze so readily, though this remains to be wholly determined, withstands temperatures that kill other varieties. Scientists think that the free water, freezing into crystals, bursts apart the vital tissues of the plant and destroys it. But bound water does not behave in that way, even though it may freeze.

Nature has provided through its evolutionary adaptations that plants living where a supply of water is always available contain mostly free water. A study of the wild grasses that grow on the face of a sharply rising bank above a creek shows that those species near the creek bed have relatively little bound water and those near the top of the bank relatively much. Science has now recognized this principle. The next step is to find, or even to develop, species that have the desired properties. Much progress has already been made on wheat, as in the case of Minhardi. Some has been made on alfalfa. The principal need now is to find a species of oats with the characteristics that will adapt it to arid regions.

Does It Explain Old Age?

That the bound water theory is as important in a study of animal tissues as it is in that

of plant tissues is shown by the fact that Dr. Gortner's lecture has been offered under the Mayo Foundation. He believes it to have a definite bearing on the problem of old age, for tissues of the aged have relatively less bound water, which is to say, less of a water cushion between the solid particles, than have those of the young. Withering and softening come as the percentage of bound water decreases. Hardening of the arteries may be a lessening of the percentage of bound water and a consequent

tightening up of the particles, with resultant hardening. Dr. Gortner believes that it is.

Whether these studies, based on colloidal chemistry, ultimately solve the problem of old age, or adapt millions of dry acres to the production of plant forms which man may harvest for food or manufacture into clothing, they are the kind of thing that gives the wide-awake person a wholly new comprehension of such academic-sounding affairs as botany or agricultural biochemistry.

University High School--A Model for the State

Boys and Girls in Equal Numbers Study Under an Expert Faculty

A HIGH SCHOOL with exactly the same number of boys and girls in each of its four classes, with a faculty of 21 teachers of whom every one has the preparation for college as well as high school teaching and one which is actually a part of the University of Minnesota, so that its students may have the use of practically all of the facilities of the University—such is the University High School to which next fall exactly 38 new boys and 38 new girls will be admitted.

A high school in which careful psychological tests are the basis on which parents are asked to decide what work their children shall take; a school in which a fully rounded four-year course in physical training runs parallel with the four years of lessons; a high school in which directed self-government has been worked out on a basis that gives its members invaluable training in self-control and thoughtful facing of situations—again, the University High School.

University High School, maintained by the University of Minnesota on its own campus as a model institution in which young men and young women who are going to teach may observe and practice secondary instruction in its best development, has the additional novelty of being the one high school in the state which is wholly a state project. Its expenses are met from the budget of the University of Minnesota and from fees. The school is a part of the College of Education.

A Demonstration of Better Methods

A visit to the University High School shows it, by surface appearance, to be much like any other high school. The children go from class to class; they recite; they study; they chatter and concern themselves with class plays, football games, and parties, just as all children of high school age do. But on closer inspection one comes to the conclusion that this school

may be likened to a bazaar in which are demonstrated, one after another, the best teaching methods that have been evolved. Not that there is anything showy about the processes that go on; the methods employed have been evolved for use, not for display. One must look closely and make inquiry to see them demonstrated.

The momentary flash of surprise that comes when one learns that pupils in this school receive five psychological tests when they enter passes as soon as it is explained that these tests show, better than anything else that has been devised, the type of work the pupil should take up. The student whose test results indicate that he should specialize in tasks requiring mechanical ability is warned away from Latin. As the principal, C. W. Boardman, explains it, the parents are advised that Latin would not be the best subject for this pupil.

"Of course, if the father insists on Latin, Latin it shall be," he says. "If, after the results of our tests have been shown the parent and we have explained to him why it would be better for his son to specialize in another type of work, he still demands that the boy take Latin, he may have it. But as a matter of fact no parent has ever so insisted in all the time since we introduced the tests. Many of them, on the other hand, have come back to thank us for our advice and tell us how glad they were to have followed it."

Incidentally, due to the breadth of courses offered in University High School, it can follow out the dictates of the tests better than others can, for it has something to offer each group as revealed by the tests. Most schools would be unable to meet a good many of the needs shown by these examinations.

Work Is Checked Step by Step

The careful check made on pupils in this school is not restricted to the time of entrance.

Progress is also carefully checked. Take reading as a typical subject, the students of University High School do not merely take a test in "reading" as a generalized proposition. One test shows their ability to read the words; another proves up on their ability to comprehend the words they pronounce; still another registers their capacity for accurate spelling and grammar. They are taught, also, to read either for the full content of a book or to skim it rapidly so that they get the central thought when no more than that is necessary. Similar principles are followed in 'ritin' and 'rithmetic instruction.

Studies conducted by members of the University High School faculty are aimed at the discovery of new teaching truths that can be used throughout the schools of the state, and the results of these studies are published and distributed by the College of Education.

One of the most interesting of the recent studies was that of the vocabulary a history student should have. Miss Mary Gold of the English Department did the work. Starting with the assumption that a child, who did not know what treaty, battalion, siege, policy, or compromise meant, might read a great many thousand words in history textbooks without arriving at any very full understanding of history, Miss Gold selected 52 key words in the study of history and examined a class on these words. One student whose father is a professor of history in the University knew 46 of the first 52 words. He had heard history with his morning oatmeal and his evening strawberries—for even a professor may eat strawberries. Other members of the group ranged down to a familiarity with no more than 18 or 20 words. Drill in history vocabulary followed and it was found that the history marks increased in a manner strikingly similar to the increase in understanding of the words used in history.

"No one would think of teaching arithmetic to students who were unfamiliar with the plus, minus, and division signs, yet educators have gone on for years teaching history to children without making an effort to know whether the pupils really knew the symbols used to transmit the facts," explained Mr. Boardman. "A

study of this kind is a real contribution to the effectiveness of teaching, not only in our own school, but in all Minnesota schools."

A Venture in English Study

Another interesting venture has been that by Miss Dora Smith, who set about developing a method of teaching English literature that would make literature enjoyable. Her methods were aimed at bringing out the emotional and esthetic values in literature in such a way that the pupil would want to read rather than reading because a lesson had been assigned and she must know the content of it. While this might seem a difficult experiment for which to find an accurate measure of results, Miss Smith chose the simple index of the number of library books her students were reading. As the class advanced, its members were found to be reading half again, or twice, or three times as many library books as they had previously. The venture was an obvious success.

Financial responsibility, self-control, and the application of serious thought to group problems are developed in University High School through the workings of the high school senate which Mr. Boardman has devised. In matters of policy, such as the decision whether an entertainment shall be given, and if so how, and sometimes in matters of discipline where the case is of a sort that affects the entire school, this elected senate reaches a decision and reports it to the principal. Principal Boardman is inclined to emphasize the fact that the decision is reported to the principal. He does not take dictation from this body; not by any means. But he is pleased to find that in many cases its decisions are sane and just. All school funds are audited by a student treasurer whom the senate elects.

Senior Students Practice Teaching

Outstanding among the services performed by University High School is the opportunity it gives each year to 275 or 300 senior students in the College of Education to do practice teaching and familiarize themselves, under actual conditions, with classroom procedure in high school work. It is on account of this

need that the school is maintained, but it is not managed with the practice teachers uppermost in mind. The school is primarily for the pupils, as is any other good school, and the fact that it has a regular faculty of 21 for only two or three over 300 pupils shows the extent to which individual direction and guidance is carried. Another hundred or so seniors in education for whom there is no room in University High School obtain their teaching practice in the Minneapolis public schools.

Among the plans for development next year is one to supplement present training in physical education with supervised classes in social dancing and to begin group instruction in social procedure. No volume on etiquette is to be used as a text, but the students are to be taught,

by lecture and demonstration, what a well-behaved person is expected to do in common social situations, just as students of home economics are taught how to set a table and at what point in a meal the salad should make an appearance. Mr. Boardman expects this innovation to prove valuable.

"We take particular satisfaction in our unusually low percentage of failures," the principal of this model little high school declared. "It is by no means unusual for a high school to have between 15 and 20 per cent of failures in classroom work, but our average record has been but three per cent of failures. And what is more, our students do more work than those in most high schools and I am practically certain that they get more pleasure out of doing it."

Vol. 7 No. 91

September, 1926

MINNESOTA CHATS



For a Better
Minnesota

Foreword

Are These the Benefits of Education?

TO acquire information.

To get into the habit of thinking, which is to say, using and correlating information, and reaching conclusions.

To accustom oneself to habits which make the acquisition and use of knowledge more easy.

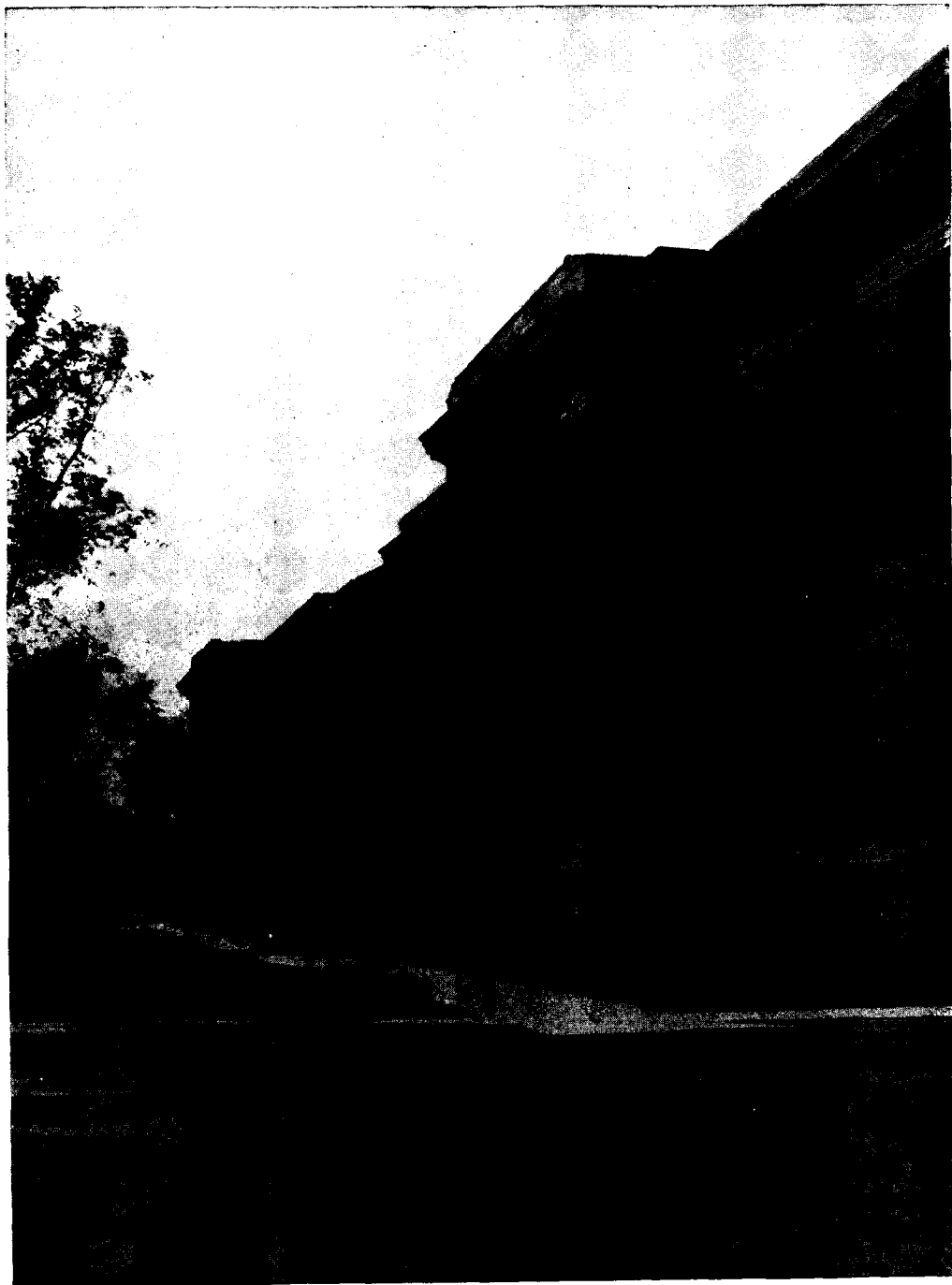
TO develop a sense of proportion by getting a view of more things in clearer relationships.

To acquire the knowledge that beauty of thought and action is worth while, together with the sharpened appreciation that enables one to recognize fine thoughts and acts.

To learn to treat the brain with respect and use it, knowing that intelligence enables one to change a tire better as well as solve problems in astrophysics.

TO gain the idea that doing well something we sincerely believe to be worth doing, is success, whether or not it yields us fame or wealth.

To learn to respect the rights and thoughts of others.



The New Face of the University
Colonnades of the Library and the School of Chemistry

University of Minnesota Will Welcome 10,000

Classes for the Year 1926-1927 Will Begin on September 27th

THE University of Minnesota will reopen its doors for class work on September 27th with a prospective undergraduate enrolment of 10,000 students. This amounts to approximately one university student among every 250 people in Minnesota, which can hardly be considered an unduly high ratio if, as seems certain, the 250 must find in that one the doctor, dentist, engineer, architect, skilled agriculturalist, teacher, physical educator, and research worker to serve them in the future. A casual census of Minnesota would show that the state is still an importer of trained skill and of human units devoted to intellectual callings.

In line with the University's policy of devoting as much attention as possible to the direction and guidance of students, so that they may take full advantage of the facilities provided at the University of Minnesota, "Freshman Week" has been instituted this year. Entering students are required to present themselves September 17th to go through the routine details of registration and then take part in a series of exercises designed to introduce them to university life, to the university establishments in which they will study, and to the ideals of behavior and work with which a new student should approach an institution for higher education.

Will Be Told How to Study

In addition to the usual physical and psychological examinations, the payment of fees and the filling out of registration blanks, the new students will be required to attend lectures on such subjects as "How to study," "The use of the library," and on important regulations of the University or the different colleges. They will also be conducted on visits to the library, scientific laboratories, and points of interest and importance about the campus. In a word, "Freshman Week" will hold something the same relationship to university life that a gen-

eral education holds to life. Those who experience it will know better what they are confronted with and will be enabled to take a more direct course to some goal.

One building, the new home of the Department of Botany, is going up as the college year 1926-27 begins, and the addition to the Engineering Experiment Station that will house the department of tests and inspection of the State Highway Department has recently been completed. Plans are maturing, also, for three other structures, the new Physics Building, to be built from Comprehensive Building Program funds, the Field House for athletics, to be financed from athletic receipts, and the University Auditorium. This will be paid for by subscriptions to the Stadium-Auditorium fund and will be begun when payments on that account warrant it.

The University is also making tentative plans to start on the system of dormitories for freshman students which was approved at a summer meeting of the Board of Regents. Without pledging the credit of the state, the University plans to issue bonds against the potential earnings of the dormitory system as a means of financing the dormitories. Charges in the dormitories will be no more than will cover interest, a sinking fund for retirement of the bonds, and reasonable costs of administration and upkeep. President L. D. Coffman believes that this will make the cost of rooms in the dormitories at least no greater than the charges in private homes. There will be the marked advantage of living in a new building, built specifically for the purpose to which it is put, and supervised by the University with a view to giving the students the true flavor and worth of a university life.

Three divisions will have new permanent heads this fall, while four others will be under the administration of new temporary heads. Dean R. A. Stevenson has come from the Uni-

versity of Cincinnati to become dean of the School of Business as successor to Dean George W. Dowrie, who has gone to Leland Stanford to teach. Dr. C. S. Lind has been appointed director of the School of Chemistry and professor of chemistry, thus bringing the faculty of that school back to a normal status after a year during which there was a vacancy due to the retirement of Dr. George B. Frankforter. Professor S. C. Shipley has been appointed acting head of the Department of Mechanical Engineering, which was left without a director by the death of Professor J. J. Flather, and a similar vacancy in the Department of Electrical Engineering, caused by the death of Professor George S. Shepardson, has been filled by the appointment of Professor F. W. Springer as acting head.

Dr. W. C. Cook of the University of Montana Agricultural Experiment Station will spend the coming year at Minnesota as associate professor of entomology and head of the work in economic entomology. He takes the place of Dr. Royal N. Chapman, who is on a year's leave of absence, studying in Europe. Dr. Chapman won one of the recently created Guggenheim fellowships.

Minnesota will have a new man at the head of the work in Journalism this fall, and for the first time that work will be directed by a man with the full rank of professor. The committee appointed by the Board of Regents to develop the work in journalism under the \$350,000 bequest from the estate of William J. Murphy, recommended the appointment of Professor Edward Marion Johnson, who has been associate professor of journalism in the University of Wisconsin. Professor Johnson accepted the appointment in June and came to Minnesota early this month to take up his new work. Pending his survey of the journalism situation at Minnesota, no announcement can be made of probable changes in the way the work will be carried on. He has made a specialty of the community newspaper field and may be expected to become a leader in the community newspaper group in Minnesota.

Professor Donald M. Paterson will serve as chairman of the Department of Psychology

during the year's leave of absence of Dr. R. M. Elliott, who is touring the world. Dr. Elliott's absence, together with the death of Professor W. S. Foster and the resignation of Professor Karl Lashley, has resulted in the appointment of two new assistant professors in psychology, William Heron, from the University of Kansas, and Arthur G. Bill, from the University of Chicago. Dr. John E. Anderson, director of the Institute of Child Welfare on the Minnesota campus will also devote part of his time to instruction in psychology.

MINNESOTA is facing a football season of more than usual interest this year. For the first time since the earliest days of football the Gophers will play a double-header, meeting Michigan at Ann Arbor on October 16th and again in Minneapolis on November 30th. Among many comments made on this remarkable arrangement, it has not yet been pointed out that no other arrangement could have created so strong a possibility that the season's last game would be a championship affair. Even if Minnesota should lose the first Michigan game it will remain a championship contender if other teams lose at least one game and Michigan goes through unbeaten to November 20th. On that date Minnesota would have a chance to wipe out the first defeat and at least tie for the lead. If Minnesota wins the first game of the double-header, the return match in November will become the most interesting contest in recent western conference history.

To remain in the rôle of championship contender until November 20th, Minnesota will have to win from Wisconsin on October 30th and from Iowa the next week, November 6th. Both of these games are certain to be hard ones, and both will be played away from home.

Triple Tie with Wisconsin

Interest in the double-header with Michigan should not be allowed to detract attention from the sensational triple tie with Wisconsin which will be played off this year. Gophers and Badgers have tied for three straight years, with scores of 0-0, 7-7, and 12-12. The Iowa eleven will be a relatively unknown quantity

during the early part of the present season, many of Iowa's well-known players of recent years having been lost by graduation last spring.

Minnesota will be captained this fall by Roger Wheeler, a senior in the School of Chemistry, who has been successful in holding the position of right end during the entire two years that he has been eligible for Minnesota football. Many of last year's best players will return, including Joesting and Almquist of the 1925 "sophomore backfield" that won fame. Murrell, a third in that combination, has transferred from Minnesota to West Point.

As assistants in coaching, Dr. C. W. Spears will have George Clark, formerly head coach at the University of Kansas, Sig Harris, who is

known to all Minnesota football fans, Edward Lynch, an end coach who played under Dr. Spears at Dartmouth, Louis Gross, who won the Conference Medal at Minnesota in the spring of 1925, Sherman W. Finger as head freshman coach, and Merton Dunnigan, the former Minnesota player, as assistant with the freshmen.

The season will open on October 2nd against North Dakota. Other games will be: Notre Dame, October 9th (Dad's Day); Michigan at Ann Arbor, October 16th; Wabash at Minnesota, October 23d; Wisconsin at Madison, October 30th; Iowa at Iowa City, November 6th; Butler at Minnesota, November 13th; Michigan at Minnesota, November 20th.

Clue to Individual Lies Inside, Not Outside, the Head

Psychologists Work to Dovetail Personality and the Earner's Job

TWENTY-FIVE years of the intensive study and increasing application of the relatively new science of psychology have left an imprint on many phases of life and have influenced our thinking and actions in business, education, politics, social affairs, and even in sports.

Scientific psychology has taught us, for example, that people cannot be classified as tall and short, blonde and brunette, kind and selfish, with any likelihood that the classification will help us to determine what kind of people they are. People do not fall into large, easily distinguishable groups like that. The variations between individuals are infinite in kind and, often, extremely hard to discover.

These are some of the opinions of Professor R. M. Elliott, chairman of the Department of Psychology at the University of Minnesota, who points out that the psychologist's task is that of helping human beings to adapt themselves to the various problems that confront them and adjust themselves satisfactorily to the situations that arise. Psychology is trying to go into the schools, the factories, the business offices, and the homes of the lands and show people how to attain the goals they seek.

This understanding, says Professor Elliott, must be obtained by comprehending the inside of a person's head, not by studying the outside, as the phrenologist with his "bumps" used to do.

"If we were to take an eye, a nose, an eyebrow, and a mouth, and make all of the combinations we could with them, we should probably have at least 2,000,000, even with four such relatively simple objects," he explains. "Assume then that we have all the multitude of traits that may be found in human beings. Then think what a tremendously large number of combinations can be effected with the traits, qualities, and thousands of factors that enter into human behavior.

That will give some realization of the number of different kinds of people there are in the world. It will show why classification is far less simple than cutting folks up into the tall and short, lean and fat, light and dark."

So the problem of psychology has become that of affecting industrial environment and educational opportunity so that the individual may find himself or at least place himself in relatively congenial work, a vast change from the older method of selecting an individual for a task and cramming him into that hole, no matter what results such a proceeding had upon himself and upon the effectiveness with which the job was done.

Under the new method psychologists seek first to obtain a "behavior profile" of the individual whose capacities and interests they are to determine. Is the individual talkative and argumentative or does it irk him to try to convince others after he has reached a satisfactory opinion of his own? Is he mechanically dexterous, or does working with the hands confuse him because he is more effective when thinking out something for others to do? Such determinations are the first step of the psychologists when they try to pick out the salesmen and scholars, the inventors and lawyers, the cabinet makers and social workers in any group of young people.

Uses in Education and Business

Opportunity for the application of scientific psychological methods has been afforded principally in the schools and colleges and in industry and business according to Mr. Elliott. Employment managers are making increasing use of it and school administrators are finding it invaluable as an aid to their efforts towards directing young people into the fields in which they will find the greatest happiness.

"The objective of a good employment manager is to find the man who will fill a given position most satisfactorily," he says. "This

does not necessarily mean that he must select the best man for the position. There are many jobs known as stepping stone jobs. If men of unusual mental alertness are constantly selected for such positions the jobs will be vacant most of the time as the various ambitious men leave it to step into something better. If the employment manager uses scientific methods to determine the probable behavior of the men he considers, he will select for a stepping stone job the man who can do the work well enough but who will not be so likely to step. This determination can best be made by taking some measure of the man's mental alertness."

Psychology vs. "Worldly Wisdom"

Those who believe that "worldly wisdom" or "common sense" are satisfactory bases for the determination of important problems make the present day psychologist bristle. Scientists know, for example, that the eye is capable of playing queer tricks. It is perfectly possible for the man who depends on common sense to see what appear to be ghosts, for example, and if he depends on common sense alone he may believe in ghosts "because he has seen them." Or he may believe the world is flat, for most of the eyesight evidence that one obtains would go to support such a belief. "In education also," says Professor Elliott, "common sense might dictate that small classes in the university were preferable to large because the instructor could give each student more individual attention. Yet a scientific examination of the question might indicate that the greater competition among students in larger classes offsets the individual attention. Or it might show that in teaching a large class the instructor became so much more impersonal, and therefore so much fairer, that this advantage, also, more than offset any loss from numbers.

"The fallacy of ignorance—which is to say, the ease with which we believe things on insufficient evidence—is one of the menaces to happiness which the psychologist is trying to remove," he explained.

"Much of it boils down to the statement that people are neither one thing nor another, but that they represent an infinite number of degrees of difference, which degrees must be

determined by experts skilled in the use of those instruments that enable us to measure such things. All human beings do things, and it is necessary that someone do most of these things. Psychologists are trying to analyze men and women from the inside and determine which of them can do the various things most effectively. If we finally arrive at a situation in which such selection is effective, nearly every one will be happier, because he will be occupied with something he can do well, and the entire world will be correspondingly better off.

Studies of behavior and the solution of problems arising from individual differences and human aptitudes are bringing results in many fields, according to the psychologists. Such knowledge is important in the relationships between employer and employee, mother and child, husband and wife, teacher and pupil, and in other situations.

What Are "Movies" Doing to Us?

Another field of study for the psychologist which Professor Elliott thinks most important is that of the differences that will crop out in human behavior as a result of our swiftly changing mode of living. What are the movies doing to us? Will the man who ignores the rights of others because he drives a swift automobile, have the same attitude toward society and government as the man had who placidly drove home a cow along a path bordered with ragweed and goldenrod? What are we to become as a result of these changes?

As yet science does not know. Professor Elliott is not at all certain, however, that the net result of such a thing as the movies or the radio is bad. He thinks it possible that the movies appeared at a time when city life had become so monotonous that without them the factory and office worker would have sought an outlet in violent or anti-social forms of self-expression. But he is convinced that habitual attendance at movies or use of an automobile is sure to have some influence on the human race. He sees these among the forces that mould man in his continual evolution.

The Value of a Great Herbarium to the State

By J. Arthur Harris

Head of the Department of Botany

IN asking for a series of brief statements concerning what is most important in the fields of the various departments of the University, the editor has directed attention to one of the greatest problems of our day—that of the selection of the lines of endeavor to which we may most profitably devote our efforts. The ability of the University to serve the public from which it derives its financial and moral support will depend very directly upon the solution of this problem.

The higher education of the young of the commonwealth is so obviously the primary function of the state university that it requires no special emphasis here. Instead, we may properly and with satisfaction point to the fact that, in some of its departments at least, the University is in a position to render varied and additional public service because of the amassing of able and highly trained personnel and of large material facilities for the effective performance of its primary function.

In considering these various secondary potentialities of the University it would be quite as idle to maintain that some one feature of the work of a department transcends all others in importance as it would be to prove that some one department or college of the University exceeds all others in the importance of the service rendered the community. In botany, for example, the field of research and of practical application is very broad, and the needs which botany may fill in education and in public service are widely varied. The importance of having all the different units advance as a co-ordinated and unbroken front cannot be neglected.

These considerations need not, however, preclude the singling out of some one activity which is of so much importance that it merits emphasis and deserves wider recognition. One such feature of the work of a department of

botany is the development of a great collection of pressed or dried plants, carefully mounted, labeled, and filed for reference after critical study. Such a collection is an *herbarium*.

The Herbarium of the Department of Botany of the University of Minnesota is unusually large, comprising in round numbers three hundred thousand specimens. At one time it held its place among the greatest herbaria of the country. Why should it be vastly increased in volume, improved in accuracy of identification by critical study, and made more readily available to students of the state and of the world?

Botany Is Basically Important

The reason lies in the basic importance of botanical science. All human and animal food is derived directly or indirectly from the plant kingdom. Protection from the elements is largely secured by the utilization of plant products. Many of our most important drugs and our most highly prized perfumes are of plant origin. Many of the great industries and commercial activities of our day are at base botanical.

It would seem to be self-evident that an exact knowledge of the kinds, or *species*, of plants involved in any agricultural or commercial undertaking is a matter of primary importance in the utilization of plant products. It is not generally known, however, that such authoritative information is not easily obtained. There are now known to science about a quarter of a million different kinds of flowering plants alone—to say nothing of the algae of the seven seas and of all the fresh waters of the world, of the moulds, plant rusts, and mushrooms, of the mosses and liverworts, and of the ferns.

In attempting to keep straight the identities of this inconceivably large assemblage of living forms, even highly trained specialists are help-

less without the adjunct of great collections of carefully studied and checked specimens to which reference must be made. The herbarium is as essential to the systematic botanist as the library. Such great herbaria can no more be the product of one man's work, or even of the work of a single group, than the books of a library can be the product of the librarian and his staff. The specimens must be the result of wide and discriminating collecting by hundreds of botanists working in all the corners of the earth, and of the critical study of large numbers of specialists each of whom checks the preliminary identification of the species belonging to the groups in which he is particularly interested, and on which he is especially fitted to pass judgment.

Specimens become increasingly valuable as they are studied and the identification verified by such specialists, and as they are cited by number in monographic treatises on classification. Great collections of this kind can be built up only on the basis of special endowment or in connection with our larger educational institutions.

A primary purpose of such a state herbarium, which can best be developed as a part of the state university, should be to provide as nearly as possible a complete representation of the flora of the state. There are many practical reasons why this should be known in detail, and be represented by authentic herbarium specimens.

No one can reasonably question the economic value of a precise and comprehensive knowledge of the kinds of trees which occur in the state and of their distribution over its area. Such valuable information can be available in an authentic form only when actual specimens from definitely known localities are preserved in such a way that they exhibit to the trained botanist the characteristics which enable him to distinguish clearly the species to which they belong. Even the professional forester is often unable to furnish the desired information and must turn to the botanist for aid. Minnesota, for example, is a state which has derived much of its wealth from its timber. It has also been studied botanically with unusual thoroughness.

Nevertheless there are in reports of various kinds innumerable errors of statement concerning the distribution of Minnesota trees. We do not as yet even know definitely whether certain trees do or do not occur within the limits of the state. We cannot have trustworthy information until actual specimens of leaves, flowers, and fruits are preserved in either the Herbarium of the University or in that of some other institution.

Would Help Reforestation

It is not merely the *present* distribution of forest trees which is important. One of our great national problems is that of reforestation. Our untold timber wealth has been depleted, and new timber resources must be created for the use of future generations. This is essential not merely for the timber itself but because of the necessity for protecting watersheds from erosion and for controlling stream flow and lake levels. It is apparent that exact knowledge of the *former* distribution of valuable forests, and of the plant species of which they were composed, may be of value in formulating a wise constructive plan of reforestation.

In many regions the grazing of native pasture land is an important economic asset. The grasses and other plant species which are of significance in this great industry must be accurately known botanically before information concerning their distribution, feeding value, means of propagation and preservation, and other important economic characteristics can be properly classified and placed before those to whom it would be of value. In many regions in which grazing is the leading industry, profound changes in the vegetation may take place as the result of overloading of the range with cattle or sheep. This deterioration of the natural pasturage may be of great importance for the future economic welfare of the state. Apparently this deterioration and the slow recuperation of the land under a policy of more sane long time utilization, are orderly sequences. A detailed and exact knowledge of the plants involved may be of value in the investigation of these changes and of the means of formulating effective working plans

for the preservation or the redevelopment of the range.

Has Other Practical Aspects

The economic importance of a knowledge of plant distribution is not limited to its application to forestry and grazing. Plant species which are of no direct economic importance in themselves may be of indirect significance in that they may indicate the potentialities of the land upon which they grow, either for forest production or for agriculture.

All these fields of applied science require much more in the way of botanical effort than the mere accumulation of dried and mounted plants. Such collections are, however, an indispensable aid to the other requisite botanical investigations.

Only two more concrete illustrations of the direct practical importance to the state of a great herbarium will be given.

It is now definitely known that hay fever may be caused by the pollen of many different species of plants but that one human individual may be subject to one species whereas another may suffer from the presence of the pollen of an entirely different species. It is quite possible to determine by simple means readily available to the physician to what particular species the difficulty of any individual is due. If a state herbarium were sufficiently complete, the medical profession of the state might have at any moment authentic information as to regions to which an individual patient might properly be recommended.

While, as emphasized above, a primary purpose of a great state herbarium may be the preservation of representative specimens of the present and former flora of its confines, it cannot properly be so limited. Agriculture, horticulture, and reforestation must to no small extent be dependent upon species from outside the state. Means of checking the identity of species which are grown on an experimental or commercial scale within the limits of the state should be available, and may be of material economic importance. The origin of agricultural seed and the consumption of agricultural products are no longer local. There is grave danger of the introduction of noxious weeds

and of other pests in seeds and in hay and in connection with the shipment of livestock. Means of identification of such plants should be at hand to the end that information concerning their origin and character may be the ounce of prevention which is worth the pound of cure.

Must Consider Cultural Value

There is another argument which will appeal even more strongly to those who are characterized by breadth of mind and public spirit. In these days of commercial emphasis and economic prosperity, we must not forget that great collections in the fields of art and of natural science have a social value which may transcend their immediately tangible economic value—great as this may be. The material paraphernalia of culture constitute not merely a direct cultural, but an indirect economic, asset of the municipality and the state. Cities without parks or museums may have money in their vaults, but no modern city has grown to commercial greatness without such non-mercenary assets. All but the more sordid demand them and all but the more blindly miserly realize that it is to their advantage to support them. The wealth of the community is not written in terms of dollars hoarded or even in dollars invested but in the richness of the life of its citizens. Men of discrimination seek as a place for the investment of their means and their energies those centers which have shown the public spirit and sagacity to recognize the value of educational museums and research collections. A great herbarium, like a great municipal museum, gallery, or orchestra, more than justifies its existence by the prestige which it lends the state.

Tropic Plants Need Study

There is a broader aspect of the problem which demands emphasis. Our future national prosperity depends in some measure on the development and utilization of the plant wealth of the tropics. Our possession of the Philippines presents problems which cannot be neglected. Our relations with South America should be a matter of thoughtful consideration. The economic development of these regions, in which as a nation we must participate, must

rest in part on sound scientific knowledge of their plant products. This will only be possible if we can build up in this country collections which may serve as a base of reference for future work. At present, botanists are unable to cope with the task before them. American commercial interests are the losers.

This is not all. Our future peace and well-being may depend in some measure on the maintenance of friendly relations with the peoples of the tropics. Their friendly relations will depend to some extent on scientific co-operation on the development of a knowledge of the botanical resources. Today much is being done in Europe that should be done in America, and we lose much in prestige and in commercial opportunity by this fact.

The potentiality of such collections which is possibly the most important still remains to be emphasized.

Encourages Plant Study

In every state there are citizens, old and young, who turn instinctively to the observation of nature. They derive pleasure and inspiration from the acquisition of knowledge of the living forms with which they may come into contact. Encouragement of such interest, and kindling of such interests in ever widening circles of citizens of all ages is one of the antidotes for many of the evils of our time. It is an educational opportunity of larger order which our universities cannot afford to neglect. Dead and dried museum specimens may not directly inspire masses of people to study nature. They can, however, be the means of maintaining in our universities lines of work which most directly appeal to those who must pursue their own development outside academic halls, and of enabling our educational institutions to afford some leadership to a potentially great citizen student body.

Eye is Better than the Crucible in Testing Steel

Metallographers Judge Quality with the Aid of Microscopes

THE picture that lies on the professor's desk seems to be that of some disk of rare marble. With its grains and lines, cross-bands and counter-bands it is beautiful; a specimen perhaps for a column to be used in some splendid, new business block.

"Now that," he tells us, "shows a cross section of the only kind of steel the T-B-K people will use for roller bearings. Unless the microphotograph shows such a design, they will reject the material."

Back in the days before the blight felled all the spreading chestnut trees, it was the village smith, "with broad and sinewy hands," who exercised final judgment on the worth of iron or steel materials. Today when a steel shaft, an axle, a bearing, or some other important part "fails" in service, it is subjected to the supercritical eye of a delicate camera in which the image is many times enlarged by microphotography. The smith looked at the outer covering of the piece of steel, but the scientific metallographer of 1926 gazes into its very heart.

Better yet, he can not only do what the physician does with his X-ray, his knowledge makes it possible for him to make changes in the heart and other vital parts of the steel if they do not suit him in the form revealed by the photograph.

In a large, well-lighted room in one corner of the School of Mines building at the University of Minnesota, one may talk with Dr. Oscar E. Harder, head of the work in metallography, and learn why it is that when a motor bus axle breaks or when the drive shaft of a locomotive becomes faulty the keen-minded executives of the owning concerns look to the laboratory for the information which will prevent a repetition of such an experience.

The Advance of Steel Testing

"The selection of steel for the big machines of industry and transportation is a science that

has progressed through many stages," he will tell you. "Originally, long ago, when a manufacturer wanted steel, he asked for steel. He specified the amount and the shape, but little more. This proved highly unsatisfactory. The next step was to order steel with a fixed chemical composition. This was an improvement, for chemists know what change it makes in the properties of steel when so much of this or that other element is mixed with it. Owners were still dissatisfied, however, so they took the next step in advance and bought steel for which definite strength specifications were laid down. In other words, the custom of demanding definite chemical properties was followed by demands for definite physical properties.

"Experiment finally proved that the worth of steel in withstanding strains and performing labor could be judged better by a microscopic examination of its appearance than in any other way. The microstructure tells the story."

Examination of the "marble" picture shows one in which whitish patches of material, mixed in a darker area, run directly across the specimen. It is in such instances, when the weaker material in the steel crosses the whole part in a continuous band, that breaking is likely to occur, Dr. Harder points out. A chemical analysis of the steel might show that both the stronger and weaker elements were present, but only the microphotograph could show the arrangement of the two in a manner likely to produce a break or one that was safe.

Heat Treatment Changes Structure

The ability of metallurgy to reveal the structure of a piece of steel and show why the machine part made from it failed in service is splendid enough, but science has not stopped there. Metallurgists also know how to change the structure of the steel without changing its chemical composition. These changes are brought about by the scientific application of

heat. The process is known as "heat treatment." A picture of a piece of steel taken before heat treatment may show the veins and bands running across in such a way as to make it highly susceptible to breaks, while the photograph of the same piece after heat treatment will reveal the weak and strong elements mixed together in an even granular arrangement that gives uniform strength over the entire surface.

The commonest cause of the breaking of a steel part, the "fatigue fracture," is not always due to faulty structure in the material, according to Dr. Harder. It may be due to improper heat treatment, improper finishing and machining, or improper design of the part. While a material of faulty internal structure may be greatly improved by proper heat treatment, improper heat treatment may result in a still coarser grained substance and a correspondingly greater likelihood of breaking.

"It is interesting to know that every step in advance in the series of methods used in selecting steel for machinery has come from the laboratory," Dr. Harder points out. "Industry can produce more rapidly and more cheaply when every tool is as nearly perfect as it can be made. Breaks, on the other hand, not only destroy material, but hold up the operation of much perfect machinery until the imperfect pieces can be replaced. Meanwhile many human hands are unemployed. Selection of materials that can be wholly depended upon is an outstanding necessity. There are always some people who wonder why a scientist should be fiddling about in his laboratory taking pictures of little rods of steel, heating them up, photographing them again, and jotting down quantities of data on what he has found. But when they learn that such studies may enable a mammoth railroad system to specify for its engine parts just the kind of steel that will stand the colossal strain of moving modern traffic, they begin to realize the reason for his 'puttering.'"

How Cold Affects Steel Parts

Just now Dr. Harder is at work on one experiment, among others, by which he hopes to show the effect on steel in locomotives, mine machinery, and the like, of the intense winter

cold that is experienced in some parts of the Northwest. It has long been a popular theory that steel is weaker under intense cold than it is at normal temperatures. With his laboratory assistants and graduate students Dr. Harder has made between 4,000 and 5,000 tests of steel pieces at temperature down to 70 degrees F. below zero. He is not yet ready to publish his results but has already satisfied himself beyond a doubt that extreme winter weather does weaken steel and increase the likelihood of parts failing in service.

This study, which may result in noteworthy increases in transportation efficiency, has also required a tremendous amount of seemingly trivial detail work. Not only must the tests be made at differing temperatures, but the results of every test must be noted down, calculations must be made, and charts drawn to show the line of variation in the steel's strength as the temperature rises or falls. In all, each of the 4,000 to 5,000 tests requires probably five operations, bringing the whole amount of detail work to a maximum of 25,000 operations. When the five years of work and the 25,000 operations have been completed, the results will be printed as one of many papers in a dull looking scientific periodical.

"Ho-hum," the non-technical man will say as he picks up the paper, but the man whose duty it is to buy materials for some railroad will know that the knowledge revealed there will ultimately save not only dollars but lives.

Can Copper Be Tempered?

This laboratory man finds, as do others, that the day brings forth discussions of the impractical as well as the practical. One of the commonest impractical matters for which his opinion is asked is the age-old search for a "tempered copper." It is a futile search in his opinion. He admits that it is possible to harden copper, but gives two reasons why it is almost useless. In the first place, we already have steel, which is harder than copper can be made by any process, and in the second place, hardening of copper spoils to a great extent that metal's most desirable properties, such as ductility, which makes it possible to draw copper out into symmetrical wires, and conductivity,

which gives it so important a place in the electrical industry.

Copper specimens brought in with a request that he pass judgment on the method by which they have been treated, usually by someone who believes he has made a revolutionary discovery, fall into the four following groups:

1. The fire-water method of treating, which gives an alloy comprising copper and a copper oxide. This makes the metal harder, but also more brittle and serves no practical purpose.

2. Copper specimens intentionally alloyed with some other metal. This also increases the hardness, but injures the copper's conductivity and other typical properties and really decreases its value.

3. Handworking or hammering the copper. This changes the molecular structure and hardens the metal, just as hammering does other metals, but again damages its ductility and conductivity, and is not worth the effort.

4. Some "wonderful secret process." This process is invariably found to have been one of the three already mentioned and no more useful than they are.

Professor Harder believes that the famous "lost art" of hardening copper is no longer worth seeking for. At best it gives copper, at great expense, properties already possessed by more abundant metals, and damages the typical usefulness of the copper itself.

To show the variety of researches combining scientific and practical worth that may be conducted in a metallurgical laboratory, he gets down a huge bottle which seems to be filled with human teeth. In fact it is revealing no secret to say that it is filled with human teeth. The importance of metallurgy to dentistry, naturally enough, lies in the matter of fillings. Dr. Harder has long been making a study of dental metals with a view to developing alloys

of gold and silver with just the right wearing qualities and expansion properties to keep them where they are put and make them serve as long as is scientifically possible. This work is especially appropriate at the University of Minnesota because of the unusually high rating of its College of Dentistry and the large number of progressive steps in dental education that have first been taken there.

Experiments with Magnetism

Dr. Harder leads his interviewer into an adjoining laboratory from the roof of which are suspended a vast number of small iron rods, probably a third of an inch thick and a foot long. Hanging from the ceiling on thin wires, they are motionless, peculiar looking, and exciting to one's curiosity. These are pieces of magnetized steel, he tells you. They have been hanging there, some for longer, some for shorter periods, but all of them for years, five or six or seven. The experiment is intended to show how long steel retains magnetic charge and that knowledge, when the final computations have been made, will be important.

Near by on a desk are a large number of small pieces of steel with great warts and bunches looking like steel fungus-growth on them—materials in an experiment in welding that is being conducted by Dr. L. J. Weber, of the Department of Metallurgy, and not far away on another desk are many other pieces of steel, the materials of an experiment by Mr. R. L. Dowdell on the theory of hardening steel. So carefully must Mr. Dowdell proceed with his work that he has gone a step further than most of the others. He not only knows what the steel he is working with will do; he goes into the laboratory and makes that steel himself. Then he knows exactly what should be expected of it.

MINNESOTA CHATS



For a Better
Minnesota

The University of Minnesota and State Progress

BY L. D. COFFMAN

President of the University of Minnesota

A state has aspirations and ambitions the same as have persons. A state adopts policies and creates agencies to achieve her ambitions, just as do persons. The ambitions which are dearest to Minnesota have to do not with material prosperity, but with human attainments. The wish for material prosperity is subordinate to the hope that every individual citizen, old and young, shall develop into his own best self. Cultivating the human crop is the state's highest ambition.

Fortunately, cultivating the human crop is also the surest way to material prosperity. Education, the state's chief agency for cultivating the human crop, is an excellent financial investment, quite aside from its aid to human beings in attaining their own cherished ideals. Pasteur's education, resulting in the discovery of the cause of disease in sheep, for example, added more wealth to France than was spent on her whole educational system for a year. Walter Reed's education, which led to the discovery of the cause of yellow fever, not only saves thousands of lives annually, but has a money value as well. It made possible the digging of the Panama Canal. What would the world be willing to pay in money for the products of Thomas A. Edison's mind! Education pays. It is an investment, not an expenditure!

Think of an educated people and you think of comfortable homes, comparative freedom from disease, labor saving devices, reasonable hours of work, facilities for enjoying leisure, etc. Think of a nation with little or no education and you think of shacks for homes, ravages of disease, antiquated tools, long hours of labor, and minds too full of superstitions and fears to enjoy what little leisure they have. Education is the handmaid of social progress. It has a money value to the state, because the source of the state's greatest wealth is *her people*. Education makes not only a happier, healthier and more idealistic people, but it makes a wealthier people as well. The stalwart Minnesota human stock, if developed by adequate education, must surely build a great state.

People Show Faith in Education

WITH growing faith in education as the best agency for hastening human progress, Minnesota is sending an increasing number of her sons and daughters to high school and college. Where fifteen years ago, one Minnesota youth graduated from high school, now more than four graduate. Where fifteen years ago one of those high school graduates entered the University of Minnesota, now more than three enter. A state with that sort of faith in higher education wants nothing but the best University for her sons and daughters to attend. What is really involved in conducting a first-class university is not always understood by the people who want

Numbers Graduating from Minnesota High Schools:

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1913	4854	1916	6251
1919	7606	1922	10109
1925	13550		

Students Enrolled in the University of Minnesota:

—oOo—

Year	Collegiate Students	Sub-Collegiate and Short Course Students	Exten- sion Students	Total for Uni- versity (Less Duplicates)
1913-14	4155	3209	1628	8992
1916-17	6311	6147	2515	14973
1919-20	9027	3169	5331	17326
1922-23	11810	2160	5944	19541
1925-26	14410	2898	7642	23618

There is an increase of more than a thousand at the opening of the fall quarter 1926-27 over the same period in 1925-26.

a first-class university. It is in the hope of making as clear as possible what part the University of Minnesota plays in building a greater and greater state that this open letter is addressed to the citizens of the state.

The first purpose of the University is to educate the students who come to the campus. The proud father and mother who have skimped and saved in order that the son may go to the University "so that he may not lose what we have lost" crave something they cannot well define. To know and understand the present means first to know the past. To see the full beauty of nature around us, we must first appreciate the wonders which emerge only under the microscope or in the laboratory. Life cannot be most abundant, and the mind cannot be liberated from haunting uncertainties and fears, until we have come to know our place in a world of people. To know our place we must know ourselves and know people—people moved by emotions and prejudices, yet aspiring to nobler things and striving for a higher justice in human relations. These and scores of other enrichments of the human spirit, the fathers and mothers of today want for their children. This explains the sacrifices they are willing to make that their sons and daughters may go to the University.

But this enlarged vision, this broadened mind, this enriched personality must live in a humdrum world after all. Three meals a day will be found essential to the enjoyment of the most beautiful rose garden. A comfortable home is not earned by contemplating the wonders of the heavens. Youth is a time to prepare for making a living as well as a time to prepare to live. Therefore the University has its many schools and colleges—medicine, engineering, agriculture and the like. The University must prepare her graduates to do in the best way the highest sorts of service which the people need to have done. Thus cultural and professional education go hand in hand in a University.

Three Great Problems in Education

HOW well are we doing this job of educating the students on our campus? That is a hard question to answer. Certainly there is no lack of effort on the part of the more than seven hundred teachers who are giving their lives to the task. On the other hand, there are many problems which perplex us. Doubts force themselves upon us when we contemplate certain conditions, over many of which we have little or no control. Three of the most vexing conditions are these:

I. *Poor housing conditions.* There were more than fourteen thousand students on the campus last year—more than all the people of Fairbault or Virginia. Except for one girl's dormitory, housing fewer than three hundred girls, and a few co-operative cottages, all the students live in homes outside of the control of the University. These ten thousand students are young, virile, and anxious to taste of all of life's experiences. Many there are who do not make the best use of their precious years at college because they yield to the more immediate pulls which a better home environment might enable them to resist. Oxford and Cambridge, Harvard, Yale, Princeton, and Pennsylvania have depended upon dormitory life

A Guide to the Public Demand

The University of Minnesota gave instruction to the following numbers of students during 1925-26:

—oOo—

College or School			
Science, Literature, and the Arts	4,609	Pharmacy	164
Engineering and Archi- tecture	1,226	Chemistry	199
Agriculture, Forestry, and Home Economics	782	Education	1,833
Law	300	Business	313
Medicine	607	Graduate	1,137
Nursing	350	War Specials	35
Medical Technicians	13	Summer Session	4,325
Dentistry	378	Mayo Foundation (Sum- mer Quarter)	187
Dental Nurses	32		
Mines	77	Grand Total (Collegi- ate)	14,410

to help them to enable their students to "see life steadily and see it whole." College life cannot be most helpful unless the home conditions in which the students live minister to the same ideals as do their studies, their sports, and their debating. The state is throwing money away if as sometimes happens the instruction which it pays for in the classroom is nullified by living conditions which lead a student to failure.

II. *The difficulty of building up a strong faculty.* While no teacher worthy of the name is interested only in his salary, it is true nevertheless that in the long run, other things being equal, the best teachers will be attracted to that institution which pays the best salaries. The institutions with which Minnesota is in most constant competition in her efforts to secure and hold strong faculty members are the Universities of Iowa, Wisconsin, Illinois, Ohio, and Michigan. A detailed study of the salaries being paid to the faculty in these institutions reveals that our salary scale is less than any of theirs except one. The key to the success of any educational institution is the teacher. We can neither get nor keep the best teachers without a higher salary scale.

III. *The relatively diminishing state appropriations for the support of the University.* In 1913-14 a dollar would buy what it takes a dollar and sixty cents to buy today, yet the legislature appropriated more dollars in 1913-14 for each student then registered in the University than the last legislature appropriated for each student now registered in the University. No one will believe that the legislature of 1913-14 was overgenerous. Maybe some of you who will read this letter lived at a boarding house in 1913-14. Perhaps you paid \$3.50 per week for board—you could get good board for that then. Suppose you were to go back to the same boarding house today, and were to get all the boarders to declare they would pay only \$3.25 per week for board. Can you not imagine the result? The landlady would say "But it costs me \$5.50 today to give you as good board as I gave you for \$3.50 in 1913-14."

"Very well," you reply, "give us the best you can for \$3.25."

The table would have to be set pretty meagerly, wouldn't it? The University gets only \$3.25 per student today where it got \$3.50 per student in 1913-14.

While it is somewhat more difficult to observe the decline in quality of university education than it is to note the decline in the quality of table board, yet somehow we can't help feeling that quality can't be kept up when the charge for it goes down and stays down. There are more students per teacher, and more young inexperienced teachers in the University of Minnesota today than ever before in its history. For the state to fail to make appropriations in proportion to the increase of the student body is the most expensive economy which can be practiced.

University Scholars Seek New Truths

THE second purpose or function of the University is to discover new truth. Anyone suffering from cancer, spending his weary days almost without hope, will not think it extravagance for the University to main-

Spend Less Per Student Than in '13-'14

—oOo—

The University of Minnesota has less to spend on each student than in 1913-14 when a dollar would buy as much of commodities in general as does \$1.70 today.

The amount expended for salaries, maintenance, and equipment per student enrolled in the University of Minnesota:

1913-14	\$487.49	1919-20	402.83
1916-17	358.38	1922-23	401.74
1925-26		364.68	

The average annual appropriation for higher education per state per year for Illinois, Iowa, Michigan, and Ohio for the years 1923 to 1927 (excluding normal schools and teachers' colleges) was \$5,988,461.

For Minnesota it was \$4,433,293, a difference of \$1,555,168 in favor of our neighboring states.

The Salary Handicap at Minnesota

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The salaries most commonly paid at the Universities of Illinois, Iowa, Michigan, Ohio, and Wisconsin were calculated, and these five figures averaged. The amount that this average figure exceeds the amount most commonly paid at the University of Minnesota was then ascertained. It is this difference which appears in the following table as "Minnesota's Salary Handicap."

	Professors	Associate Professors	Assistant Professors	Instructors
Faculty of Arts and Sciences	\$110	\$ 87	\$110	\$ 60
Faculty of Engineering	85	287	455	45
Faculty of Agriculture	292	238	275	8
Faculty of Education	431	508	287	208
Faculty of Business	919	283	412	75

tain at the Cancer Institute, the equipment and the men necessary to search day in and day out for the cause and cure of that dreaded affliction.

Farmers remember too well the old time scourges of hog cholera to deplore the money spent to discover the serum which now so effectually prevents the losses.

Hardier and more rust resistant crops are the direct result of the patient search for new truth.

Billions of dollars worth of Minnesota iron ore still await the answer of science to the question "How can low grade iron ore be utilized in commerce?" Where is the man of so little faith in the results of the persistent search for new truth as to say, "It can't be done. Don't spend a dollar trying to find the more economical method of smelting."

What a myriad of questions we still have to answer! How to keep the soil from becoming exhausted; how to renew the forests; how to lengthen the life of our expensive roads; how to prevent the many diseases of man; what the best method of learning is for the many types of children; and so the list might be endlessly extended. This is the age of science, and these scores of questions call for patient searchers after the answers. The state which neglected to support these searchers for new truth, would be like the general who refused to send his tired soldiers reconnoitering in search of new supplies of food until they had completely exhausted their present supply.

Of course the place where these searches should be carried on, is the University of Minnesota. The Agricultural Experiment Station, the Mines Experiment Station, the Engineering Experiment Station, the Mayo Foundation for Research in Medicine, are the most widely known units maintained to encourage this search for new truth. However, scores of other faculty men in no way connected with any of these well organized research units, are patiently working on scores of other problems. It may be a study of radium, to find out the reason for its effect on the cell tissue of the body, or it may be a study of radio to find out its effect on the intellectual tissue of society. It may be a study of the make-up of the atom, or it may be a study of make-up of the universe. Any study which enlarges the boundaries of human knowledge, stands a good chance of setting man a step forward in his advance toward ultimate good. The state is short-sighted if it does not make adequate provision for research at the University.

Must Carry Learning to the Many

THE third purpose or function of the University is to co-operate with other agencies in giving all the citizens of the state who cannot come to its campus the education they most want and need. If it is discovered today that alfalfa is a valuable crop to replenish the diminishing nitrogen in the soil, the state is concerned that the farmers learn of that discovery in the shortest possible time. We cannot afford to delay until the rising generation shall have learned the new truth in the public school. Likewise, we need to spread quickly the information about testing seed corn,

A Few of the Many State Service Activities Stimulated or Actually Carried on by the University Last Year

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Corn testing associations in operation, 95.

Egg laying demonstration farms in operation, 24.

Alfalfa acreage increased 300% and sweet clover acreage 400% in the last three years.

In boys' and girls' club work, 23,915 farm boys and girls were enrolled, and 19,066 completed the entire year's work.

More than 15,000 meetings were held by county agents with nearly 100,000 people in attendance.

The "green bug" was effectively checked in most places and campaigns for smut control were organized in 50 counties.

A Few of the Studies Completed Last Year by the Agricultural Experiment Station of the University of Minnesota

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The diseases of wheat.

Corn stalk syrup investigations.

Diseases in cattle caused by feeding sweet clover hay.

Nutritional diseases of cattle and swine.

Physical effect of alkali on concrete.

The seed corn maggot and the potato blackleg.

The control of flax rust.

Costs and margins in marketing.

Similarly practical studies are being constantly made in many other fields such as Mining, Engineering, Medicine, Chemistry, Psychology, and the like.

checking livestock diseases, improved methods of public school teaching, skilful practices of the modern dentist, and scores of others.

For this state-wide educational work, of course, the newspapers are a powerful agency. Women's clubs and men's clubs, churches, and professional organizations, all are doing their part. The University is chiefly concerned with spreading those truths which require the service of trained specialists to interpret. It is the University's purpose to answer the citizen's specific questions as to whether he is applying the new truth properly to his situation. Hence, the preparation of bulletins and sending them to those who can use them; the sending of specialists to confer with an individual or a group who desire help; the answering of thousands of letters and phone calls which ask technical questions; the holding of regular evening classes, well organized short courses and clinics; and offering by correspondence to those who cannot attend the University the same sort of instruction as is given on the campus; these are the sorts of services which the University is rendering in order to give the present generation of Minnesota citizens as full advantage as possible of the information and truth which are already available to help them solve their economic problems and to live the richer, fuller life.

These, then, are the three purposes of the University: the cultural and professional education of the host of young people on the campus, the search for new truth in all the vast fields of human interest, and the state-wide educational service to those who cannot attend the University. These may serve to give a little clearer picture of the relation of the University to the progress and development of the state, than many of our people have at present. We are so prone to take for granted the wholesome progressive social movements of our times that we scarcely pause to ask what agencies and institutions are chiefly responsible for them. San Francisco had taken for granted for years that to turn a faucet in any kitchen meant a stream of pure water. They had become quite unconscious of the network of mains and submains which checkered the city underneath the surface of the earth. Only when the earthquake came and twisted those mains to pieces so that pure water no longer flowed through the kitchen faucet did San Francisco understand the meaning of the foundation work which was underneath the happy condition which they had been taking so completely for granted.

University Is Fundamental to Progress

THE University is an essential part in this foundation of state progress. The ambitions of the state, either to assure the high human attainments of her people, or to advance her material prosperity will be found to be dependent upon the University for their fullest realization. The University is anxious to do her part and is sobered by the great responsibility which is thus put upon her. She asks only that the state shall realize how impossible it is to carry her part unless she has adequate financial support.

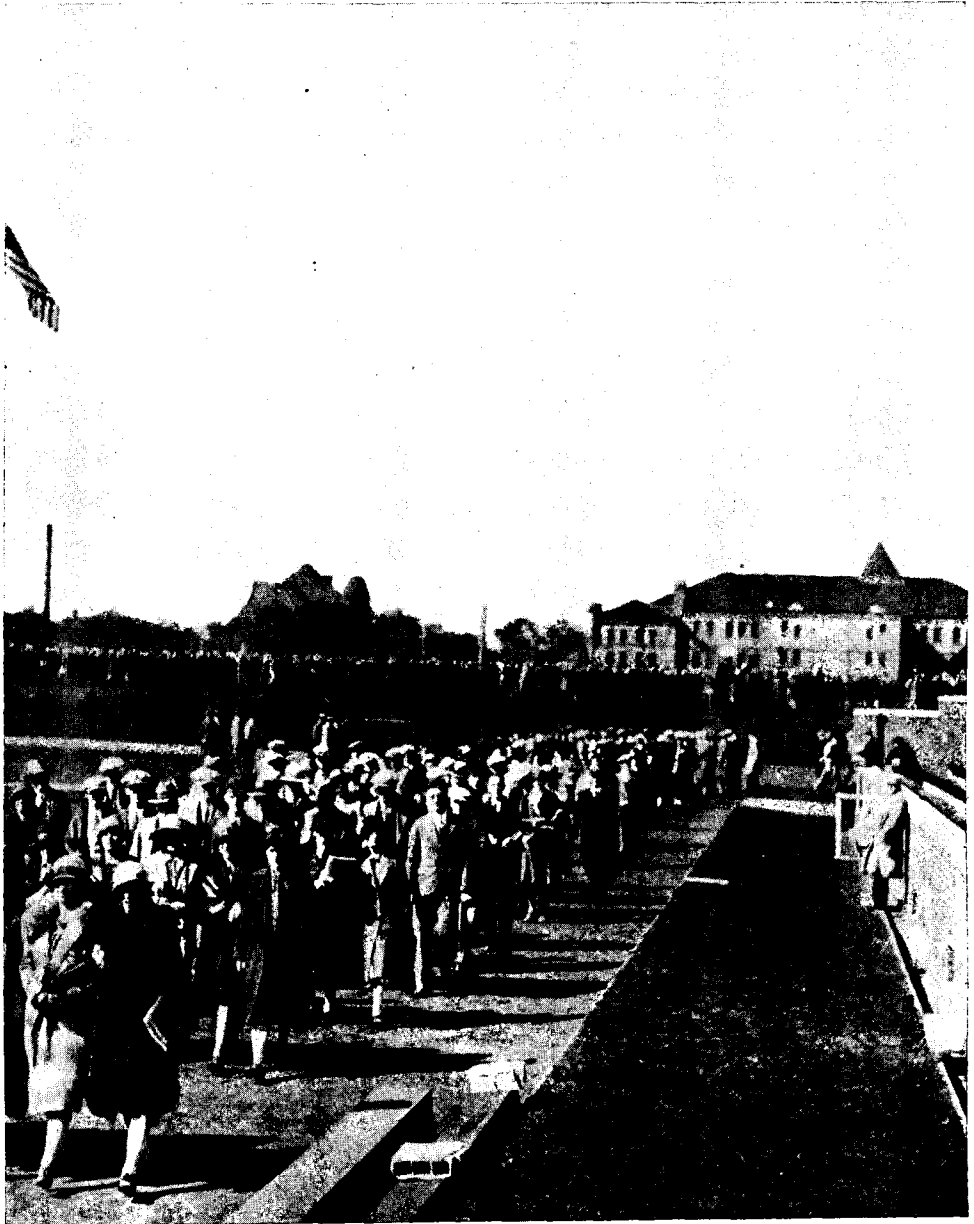
Vol. 7 No. 93

November, 1926

MINNESOTA CHATS



For a Better
Minnesota



A Happy Start on the Long March of Life

The eager line of Minnesota freshmen (seen also in the background) enters the Stadium for the Welcome Convocation

THE STUDENTS—THEY DO NICELY, THANK YOU

The University Sees Them in Quite as Important a Light as Their Mothers and Fathers Do

NO matter whether they live in Austin, Wheaton, Stillwater, Red Wing, Crookston, or Virginia, the father and mother with a son or daughter at the University of Minnesota probably have exactly the same mental picture of that institution. It is a simple matter to determine what this picture is. It is simply a mental image of John or Mary, as the case may be, surrounded by a more or less extended arrangement of buildings, trees, lecture rooms, laboratories, dining tables, and study nooks.

To them the University of Minnesota is not an impersonal thing. It probably is not an extremely definite thing. It is really a relationship; the relationship between John, or Mary, and the big educational community in which those two are living and pursuing their studies.

This is not surprising. All these many fathers and mothers would realize, if they gave the subject thought, that these young people are also in the foreground of the picture seen by those who conduct the University's affairs. From the Board of Regents and President Coffman on down through the University organization there is a strong and still growing realization that the student is, and must be, at the focus of the University's interest. Buildings are important, but young lives are more so. Books contain knowledge and inspiration, but they have been written by older Johns and Marys for the benefit of these young Johns and Marys. They are tools for the strengthening and improvement of human beings and human society. And the same is true of learned societies, of expensive laboratory equipment, of student organizations, and of the many other items and things that enter into a great university's makeup.

Those who make any effort to follow the affairs of the University of Minnesota have observed in the past few years the beginnings of a number of important policies aimed to provide better understanding of the student by the University; better guidance of the student once he comes to be understood; better housing conditions for students who are away from home; better methods of giving the new student an understanding of the new and still strange community in which he has to live; and, among many other things, better and larger facilities for those physical activities which are so important an outlet for surplus energy and so fine a training in persistence and self-control.

One of these efforts is the Freshman Convocation, now held each fall in the Stadium, at which President Coffman welcomes the incoming students and in a brief address endeavors both to make the freshmen feel at home and to point out to them some of the turnings at which they must choose wisely if University life is to give them all it may. Another is Freshman Week, conducted each fall as a more detailed introduction of the student to his home for four important years. As a gradual development of the past three years, the University's system of student guidance has come

to be a strong factor in solving the problems of those students who have bumped into unexpected obstacles or found themselves in blind alleys, due to unusual elements in their own personalities or to immature judgments on the courses either of study or personal conduct they should pursue.

These are among the more recent developments in the policy of giving the student all necessary supervision and guidance. And for years there has been strong and effective machinery at Minnesota for the general supervision of studentship and student life. This has necessarily been built up in the following divisions:

- I. Supervision of classroom accomplishment.
- II. Supervision of student activities outside the classroom, both constructive and social.
- III. Supervision of student behavior in those cases where this becomes a matter for University attention.
- IV. Supervision of students' living conditions.
- V. Attention to the health of students.
- VI. Attention to, and help with, the knotty personal problems which from time to time are likely to confront young persons.
- VII. Encouragement for the student to take a voluntary part in activities that will strengthen him in culture, in health, in outlook, and in effective response to practical situations.
- VIII. Supervision of fraternities and sororities.

The University Health Service for Students

ONE of the first of these helpful agencies with which the student comes in contact when he reaches the University campus is the Student Health Service, directed by Dr. Harold S. Diehl. This institution has held a marked interest for the Minnesota public, and most Minnesotans know something of its activities. Its three outstanding purposes are to determine the physical condition of all students when they enter the University; to let students who need attention know just what is the matter with them and how it should be remedied; and to serve as an emergency medical unit on the campus for students who fall ill, or in case of any serious outbreak of disease. The Health Service also maintains a comprehensive follow-up service for those students whose original examinations show them to be in need of treatment. It examines students who wish to take part in athletics and passes upon their fitness. It also assigns certain students to the special classes in corrective gymnastics instead of to the regular gym. classes. A hospital of moderate capacity is maintained as one of this department's units.

Because the Health Service has now been in existence for more than four years it presumably has a physical record of every student at Minnesota. These students, upon entering the University, were given tests for certain communicable diseases, such as diphtheria, so the Health Service has a record of those who are immune and those who should be treated, if they wish, with a protective serum. It also has a record of the past diseases of all students. These and other facts of a student's physical condition are often of the greatest value in determining how to handle the case of a student

who begins to fail in his work, for no apparent reason, or of one who becomes over-nervous, depressed, or undecided about important matters. Through co-operation between the Health Service and psychologists in the Student Guidance Organization, of whom Dr. Donald G. Paterson is the chief, an arrangement has been made which has helped banish the difficulties of many a student.

Supervision of Non-Academic Activities

MUCH of the task of supervising the organized activities of students, apart from studies, falls on the shoulders of one who for years has been one of the best known figures on the Minnesota campus, Dean Edward E. Nicholson. Dean Nicholson and his office force face a formidable task, for the number of organizations is large. His staff is so organized, however, that due attention is given to all the thousand and one matters, small and large, which it must handle. His title is, dean of student affairs.

Dean Nicholson is, among other things, the chief disciplinary officer of the University, except in matters pertaining to scholarship, which are handled for the most part by college rather than general University officers.

The dean of student affairs and his staff work for order and application among the men students of Minnesota by constructive rather than critical methods. Dean Nicholson has the co-operation of such honor organizations in the several classes as Iron Wedge, Silver Spur, and Grey Friars. These are groups of men students who dedicate themselves to the advancement of the best in university life. When something must be organized so that it will work out for the better interests of all, these groups help to organize it. It is not to be doubted that if some insidious influence were found on the campus at work to the disadvantage of the institution and its students, these groups of enthusiastic young men could be depended on to overcome it.

Under Dean Nicholson's regime there have been built up such organizations as the All-University Student Council and the Student Board of Publications. The first of these, to which members are elected from the different colleges in the University on a representative basis, supervises student politics, laying down rules for the nomination and election of class and group officers. It has also adopted a classification of positions in student activities, grading some of them major, some of them minor. No individual student holding a major position on a publication, in a dramatic society, a debating organization, or class organization may hold another major position. In this way a double purpose is accomplished. The activities are manned by students who have time to run them efficiently, and no student is permitted to hold so many offices that his class work suffers. It is a regime of moderation and efficiency.

In this office, also, are administered the student loan funds which have been so welcome a port in time of financial storm to hundreds of Minnesota undergraduates. These loan funds, in which only the interest on a number of small and large endowments resulting from gifts to the University is used, mount up in the course of a year to many thousand dollars.

In the last annual report from the office of the dean of student affairs it is shown that 203 loans to students were approved during the preceding year. The actual loans are then made by the finance officers of the University. In the year in question these loans probably averaged \$50 per student among the 203, making a total in the neighborhood of \$10,000. Almost every penny so loaned to Minnesota students is eventually repaid. Last year \$26,000 was loaned to students.

AN excerpt from Dean Nicholson's report for 1925 reveals much of the nature of his work with students. It says: "Any organization of students, in order that it may be recognized by the University, with the privileges that go with such recognition, must apply to the Senate Committee on Student Affairs for such recognition, submitting their constitution and explaining their purposes. There are listed in the records of this office 172 such organizations. This list covers organizations of a permanent character, such as fraternities and dramatic clubs, and a comparatively large number which are ephemeral in character, such as groups from some of the high schools, or from some locality in the country, or groups representing political beliefs. As a rule these have one or two meetings and then disappear until some special reason calls them together again."

That these student organizations are not all trivial is shown by the most recent list of new ones, which includes a professional advertising fraternity, a forensic fraternity, a social sorority, a music fraternity, another sorority, a social organization of men in agriculture and forestry, an organization of business and commerce students, one of architectural students, one of medical students, an interfraternity group of the class of 1928, a group of Methodist Episcopal students, a Swedish literary society, the Walther League of Lutheran students, and others.

Dean Nicholson's office also keeps in close touch with students who are working their way through the University. When the University Employment Bureau, maintained to find work for needy students, is unable to place a man or woman, he often is able to find something for the student to do. Dean Nicholson's most recent figures show that about 66 per cent of the men students in Minnesota earn at least a part of their way through the University. About 40 per cent of the women students earn part of their way through college and 18 per cent of them, all of their way.

A careful supervision of the finances of such student publications as the *Minnesota Daily*, *Ski-U-Mah*, and *Gopher* is maintained by the Student Board of Publications, with which the dean of student affairs sits. His office also governs, with the help of the All-University Student Council, such major student events as the Junior Ball, Homecoming, and the Senior Prom.

University rules governing social affairs attended by women students are drawn up jointly by Dean Nicholson and Dean Anne Dudley Blitz, whose title is dean of women. Enforcement of these rules rests chiefly with Dean Blitz.

Activities of the Dean of Women

ALICE SHEVLIN HALL, a handsome and dignified building near the heart of the Minnesota campus, is the center of much of the activity on behalf of women students carried on by representatives of the institution or by the students themselves. Shevlin Hall contains rest rooms, a splendid cafeteria managed by the University, a ballroom, committee rooms, and the offices of the dean of women, Anne Dudley Blitz. It also adjoins the large gymnasium for women.

Besides administering a large number of loan funds for women students and supervising the award of many scholarships available for women, Dean Blitz maintains close personal touch with a large number of these girls. Working through organizations of students similar to those among men students co-operating with Dean Nicholson, she is able to wield influence in most of the activities of the group with which her duties lie.

The Woman's Self-Government Association, a voluntary student organization, is the most powerful women's organization on the Minnesota campus. "W.S.G.A.," as this body is known on the campus, conducts a bookstore dealing in secondhand textbooks and in that way raises money for eight or ten scholarships of \$100 that go to deserving women students. Its social activities are many, and are designed especially to benefit those students who do not participate to any extent in the social life of the sororities. "Sunlites," or afternoon dances, in the Minnesota Union on Saturday afternoons when there are no classes, are conducted by W.S.G.A. It also supervises each year a series of vocational conferences for women, bringing to the Minnesota campus some well-known women advisers with whom the students talk concerning their capabilities and ambitions.

A group of senior advisers for freshman girls is one of the divisions of the Woman's Self-Government Association that has been doing good work. These seniors meet incoming students on the train and serve them until they find their rooms and get "onto the ropes." Many of them also keep in touch with their freshman wards at least throughout the first college year.

Dean Blitz also has the duty of approving the chaperons selected for all mixed parties in the University community. The Young Women's Christian Association, several other religious organizations among women students, and the Women's Athletic Association, devoted to student sports, operate in close sympathy with the dean of women.

This office also plays a major part in finding employment for many women students who are partially or wholly self-supporting. Entire oversight of the housing of women students and of rules governing the reception of callers and the conduct of social affairs in houses where women students live rests with Dean Blitz.

The Student Housing Problem

THE last complete report for a full year showed that there were 2,215 women students at Minnesota who lived at home or with friends in one of the Twin Cities; 330 who lived in rooming houses approved by the Housing Bureau; 284 in the University dormitory for women, Sanford Hall;

41 in co-operative cottages, owned by the University, in which the students cut the cost of housing by doing much of their own work; 16 in the home management houses operated at University Farm by the Department of Home Economics; 285 student nurses in hospitals and nurses' homes; 165 women students living in sorority houses; and 45 working for room and board in private dwellings.

It has been learned that many of the out-of-town students who now make their home with friends in Minneapolis or St. Paul would prefer to live in the immediate neighborhood of the University and would do so if the much needed dormitories were erected. President Coffman and other leaders at Minnesota are eagerly looking forward to the time when clean, new dormitories, owned and supervised by the University, will be available for every out-of-town student, whether man or woman, and a beginning will be made on such a system as soon as financing can be arranged. The first dormitories to go up will be set aside for freshmen.

The University maintains a wholly effective supervision over the private rooming houses in Southeast Minneapolis where women students rent rooms. Women may room only in a house approved by the Housing Bureau, which is a department under the dean of women. This bureau inspects all rooms offered to students, designates whether one or more students may live in a given room, inspects the sanitary conditions, and fixes a price limit beyond which the landlady may not go if the rooming house is to be approved. Through its ability to withhold approval it has in this way a complete mastery of the situation.

The co-operative cottages are dwellings that stood formerly on lots purchased by the University. These have been moved to sites where they do not interfere with University activities, refitted, and used as homes in which students who must watch every expense may reduce costs by doing their own work. These groups employ a cook and take in an older woman as a chaperon. It is a usual thing for the groups of girls living in co-operative cottages to make higher average marks than any other group that can be singled out and defined.

A recent report by Dean Blitz showed that altho there are 55 Greek letter fraternities of men maintaining houses near the University of Minnesota campus, the women students had at that time but 19 sororities with a total capacity of 247. In the fall quarter of 1924-25 they had 189 residents. The relative smallness of this number makes supervision less of a problem than it otherwise might be. The University, however, has been strict with the sororities, and from time to time in recent years one or another of them has been put on probation for infringement of rules and punished by being refused the privilege of pledging new members. The sororities, like the fraternities, must maintain a "C" average in scholarship to be in good standing. In enforcing this rule the University has enjoyed the co-operation of graduate members of these clubs and also of the national organizations of which most of them are a part.

Social activities among University of Minnesota girls are much more widespread than one might think if he read only the society news relative to sororities. In each class there is an organization of women students, organized on thoroly democratic lines. For the freshmen, this society is "Bib

and Tucker"; for sophomores, "Pinafore"; for juniors, "Tam o' Shanter"; and for senior girls, "Cap and Gown. Mortar Board is another organization of senior women who are eager to help in all situations where a group of the more experienced and mature "co-eds" may be of service. It is an honor organization to which members are elected each spring.

Under a ruling that has been in full effect for more than a year, all undergraduate parties at which girls are to be present must be held on either Friday or Saturday night, so that they will not interfere with studies, and must be approved by the proper University authorities, which is to say, the dean of women, at least three days before they are to be held.

This rule was adopted by three of the strongest organizations on the Minnesota campus, namely, the All-University Student Council, the Interfraternity Council, representing men's Greek letter societies and their faculty adviser, and the Pan-Hellenic Council, which speaks for the sororities.

A rule recently adopted by the All-University Council requires that students who hold an office in any organization of students must have had a record free from failures and an average of "C" in the preceding quarter, and that they must maintain this average of "C" during their tenure of office. This ruling now applies both to organizations of men and of women.

Student Activities at Minnesota

TO describe in detail the voluntary activities of students other than purely social ones would require a fair sized volume. Student interest in "activities" is one of the remarkable phenomena of education in the twentieth century. It has arisen in part, no doubt, from a widespread student revolt against the over-theoretical nature of many of the older methods of education. Students became weary of jokes in the public press at commencement time, or the sage remarks of distinguished and self-made business men who granted interviews, and of the rather monotonous character of much of the "pure theory." As a result a colossal epidemic of organizations came into being. "Let's do things and gain practical experience along with the theory" was their war cry. The original form was the debating or literary society, such as still persists everywhere, tho in most places it has been somewhat dwarfed by comparison with other activities.

Student publishing was the next form in which these organizations reached the stature of maturity. Today it is a giant in nearly every American educational institution. Student dramatics also took an immediate leap forward once the inhibitions and crudely amateur traditions of old-fashioned student dramatics had been done away with. Begun as a reflection of the world-wide interest in little theaters, one-act plays, and the general improvements in dramatic art, the undergraduate drama fixed itself first in student favor and then in the curriculum of most of the universities.

Societies devoted to language subjects — Spanish, French, Italian, German, Scandinavian,—have grown apace on the Minnesota campus. There is a huge organization of foreign students, known as the Cosmopolitan Club. There are student organizations devoted to the various branches of engineering. There is the big athletic organization, and its offshoots, such

as the Outing Club. Then there are also such units as Scabbard and Blade, organized by men students interested in matters military, some racial groups, such as the Menorah Society of Jewish Students, and many religious and benevolent organizations.

These organizations show, more than anything else, that the world of today has become more thoroly awake than it ever was before. Instead of wasting their time in fireside chit-chats and knitting, the women students take part in student government, they debate, they write plays and act them. On the sports fields they engage in archery, in tennis, in hockey. It is only a matter of throwing the searchlight on one more aspect of the world's recent changes. Wherever the shaft of light is thrown, it shows that new ideas and new activities are in vogue.

Does John "waste his time" writing stories of university athletics for the *Minnesota Daily*? Perhaps not, when one thinks that his Uncle Will, who went to college 20 years ago, also had some time to "waste" and probably made a much more proper job of wasting it, shooting pool in an ill-ventilated back room or making rings on a polished table with the wet bottom of his beer glass. The number of students who attend, say, burlesque shows, and their rating in importance on a university campus, are certainly reduced in corresponding ratio as the number who engage in "activities" rises.

Student Religious Activities

OF the religious influences brought to bear on students at the University of Minnesota a careful study has been made in a recent report to President Coffman. At one point this report says:

"The University community contains seventeen churches, thirteen of them near the Main Campus and the other four near University Farm. All of these churches serve and provide opportunity for worship to members of the University. All of them have substantial, well-equipped buildings, several of the structures having been put up quite recently with an eye especially to the needs of a University community. The state-wide importance and character of their functions is reflected in equally state-wide support. A number of these churches draw support not only from the resident constituency but from the city and state organizations of their respective denominations. The pastors of these University churches are carefully chosen with regard for the double service they are expected to render.

"Besides the churches and next to them in importance are the students' societies. The Young Men's and Young Women's Christian Associations are well organized and function effectively on both campuses. Along denominational lines the students have formed the following groups: Baptist Students' Union, Students' Catholic Association, Northrop Club (Congregational), the Episcopal Unit, Lutheran Students' Association, Wesley Foundation (Methodist), Presbyterian Union, Christian Science Society, and the Menorah Society (Jewish). As an addition to Lutheran societies, there is a branch of the Walther League on the campus.

In each church there is a Young Peoples' Society, composed of students and chiefly directed by them. The Southeast Federation of Young People's

Societies is the united form in which these groups occasionally meet. Kappa Kappa Lambda and Kappa Phi are organizations of Lutheran and Methodist women, respectively.

To facilitate the work of church and religious organizations which wish to assist entering students, the registration form of the University of Minnesota contains a blank on which the student may state his religious preference. The names of students are then turned over to the organizations with which they have expressed a desire to associate.

An informal organization of pastors and secretaries of Christian associations meets frequently in the University district to confer on individual problems and to plan certain events which are promoted jointly. Among the latter are the voluntary courses in religion, which have been offered now for four years and which cover religious subjects in a form which the University, under the constitution, may not teach. Pastors of various denominations give these lectures to any students who wish to enroll. They do not carry University credit and the institution's only connection with them is that it furnishes the rooms in which they are conducted.

This report emphasizes the amount of student initiative in religious work on the campus. "While pastors, faculty members and the Christian Association secretaries do considerable coaching and advising," it says, "yet the work itself is largely done by students. This gives them training in religious activities that will prove valuable during their later life in either lay or clerical callings."

Building the Physical Man

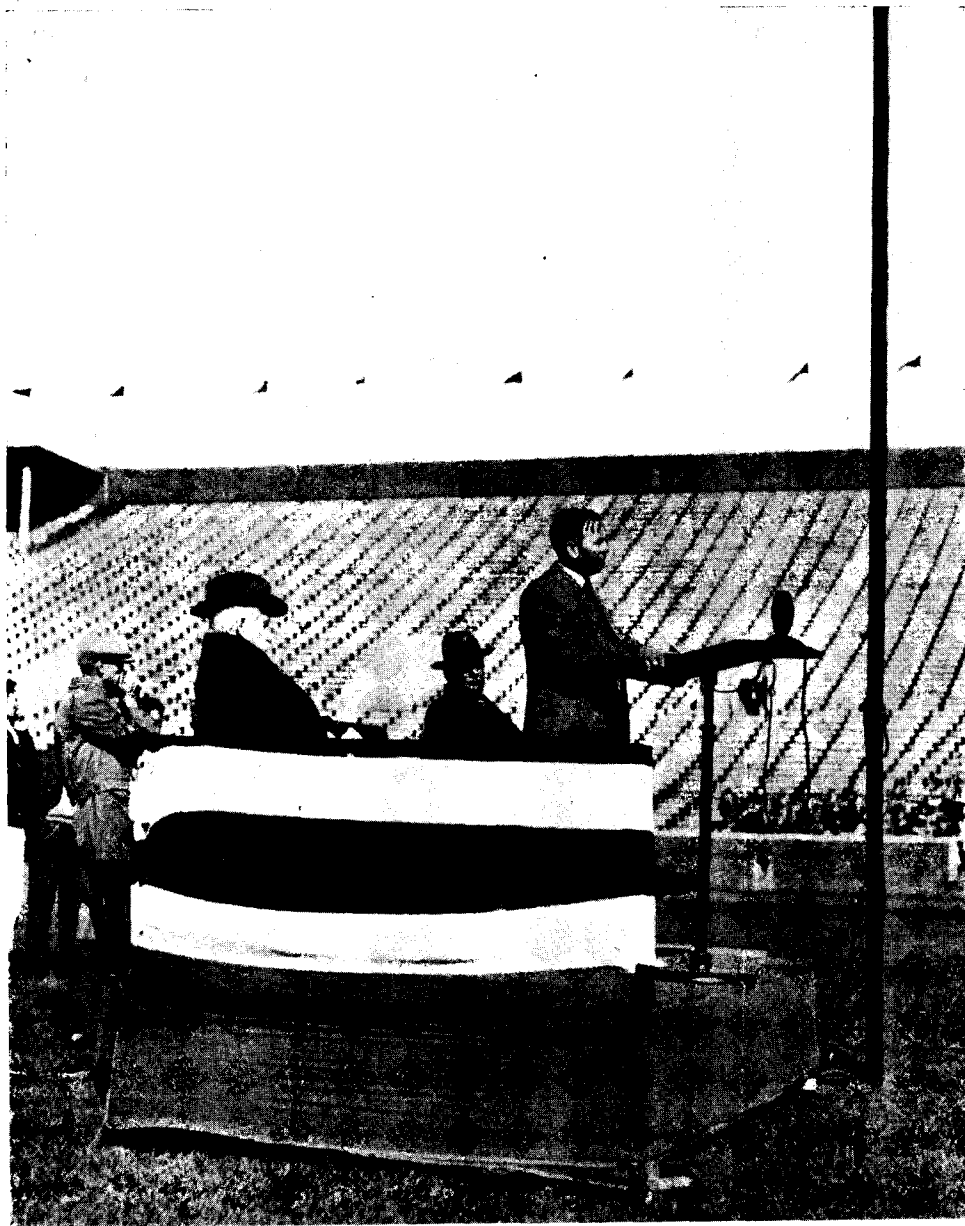
THE growth of interest in sports of every kind has been a phenomenon of American life of the past decade almost as notable as the progress of the radio or the motor car. Thousands turn out to witness big athletic events today where tens showed interest in them 15 years ago. It is also true that the number who take part in golf, tennis, swimming, skating, and similar individual sports has doubled and redoubled in recent years.

Borne along by this inevitable trend, American colleges and universities have thrown every protection around intercollegiate sport to keep it sane and clean. And at the same time they have given recognition to the need for bodily activity so overwhelmingly expressed. At Minnesota, as at other institutions, provision has been made for sports on the campus among students who lack the stamina or the desire to go in for intercollegiate athletics. A place is made for every man who wishes to participate. He may choose baseball, basketball, swimming, cross-country running, or any other sport. This fall for the first time "touchball," the modified football which does away with violent contacts, has been introduced on the Minnesota campus. As if by magic, 96 touchball teams were formed among the men students at Minnesota.

Interest in athletics in its intercollegiate phase is caring for interest in athletics in its broader phase. The receipts from football are making possible, without state appropriations, provision of playing fields, buildings, and equipment, by which the youth of the state are given the opportunity for healthful exercise which it so obviously craves and so eagerly accepts. Min-

nesota now has between 15 and 16 acres of space, including the campus Parade Ground, set aside for physical activities. The splendid new Stadium, a gift of friends and alumni, together with students and faculty, is making possible, through football earnings, the erection of a mammoth field house in which outdoor type sports will be possible in the winter, and which will also make adequate provision for Minnesota basketball players, something they have lacked hitherto.

A recent report of the University of Minnesota Committee on Intercollegiate Athletics showed that 1,145 men, including freshmen and varsity candidates, received athletic instruction last year. In addition to these, almost all the rest of the 7,000 men in the University took part in either intramural sports on the campus, or military drill, or both. The great part a healthy body plays in the successful pursuit of any calling has come to be recognized so thoroly that there is little likelihood of the tide's turning in the other direction.



The Minnesota of Today Greets That of Tomorrow

President L. D. Coffman speaking at the Freshman Welcome (Seated, left, Dr. W. W. Folwell; right, Fred B. Snyder, president of the Board of Regents)

HOW THE UNIVERSITY SERVES ALL OF US

Problems of Health, Agriculture, Industry, Engineering, Government, and Education Are Among Those It Helps Solve

ONLY those who make a rather close survey of the work accomplished by a large state university, such as Minnesota, realize fully the extent to which it serves the commonwealth that supports it. The University makes itself useful in so many fields that only now and then is one permitted to see a cross section of its work, tho many thousands are thoroly familiar with its performance in the special walks of life where their main interests happen to lie.

In addition to its function of training thousands of young people in cultural, professional, and vocational subjects, and its duty of extending through research the boundaries of human knowledge, the University of Minnesota is performing direct services to state and public at all times. And these services are so important that they alone would probably repay the cost of maintaining the institution if it carried on neither instruction nor research. The two latter, however, are by all odds the most important services of the University.

The services of the University's professional schools can be listed most readily because their fields are so definite by comparison with those branches which train chiefly for general service.

Thus the Medical School, besides training the physicians who are to safeguard or restore the people's health, also includes a department in which nurses are trained, and it prepares medical technicians to carry on the laboratory duties for which many physicians cannot find the time. The Medical School also conducts a model hospital, which combines with its primary function of caring for the sick, the necessary opportunity for medical students to see their art practiced under actual conditions by men thoroly able to demonstrate the best methods.

Thousands of persons are treated annually in the dispensary maintained by the Medical School, only a registration fee being charged. In this school also are trained many young men and women who will go out into public health work, doing on a social scale what the physician in private practice does as an individual. In co-operation with the General Extension Division, the Medical School conducts each year three or more short courses, aimed to give the physicians of the state and Twin Cities an opportunity to bring their knowledge thoroly up to date in whatever subject the courses treat. These have been largely attended. Individuals in the Medical School are constantly in demand, also, as experts in post-mortems, in examining into the medico-legal aspects of certain court cases, and for like services.

Besides these services, there is the highly important function of conducting original medical investigations, and work of this sort is going forward at Minnesota at all times in anatomy, for example, and in physiology, pharmacology, and many other branches.

Under a gift which will soon become available, the Medical School of the University of Minnesota will add a hospital for crippled children, to the general, cancer, and eye, ear, nose, and throat units already in operation.

Practical Work in Engineering

IN the College of Engineering and Architecture in the University of Minnesota has been brought together a group of men capable of dealing with any problem that may arise in the state with respect to construction, whether of highways, buildings, or special purpose structures like municipal water or garbage disposal plants. In that college also are engineers skilled in all branches of electrical engineering; mechanical engineering, including plant installation and the effective designing and use of machinery; municipal engineering; sanitary engineering; drainage and sewage problems; and the engineering phases of transportation.

This rather long enumeration is made because it is by no means unusual for some individual, group, or community in Minnesota to take advantage of the opportunity offered at the University. Manufacturers, municipalities, inventors, men with construction problems, and persons who wish to make sure of their ground before they invest money are served every month by these men in the College of Engineering.

Through its School of Architecture, this college also is making a splendid contribution to the beauty and utility of the new buildings and homes erected in Minnesota as it turns out more and more young people with the skill and taste that serve this end.

The Minnesota State Tax Commission has entrusted to a member of the Minnesota Engineering Faculty the duty of appraising the public utilities of the state. The State Highway Department uses the part-time services of a faculty member to direct its Department of Tests and Inspection, and has transferred to a new building on the campus its important tests and inspection laboratory.

Not least among the services of the College of Engineering is that members of its faculty help the University to solve its own problems in engineering and construction.

It maintains also a department of experimental engineering in which thousands of tests and demonstrations are made each year, both for students and for private individuals or concerns. Original investigations and research into engineering problems go forward at all times in the experimental laboratories of the College of Engineering.

Arts Unit Is the Largest

ALTHO the main functions of the University's largest unit, the College of Science, Literature, and the Arts, are those of providing training in liberal arts for several thousand students, and teaching fundamental subjects to those students who plan to go on into the professional schools after two or three years, it also performs a number of direct services. From its ranks

come a majority of the instructors who teach the night classes of the General Extension Division. Direction of the important Minnesota Geological Survey is included in the organization of this college, and the head of its Department of Geology is head of that survey. It has supervised, also, most of the important botanical studies that have been made in Minnesota.

This college also has developed a number of vocational courses to prepare students for special callings, among these being journalism, consular or diplomatic service, library work, musicianship, interior decoration, social service, and service in the field of preventive medicine and public health. Other courses of this type are being developed as the needs become apparent.

A majority of those students who pursue advanced studies to prepare themselves for college teaching, do their work in the College of Science, Literature, and the Arts. The chief exception is found in those who necessarily do such work in the professional schools or College of Agriculture.

It is this college, also, which has the task of fitting the beginning students into the scheme of things collegiate, setting them on the broad path to right habits of study and living, and examining into the basic causes of failure among those who falter.

A Contribution to Business

ONE of the youngest major divisions of the University of Minnesota, the School of Business, directs itself chiefly to the job of teaching its students the fundamental economic and social facts upon which successful and ethical business is based. It is gradually broadening out, however, by offering special training in a number of important fields, including statistics, accountancy, personnel direction, and the like. It lays chief emphasis on giving young men that background which will enable them eventually to become sound business executives, or to step successfully into business positions which are assured them through ownership or connection.

As do all the professional and semiprofessional faculties, the School of Business provides splendid opportunities to those who wish to continue training with a view to teaching. Researches into important business problems in Minnesota and the Northwest constitute an expanding phase of the work in this school.

"The State-wide Campus"

IN its General Extension Division, the University of Minnesota is carrying on an important and successful venture in the field of adult education. Educational institutions have long recognized that those who are past the age of the average undergraduate, or who, because they must earn a living, are unable to take advantage of the more usual opportunities for study, are entitled to every chance for self-improvement that the state can properly afford.

This division conducts late afternoon and night classes and also maintains a large division of correspondence study for the benefit of those who live where the regular extension classes cannot be organized. By dividing its curriculum into a business group, an engineering and industrial group,

and a liberal arts group, the division is enabled to offer a wide range of service which in most cases hits the spot where it is most needed.

From this division, also, are directed the Department of Community Service, and the Bureau of Visual Instruction that provides films to hundreds of groups that might otherwise find it difficult to obtain just the entertainment they wish. The Municipal Reference Bureau, maintained to solve problems which Minnesota municipalities refer to it, is also a branch of the Extension Division.

Practically of equal importance with the night classes of this division are the short courses it offers from time to time during the year. Reference has been made to those in medicine, which include one of twelve weeks in embalming. Other such courses are offered from time to time for dentists, merchants, bankers, and other groups.

National Leadership in Dentistry

MINNESOTA'S College of Dentistry is not only famous for service within the state in placing the dental profession on the highest plane, but also as a national leader in the advancement and improvement of dental practice. This college has probably led in more important progressive steps than has any other in the country. The splendid standards of performance and ethics for which Minnesota dentists are noted can be traced almost wholly to the College of Dentistry and its dean.

In the field of pharmacy, also, the college in the University of Minnesota is the chief inspiration to high standards and skillful performance in the state of Minnesota. Its faculty at all times take an active part in the affairs of the State Pharmaceutical Association and provide the members of that association with expert services in testing the purity of drugs, developing better methods of raising drug plants and manufacturing their extracts. In a calling so fraught with temptations that nearly every phase of it is carefully restricted by law, the pharmacists of Minnesota stand as examples of the most skillful and ethical practice.

Mining Skill Adds to State's Wealth

THE School of Mines performs, in its special field, much the same services that are performed by the College of Engineering and Architecture for those whose interests are of its kind. Besides its formal instruction and research, the School of Mines maintains a Mines Experiment Station, called the finest in the world dealing with the problems of iron ore, in which a series of important discoveries have been made. Each of these has added, or will add, to the wealth of the state through prolonging the life of the iron mining industry and so adding to state revenues and private incomes from that source. In the Mines Experiment Station is housed the North Central Station of the United States Bureau of Mines, also engaged in important investigations.

For many years the Minnesota State Tax Commission has depended on the experts in the School of Mines to estimate the tonnage on which

mining properties in Minnesota should be assessed. Upon the skill and integrity of these men depends no small part of the state's income from taxation of mineral properties.

Chemistry has become so important in industry, medicine, agriculture, in the public utility field and elsewhere that the services performed by a School of Chemistry are practically self-evident. In this school the students in engineering, medicine, dentistry, agriculture, mining, pharmacy, and forestry are taught the varying amounts of chemistry that those callings require, and thousands of other students study under its faculty for the extension of their own general knowledge.

Just as individuals and concerns constantly refer problems to the Engineering Experiment Laboratories, a constant stream of inquiries comes to the professors of the School of Chemistry, and in the course of a year they serve scores of municipalities, manufacturing concerns, milling companies, public service corporations, or individuals.

The entire field of chemical engineering, including manufacture of chemicals and of other articles by processes chiefly chemical, including soaps, dyes, artificial substances, special materials, and the like, is comprised in a department in the School of Chemistry.

The Broad Scope of Agriculture

THE services performed in the Department of Agriculture are multiform, as it includes the College of Agriculture, the Agricultural Experiment Station with its substations and farms, the Schools of Agriculture and the Agricultural Extension Division. Instruction in Home Economics and in Forestry is also given in this college. In the Experiment Station it carries on work looking to the improvement of plant species, the development of new species, the improvement of animal strains, the examination of soils, solution of farm engineering problems, and the like. The business problems of the agriculturist also come in for attention by the Division of Agricultural Economics. Instruction, of subcollegiate, collegiate, and postgraduate rank is given in the schools and the college.

By its Extension Division, the Department of Agriculture makes approximately 1,000,000 contacts a year through which to spread knowledge, give advice, offer inspiration, or answer questions. In this field it supervises boys' and girls' club work, maintains contact with county agents, distributes literature on agricultural subjects, sends out speakers, or radio broadcasts addresses.

In its College of Education Minnesota yearly trains about 1,000 young people whose aim is to become teachers of high school rank or principals and superintendents in the Minnesota public schools. In this way it is the fountainhead of renewal for thoroly prepared teachers throughout the state, and it provides also the only place in the state where those who desire to pursue advanced work in the field of education can find that opportunity. Its faculty are at all times performing special services for some Minnesota communities, such as surveys of the public school systems, of the school building problems, or the problems of educational finance.

While the Law School confines itself chiefly to the training of young men and women for the profession of law, members of its faculty often render important public services, such as aiding in the codification of laws, serving as members of committees having legal aspects, such as the governors crime commission, and the like.

The Graduate School at Minnesota is a central organization that utilizes the faculties and equipment of all other schools for the instruction of students with the Bachelor's degree who wish to continue their studies toward the degrees of master of arts or doctor of philosophy. Whether this work be in the fields of economics, agriculture, medicine, dentistry, Romance languages, geology, or what not, the courses of study are laid out by the Graduate School and the student's accomplishments are passed on by that organization. This department has grown in power and importance during the past decade until today it draws students from all parts of the world, tho a preponderant number come from Minnesota.

The Search for New Knowledge

PRESIDENT COFFMAN has repeatedly pointed out in his public addresses that a strong faculty is one whose members are seeking to extend the boundaries of knowledge in their chosen fields. A strong university, he says, must have the conditions which make it possible for these studies to go on. This is the field of research.

The activity of the Minnesota faculty in research is revealed by a volume recently published by the Graduate School, listing and briefly describing research studies now going on at Minnesota. The volume runs to 293 pages and reveals that teachers in the University of Minnesota are engaged in studies of tremendous variety, many of them of very great importance.

Through such researches, faculty members in the University have revealed new uses for Minnesota's minerals, such as sand, clays, shale, marl, iron ore, and a variety of "rocks." They have developed plant species that would be more hardy and prolific in the Minnesota climate. They have made important contributions to health through studies on the main campus and under the Mayo Foundation at Rochester. Important contributions to cultural knowledge are at all times being produced by Minnesota scholars in the fields of history, English, philology, economics, and the like. In psychology the contributions have been of increasing importance. The College of Education at Minnesota is among the national leaders in studies of effective educational procedure.

The same may be said for the research work in the several departments of the College of Engineering and in the School of Chemistry. Dr. S. C. Lind, one of the nation's best known students of the activity of radium, has recently been added to the faculty of the School of Chemistry with the title of director. He brings with him an important loan of radium from the government for use in his original studies. Studies in physics, in geography, in the field of social welfare are among the important ones conducted at Minnesota. Studies in the prediction of student performance in

colleges and of the best bases for admission to college, made by Dean J. B. Johnston, of the College of Science, Literature, and the Arts, have been attracting national attention.

Such accomplishments are important, not only because they often uncover new knowledge of the greatest usefulness, but because they stimulate the researcher and, in turn, provide inspiration to the students who are working under these men.

Those who consider that research has been at the bottom of the tremendous strides made by the world in chemistry, electricity, the radio, the internal combustion engine, medicine, surgery, public health, construction, heating, sanitation, railroad transportation, and in the methods of manufacturing and of financing industry, will need no further argument to convince them of the importance of this field. And, just as a world much poorer than our own, was able to support the workers who brought those things about, so the world of today, enriched by their discoveries, is in duty bound to see that men and women with the precious talent for research and discovery receive every encouragement to push ahead.

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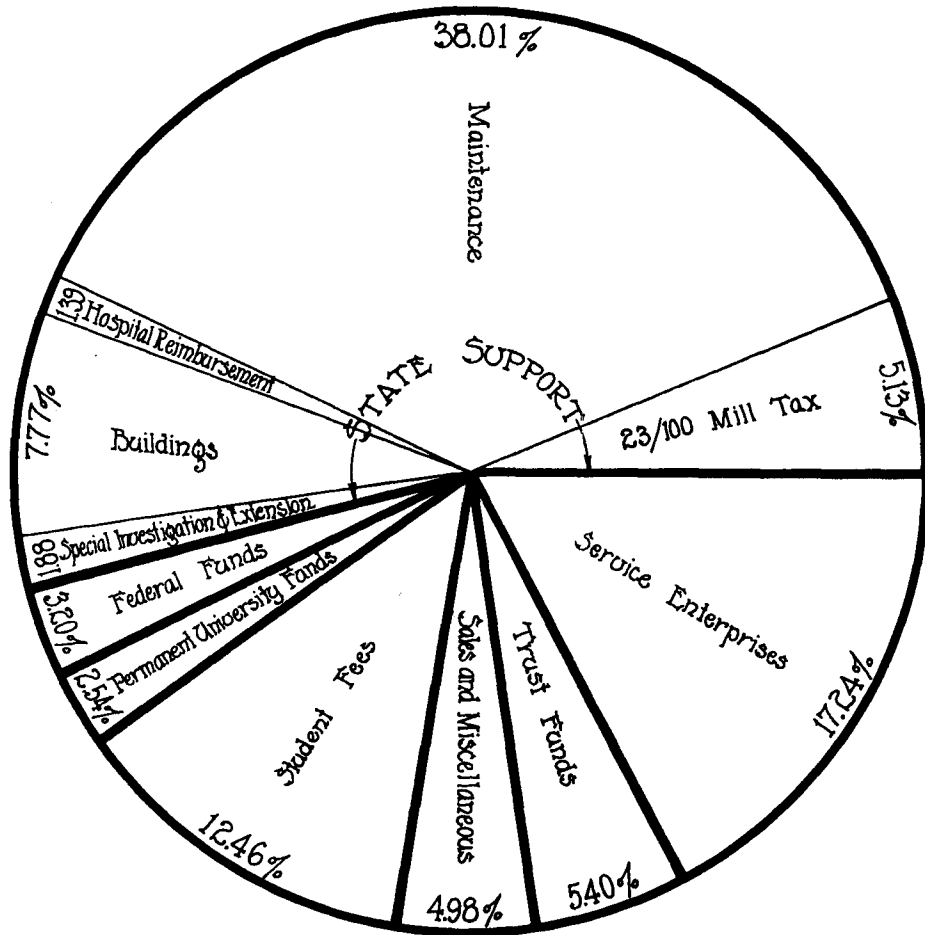
January, 1927

MINNESOTA CHATS



For a Better
Minnesota

Sources of the 1925-1926 University Dollar



	Amount	Percentages
1. State Support		
23/100 Mill Tax	\$ 432,547.57	5.13
For Maintenance	3,200,000.00	38.01
For Hospital Reimbursement	117,268.00	1.39
For Buildings	654,515.82	7.77
For Special Investigation and Extension	158,100.00	1.88
2. Federal Funds	269,235.37	3.20
3. Permanent University Funds	213,558.81	2.54
4. Student Fees	1,048,652.70	12.46
5. Sales and Miscellaneous	419,706.81*	4.98
6. Trust Funds	453,674.19	5.40
7. Service Enterprises	1,450,650.29**	17.24
Total	\$8,417,909.56	100.00

* Includes transfers between departments of \$171,028.51.
 ** Includes transfers between departments of \$464,685.23.

SOURCES AND USES OF UNIVERSITY FUNDS

By W. T. MIDDLEBROOK
Comptroller, University of Minnesota

IN the course of a year the University of Minnesota receives and spends a good deal of money. During the year that ended July 1, 1926, for example, its receipts were \$8,417,909. This is a large sum. It is half as large as the bank clearings for a whole day in the city of Minneapolis. It approaches the equivalent of \$3 for every man, woman, and child in the state of Minnesota.

Closer examination of the income and expenditure figures of the University would show, however, that it would be much more accurate to say that this sum was handled by the University of Minnesota, rather than to say that it was received to be spent "on the University." The latter statement would be very far from the truth. About one fifteenth of the whole sum goes into buildings as provided for by a law passed in 1919. The University needs the buildings because of the greatly increased attendance, but their construction adds to, rather than reduces, the general maintenance cost. Nearly three fifteenths, or \$1,373,362, is spent on service enterprises, such as dining halls and cafeterias, health service, dental service, and the like. This is spent not for actual university operation. It is paid out by the University to make things easier, cheaper, and happier for the students and then repaid to the University by the students at the rate of cost plus just enough to cover overhead and keep the enterprises functioning smoothly. Over \$260,000 is received from the United States Government for specific uses in the advancement of agriculture and the mechanic arts and is devoted wholly to the specified purposes. Another large sum of more than \$150,000 is turned over to the University by the state with the request that it do certain designated jobs with the money and meet the expenses with these funds.

With this by way of introduction, let us turn to the actual money figures of University of Minnesota receipts, divided into classes based on the sources of the money and the purposes for which it may be used. The University received during 1925-26:

I. From the State of Minnesota

A. For general University purposes	
The 23/100 mill tax	\$ 432,547
The maintenance appropriation	3,200,000
B. For buildings	
Under act of 1919, etc.	654,515
C. For special services to the state	158,100

The first two items are unrestricted appropriations to the University of Minnesota. They represent the principal cost of the University to the taxpayers at large. Combined, they fall nearly \$100,000 short of meeting the University's salary roll, which amounts to \$3,712,322.

The item "B" includes the annual \$560,000 given the University for its comprehensive building program by the 1919 Legislature and the ap-

propriation specially made by the 1925 Legislature for construction of a dormitory at the Grand Rapids School and Station.

The third item, "C," covers the expenses incurred by the University in carrying on a number of tasks specifically designated by the Legislature. Naturally, the institution is glad to carry these on. It wishes to do so. But use of the money is definitely restricted. These funds contribute nothing towards solving the problems arising from swift growth and keen competition for teachers. Typical problems for which this money is appropriated are investigations of various soils, some low in lime content, some sandy, peat soils, or for a general soil survey. Some goes to experiments at the Mines Experiment Station looking to increasing the commercial value of Minnesota's lower grade iron and manganese ores, which amount in the aggregate to billions of tons. About \$98,000 of the total goes for the support of county agents and agricultural extension work.

II. From the United States

TOWARDS various projects for the benefit primarily of
 agriculture \$269,235

This money is appropriated and spent almost exclusively for definite and beneficial projects in agricultural education, agricultural extension, and in the agricultural experiment stations. It contributes directly and materially to the advancement of agriculture and the betterment of status of the Minnesota farmer and stock raiser. And yet it cannot do much to relieve the general University situation because it must go for the purpose for which it is provided and cannot be used to meet any unforeseen situation, such as sudden growth, involving the need for more land, more teachers, or more equipment for general instruction.

This money is the combined income from the Adams Act of 1887 giving \$15,000 annually for the support of an agricultural experiment station, which was raised to \$30,000 in 1906 by the Hatch Act; \$50,000 annually for the further support of land grant colleges, provided under the second Morrill Act of 1890 and the Nelson Act of 1907; funds given to agricultural colleges under the Smith-Lever Act of 1914, which amounted in 1925-26 to \$116,539; funds provided under the supplementary Smith-Hughes Act, amounting to \$33,780, and under the Purnell Act of 1925 which began at \$20,000 annually the first year and will increase to \$60,000 in 1929-30 and succeeding years.

III. From Long Established Permanent Funds

THE Act of Congress of 1849, establishing the territorial government of Minnesota, provided that sections 16 and 36 in each township in the territory should be reserved to be sold for the benefit of education in the territory, the proceeds to go into a permanent fund. The Act of 1851 authorized the secretary of the interior to set aside land not exceeding two entire townships for the use and support of a state university. The first Morrill Act, approved in 1862, donated public lands to the several states and

territories for the establishment of colleges of agriculture and the mechanic arts, giving rise to the term "land grant colleges."

The proceeds of the sale of lands thus granted formed the basis of the Permanent University Fund. The state has added to this fund from time to time. The Legislature of 1923 directed that 10 per cent of the proceeds from the occupational tax on mined iron ore be added to the Permanent University Fund. Forty per cent goes to the Permanent School Fund and the remaining half into general revenue funds. The total Permanent University Fund amounted in 1926 to \$3,345,599.

From the interest on this fund the University received in 1925-26:

A. Income from the Permanent Fund	\$134,808
B. Income from Swamp Land Fund	78,750

In explanation of the second item it should be said that the constitution of Minnesota provides another permanent fund into which shall go income from the sale and lease of swamp lands and the removal of natural resources from them. This fund is now in the neighborhood of \$10,000,000. Only the income is used, half going to the support of common schools and the rest being divided between state institutions for education and charity. The University of Minnesota's portion is given above.

These figures should prove especially enlightening to those who think that the University of Minnesota has at its disposal unlimited resources arising from the sale of state lands and income from ore deposits. The whole of it comes to only a little more than \$200,000 a year, common schools properly receiving many times as much as does the University.

IV. Income from the Private Bequests of Friends and Philanthropists

EXCLUSIVE of bond maturities, producing funds to be reinvested, the University of Minnesota received in 1926:

Income from Trust Funds, slightly over	\$330,000
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Public spirited citizens have been helping nobly to build a university of the kind Minnesota must have. By their gifts they have both improved the institution's service to the state at large and to its students, and have helped reduce a burden that would otherwise fall on the shoulders of taxpayers. In the past fiscal year the total of these funds had risen to about \$4,500,000, and the University drew income from that sum; but these gifts are, for the most part, for specific purposes, and not for general support.

Friends and alumni have been generous in the past six years, having added about \$4,000,000 in the form of gifts, bequests, and trusts. Whenever these gifts have come in the form that made it possible, the University has set them aside as a principal from which the income could be used for loans to worthy students. Other gifts are the basis for scholarships that go to students showing special abilities and aptitudes. Some are restricted by the terms of the gifts and the income is used for research, graduate study in medicine, endowment of professorships, and the like. The W. J. Mur-

phy Endowment for journalism is an example of a gift to finance undergraduate study.

In the list may be enumerated also those for the Cancer Institute, from the Citizens Aid Society, the Todd Memorial Eye, Ear, Nose, and Throat Hospital, the Caleb Dorr student loan fund, the Minnesota Hospital and Home Endowment, from William Henry Eustis, the George G. Eitel scholarship fund, the John Lind fund, and the like. Recent donations have also included an annual \$50,000 for five years from the Laura Spelman Rockefeller Memorial for the support of an Institute of Child Welfare, and the gifts of alumni, students, faculty, and friends for the Stadium and Auditorium.

V. Income from Charges Arising in the Course of Operation

BECAUSE it has found that it cannot operate efficiently without charging student fees, the University of Minnesota has had to make charges against all students, thus giving those who benefit directly a chance to share the burden with those who support the University just as they do at other state institutions. Because it found that it could save money for students and improve conditions for them by operating certain service enterprises such as the Student Health Service, the cafeterias, and the still very inadequate dormitory system, the University spends nearly \$1,400,000 a year operating these. It gets back the million in the price of meals, examinations, and the like, and that sum shows in income. Because so large an institution is bound to produce certain services and products for which the public is glad to pay, the University secures some income from the sale of produce and animals raised at University Farm, from charges for services to the public in the dental clinic, the medical dispensary, or the University Hospitals. Income from these various sources in 1925-26 was as follows:

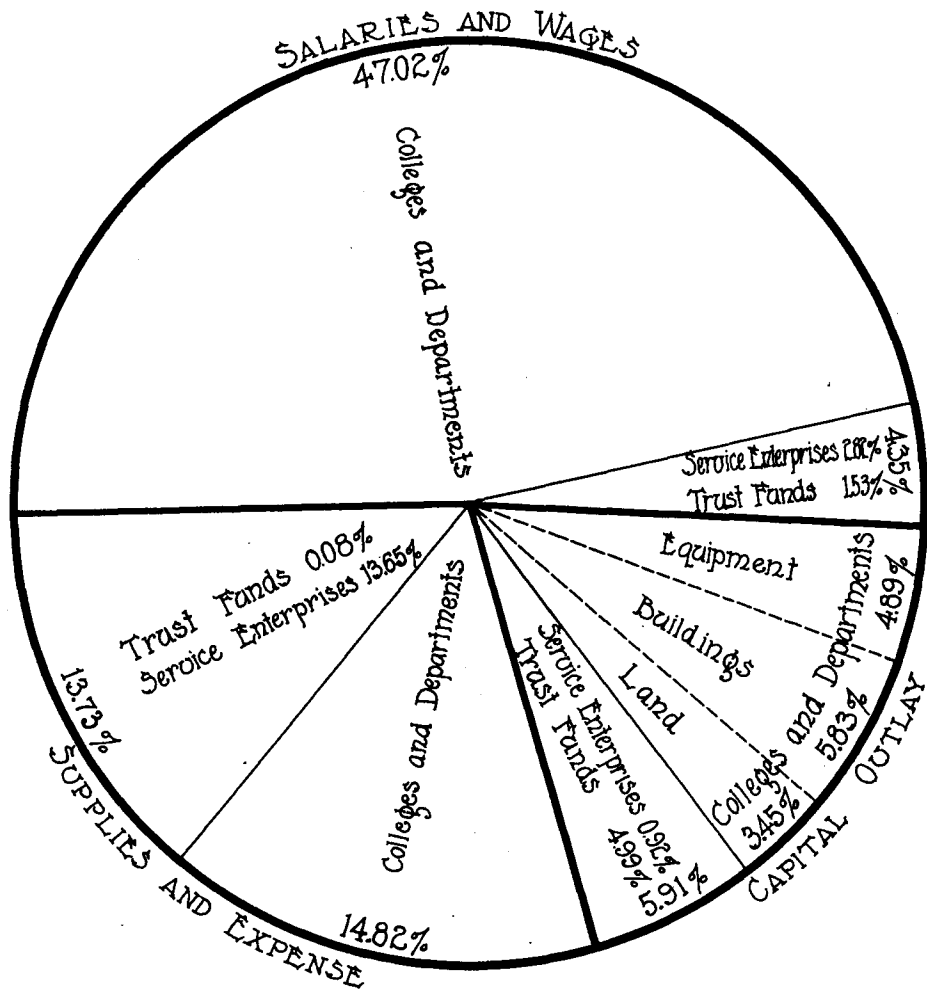
A. Student fees	\$1,048,652
B. Service enterprises	1,450,650
C. Sales and services	419,706

Student Fees

THE Act of the Territorial Legislature of 1851 authorized the Board of Regents to charge an admission fee to the University, but stipulated that as soon as the board thought income warranted such a change, tuition should become free to all students who were residents of the territory. That this ideal has never been reached is due not to any lack of desire on the part of the regents, but rather to force of circumstances. The ever increasing number of those who seek higher education and the consequent inevitable necessity for more staff, more buildings, more land, more equipment and supplies forced the regents to expand constantly every possible source of income. The development has been a steady, though gradual, increase of student fees rather than the attainment of the ideal of free higher education which the territorial founders had in mind.

Fees now collected are wholly reasonable as compared with those charged at other state universities. As President Coffman has pointed out,

Uses of the 1925-1926 University Dollar



	Amount	Percentages
SALARIES AND WAGES		
Trust Funds	\$ 121,731.56	1.53
Service Enterprises	222,799.60	2.82
Colleges and Departments	3,712,322.00	47.02
SUPPLIES AND EXPENSE		
Trust Funds	6,688.89	.08
Service Enterprises	1,078,242.22	13.65
Colleges and Departments	1,169,814.14	14.82
CAPITAL OUTLAY		
Trust Funds	394,577.04	4.99
Service Enterprises	72,320.45	.92
Colleges and Departments		
Land	271,945.38	3.45
Buildings	459,985.54	5.83
Equipment	385,748.69	4.89
Total	\$7,896,175.51	100.00

the University may be forced to increase fees still further, but it is extremely doubtful that revenue from this source can or should solve the financial problems of the University of Minnesota.

Departmental Sales and Income

MANY of the departments of the University render services or yield products in connection with, and incidental to, their work of teaching and research. Dental students must have actual practice in treating teeth and medical students must have a chance to observe skilled practitioners as they care for the sick in hospitals. Furthermore, the animals, the fields and gardens required for agricultural instruction produce an annual crop which it would be wrong to waste and uneconomic competition to give away. Charges for these services and goods yield a considerable annual income. At the dental clinic the charge is for the expensive materials. At University Hospital it covers the cost of operation and food. There is no charge for medical care. The Dispensary charges only a 10 cent registration fee. Yet the total is reasonably large. Even so, the University is today operating its hospital at a loss inasmuch as the state has not seen fit to reimburse the hospital fully for the indigent patients sent to it by counties, although the counties pay to the state half the cost of their care.

The Service Enterprises

THE bald statement that the University of Minnesota receives more than \$1,450,000 a year income from service enterprises is misleading. It "spends" very little on service enterprises. It lays out large sums of money to buy food and services for its cafeterias, health service, its small dormitory system, and the like, and it gets this money back from the students by moderate charges for things they almost certainly would have to pay more money for if they obtained them elsewhere. A student can get a splendid breakfast for as little as 18 cents in the Minnesota Union cafeteria.

The service enterprises are divided into two major classes. There are the ones operated for the benefit of the student body, which have been described, and there are those maintained to reduce the cost of general operation. Among these are the various shops for repair of equipment, printing and mimeographing, the cold storage plant and the chemical and general storehouses, dealing in absolutely necessary materials and supplies. Bulk buying and material economies result from these. And much of the income of service enterprises in the second class comes through budget transfers from other departments of the institution which buy services and supplies from the storehouses and the shops. In this way a considerable amount of money appears twice in the general financial statement, the University buying a quantity at wholesale, and the several departments buying the same supplies at retail from the University.

Some profit is made by the service enterprises, though in general it is little more than enough to maintain efficiency and buy needed equipment or replace old equipment. An effort is now being made to build up a fund which shall be the basis for an expanded dormitory system to be financed

chiefly by debentures. Fewer than 400 students among the 14,000 can now obtain accommodations in the University dormitories and the entire "system" includes but one thoroughly modern building on the main campus.

More About the State Support Funds

IT remains to discuss in more detail the state support funds mentioned at the beginning of this article. State support has been the principal source of the University of Minnesota's income. While in some years appropriations have lagged behind the need, the state has in general supported its University with fairness, and has kept faith with its founders.

For a number of years the Legislature has made it a policy to grant a lump sum appropriation for general maintenance, including the cost of teaching and research, of meeting the expenses of operation and of purchasing equipment. This appropriation has reached \$3,200,000 a year, but it has not kept pace in the last five years with the growth of the student body, the increasing demands for research and the cost of operation. In 1921-22 the Legislature voted an annual \$3,000,000 for an enrolment of 10,424 students of collegiate rank, and in 1925-26, it voted \$3,200,000 for 14,410 students. One fifteenth more was provided for six fifteenths more students.

Since 1905 the University has also received the income from a state levy of 23/100 of a mill for University support. This yielded \$470,480 in 1924-25, but during the past year it yielded but \$432,547.

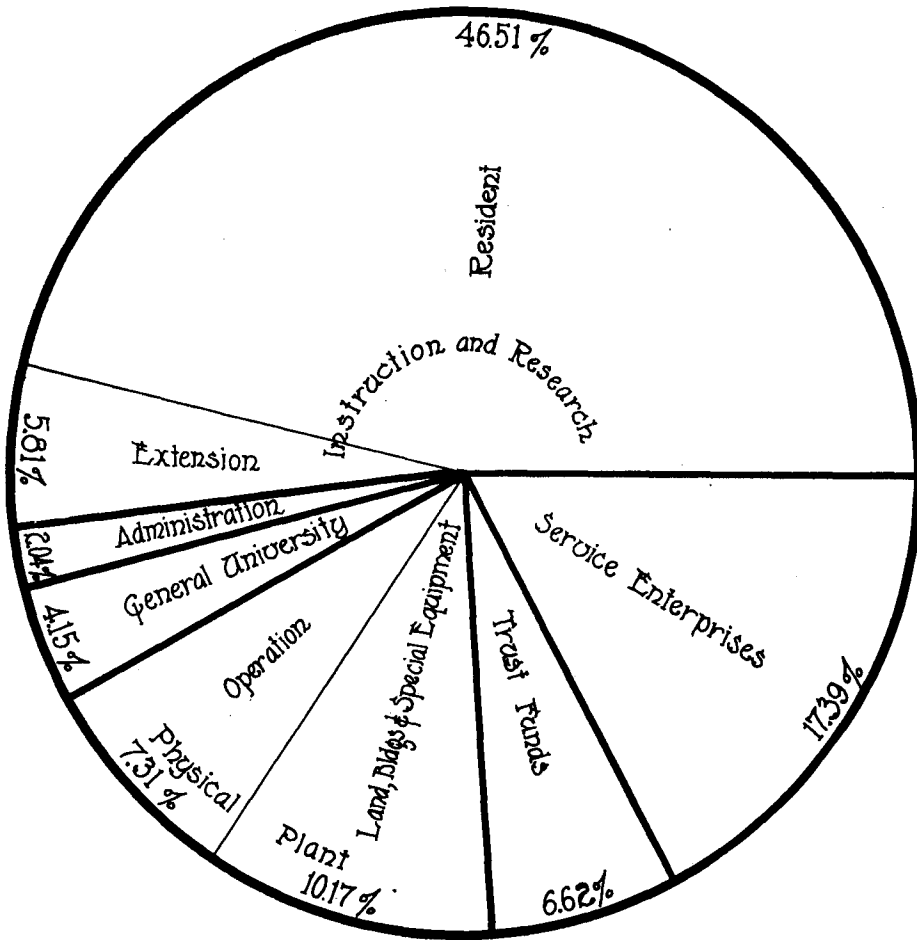
In 1919 the Legislature came to a realization of the difficulties and uncertainties attending special appropriations for specific buildings and wisely provided a comprehensive building program, giving \$560,000 a year to be used as the Board of Regents deemed best to increase the buildings of the institution. When the appropriation was passed a definite list of buildings was under consideration. The cost of removing the Northern Pacific Railway tracks from the campus, however, together with the materially higher cost of construction during recent years will prevent the erection of some of the buildings then in mind, but the board has been able to meet the more pressing needs of the University. Among the structures erected have been the new Library, the Dairy Building at University Farm, the Mines Experiment Station, the Music Building, the Electrical Engineering Building, and the Botany Building. Buildings for Physics and Plant Industries are under way and a Law Building is to go up.

The Use of University Funds

MANY of the uses to which University of Minnesota funds are put have been implied or stated in the discussion of receipts. This is especially true of those funds which the University receives for designated purposes. It is also true of the funds received back from service enterprises into which the University has put money for the benefit of its students.

Understanding of all the purposes for which the University uses money implies an understanding of the entire University, a complex and

Distribution of the 1925-1926 Dollar within the University



	Amount	Percentages
1. Instruction and Research		
Resident	\$3,672,679.53	46.51
Extension	458,766.21	5.81
2. Administration	160,975.55	2.04
3. General University	327,301.65	4.15
4. Physical Plant		
Operation	577,303.53	7.31
Land Bldg. and Special Equipment	802,789.28	10.17
5. Trust Funds	522,997.49	6.62
6. Service Enterprises	1,373,362.27	17.39
Total	\$7,896,175.51	100.00

growing institution. No doubt there are some who think that \$6,000,000 is spent on 14,000 students of college rank. As a matter of fact there are nearly 25,000 students. Besides the 14,400 regular students in the various colleges there are those in night classes, whose fees pay most of the cost but yet enter the above total costs; those in correspondence courses; those attending short courses; and many graduate students. Some are both students and minor teachers, holding fellowships, assistantships, or part time instructional positions. If it were not for the large number of these, who are willing to make sacrifices to continue their education, the University would be gravely handicapped in conducting many important researches. These advanced students take part in them for little pay and contribute their time and brains under the guidance of the experts who take charge of the research projects. A university actually commands more expert and yet low-cost service than could any other kind of a "business." This is because of the enthusiasm and ambition of the advanced students. Yet the sum total of the salaries received by these men and by the regular faculty and staff amounted to \$3,712,322 in the year 1925-26.

The University of Minnesota must maintain its campus, heat its buildings, pay janitors to keep the buildings clean and orderly, purchase and operate trucks to handle supplies economically, and buy paper and ink for printing agricultural bulletins, university catalogs, examination papers, research articles, and the like. It must buy classroom supplies, laboratory supplies, microscopes for biology, expensive equipment for chemistry and physics, livestock for University Farm, gymnasium equipment for physical education, medicines for its hospital and dispensary, seedlings for its forest nursery, fertilizers for its stations at Morris, Crookston, Grand Rapids, Duluth, Zumbra Heights, and Waseca. It must pay electric light, gas, and water bills. It must keep campus streets in order and sometimes pave them on order of the Minneapolis City Council. It must have engines and machinery in its engineering and mining laboratories. Three years ago it paid \$750,000 to have the Northern Pacific tracks removed from the campus. When the University was established no one foresaw a growth which would make it necessary for the campus to expand beyond those tracks. University Farm has expanded but is still too small. The University needs more land there and more still near the main campus for the expansion of the dormitory system and the medical group. These items suggest the broad outlines of expenditure.

Coming down to cases, what use did the University of Minnesota make of its funds in the year that ended July 1, 1926? In its accounting classification are recognized nine major purposes for which money is spent, namely: administration, general University enterprises, resident instruction, and research extension instruction, buildings and grounds, service enterprises, and trust and special funds. It is not possible to segregate the cost to the University of services rendered by members of the staff to the state and public at large, but that item would be considerable.

The expenditures under each of the heads were as follows in 1925-26: administration, \$160,975; general University, \$327,301; resident instruction and research, \$3,672,679.53; extension instruction, \$458,766.21;

buildings and grounds (physical plant), \$1,380,092 (including investment in new buildings); service enterprises, \$1,373,362; disposal of trust and special fund income (loans, scholarships, research, etc.), \$522,997 (including maturities for reinvestment).

Another View of Expenditures

THE next question is, what is the character of the expenditures? How much goes for salaries? How much for supplies and expenses? How much for equipment, land, and buildings? Reverting to accounting classifications, there are two types of expenditure, operating expenses and capital expenses. Operating expenditures include salaries, supplies, and "expenses," which will be explained in a moment. Capital expenditures are those made for land, buildings, and equipment—things of continuing use. Supplies may be agricultural or botanical supplies, feed for animals or food for students, coal, hospital supplies and medicines, laboratory supplies or those for university offices. Money listed under "expense" is that laid out for necessary travel, communication by mail, telegraph or telephone, for publications and printing, for rent, insurance, light, and gas, and for repairs to equipment and buildings. Equipment includes education and research equipment, furniture and fixtures, livestock and poultry, trucks, machinery and appliances, recreational equipment, and the like.

Excluding money spent in service enterprises and also the proceeds from trust funds, which go for special purposes, University of Minnesota expenditures for 1925-26 seen in the cross-section described above, were as follows: salaries, \$3,712,322; supplies and expenses, \$1,169,814; equipment, \$385,748; land and buildings, \$751,930.

It should be remembered that this money is not gone beyond recall—far from it. By the coldest of practical calculations the entire University plant, which belongs to the state and its people as much as ever it did, had a net worth June 30, 1925, of \$32,295,478.19. That was the last year for which the final figures have been printed. On this capital it pays as dividends each year something like 1900 graduates, splendid new citizens of Minnesota, equipped with health, a wholesome outlook on life, a trained mind, good habits and morals, and a determination to make their lives count for the betterment of Minnesota and of the world. As extra dividends the University of Minnesota declares its contributions to science, to literature and art, its services to the people of Minnesota, its improvements of agriculture, mining, medicine, and engineering, and the satisfaction Minnesota takes in knowing that its University is one of the most respected anywhere to be found.

THE GROWTH OF THE UNIVERSITY

*An Outline of Minnesota's Expansion, Drawn from Figures in the
Office of the Registrar*

By R. M. WEST

THE University of Minnesota was established by act of the Territorial Legislature of 1851. In 1869 the institution opened its doors to a class of 18 students. Last year, 1925-26, the total enrolment was 23,618 individuals, recruited from every county in the state, every state in the Union including the island possessions, and from many foreign countries. In a little more than a half century, the state of Minnesota has conceived and developed an institution of higher learning which is exceeded in size by but a very few American universities, and which is equal in quality of educational standards and opportunities to any university in the country. This is an achievement of which the state may well be proud.

During the life of the University its campus has grown from a few acres in the town of St. Anthony (now Southeast Minneapolis) to a total, including the experimental farms, of more than 5,000 acres located in many parts of the state. From a single building, the physical plant has increased to a total of more than 60 which are used for class and laboratory purposes. The first faculty consisted of less than 10; the present teaching staff includes the equivalent of 689 full time persons of the rank of instructor or above. However, a university is not primarily the group of buildings which houses its classrooms, laboratories, shops, and offices; it is not the group of teachers, administrative officers, technical, clinical, and service employees which compose its staff. The university is first and foremost the student body which is enrolled; and in the growth of the student body is to be found the best index of the growth of the university.

Three general types of students are included in the student body of the University of Minnesota, and three distinct types of instruction have been developed. These are designated as "extension," "non-collegiate," and "collegiate."

Organized extension instruction at Minnesota dates from 1910-11 when the enrolment was 287. Since that time this function of the University has developed rapidly until in 1925-26 there were 5,718 persons enrolled in evening classes and 2,029 in correspondence study courses. One hundred five were enrolled in both units leaving a net total of 7,642 individuals who were pursuing university extension work during the year.

Extension classes are now held in many of the larger cities throughout the state. For the most part these classes are scheduled in the evening and are intended primarily for those who are interested in furthering their education but who for various reasons find it impracticable to devote more than a limited portion of their time to study.

Through the correspondence study department of the Extension Division similar opportunities are made available to every citizen of the state irrespective of his place of residence.

No special requirements limit the registration in these courses. Anyone with sufficient education and experience to pursue extension or correspond-

ence courses to advantage may enroll. Through the Extension Division, the University has been taken literally to that part of the people of the state who are unable to come to the University. The development of this phase of instruction marks a significant step in the popularization of higher education.

Growth of Extension Work

DURING the last decade enrolment in extension and correspondence courses, together, has more than doubled. The registration for last year, 1925-26, as compared with that for the year preceding is greater by more than 1,000. The possibilities for growth and development in the future appear to be without limitation.

Non-collegiate students are those whose previous education is less than the equivalent of a four-year high school course. Instruction for this group at the University of Minnesota is limited to the University High School, which is maintained in the College of Education primarily as a laboratory for the training of high school teachers, and to the Department of Agriculture.

In the latter unit a group of agricultural schools has been developed, which offer vocational instruction in agriculture and home economics to young men and young women, particularly to those from the rural portions of the state who may not be adequately prepared to pursue such courses as are offered in the College of Agriculture, Forestry, and Home Economics.

Four of these schools are now in operation. The oldest at the Central School, University Farm, was opened in 1874-75 with two students. Last year this enrolment had grown to 599. The school at Crookston with 289 students and the one at Morris with an enrolment of 340, were opened in 1908-9 and 1910-11, respectively, and this year marks the opening of a fourth school of agriculture at Grand Rapids in the north central section of the state.

In addition to the University High School and the schools of agriculture, non-collegiate instruction also includes a number of agricultural short courses varying from a few days to several weeks in length and covering a variety of phases in the fields of agriculture and home economics.

Most of those enrolled in these short courses are mature men and women who find it possible to devote a brief time in residence at the University to intensive instruction in some special field.

The Organization by Colleges

THE student body of college rank is composed of those who have met the entrance requirements of at least the equivalent of a four-year high school course. Most of these students are devoting their entire time to their university interests and are candidates for a university degree. This group makes up the largest part of each year's enrolment.

As the University has grown in size it has grown, too, in complexity. Students with common interests and the common objective of a definite profession have been segregated into separate administrative units designated as

schools or colleges. At Minnesota there are now 12 such units as compared with the single college of liberal arts which existed during the first few years of the University's operation.

In order of their organization, these units are as follows:

1. The College of Science, Literature, and the Arts, which in the first two years of work offers, together with general and vocational work, the courses necessary for pre-professional preparation for medicine, law, dentistry, education, and business. In the last two years it offers opportunities for specialization in the various fields of language and literature, and social and natural sciences.

The enrolment in this college is approximately a third of the total collegiate enrolment. In 1925-26, 4,609 students were registered, a number larger than the entire university enrolment of 20 years earlier.

Approximately two fifths of the enrolment in this college is composed of women.

2. The College of Engineering and Architecture.

3. The College of Agriculture, Forestry, and Home Economics, which is one of the major divisions of the University Department of Agriculture.

4. The Law School.

5. The Medical School, which offers in addition to the preparation for the practice of medicine, opportunities for those desiring to become nurses, public health nurses, and medical technicians.

6. The College of Dentistry, which includes courses for the preparation of both dentists and dental nurses.

7. The School of Mines.

8. The College of Pharmacy.

9. The School of Chemistry.

10. The College of Education.

11. The School of Business.

12. The Graduate School.

A Record of 55 Years' Growth

SOME idea of the rapid growth of the University, particularly during the last quarter of a century, may be gained from the following table of total collegiate enrolments by five-year periods:

1870-71	24	1900-01	2,917
1875-76	154	1905-06	3,234
1880-81	215	1910-11	4,111
1885-86	207	1915-16	5,725
1890-91	1,005	1920-21	9,854
1895-96	2,137	1925-26	14,410

Last year, alone, the number of students of collegiate grade, jumped from a total of 12,736 in 1924-25 to 14,410, an increase for the year of nearly 1,700 students or about double the total enrolment of any other college in the state. This increase for the one year was equal to the total growth of the University during the first 24 years of its existence.

For the current year, 1926-27, the total collegiate enrolment already shows a gain of 8 per cent over that for the corresponding date of 1925-26.

It must not be assumed that each of the 12 units of collegiate instruction has developed at the same rate. The College of Education, for example, which is one of the last units to be organized, shows the second largest enrolment, while the School of Mines, established more than 15 years earlier shows the smallest.

The Enrolment in 1925-26

THE following table of collegiate enrolment for 1925-26 will indicate the relative sizes of the individual units as they now exist:

	Men	Women	Total
College of Science, Literature, and the Arts	2,749	1,860	4,609
College of Engineering and Architecture	1,205	21	1,226
College of Agriculture, Forestry, and Home Economics	384	398	782
Law School	289	11	300
Medical School (including Nursing)	571	399	970
College of Dentistry (including Dental Nursing)	375	35	410
School of Mines	77		77
College of Pharmacy	136	28	164
School of Chemistry	187	12	199
College of Education	329	1,504	1,833
School of Business	271	42	313
Graduate School	828	309	1,137
War Specials	35		35
Summer Session (1925)	2,165	2,347	4,512
Net total collegiate enrolment (all duplicates deducted)	8,239	6,171	14,410

The Outlook on the Future

IN conclusion it seems pertinent to look for a moment at the probable growth in enrolment of the near future and the factors controlling it. In higher education today attention is being turned more and more to the special needs of the individual student.

The limited number of prescribed curricula, typical of the mass education of previous decades, is giving way to many differentiated courses of study with almost unlimited possibilities for arrangement of electives within each course.

This permits the selection of subject-matter which correlates best in the preparation for definite vocations and professions and, because it adds to the practicability of university education, it contributes to its popularity.

This liberalizing of education is further evidenced by the gradual removal of the more or less artificial "hazards" from the requirements for admission, thus providing better articulation with the secondary schools of the state and contributing to increased enrolments.

At the present time there appears no evidence of any diminution in interest in university education. In the year 1925-26, 14,534 students

graduated from the public high schools of Minnesota, an increase of 59 per cent over the number graduated five years earlier. During the same period the University's enrolment increased in nearly as large proportion.

It is true that there is provision within the University for limiting the enrolment in two of the collegiate units; dentistry and medicine. The laboratory and clinical facilities make this necessary, but it seems improbable that such limitations will ever be extended outside of the professional schools. In fact, further limitation of enrolment rests, in the last analysis, with the state: the ability of society to absorb in its various professions those graduates of the institution who have specifically prepared for them; the ability and willingness of society to continue to give to the University the generous financial support it has given in the past.

What Are Society's Needs?

THE extent to which society is able to absorb university graduates depends in a measure on the degree of specialization which is required in preparation for any specific profession. It is reasonable to assume that there are limits to the numbers of doctors, lawyers, dentists, chemists, miners, and engineers needed each year for replacement within the profession, and that when these limits are reached the increased enrolment in units preparing for these professions will be only such as is needed to provide for increases in population. Changing social and economic conditions, however, will alter these limits from time to time, making them wider or more circumscribed.

For the extension of liberal college education, on the other hand, there appears to be no limitation of numbers so long as the state through the support of its University is willing and able to pay a large share of the cost of education. If that time should come when such support is no longer forthcoming, and the cost of education must in whole or in large part, be borne by each individual student, then enrolment will stop advancing, numbers of students will decrease, and equal educational opportunities for rich and poor alike will disappear.

It seems inconceivable, however, that Minnesota, always a pioneer state in the interests of education, should suffer such conditions to obtain. It is easier to picture the University of this state growing in the future as it has in the past, maintaining its high standards of democracy in education, and reaching out further and further until it shall serve effectively and well the whole people of the commonwealth.