PAGES

MISSING

The O.A.C. Review

THE DIGNITY OF A CALLING IS ITS UTILITY.

VOL. XIX. JUNE, 1907. No. 9

To Our Visitors.

THE chief purpose of this number is to place into the hands of our June visitors a description of the college and its work; to point out how the college aims to serve the farmer, and the many advantages to be derived from its courses of instruction. Those most familiar with the institution have always felt, that, if the farming community could be made aware of the scope of the college work, no pains would be spared, and no sacrifice considered too great to give the boys at least a couple winters at the O. A. C.

We have undertaken, in this number, to present in a readable way, a few of the features of each department. We have not attempted to exhaust the subject in any case, but have simply aimed to show that every phase of rural life is dealt with; that help is given upon every problem which confronts the farmer, and the most approved methods of meeting the ordinary difficulties are advanced. In presenting this "Review" we are assuming that every man into whose hands a copy of it will fall, is striving after something better than the practice of days gone by, and even of the present time. The people of yesterday had not the opportunities of the people of to-day. Education, not long since, was the heritage only of the wealthy, now it is the just demand of every boy and girl. To meet this demand the farmers of this Province are requested to provide. Two winters at college means but fourteen months of a boy's time, but throughout his life there will be no day in which the fruits of those few months will not be tasted and enjoyed as the daily round of labor is performed.

We invite you to peruse these pages at your leisure, and to ask yourselves the question—can you afford to neglect the chances so brought within your reach?

The College and the Farmer.

THE Ontario Agricultural College was established for the benefit of the farmers of the Province. For nearly thirty-five years the Legislature has appropriated public funds for its maintenance and extension. Many men have been giving the enthusiastic service of the best years of their lives to carry on the work and to accomplish the purpose for which it was founded. It is the one educational institution that belongs to the farmers of this country, and is conducted for their direct benefit. It may then be in order from time to time to ask whether it is doing the work for which it was intended, and whether the farmers are getting from it all that they have a right to demand. The agricultural interests of this Province are so important, not only in themselves, but also in their relationship to the other industries, and the amount of money expended is so large that every citizen of this country, whether farmer or not, has a right to make close scrutiny of the working of the institution, and to be free to demand a satisfactory answer as to whether the college is working along right and profitable lines. The money expended is public money, and, therefore, all persons have, or should have, the right to make fair enquiry. Those who administer the affairs of the institution have also the right to demand that the enquiry shall be fair, and that criticism shall be based only upon full and accurate information.

The first duty devolving upon the institution is that it shall provide an education for young men who propose to make agriculture their life work. There has been prevalent an opinion that the College would or should take any young man, whether he comes from Ontario or any other country, whether he has been brought up on a farm or in the city, whether he has any acquaintance with farm work or not, and teach him how to farm and to farm in the best manner. This would be impracticable. The College is not for that purpose. There is a better way and a cheaper way of learning the rudiments of farming, and that way is by direct, practical experience, upon an Ontario farm, under the direction of an Ontario farmer. Having an acquaintance with the general practice of Ontario farming the young man may come to the College and expect to receive an education, a training that will explain to him fully the theories of the practice, sharpen his mind so that he can continue to train himself, improve his methods and put him in touch with all the latest and most promising sources of information, so that he can keep in touch with all the work of those who are foremost in the industry. The aim of the College course of study is to raise the farmer from a mere laborer or drudge and to give a training that will assist him to work in the highest level of modern agricultural progress. The claim is not made that only a College course will enable a farmer so to

improve himself. We have hundreds of successful farmers in Ontario to-day, men of energy, men of keen intellect, men of progress who would disprove any such contention, but the College course is without doubt the best means whereby the average young man who knows the general principles of farming can be set right and equipped for the pursuit of his work along the most promising and most profitable lines. The farmers of Ontario should not make the mistake of thinking that the College staff hold the opinion that they, and they alone, can train farmers for a successful career.

The next duty of the College is to assist the farmers, men of mature years, who have never had the opportunity of taking a course at the institution. There are two ways—the professors can go out to the farmers, or the farmers can come to the College. There are conventions, institutes and exhibitions to which members of the staff can go, and to these they should go, as far as time and other duties will permit. But the farmers cannot expect no more of these men than they would of other human beings. Every man's time and physical powers are limited. It would be a grand work and be productive of magnificent results if the professors in the various lines could visit the farms of the individual farmers. There may be special occasions on which this can be done, but one has only to note that there are about 175,000 farms, large and small, in Ontario. If, however, the professor cannot go to the farmer, the farmer should feel himself quite free to go to the professor. Many farmers may hesitate about doing this, but this College belongs to the country, it is the farmers' institution, and any farmer who feels that he needs help or advice or thinks he might get some assistance, should have no hesitation in going direct to the College and conferring with the man in charge of the work about which he desires information. He will find a hearty welcome. Perhaps he will not get all that he expected, but he will be met with candor and an honest endeavor to give him what he desires. Such a trip will cost some money. Of course it will. But if he is not repaid many times over for the cost of his trip it will be because he is indifferent, unobservant or has gone in the spirit of criticism, and not of fair enquiry. The visit and the enquiry will also be an inspiration to the professor, and will probably add to his stock of knowledge. The greatest secret in the success of any Agricultural College is the bringing of the professors and the farmers into close, continuous personal intercourse. The professors of the Agricultural College are very human, and will be wonderfully stimulated if only the individual farmers will get into close touch with them and confer with them as to their work at close range.

The next duty of the Agricultural College is to undertake experiments which the great mass of the farmers have not the time or the facilities to work out. The results of these experiments are set forth in bulletins and reports, which may be had for the asking. A wide-awake farmer must be a reading man. He cannot afford to be without the agricultural papers, and he should see to it that he has sent to him the records of all these experiments. Of course, the best way is to supplement this reading by a careful observation of the experiment itself. Perhaps he can himself reproduce the experiment upon his own farm. If he does, what then? Why simply this: He has raised himself up to a higher

grade in agricultural work; he has brought a new element into his work; he has increased his interest in his calling; he has lightened his labors because he has made it more attractive and interesting.

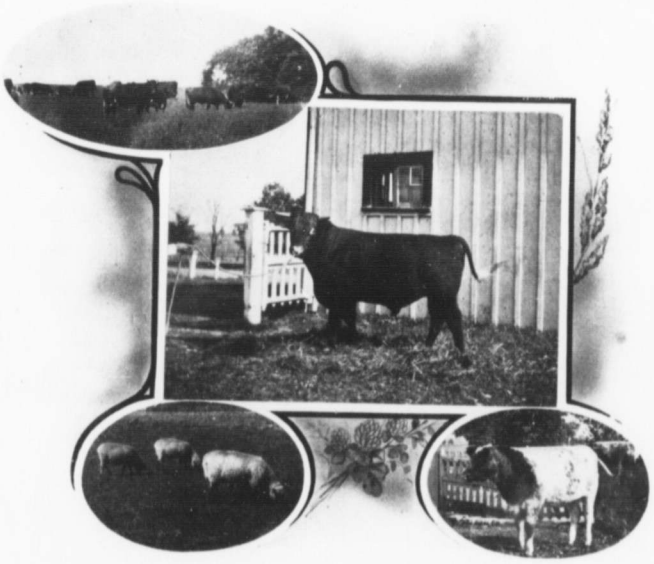
Our Agricultural College has grown and expanded. The writer of this article well remembers the day when first he saw it over twenty-one years ago. The small College has become a big institution, the handful of students has grown to a thousand, the old mother building has brought forth a brood of offspring, and isolation and criticism have given place to publicity and appreciation. What has accomplished this? Two things. In the first place, there has been no breaking away from the original plan of a college for farmers; the funds and courses have not been diverted to other purposes; through all these years the orders have been to keep on teaching agriculture and permit nothing to come in that would interfere with the purpose for which the institution was established. The second thing is that the farmers and the College have been brought into close relationship. The farmers have come in contact with the professors and their work and have found that here were men who were interested in the welfare of the farmers, who were trained experts along their lines, who did not claim to know more than they really did, who were doing their best honestly to serve the great agricultural interests.

What of the future? Will progress continue? Will the College grow and increase in importance? That depends upon two things. First, the teachers of the College must keep in mind that their life work, their calling is to teach future farmers and to help present farmers. There is every indication that they are awake to the importance of this. Second, the farmers must get more and more in touch with the College and its work, and keep in touch. I am inclined to think that the future of the College depends largely upon the farmers. They will make it and shape its work. They will get from it just what they ask. Their enquiries, their demands, will largely shape its future. Farmers of Ontario, here is your institution, and you can make it what you will. If you come to it with your requests, your honest criticism, and your loyal sympathy, you can make it many times more valuable than it is to you to-day.

C. C. James.

Animal Husbandry and Farm Department.

THERE are few young men who do not take an interest in animals. The Animal Husbandry Department strives to take advantage of this fact, and employs every effort to awaken enthusiasm along live stock lines in the minds of the students. There is no disputing the fact that the more enthusiastic we are regarding our work, the less we feel the drudgery connected therewith, and many a man has become disgusted with the drudgery pertaining to the feeding and management of stock, for the simple reason that he lacks the inspiration which comes from a fuller knowledge of the animals with which he is dealing, and the possibilities they represent under skilful selection and feeding. It is the province of the Animal Husbandry Department, therefore, to show young men that the breeding and feeding of live stock is a business which calls for the highest degree of skill of which they are capable, and presents possibilities well worthy of their ambition.



The Animal Husbandry Department already has a good equipment in the way of live stock, but every year witnesses the strengthening of this equipment, and it is the ambition of those in charge to make the college herds and flocks second to none on the continent.

The horse department is as yet undeveloped, but a start has been made, and a few excellent Clydesdales are to be found in the college stables. It is intended to make additions to the stud from time to time, as well as to enlarge the accommodation for horses, and some marked developments may be looked for in this important branch in the very near future.

CATTLE AT PASTURE.

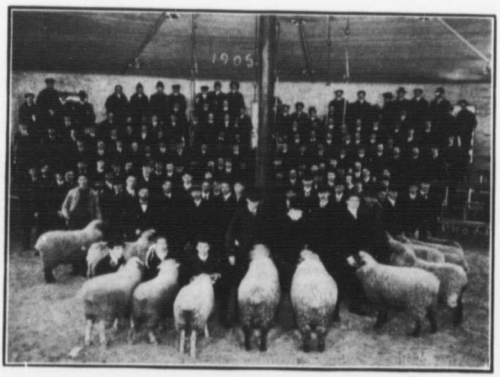
In beef cattle, Shorthorns predominate, and the College Shorthorn herd now contains numerous excellent animals, representing many of the very best strains of the breed. Herefords, Aberdeen-Angus, and Galloways are also well represented, and these breeding animals, together with a few superior steers raised each year by the college, make excellent material for class-room demonstrations.

The dairy herd comprises Holsteins, Ayrshires and Jerseys, and in the handling of this herd, utility is given a prominent place, though breed type is not neglected.

Among the sheep, the Border Leicester, Oxford and Shropshire are the breeds represented at present, and the herd of swine contains good representatives of the large Yorkshire, Tamworth and Berkshire.

Though the surplus stock is sold from time to time, the object in maintaining herds and flocks at the college is not to produce revenue. If such were the case, very different methods would be necessary, because it is impossible

to handle stock to the best advantage financially when so many breeds are kept, and when many animals must be maintained mainly for experimental or class-room purposes. The large expenditure for live stock for the college can be justified only on the basis of the educational value of the stock. One of the very important aims of the department is to make the young men who come under its training more discriminating and intelligent judges of live stock than they were before; not so much that they may be able to judge other people's stock at fairs, but rather that they may be able to select their own breeding and feeding stock more intelligently. When we reflect upon the immense importance of the live stock industry in this country, and remember that the greatest factor in the improvement of live stock is skilful selection of breeding animals, it should not be difficult for us to realize something of the importance of a thorough training in judging the different kinds of farm animals.



JUDGING SHEEP.

This is the great object, therefore, in maintaining an extensive equipment of live stock upon the college farm, to afford facilities for thoroughly training our students in the art of recognizing what is desirable and what is undesirable in animal form, both from the breeder's standpoint, and the standpoint of the world's leading markets. The animals are taken into a class-room, or pavilion, erected especially for the purpose, and the students are trained to criticize individual animals, and to compare animals one with another, stating which they consider the most desirable types, and giving explicit reasons for their selection. This practical work in stock judging is supplemented with lectures upon principles of breeding, and the feeding and management of live stock. There is also an education for the students in watching the development of young animals raised on the college farm, and studying the methods employed by the college herdsmen, a practice which helps to keep up the student's interest in matters pertaining to the farm, and to develop his taste for good stock.

Coupled with the Animal Husbandry Department is a farm of some 345 acres, which is utilized to maintain the live stock. It cannot be called "model farm," because it has to be cropped and managed in a way to meet the peculiar requirements of the institution of which it forms a part, and since the conditions which prevail in connection with an agricultural college are very different from those of an ordinary

farm, it follows that the methods employed would not always be suitable for the average farmer to adopt. An effort is made, however, to use the most approved methods in conducting the farm operations, and it is possible for the student to pick up many useful lessons in connection therewith.

It will be seen, therefore, that we are aiming to set high ideals before our young men, in the hope that we may thus awaken their enthusiasm, and stimulate them to stronger effort along the line of live stock improvement.

G. E. Day.

STUDENTS AT OUTSIDE WORK.

The Course in Physics.

THE science of Physics is not, generally, looked upon as closely allied to agriculture, and yet a little thought will show that it finds many important applications there. That branch of physics known as mechanics enables the machinist to calculate the proportions of a machine, and the manufacturer to construct it. Hydrostatics teaches the laws that control supply of water to plants. The principles of surveying teach one how to lay out his farm for various purposes, to take the levels for constructing drains, etc. A study of the subject of "heat" leads to intelligent understanding of the laws that govern the weather, cold storage and ventilation, all of which hold important places in advanced and successful agriculture.

When a student enters the College he makes his first acquaintance with this department in the subject of Soil Physics. What is Soil Physics? Well, there are certain soil conditions that are necessary for the best production of a crop. The amount of water in the soil must be right—too much will drown the plants, and too little will starve them. Soil Physics teaches how best to control the soil moisture. The temperature of the soil must be right—a field that is "cold" never gives satisfactory results. Soil Physics teaches how to cure a soil of coldness. The amount of fresh air that may enter the soil must be right, otherwise the roots die of suffocation. Soil Physics teaches the most efficient methods of securing soil aeration. Tillage operations and tillage implements are many and varied. Soil Physics makes a study of the principles underlying these operations, and the methods and practice of using the implements. In general, Soil Physics deals with the principles underlying all tillage operations.

The "freshmen," for that is the name by which we know those who are taking their first year in the college, have also a short course in arithmetic, with this department, I suppose, because of the natural relation between mathematics and physics. This course consists of a drill on problems such as a boy meets upon the farm, involving decimals, per cent. and interest. Since the metric system is being so widely discussed a thorough drill in it is given, both theoretical and practical.

There is also a short course in mechanics dealing with the principles of levers, windlasses and pulleys, and the best methods of using them. The ideas of energy, work, and horse power are introduced, and the student learns how to calculate the horse power necessary to do a certain piece of work in a certain time.

Upon the farm occasions often arise necessitating the determination of the area of an irregular plot of ground. The second year work begins with lectures and practice in surveying and calculating the area of such plots and

making drawings of them. But another farm problem arising even more frequently is that of draining a field that is too wet. During the past two years the department has been doing drainage work among the farmers of Ontario, and we have been astonished to find that many of them have still no better method of digging a drain than by the old water test, i. e., without knowing how much fall they have where the ditch is to be dug, and therefore, not knowing what the grade of their ditch should be, they begin to dig and test the grade by the water in the ditch—if the water will run the grade is right. This method has two obvious objections: 1—It is very disagreeable working in a wet ditch-bottom, and the ditch can only be dug when the land is wet; 2—the ditch is not likely to have an even grade, and consequently its efficiency is lessened, for an uneven bottom does not carry water as well as one that is even. The student is taught how to construct a home-made drainage level, and then to go out and take the levels over the course of the ditch, to determine the grade of the ditch per 100 feet, to dig the ditch within six inches of the bottom without resorting to the laborious operation of *picking*, and lastly how to clean out the bottom to the proper grade without depending on water, without the disagreeable mud in the ditch, which may be better dug when the land is dry than when wet. Instruction is also given in the best methods of laying the tile, filling and protecting the ditch. Now that cement tile are being introduced and some men are beginning to make their own tile, we have put in a complete cement tile outfit, and each student will henceforth receive instructions in the manufacture of this kind of tile.

The Second Year also receive instruction in the mechanics of farm water supply—pumps, siphons, hydraulic rams, etc. They are taught the principles of windmills, water-wheels, and the laws of electricity. As illustration of the practical application of these subjects may be mentioned the question of lightning rods. After the principles of electricity in general have been studied these are applied to the question of atmospheric electricity, and the students are asked to consider the value of lightning rods. For six years the department has been collecting information on the subject of damage by lightning; it has been found that of all buildings reported as struck by lightning almost exactly half are burned. But out of eight rodded buildings with rods in good repair only one was burned. Three rodded buildings with rods broken off near the ground have been reported, and they were all burned. These data seem to indicate that a rodded barn with rods in good repair is comparatively much safer than an unrodded one, or a rodded one with rods out of repair. After the value of rods is illustrated in this way, the students are given instruction in the proper installation of lightning rods.

Perhaps no other subject not strictly agricultural gives the farmer so much concern as the weather. Throughout the year his operations are more or less controlled by it. Time and time again he is in a dilemma to-day because he does not know what weather is probable to-morrow. He knows that the Meteorological Bureau in Toronto is able to tell 24 or 48 hours in advance what the weather is likely to be, and in 90 cases out of 100 these forecasts are correct. And sometimes the farmer wishes he also were able to forecast with as great precision. Now it is a fact that when one has become familiar with

forecasting, when he comprehends the laws lying at the basis of the science, and when he has for a time practiced the art of forecasting by the aid of the maps published by the Weather Bureau, he acquires the power to forecast the weather 24 or 48 hours in advance, with a fair degree of accuracy, simply by observation. Knowing the conditions of yesterday and those of to-day, he is enabled to assign the causes producing them, and to say how those causes will affect to-morrow. Each student of the Third Year receives a training in weather forecasting. He begins by a thorough study of the subject of heat, for most of our weather phenomena are in one way or another traceable to the effects of heat.

Cold storage is a phase of commercial life that is every year receiving more and more attention from the farming community, and the Provincial and Dominion Governments have taken steps toward assisting farmers in the erection of cold storage warehouses in order that the benefits of cold storage may be more generally enjoyed. The Third Year students make a close study of the principles involved, of the constructing of the houses according to the various systems, and of the operation of the plants.

During the winter just past the subject of ventilation of farm buildings has come in for a very extensive discussion in the Farmer's Advocate, showing that the importance of a proper supply of fresh air for stables is being realized more and more. The principles of ventilation and the various systems applicable to farm buildings receive attention during the third year.

The fourth year work in Physics is an extension of the work already begun. Drainage receives more attention. Each student is required to take levels all over a field or block of land, and from those levels to determine where drains should be placed. He is required to compute the cost of draining the field, and having done so, to consider the draining of the field from an investment standpoint. This is a very important part of the work, for not until a man has actually counted the cost, noted the increase in crop, and calculated the returns from such increase does he realize to the full the value of underdrainage. He may be told time and time again that underdrains will pay for themselves in from two to three years, but he does not fully realize it until he actually reaches such a conclusion by his own reasoning. The subjects of Soil Physics and Tillage come in for fuller and deeper treatment than in the first year. Lastly he makes a study of the climate of Ontario, Canada, United States, and the world in general, and of the relation between the climate of a country and its agricultural industries.

In conclusion, I would like to say the work of the department is not limited to that done during the college session. During the absence of "the boys" we are busy in two ways: 1.—Investigating various problems relating to agriculture in one way or another 2.—drainage survey work among the farmers of the Province. It is of No. 2 that I would speak particularly. A person often realizes that a certain part of his farm needs draining, but through lack of experience in drainage work he is not sure as to the best methods to pursue, and hence the farm goes undrained. Such men the department is endeavoring to help. Anyone wishing assistance in such problems may have it from our department—a man to visit his farm with surveyor's instruments and

survey his land, locate the drains, and provide maps showing the same. There is no charge for the work except the actual travelling expenses of one man, and these are light, since there is an arrangement with the railways whereby we can travel at a cent a mile. Thus the outlay to a man living one hundred miles from Guelph would be $2.00 for railway fare, with 25 or 50 cents for cartage of instruments. Many have already availed themselves of this offer of assistance.

RESERVOIR AND GYMNASIUM.

The Horticultural Department.

OLD students who visit the college from time to time frequently remark upon the wonderful changes which have taken place since they were in attendance. The changes certainly have been marked in many particulars. With the progress of the times and increased attendance of students, the college staff has been increased, new departments have been added, the campus has been enlarged to make room for the many beautiful buildings which have been put up, and now the place has aptly been called the Agricultural University of Canada. Those who can recall things as they were eighteen or twenty years ago will remember the old-fashioned, low greenhouses on the east side of the campus. These and the garden adjoining formed a nucleus for the growth of the present Horticultural Department. In those days the instruction in horticulture was given by Prof. Panton, whose department then included geology, botany, entomology, zoology, meteorology and horticulture. With such a list of 'ologies to teach, it may be well understood that but little time could be given to any one of them. The course in horticulture then consisted of a half dozen lectures in fruit growing given to second-year students. I can well remember how we appreciated those lectures, but they were merely a taste and students who wanted more, satisfied their longings by reading, or experience elsewhere.

Great as the development in the Horticultural Department at the College has been, it has not in any way exceeded the general progress throughout the country. Twenty years ago horticulture in Ontario had not attained anything like the importance it has to-day. It then engaged the attention of many in a general way, but now the work has

become specialized along various lines. Fruit growing has become one of the leading industries, and large quantities of fruit are exported every year to other lands. In proximity to the towns and cities, vegetable gardening has become an important occupation, so much so that those engaged in it have organized themselves into a Provincial Vegetable Growers' Association. Florists are making progress in the beautifying of lawns and boulevards, and the establishment of parks and pleasure grounds. In the country progressive property owners are beginning to realize the importance of beautifying home surroundings. With the rapid development in all these lines throughout the country, it is quite natural that a progressive institution of this kind

CLASSES AT LABORATORY WORK.

culture, both from the amateur and professional standpoint, has made wonderful progress. In Ontario we now have some of the largest commercial floricultural establishments on the continent, and their cut flowers are shipped from one side of the continent to the other. Landscape gardening, too, is receiving more attention in America to-day than ever before. In towns and cities Horticultural Societies should keep pace with the development throughout the country.

The College now offers a wide course in horticulture in all its branches, including fruit growing, vegetable gardening, floriculture and landscape gardening. First-year students receive an extended course in the first principles of horticulture. Second-year students receive a course of lectures throughout the year, covering all the branches of

the subject, and in connection with the lectures get regular instruction through demonstration and practical work. Students who remain for a fourth year to receive degrees from the Toronto University, with which this College is now affiliated, may specialize in horticulture and take an extended course in all its branches.

With the addition of the Macdonald Institute as a department of the college, the ladies now take a course in horticulture, in which special emphasis is put upon floriculture and landscape gardening, as applied to home decoration. The teachers' classes also attending the Institute receive a course in horticulture as applied to the management of school gardens. From this it will be seen that horticulture has been developed from a very minor subject on the curriculum to a major one, with many branches in which the student may specialize and prepare for a university degree.

While the instruction of students may be considered the prime object of the College, yet the public has learned to look to it for much experimental and investigation work, and upon the teaching staff of the college falls also the responsibility for experimental work. In this particular our college is behind many of the American institutions, for in many of the large American agricultural colleges there is a separate staff of workers for educational and experimental work. With such an arrangement the investigator can give his whole attention to experimental work, while the teacher who does best work must keep in close touch with the results of the investigator. No doubt in time our college will find necessity for such a division of the work, which will mean not less work for those engaged in it, but better results accomplished.

The Horticultural Department has under its special care 71 acres of the college farm. Forty-two acres are in lawns and grounds, upon which have been planted a great variety of ornamental trees and shrubs. Notes have been taken upon these, and lists of the most desirable kinds have been published from time to time in the College report. The artistic, yet natural, arrangement of trees and shrubs on the college grounds has caused our campus to be greatly admired by thousands who visit us annually, particularly during the month of June. And we say to them as we do to our students that the same principles in grouping and planting adopted here may be taken as a guide in beautifying rural homes where the grounds need not be so extensive.

Twenty-three acres have been devoted to the growing of fruits of various kinds. There are about fifteen acres in orchard in which are being tested all of the varieties of tree fruits likely to succeed in this section. Over 150 varieties of apples are included in these tests, and new varieties are being added each year. In the orchard, experiments have been in progress for several years with different kinds of cover crops, such as are now being grown in the autumn in nearly all well-managed orchards following clean cultivation during the early part of the season. A bulletin on Apple Culture, prepared by this department, may be had upon application, in which this and many other matters relating to orchard management are fully discussed.

About six acres are devoted to the growing of small fruits and a great many kinds have been fully tested and reported on. During the past fourteen years over 400 varieties of strawberries have been tested and careful note taken

of all their peculiarities of plant and fruit. As a result of all this testing, we now know what kinds of fruits do best here, and are able to recommend those most worthy of trial in other sections where the conditions may be somewhat different.

With all the many varieties of fruits now in cultivation, there is still room for improvement in many particulars. Notwithstanding we have grown over 400 varieties of strawberries, we are still looking for the ideal strawberry. With this end in view, much plant breeding has been done during the last five or six years. For instance, varieties which are particularly valuable for size and productiveness have been selected and crossed with those which are particularly valuable for firmness and good color, etc., in the hope of combining all these good qualities in one. Many hundreds of promising seedlings, both of strawberries and other fruits, so produced, are now being tested. Realizing the importance of this work of plant improvement by means of careful selection and crossing, provision has now been made for one of our graduates to devote his whole time to it, and much greater progress is anticipated in the future.

In connection with the experimental work with fruits, mention may be made of the wonderful collection of wax fruits which has been prepared in this department during the past four years. This collection probably attracts more attention from visitors than any of the other exhibits in the College museum. In the making of these models, we have been fortunate in securing the services of Mrs. Stanley Potter, an artist of continental reputation, and we hope to keep her at this work until the collection at the College contains a good representation of all the leading Canadian-grown fruits and vegetables.

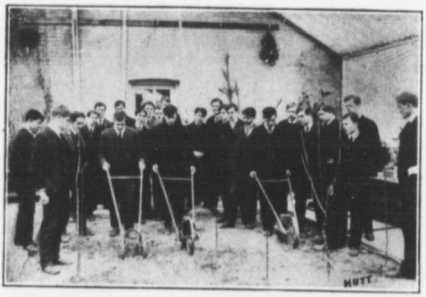
From the beginning, the Horticultural Department has grown the vegetables to supply the ever-increasing needs of the college residence. The vegetable garden includes about six acres, and in this the most intensive methods of farming are practiced. Systematic experimental work is now being carried on with all kinds of garden vegetables. In the College report for last year may be found a list of the varieties which have so far given the best results in our experiments.

TREE PLANTING.

The forcing of vegetables under glass has already become quite an important industry in many parts of the Province. Two of the College greenhouses are now used for carrying on experimental work in the forcing of such crops as

may be grown under glass during the winter months.

The floriculture work of the College has been modified from time to time to meet the requirements of the students. The large conservatory, which at one time contained such a fine display of palms and ornamental plants, has now been given up entirely to the use of students as a laboratory for use in propagating and growing plants and for various horticultural demonstrations which can be given inside during the winter when students are here. Two other large houses are devoted to the growing of plants suitable for amateur collections. All of our students, both boys and girls, are given practical instruction in the propagation and growing of house plants, and are given an opportunity to grow for themselves a collection of plants which they may take home with them when their course is completed.



INSTRUCTION IN VEGETABLE CULTURE.

The Horticultural Department of the College has also in hand much work throughout the Province which may be looked upon as College extension work. This is carried on through the Ontario Fruit Experiment Stations and the Experimental Union. Ten or twelve years ago it was realized that the tests with fruits carried on here, or at any one central station, were not of value to all parts of the Province. The Government, therefore, decided on establishing a few fruit experiment stations in different parts of the Province. This was done by selecting thirteen prominent fruit-growers in various sections of the Province who were given the work of testing the fruits best adapted to their particular sections. As head of the Horticultural Department, I was jointly responsible with the Secretary of the Ontario Fruit-Gowers' Association for the selection of the experimenters for this work, and have annually inspected each of the stations and reported to the Government on its progress. This has kept the department in close touch with the fruit interests of the Province. As a result of the experimental work carried on at these stations, we are now in a position to advise growers in all parts of the country as to which varieties of fruits are most likely to succeed in any particular section.

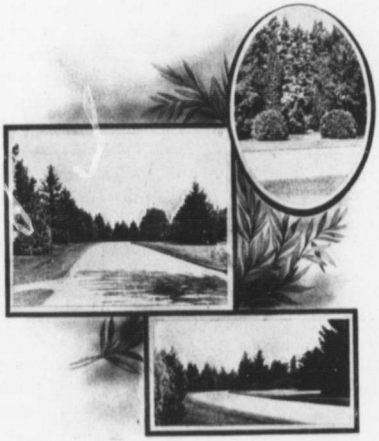
The co-operative experimental work carried on through the Experimental Union has brought the department in even closer touch with farmers, fruit and vegetable growers throughout the Province. The co-operative testing of fruits was begun thirteen years ago, when we first sent out for testing a few of the leading varieties of small fruits. This work has steadily increased from year to year. Now we are distributing fruits, both large and small, for co-operative testing in all parts of the Province. This spring trees and plants were sent out to about 2,400 experimenters. Altogether we have dis-

tributed for co-operative testing material for over 6,800 experiments with fruits. This work has been instrumental in encouraging fruit growing in many parts of the Province where no attention had formerly been given to it, and many a farmer has thus received a start in fruit growing from the plants sent out by this department.

This year the work has been extended to the co-operative testing of vegetables, and seeds have been distributed to over 1,000 experimenters. Nearly all of the schools in the Province where school gardens have been adopted are carrying on these tests. This, it is hoped, will draw attention to the importance of the vegetable garden as an adjunct to the country home.

From the foregoing, some idea may be gained of the development in this one department of the college alone during the past few years, and it is quite probable that even more progress may be made during the next decade.

H. L. Hutt.



GLIMPSES OF THE CAMPUS.

Chemistry in Agriculture.

CHEMISTRY, like many of the other sciences, has done much for agriculture, yet there is every evidence that we are only on the threshold of agricultural chemical knowledge. Chemistry is intimately associated with every line of agricultural problems, and in many cases must precede other lines of investigation. It is not wonderful, then, that of the immense endowment made for agricultural research by the United States Government fully one-half of that expended for strictly scientific investigations has been for chemical research. In our country comparatively little real investigation work has been done, but there is a rapidly-growing demand for chemical research in all of the many branches of agriculture.

CHEMICAL LABORATORY.

It is impossible in this article to give any detailed statement of the present status of agricultural chemical knowledge. The object is to draw attention to a few of the facts which chemistry has aided in establishing, and to point out some of the ways in which the Chemical Department of the Ontario Agricultural College is striving to help the farmers of the Province.

Some Facts Ascertained.

Through the work of Boussingault, Leibig, Lawes, Gilbert and many others of more recent date, the science of agricultural chemistry has been gradually developed, and to-day we think we have some definite knowledge with reference to the nature of the seed, the development of the plant, its food, and the source of its food. To-day we believe that most young plants start from a seed, which contains an embryo, or germ that is extremely rich in albuminoids, fat, phosphates, and potash. The seed also contains a store of food, in the form of starch, fat, etc., intended to nourish the young plant until the roots and leaves are sufficiently developed to gather their own supplies, that the future health and vigor of the plant depends on: (1) the amount of food available to the tiny rootlets sent out by the young plant; (2) the temperature of the soil; (3) an abundance of sunshine, and (4) a sufficient supply of oxygen. We know the plant requires oxygen for respiration, that it gives off carbon dioxide as a result of the oxidation of its food, that is, it breathes; that it gives off water from its leaves, or lungs; it assimilates food; and that it even excretes waste material. In all this it is very similar to the animal. But it goes even further,

and collects its food from the simple substances, such as carbon dioxide, and various soluble salts found in the soil, and from these builds up the complex sugars, starches, fat and albuminoids which are essential for the life processes of the plant and which are the only foods of the animal. It is subject to improvement by selection and breeding, as is the animal, but, unlike the animal, it is entirely dependent upon the supply of food constituents within its reach, and it has no way of drawing attention to its wants, excepting as its appearance may make them known to the careful and trained observer. A clear conception of these facts and a fuller realization of the idea that an infant plant, like the infant animal, requires warmth, air, sunshine, and an abundance of easily absorbed food, will greatly aid in understanding the conditions under which it will make the best growth.

Food of Plants.—It has been established that the plant's food is derived from the atmosphere and from the soil. From the atmosphere it gathers carbon dioxide and oxygen, and some plants, through outside agencies, are able to collect nitrogen. Nearly fifty per cent. of the dry matter of a plant is made up of carbon which is entirely derived from the carbon dioxide of the air. Although this compound forms but three or four parts in 10,000 parts of the atmosphere, the quantity is sufficient, owing to the wind continually bringing fresh supplies to the leaves. Thus there is an abundance of air around the leaves of the plant, but, if the soil is not open and porous, there may not be enough in contact with the roots, for it is worthy of note that air in the soil in which crops are growing is as essential to the life of plants as air in the stable is to the animal. This ventilation of the soil is necessary to supply oxygen required in germination of the seed, to permit the roots to live, for they, too, must breathe, and to supply this life-giving element to the millions of little organisms in the soil which are busy preparing soluble food for the plant. The ventilation of the soil is also required to supply free nitrogen for the use of nitrogen-fixing germs, and to remove the excess of carbon dioxide which is being continually set free in the soil.

From the soil the plant derives nitrogen, chiefly in the form of nitrates, the ash substances, and water. Fortunately, although ten elements are essential for the growth of the plant, there are only four that particularly interest the farmer, as the other six are usually found in abundance. These four are, nitrogen, potassium, phosphoric and calcium. A continuous supply of all the essential elements of plant growth is absolutely necessary; for, if one constituent is absent, or present in an insufficient quantity, no matter what amount of the other nutrients may be available, the plant cannot be fully developed. Consequently, just as a chain is only as strong as its weakest link, so the crop-producing power of a soil is limited by the essential nutrient present in relatively the smallest quantity.

Chemistry has also demonstrated that plants differ in their requirements and in their ability to get what they need. It has been proved that leguminous plants, through the action of certain organisms on the roots, are able to make use of the free nitrogen of the atmosphere, while, at the same time, they appear to have difficulty in abstracting potash from the silicates of the soil. Turnips, on the other hand, have difficulty in collecting phosphoric

acid, and cereals have trouble in collecting nitrogen. Consequently, in order to thoroughly understand the feeding of plants, we must ascertain not only their needs, as shown by the composition, but we must also consider their prevailing characteristics, and thus intelligently supply the food substances required.

Chemistry has made plain to us some of the changes that take place in the decomposition of organic matter in the soil, and the conditions under which this takes place most readily, and, as a result, why nitrogen is so readily leached from the soil. Chemistry has also demonstrated the great importance of humus matter in the soil; for not only is it a source of nitrogen, but during its decay, acids are formed which greatly aid in the solution of the inorganic food constituents in the soil. Without the presence of organic matter, the associated germ life, and the proper condition for their action, the soil cannot produce its best results no matter how rich it may be in the essential constituents of plant growth. In one sense the soil may be looked upon as a reservoir of plant food to be drawn on for the growth of successive crops, but it has been proved that it is equally correct to regard it as a busy, complex manufacturing establishment in which all the various parts must work together under proper conditions to bring the store of plant food into an available condition. This is one of the main objects of cultivation. These are points, the understanding of which give us a clear conception of the objects of the various operations in cultivation, and are points of great importance in practical farming, for they tend to take farm operations out of the old ruts and put them upon a higher plane, where the operator is able to reason from cause to effect and thus do his work intelligently. It must also do a great deal to lighten the drudgery side of farm work.

Sources of Plant Food.—Thus as the chemical nature of the food of plants became known, it was possible to gather these food substances from other sources and supply them to soils deficient in these substances. Consequently, we have hundreds of thousands of tons of potash manures taken from the celebrated Stassfurt mines in Germany and used as a plant food in various parts of the world. We have the natural deposits of calcium phosphate ground and brought into a condition that they may supply the needs of soils and crops in this particular constituent. Nitrogen, in the form of nitrate of soda, is brought from South Africa and South America and used upon land in all parts of the world. Furthermore, it has been demonstrated recently that nitrogen may be collected from the immense supply in the atmosphere, and it is being put upon the market in a commercial form. It will thus be seen that through our knowledge of agricultural chemistry we not only know the requirements of the plant, and something of the nature of the changes taking place in the soil, but we are also able to bring this food from outside places and apply it to the land in a readily available form. It has further been found that by the use of these various food substances the growth of the plant may be forced in almost any direction desired. If a barley for brewing purposes is required with a small amount of proteids, it can be produced; if we want large leaf and stem growth, or development of seed, or bloom in fruit, they can be produced, and so, in various ways, the crop can be forced into a particular line that is desired by

the nature of the food which is supplied to it.

Feeding Cattle.—Chemistry has aided in bringing out many points that have been of great value to the stock feeder. The general composition of the various feeds commonly used on the farm is known. The usual variations in composition between the immature and the mature feeds, and the cause of the difference in their value as foods is explained. Some work has been done with the object of bringing out the fattening and energy producing value of these different substances. Something is known with reference to the function of the various food constituents in the body. These, and many more points, have materially helped the cattle feeder to combine his rations in such a way as to make a more economic use of the food substances and give him a basis upon which he can make comparison of which are the cheaper foods for him to use for certain classes of stock. There is much need of more investigation work along these lines and of practical experimentation upon the proper combining of the different foods to give the most econmic results for growing, fattening, or working animals.

Milk and Its Products have also come in for a great deal of study. These substances are very complex, and because of the readiness with which they change under natural conditions, it is hard to study the exact composition or the causes of change in composition which take place. Certain fundamental facts have been of great assistance in the handling of these substances in a profitable manner.

It has long been known that certain compounds are poisonous and that these may be used to destroy insect life on plants. Chemistry has aided in bringing out an ever-increasing number of poisonous substances, and to improve many of the methods of fighting insect and fungus pests.

Much has been done, and much remains to be done along these lines. Space will not permit mention of any more instances of the great advantage chemistry has been to agriculture.

Nature of Work Done in Our Own Laboratory.

With reference to the work of this coming summer and of the future, I may say that our object is to make the work of this department as practical as possible so as to be of as much assistance to general agriculture as time and our ability will permit. We particularly invite farmers who have soils that for any reason are not productive, or not producing as well as might be expected, to communicate with us. We cannot promise to make analyses of soils in all cases, for such analyses consume a great deal of time, and unless the sample is very accurately taken and all conditions known, the results of the analyses may not be of any great value.

Swamp Soils.—There are throughout the country thousands of acres of land that were originally swamps, which have been cleared up and brought under cultivation. In many instances they have not given as good results as was expected. Some considerable time has been spent in the examining of these soils and in the experimental application of various kinds of fertilizers to them to study the influence of these upon the growth of the crop. In a number of cases the addition of potash has given wonderfully good results. In some instances a little lime has made an improvement, possibly because it neutralized the natural acidity of the soil and allowed it to work normally. In other cases the soil seemed to be

deficient in nitrifying germs, and in one or two instances very much larger returns were got by simply seeding the soil with the nitrifying organisms by scattering garden soil over the land at the rate of a few hundred pounds per acre. The experimental work in connection with this type of soils we are continuing this year, and we shall be glad to have the experience and co-operation of any of our readers who may have this type of soil.

Lodged Grain.—In many sections of the country farmers have been troubled with grain lodging badly. It is true that we have had much more than the usual amount of moisture throughout the season, which tends to make the growth stronger, but it does seem as though in some places the ground is getting over-rich in nitrogen. An abundance of this constituent tends to force a large growth of leaf and stem, which may not be strong enough to stand up properly. When the grain lodges early in the year there cannot be a proper transferring of starch and ash constitutents from the stem to the seed. It is possible that where there is an abundance of nitrogen there is not enough of the ash constituents to properly balance the nitrogen. In some sections last season there was so little grain on the straw that the whole crop was burnt off of the ground. The prevention of the lodging of grain is a problem that we have been looking into somewhat in the past, and is one which we intend to follow up. If the lodging is caused by an improperly balanced ration for the plant, then possibly we can build up the weak side, which would probably be potash and phosphoric acid, and strengthen the straw and increase the yield of grain. Some experimental work has been done that would tend to prove that some valuable results may be got along this line.

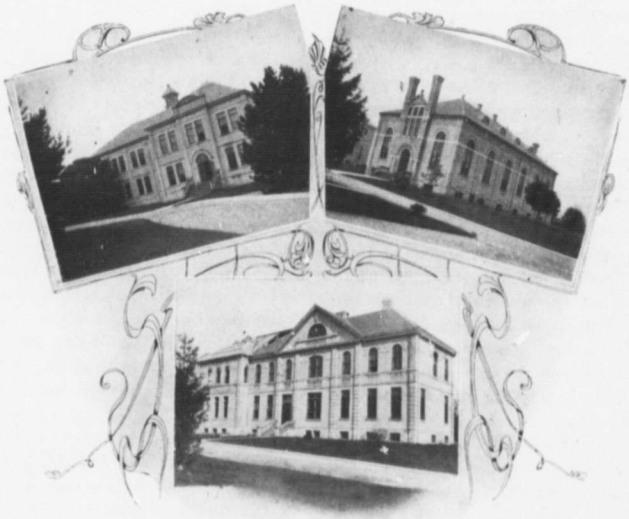
Fertilizers for Garden and Orchard. —The vegetable growers throughout the country are beginning to feel the need of some additional manure on their gardens. Where their farms are close to a large city, as in the neighborhood of Toronto, an abundance of farmyard manure may be got, but in other cases enough manure cannot be secured to force the large crops these men seek to raise. We are endeavoring by means of experimental work and otherwise to aid the vegetable growers in arriving at what plant food constituents their particular soil and crops require. The object is not only to increase the yield, but to improve the quality, for quality in many of the vegetables depends upon crispness and flavor, and these are very much influenced by a rapid and continuous growth, and to procure this there must be an abundance of readily available plant food.

In some sections of the country the complaint is made that the fruit, particularly apples, has not the bloom that it used to have. Judging by the nature of the growth in many of our orchards, and the appearance of the fruit, we are fairly safe in concluding that many orchards are in need of potash fertilizers. It is our intention to endeavor, by experimental work, to ascertain what effect the application of this one constituent will have upon the nature of the growth and the color of the fruit.

Insecticides and Fungicides. — The gardeners and fruit growers are finding year by year an ever-increasing number of insect and fungus pests to combat. This is bringing into use a large number of new materials for fighting these pests. Some of these are efficient, others, as shown by their chemical

composition, are of little or no use. For instance, a short time ago we examined a number of widely-advertised insecticides, and found some of these to contain as low as one-half a per cent. of Paris green; the greater part of the material being made up of gypsum, charcoal and sand. Such substances, applied even in large quantities, cannot be efficient as insecticides. Examinations we have made of Paris green show that the samples which have come into our hands the last few years have been pure and reasonably well made. Of late years there has been a tendency to use home-made arsenical poisons. Formulae and cost of the materials for some of these have been embodied in a recent bulletin from this Department*. Where fruit growers are accustomed to making Bordeaux Mixture, lime-sulphur wash, and other forms of sprays, there does not seem to be any good reason why they should not make their own arsenical poisons. The work involved is not difficult, and the saving in cost of materials is considerable.

We are also investigating the lime-sulphur spray. This is considered one of the best cleaning-up mixtures that has ever been used in the orchard. There are a great many formulae in use, and naturally sprays of varying efficiency are formed. There seems to be no doubt about the fact that the lime-sulphur washes made by the self-boiling formulae are not as efficient as those which are well boiled. In the self-boiling preparations the completeness of the reaction is dependent upon the quality of the lime used. Only



EXPERIMENTAL BUILDING. THE GYMNASIUM. CHEMICAL BUILDING.

*Bull. No. 154. "Insecticides and Fungicides."

freshly burnt, quick-slaking lime can be used, and every precaution taken to make the most of the heat if a proper combination of lime and sulphur is to take place and an efficient spray prepared. We hope during this season to get a number of the minor points in connection with these formulae brought into more definite form.

Crude petroleum has always been an efficient destroyer of scale, but it is so strong in its action that the tendency is to destroy the tree as well. In certain parts of the Province there is an abundance of crude petroleum, and we have been trying to make an emulsion that will not harm the tree and yet will destroy the scale. We have been partially successful, but hope to devise a better formula.

Chemistry in Relation to Cattle Foods.—Within the last few years there has been a number of mill by-products placed on the market. Many of these are advertised as being equal to or superior to bran. In some cases the products are worth a great deal more than bran, and in other cases they are not worth nearly so much. We have been analyzing a large number of samples of each of the different kinds of those by-products now being sold. The object of our work is to find out what difference there is in the composition of products of the same brand put out by different mills. We find a very wide variation in the composition, and consequently in the food value of these substances. We have also determined the digestibility of a number of these by-products and expect to do some more this year. As a result of the investigation work in connection with these foods, we are in a position to advise farmers regarding the food value of almost any of the materials which are procurable in this Province, and while we cannot state the exact money value or even a close comparative value of these different substances, we can at least give a great deal of valuable information concerning them. We are also making an effort to have the Dominion Government pass an act controlling the sale of these mill by-products.

The stock foods on the market have been investigated and further work will be done on them this year, when the whole will be reported in bulletin form. Many of these feeds are sold at extremely high prices, considering their food value. We invite farmers who wish information concerning mill by-products and stock food to correspond with us.

Chemistry of Dairying.—One of the main points of interest in connection with the butter trade this last year or two has been with reference to the incorporation of moisture in butter. The Government has stipulated that the moisture must not exceed 16 per cent. or it shall be considered adulterated and treated as such. On the other hand, the disposition on the part of the makers is to increase their over-run by increasing the amount of moisture in the butter. It is contended that in the past Canadian butter has been somewhat drier than it should be, and, consequently, does not spread on bread as easily as it should. This contention naturally fitted in with the desire on the part of butter makers to increase their over-run. Last season we analyzed a large number of samples of butter in order that the butter-makers might know about what amount of water they were incorporating. This summer we will be willing to aid butter-makers in a similar manner, and invite creamerymen to send us samples of their butter and we will try to give

them such information as they may desire concerning it.

During the warm weather of the summer some milk dealers are tempted to use preservatives to keep the milk sweet while being delivered and for some time after it is in the hands of their customers. If there is one food product more than another that should be kept perfectly free from all manner of preservatives it is milk. For that reason we are willing to examine at any time samples of milk that may be sent to us. Last year a number of samples were examined, and in a few cases we found formalin, one of the worst forms of preservative that may be used.

In connection with cheese-makers' work, we are expecting to aid the Dairy Department in determining whether there is a greater loss of milk solids when over-ripe milk is used in making cheese, or, in other words, to ascertain whether the normal sweet milk will give a larger weight of cheese than over-ripe milk. This is an important question, for if a few patrons deliver milk in an over-ripe condition, they may seriously decrease the yield, not only from their own milk, but from their neighbors'. If this decreased yield can be proved, it would be another strong argument in favor of keeping milk in as sweet a condition as possible. We solicit cheese-makers to write us in case of any difficulty, and if it is a problem within our reach, we will endeavor to investigate it for them.

Wheat and Flour.—For some years past the bakers and millers throughout the Province have been wanting the Government to install a thoroughly up-to-date plant for the testing of wheat and flour, and for the study of some of the problems in connection with bread-making. Last year the Government granted the money for this purpose, and the machinery is all purchased, and will be installed and in operation this summer. We shall have to do a certain amount of commercial work for millers and bakers, but we hope to be able to take up the problem of the blending of Ontario varieties of wheat to ascertain whether any improvement can be made in the quality of the flour made from home-grown wheat. It is well known that the quality of the flour depends upon certain chemical constituents, and that these substances are not properly balanced in all wheats. Therefore, it is quite possible that by bringing two different wheats together we may get a better flour than from either one separately. We also hope to be of assistance to the baker in studying out some of the chemical problems in his work.

This summer we expect to spend considerable time in the chemical study of the incubation of chickens. In the past, incubator chickens have not been all that could be desired. The Physical Department has been doing considerable amount of work in connection with this problem, and Mr. Graham has now asked us to look into the chemical side. We hope to be able to throw some light upon the nature of some of the chemical changes that take place under different methods of incubation.

R. Harcourt.

The Dairy Department.

THE importance and value of the dairy industry of Canada needs no apology from any one. It is estimated that the export dairy trade of 1906 consisted in round numbers of 2,500,000 boxes of cheese, and 362,700 packages of butter, valued at $31,000,000 to $32,000,000. The estimated home consumption has been placed at 1,050,000 packages of butter, and 40,000 to 50,000 boxes of cheese, making a total estimated value of $45,500,000 worth produced in Canada during the year 1906. If we add to this the value of the milk and cream consumed at home, and the value of the allied bacon industry, we have a grand total of not less than $100,000,000 as the value of dairy products during the past year in Canada. There is every prospect that these figures will be exceeded during 1907, if the season be a favorable one.

As the Ontario Agricultural College is a Provincial institution, though it really touches the agricultural industry of the whole of Canada, it would be well for our purpose if we had the value of dairy products for the Province during 1906. At the time of writing the latest available statistics for Ontario are those of 1905. We find there were in operation that year, 1,198 cheeseries, and 241 creameries. In round numbers this Proviice made in the factories during 1905, 165,000,000 lbs. cheese and 10,000,000 lbs. butter. The value of the cheese was about $17,500,000, and the butter a little over $2,000,000. In these two items of the dairy we have a value of product produced in co-operative dairies of nearly $20,000,000, not to mention the value of farm dairy butter. In addition, the farmers of Ontario have over 1,000,000 dairy cows, which, at $30 each, represents an investment of a large sum of money—sufficient to make thirty millionaires.

Brief History of Dairy Department at the O. A. C.

Soon after the Ontario Agricultural College was established, a small dairy building was erected on the west side of the Brock Road, nearly half a mile from the main college building. This building was intended for a cheese factory, we understand, but was never operated as such, owing to the difficulty of securing milk in a beef raising

section like that surrounding Guelph. The building was afterwards changed to a creamery on the cream-gathering plan. It was again changed and enlarged in 1892 to accommodate the first dairy school during the winter of 1893. A new dairy building was erected near the old one in 1893, and was first occupied during the winter term of 1894. Now these are too small for our work. They are also badly located for drainage and for convenience to the main college buildings. We need a modern dairy building containing all branches under one roof. Up to the present there have been but three occupants of the Chair of Dairy Husbandry in the College—S. M. Barre, J. W. Robertson and the writer.

In the early days, more attention was given to practical problems in dairying. Latterly, the Science of Dairying has received more attention as we recognize, "Unless Science Makes Progress Practice Marks Time." A well known American authority in an address on "Animal Nutrition" says, "What we need is to plan a campaign against the unknown." In the same address he points out, "One principle well founded is worth a thousand facts, because it includes them all."

Equipment.

The department is fairly well equipped with modern machinery for the manufacture of cheese and butter on the farm and in the factory. Equipment for handling milk and cream for city trade, for condensing milk, for the manufacture of fancy cheese and for making better use of dairy by-products are needed to bring the plant up-to-date.

Outline of Work.

The two chief lines of work undertaken are: (1) Teaching the science and practice of dairying to the regular college students, so far as time will permit in the rather crowded course of the college, and also to the Short Course students who come to us for the months of January, February, March and April; (2) carrying on experimental work during the summer months when students are absent.

The First year students are given a course of lectures and practical work relating to the farm dairy, which includes the production and handling of milk on the farm, the running of cream separators, Babcock testers, churns and the making of butter in the farm dairy, during the fall term. In the same term the Second year students take a course of lectures and practical work relating to co-operative or factory dairying which includes the principles and value of co-operation, building and operating factories, making butter and cheese in factories, testing milk and cream, methods of dividing proceeds of

THE FARM DAIRY.

sales of butter and cheese among patrons, marketing dairy produce, etc. The graduates in dairying take a course of dairy science lectures based on text-books and a laboratory course in dairying, chiefly experiments relating to the various branches of dairy work. We aim to give our graduates in the dairy a training in "the keen observation of fact, the accurate record of fact, and the inference from the fact—which is the method of science in all fields." From January 2nd, to about the end of March, the dairy is filled with Short Course students, most of whom come for three months to take factory and farm dairy work under a special staff of instructors engaged for these months. It is altogether likely that instead of a three months' course it will be necessary to make it a six months' course, or two courses of three months each, as we are finding the time too short for the amount of work covered. This is particularly so, since the introduction of laboratory work in dairy chemistry and bacteriology. In order to get the full benefit of these two sciences we find that ten afternoons in the laboratory for each of these subjects are not sufficient for the student to grasp them. This is especially true for men who know practically nothing of chemistry and bacteriology before coming to the dairy school.

Experimental Dairy Work.

The details of the experimental work in dairying are given in the annual report of the college, and we would refer readers to this report for an account of the experiments conducted each year. We shall have time to mention but a few of the points investigated.

1. We have demonstrated that it is unjust to pay all patrons the same price per 100 lbs. milk at cheese factories. Between milk testing 3 per cent. fat and milk testing 4 per cent. fat there is a difference in cheese producing capacity of 1½ to 2 lbs. cheese per 100 lbs., milk. At the present price of cheese this means a net difference of 15 to 20 cents per 100 lbs. milk, in favor of the richer milk. We worked out a plan whereby the addition of the factor two, to the percentage of fat in the milk, makes a basis of dividing proceeds, which, we believe, to be nearly justice to all honest patrons. Only this week (March 25th) we received a letter from a secretary of two factories saying they had decided to adopt our plan for the coming season, and asking for some further particulars. We know of at least one factory that has followed this plan for about ten years with very satisfactory results. We believe it is the most just and at the same time most practicable method devised, relating to this question, and we look for the time when nearly all factories will adopt the system. We have sown the seed, and must await the harvest, which will come in due time.

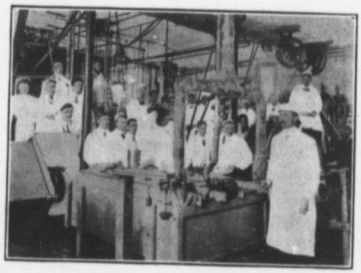
2. The Dairy Department has demonstrated that the best and most uniform quality of cheese is produced by ripening (curing) at a temperature of about 40°F. The shrinkage is also very much less by ripening at the low temperature.

Not many factories have adopted the plan of ripening cheese at this low temperature, but we believe that eventually it will become a part of our system of Canadian cheesemaking.

3. We are working at the principles underlying the manufacture of Canadian cheddar cheese. Results come very slowly, yet we feel confident of working out at least some of these principles in the near future. We would repeat, "principles are more important than facts," and if we can solve some of

the principles of cheesemaking, they will prove valuable. The subject, however, is very difficult—possibly one of the most difficult connected with the whole subject of dairying on its manufacturing side.

4. In buttermaking, the Dairy Department has demonstrated that the principle of pasteurization is the only principle so far discovered, which may be relied upon to produce a uniform quality of butter throughout the year. The method of pasteurization also produces butter of better keeping quality which is a very important point when



A CLASS IN CHEESEMAKING

exporting butter. It is the only plan, so far known, whereby Canadian butter may be able to compete with Danish, Irish or other first-class butter in the British markets.

5. It has been demonstrated that it is not necessary to ripen (sour) cream before churning in order to make good butter for present use, and also for keeping, *if the cream be pasteurized at 180° to 185° before churning.* Experiments indicate that this method of making butter will produce a finer and more perfect butter flavor than is got by "souring the cream."

6. We think we may fairly claim some of the credit for inaugurating the campaign against "the unprofitable cow." A few years ago dairy writers and speakers took for their text "Dairy Form." We took for our text "Dairy Perform," and started a crusade against the fallacious theory that a cow can be judged by her "form." So long as this doctrine prevailed little or no progress was made in the improvement of dairy cows, but since the introduction of the scales and tester into the dairy herds, we venture to say more improvement has been made, than ever was made in double the same time in the whole history of dairying. Forces are now at work which will root out every scrub, pedigreed and non-pedigreed, in the herds of progressive dairymen. Those which are not progressive will be left behind in the race for supremacy among the nations competing in the markets of the world. No greater movement than this has ever been started in the dairy business. The next pressing problem is, how shall we breed our dairy cattle so as to get a large proportion of the cows profitable milkers? On this question we need light very badly.

Summary.

The Dairy Department of the Ontario Agricultural College stands for Truth, Honesty, Economy, Excellence and Progress in the Dairy Industry of the Province. We aim to instil these principles into the minds of students by means of lectures and practical work; and by means of addresses, bulletins, etc., help the dairymen on the farm and in the factory to work out these same principles. We hope to keep in the forefront of dairying. The department, in co-operation with the many other dairy agencies which are doing good work, desires to assist in the campaign against dirt, indifference, selfishness, greed, and against inferior quality of Canadian Dairy Products.

H. H. Dean.

Department of Field Husbandry.

THE work in Field Husbandry may be divided into three general divisions, as follows: 1—Lectures in connection with the regular and the short courses at the college; 2—Experiments conducted on about 2,000 plots at the college; and 3—Experiments conducted on fully 4,000 farms throughout the Province of Ontario. Besides the foregoing it is also necessary to give a considerable amount of attention to the answering of correspondence, to the delivering of lectures at various agricultural conventions, to the judging at seed fairs and at agricultural shows, etc.

The experimental grounds at the college consist of about fifty acres, and are located at the rear of the main college building. The land has a general slope towards the southwest and the soil would be properly called an average clay loam. There are about five miles of wagon roads through the grounds, dividing the land into ranges, and about twenty-two miles of paths dividing the ranges into plots. About one-quarter of the land is manured each year with twenty tons of farmyard manure per acre; thus most of the land receives an application of farmyard manure once every four years. No commercial fertilizers are used except in distinct fertilizer experiments and these occupy only a small number of plots each year.

The work in the experimental grounds consists in planning the various experiments; laying out, seeding and looking after the field plots; harvesting, threshing, weighing and testing the grain; taking up, weighing, counting, testing and storing the potatoes and roots; cutting, weighing and harvesting the grass, corn and fodder crops, etc. All the experiments are conducted with great care and accuracy, and for several years in succession, in order to secure strictly accurate results. These experiments deal with such crops as are grown on about 10,000,000 acres of Ontario land annually. The various experiments include tests of varieties; selection of seeds; selection of plants; hybridization; dates of seeding; methods of sowing; methods of cultivation; mixtures of grains for green fodder, for hay and for grain production; mixtures of grasses for pasture; application of manures and fertilizers, etc. A great deal of thought and care is required in planning, supervising, and examining these plots, in studying, comparing and summarizing the results for presentation in reports, bulletins, newspaper articles and lectures.

All of the field experiments are conducted for at least five years before they are dropped and many of them are continued for a much longer period of time. For the results of the tests which have been carried on for five or more years, the reader is referred to the reports of the Professor of Field Husbandry, which are embodied in the annual reports of the Ontario Agricultural College. As different seasons vary so much in temperature, rainfall, etc., the average results of experiments continued for several years are of much greater value than those secured from only one or two years' work. About thirty thousand of the farmers of On-

tario visit the college in the month of June each year, and amongst other things inspect that portion of the farm in which the experiments in Field Husbandry are in progress. While the visitors are examining the various crops under experiment, the results of previous tests are presented by the person in charge of the party. In that way the object lessons become more interesting and the results of former years are made more helpful. During these visits many very excellent discussions take place. The visiting farmers are at perfect liberty to ask any questions which they wish along the line of Field Husbandry. Such questions are usually answered by giving the results of experiments which have been conducted at the college within the past twenty years. The questions and answers here given will illustrate how these practical discussions in the field can be made so helpful to those actually engaged in farming in Ontario.

Question—Can both wheat and oats be successfully treated for the prevention of smut?

Answer:—The treatment for smut in both wheat and oats is easily performed, comparatively cheap, and when properly done is very effectual.

Q.—Which treatment do you consider the best?

A.—In the results of experiments conducted for three years with winter wheat and for five years with oats we obtained the most satisfactory results by immersing the grain for twenty minutes in a solution of formalin. This solution was made by pouring one pint of formalin in forty-two gallons of water. After the oats were treated they were spread on the floor and stirred occasionally until sufficiently dry for sowing. If the oats are treated in the winter they should be very thoroughly dried before they are placed in bags in readiness for sowing in the spring.

Q.—Do you think it would pay a farmer to treat his grain for smut?

A.—I certainly think it pays well to treat grain which is infested with the smut spores. In our experiments at the college we have found that the grain which was not treated had fully five per cent. of smut, while that which had received the formalin treatment was entirely free from this fungus growth.

Q.—Is it necessary to treat the grain every year?

A.—If the smut in the grain is all killed in the one season and such precaution is taken that no living spores can get into the grain by its contact with bins, bags, etc., which are infested with the smut spores, it should not be necessary to again treat the seed grain for several years.

Q.—Will wheat turn to chess?

A.—On several occasions I have sown chess in rows in our experimental grounds and have never failed to obtain a crop of chess from the seed thus sown. We are always careful, however, to cut the chess while the plants are still quite green, so that there is no possibility of the seeds lodging in the ground to remain there until they receive the proper conditions for germination. We always carefully pick by hand all winter wheat before it is sown. In the hundreds of winter wheat plots which we have grown during the past ten years, I have never yet been able to find a single plant of chess. At the suggestion of farmers we have conducted several peculiar experiments, but have never been successful in obtaining chess from wheat.

Q.—What are some of the stiffest strawed varieties of oats which you have grown in the plots?

A.—The Tartar King and the Storm King are two of the stiffest strawed varieties, but even these varieties, when sown on low, rich land, and especially if the weather is unfavorable, sometimes become very badly lodged. When these varieties become lodged they are not apt to fill satisfactorily, and sometimes are harvested with considerable difficulty.

Q.—Have you any better yielding oats than the Black Tartarian or the Egyptian, which used to be grown so extensively?

A.—We have introduced varieties which have produced very much higher yields than either of these sorts; for instance, in the average results for the last sixteen years the Siberian, the Oderbrucker, the Banner and the Joanette have each given an average annual yield of fully ten bushels per acre more than either the Egyptian or the Black Tartarian variety.

Q.—Do the early oats yield as heavily as the late varieties?

A.—Generally speaking, the early varieties of oats do not give as large yields of grain per acre as those varieties which ripen later in the season. There are a few varieties of early oats, however, that are giving excellent satisfaction. The Daubeney oats are very early, produce a good length of straw, a spreading head, and grain which is white in color and very thin in the hull. This variety is one of the very best yielders of all the early oats which we have grown at the college, and one which is becoming more extensively grown throughout the Province from year to year.

Q.—Is there much difference in the percentage of the hull of different varieties of oats?

A.—There is certainly a very great difference in the different varieties in this respect; for instance, the Daubeney and the Joanette varieties have only about twenty-two to twenty-four per cent. of hull, while the Early Dawson and the Pioneer varieties have from thirty-five to forty per cent. of hull. We frequently find that a variety which gives a heavy weight per measured bushel is an oat of poor quality, owing to the comparatively small amount of meal, and the large amount of hull obtained from one hundred pounds of the grain.

Q.—Is Spelt and Emmer the same kind of grain?

A.—By most authorities wheat is divided into seven distinct types or species. Emmer and Spelt represent two of these. There are several vari-

SHORT COURSE STUDENTS JUDGING GRAINS.

eties of each of these two types. It will, therefore, be seen that Emmer and Spelt are quite distinct. In both types, however, the grain is very closely surrounded by the chaff, and there is not a clear separation of the chaff and the grain in the process of threshing. The grain is usually ground and the meal used for feeding stock. But very little, if any, Spelt is grown as a field crop throughout Ontario. In a good many cases, however, Emmer is grown under the name of Spelt. In the experiments at the college and also in the co-operative tests throughout Ontario, Emmer has produced very high yields of grain per acre, being about equal in this respect to the very highest yielding varieties of oats and of barley. The straw of the Emmer is rather weak, but is very free from rust. The true Spelt has given very poor results in the experiments both at the college and throughout the Province.

Q.—Have you grown the beardless barley, and if so, with what results?

A.—We have had under test several varieties of beardless barley. They are quite early in maturing and fairly stiff in the straw, but none of them produce nearly as much grain per acre as the leading six-rowed bearded varieties. Probably the best known beardless barley in Ontario is what is called the Success. This variety, however, produces only about two-thirds as great a yield of grain as the Mandscheuri barley.

Q.—Is the Mensury barley identical with the Mandscheuri variety?

A.—There is some difference in the appearance and a very marked difference in the productiveness of the Mensury and the Mandscheuri varieties of barley. We secured Mensury barley from several sources in the United States and Canada and retained the strain which gave us the best results. Even this strain of the Mensury barley, however, has produced an average annual yield of fully eleven bushels of grain per acre less than the Mandscheuri in the average results at the college for a period of sixteen years.

Q.—Is the Mandscheuri barley considered to be distinct from the Mensury variety by Dr. Saunders, of the Central Experimental Farm, Ottawa?

A.—Dr. Saunders would not recognize the Mandscheuri barley as being distinct from the Mensury until the summer of 1905. In the spring of that year Dr. C. E. Saunders wrote to Guelph for a package of the Mandscheuri barley. This was grown in comparison with the Mensury and the Common Six-rowed. When visiting the Central Experimental Farm at the end of June, 1905, I saw these barleys growing side by side and they were all quite distinct. Dr. Saunders and I could distinguish a marked difference between the appearance of the Mandscheuri and the Mensury, even when we were probably ten rods distant from the plots.

Q.—Does the Mandscheuri barley do equally well in all parts of the Province?

A.—This variety has certainly made an excellent record, not only at the college but in practically all of the sections of Ontario. We imported the Mandscheuri barley in the spring of 1889. After testing it at the college for about five years and finding that it was giving such excellent results, we distributed small quantities through the medium of the Experimental Union. The experimenters soon increased the seed and sold to their neighbors. According to inquiries made amongst farmers throughout the Province, it appears that fully 500,000 acres

of this variety are now grown annually.

Q.—How did the Mandscheuri barley turn out at the Central Experimental Farm in 1905?

A.—Although the appearance of the plot at the end of June was superior to that of the Mensury and the Common Six-rowed, I learn from the report that the yield per acre was exactly ten bushels per acre less than that of the Mensury, and four bushels per acre less than that of the Common Six-rowed.

Q.—Will you kindly give us the results of past experiments in growing grains in mixtures?

A.—We have obtained better returns from growing grains in mixtures than from growing the same grains separately for the production of green fodder, of hay, or of grain. For green fodder or for hay we have obtained the best results by sowing two bushels of Siberian oats and one bushel of Prussian Blue peas per acre, and for grain we have obtained the largest yield by the use of one bushel of Daubeney oats and one bushel of Mandscheuri barley per acre.

Q.—Can permanent pastures be used to advantage in Ontario?

A.—I consider that in many cases permanent pastures can be used in Ontario to very great advantage. The pasture area of the Province is increasing from year to year, but I fear that very little is being done to improve the quality of that pasture. Many farmers sow Red clover and Timothy, and then, owing to scarcity of labor, leave the land to pasture for a number of years. The clover mostly disappears in a short time and the Timothy often furnishes only a very small amount of pasture crop in the months of July and August, when it is most needed. If a person wishes to seed down a field to remain in pasture for a number of years I would certainly advise the use of some of the hardiest varieties of grasses and clovers, which are apt to remain comparatively green and give a fair amount of pasture even in a hot, dry, period of summer. We have tested a large number of grasses both singly and in various combinations for pasture purposes, and I would suggest the following for an average soil: Orchard Grass, 4 lbs.; Meadow Fescue, 4 lbs.; Tall Oat Grass, 3 lbs.; Meadow Foxtail, 2 lbs.; Timothy, 2 lbs.; Alfalfa or Lucerne, 5 lbs.; Alsike Clover, 2 lbs.; and White Clover, 2 lbs. per acre. This makes a total of 24 lbs. of seed per acre. In the old country they usually recommend from 45 to 50 lbs. of seed per acre. In the mixture which I have here given it will be observed that none but the hardy and comparatively strong-growing varieties are mentioned.

Q.—I would like to know what you would recommend for sowing in the spring of the year to produce pasture for cattle in the same season.

A.—In our experimental grounds we have grown separately some seventeen varieties of farm crops in order to study their value for pasture in the same season in which the seed was sown. We find that a mixture is likely to give better results than any of the crops grown separately. Of the mixtures used we find the following to be one of the very best: Oats, 51 lbs.; Early Amber Sugar Cane, 30 lbs.; Common Red Clover, 7 lbs. per acre. This makes a total of 88 lbs. per acre of the mixture. The crop is usually ready for pasture about six weeks after the seed is sown. The oats grow quickly and produce a large quantity of feed which is very appetizing. The Early Amber Sugar Cane gives a good pasture before the oats are finished, and it is also

greatly relished by the farm stock. During the latter part of the season the pasture is usually composed of a mixture of Early Amber Sugar Cane and Common Red clover, with probably a very small amount of oats. Besides having our various small experiments we have grown some six or eight acres of this mixture in one year and have pastured it off with cattle quite satisfactorily. At the end of the season there was a complete mat of Red clover ready to come through the winter to furnish a crop of clover in the following season.

Q.—Does Alfalfa thrive at Guelph?

A.—We have tested Alfalfa or Lucerne quite extensively during the last twenty years, and find that the crop thrives splendidly. We usually sow at the rate of 18 to 20 lbs. of seed per acre in the spring of the year, either with or without a grain crop, on land which has been well cultivated. The crop has been used both for green fodder and for hay. It gives an average of three cuttings each season, furnishing a total yield per annum of about twenty tons of green crop or of five tons of cured hay per acre. The crop should be cut when it is starting to bloom and carefully cured so as to retain the leaves. When properly handled the hay is of excellent quality, being even richer than that made from Common Red clover. There is not much use of sowing Alfalfa on cold, wet, soil. As the roots of the plants grow to so great a length, it is important that the subsoil be well underdrained, either naturally or artificially.

Q.—What are the results of your tests in sowing grains at different dates of the year?

A.—We have sown oats, barley, spring wheat and peas on six different dates in each of five years by starting to sow as early in the spring as possible when the land was warm enough and dry enough to work to good advantage, and by allowing one week between each two dates of seeding. The results are exceedingly interesting, and show the importance of sowing spring wheat, barley, oats and peas in the order here indicated. The best results were obtained from the first date of seeding with spring wheat and with barley, and from the second date of seeding with the peas, and from the first and second dates of sowing with oats. One of the most important features of the experiment was the fact that, for every day's delay in seeding after the first week had past after the land was in the proper condition for seeding, there was an average decrease per acre of 56 lbs. of oats, 53 lbs. of barley, 29 lbs. of spring wheat and 23 lbs. of peas.

Q.—Do you get better results from planting corn in hills or in drills?

A.—From the results of experiments conducted by farmers through the medium of the Experimental Union, we learn that on the average the corn which was planted in hills or squares produced about one ton of total crop per acre more than that which was planted in rows. The same amount of seed was used in both cases. Of this increase, about one-fifth of a ton was in the form of ears and four-fifths in the form of stalks and leaves.

Q.—Would you advise farmers to grow any of the sorghums as a farm crop?

A.—Some of the sorghums have given very good results. The Early Amber Sugar Cane and the Early Minnesota are amongst the leading varieties. On light, warm soils the sugar canes will sometimes thrive better than corn, especially if the season is com-

paratively dry. The sugar cane is very sweet and readily eaten by farm stock.

Q.—Do the long red mangels produce the greatest yield of roots per acre?

A.—As a rule the long red mangels give larger yields per acre than either the intermediate or the globe varieties, but during the last few years a yellow intermediate variety, known as the Yellow Leviathan, has given a larger yield of roots per acre than any strain of the long red mangels which we have grown.

Q.—Do the sugar beets yield as well as mangels?

A.—As a class, the sugar beets do not yield as heavily as do the mangels. The Giant White Feeding, the Royal Giant and New Danish Improved are amongst the largest yielding varieties of sugar beets which we have grown at the college. Analyses show these varieties to contain about 10 per cent. of sugar. The varieties of sugar beets which have been specially bred for the production of high sugar content, yield between 15 and 16 per cent. of sugar.

Q.—What method of corn cultivation would you recommend?

A.—Deep cultivation between the rows of corn in the early part of the season, gradually getting shallower at each successive cultivation as the season advances, is the method which has given us the best results in our experiments on the college plots.

Q.—Have you had any rot in the potato crop at Guelph, and if so, do you find that all varieties rot to the same extent?

A.—In 1897 potatoes rotted considerably. From that time until 1903 we had but little trouble from this disease. In 1903, 1904 and 1905, however, the potatoes rotted quite badly. There was also some rot in 1906.

There is certainly a marked difference in the amount of rot developed in the different varieties. In the average results for the last four years some varieties have had less than five per cent. of rot. These are mostly new varieties, and some of them have been imported from the old country. Those freest from rot are Robertson's Champion, Stray Beauty, Skerries, Holborn Abundance, Green Bay, Seedling No. 230 and Main Crop. Each of these varieties have had less than five per cent. of rot. In comparison with these, we find that there was upwards of 30 per cent. of rot in the average crop of the Beauty of Hebron, Hanlan Beauty, White Pinkeye and Montana Bluff.

Q.—Have you found any potato which has given better results than the White Elephant variety?

A.—The Empire State gives a better yield per acre, produces potatoes of superior quality, and is not nearly as subject to rot as the White Elephant variety.

Q.—Do you cut potatoes for planting?

A.—We prefer cutting good sized potatoes into pieces, weighing about an ounce and a half each, having two, three or four eyes in each piece. We find it is a great advantage to cut the potatoes, sprinkle them over immediately with land plaster and plant on the same day.

Q.—To what depth should potatoes be planted?

A.—In the results of experiments conducted for seven years in succession in planting potatoes one, three, five and seven inches deep, we obtained the highest average yield per acre by planting at a depth of five inches. The soil in which these experiments were conducted is what might be termed an average clay loam.

Q.—What variety of sweet corn do you perfer for home use?

A.—For home use I prefer the Yellow Bantam variety. The ears have eight rows and the grain is very tender, sweet and juicy. We have tested about fifty varieties of sweet corn in all, and find the Yellow Bantam to be one of the earliest. As a late corn, the Country Gentleman is one of the best.

Q.—Will Cow Peas thrive well in Ontario?

A.—Cow Peas are grown extensively in the Southern States, but as yet we have found no variety which has given good satisfaction in Ontario.

Q.—Have you been enabled to introduce many new varieties of farm crops which are better for Ontario than the old standard varieties?

A.—We have been instrumental in introducing some new varieties which are decidedly better than some of the old standard kinds, and which are now grown extensively on the farms in the Province.

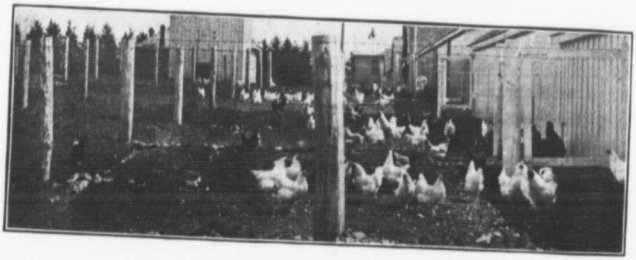
Q.—Do you expect to be enabled to introduce other varieties which are superior to those which you have already distributed?

A.—We are now endeavoring to improve the very best varieties through systematic selection and through cross-fertilization. The results so far are very promising. We are commencing to distribute some improved strains obtained through selection and believe that they will make a good record for themselves throughout the Province. Last year we had about 15,000 plants, resulting from crosses between our leading varieties.

Q.—Will you explain a little more fully your work in cross-fertilization?

A.—The flowers of wheat, oats, barley and peas are self-fertilized, while those of corn are generally cross-fertilized through the influence of the wind. If we desire, therefore, to secure crosses between two varieties of any of the first-named grains, it is necessary to cross-fertilize the flowers by hand. This requires time, care, and patience. During the last five years we have obtained some very interesting and promising crosses between such grains as Dawson's Golden Chaff and Turkey Red varieties of winter wheat, Common Emmer and Red Spelt, the Herison Bearded and the Red Fife varieties of spring wheat, the Joanette and the Siberian varieties of oats, the Mandscheuri six-rowed and the Chevalier two-rowed barley, etc. We believe that we will be enabled to secure new varieties which will combine approximately the good qualities of the parents; such as a winter wheat with the strong straw and the high yielding properties of the Dawson's Golden Chaff, and of the good milling qualities of the Turkey Red; a spring wheat with the compactness of head and the heavy weight per measured bushel of the Herison Bearded, and the quality of grain of the Red Fife; an oat with the great stooling power, the high yielding property and the thinness of hull of the Joanette, and the character of straw of the Siberian variety; a barley with the strength of straw and the circumference of head of the Mandscheuri, and of the length of head and quality of grain of the Chevalier, etc. This is work which requires several years to develope, but in which we are greatly encouraged, believing that in time we will be able to originate varieties of several classes of farm crops which are more suitable for the farms of Ontario than those which are now in general cultivation.

C. A. Zavitz.



Poultry Department.

NEARLY all the readers of the "Review" are familiar with the Poultry Department in general. In this article I shall deal only with the experimental work which is being done this year.

During the summer of 1906 there was constructed a poultry house 110 feet long. This was divided into three pens —the object being to test fowls for the production of eggs, in flocks of 50, 75 and 100 each. The birds in these pens are as nearly alike as possible, being of the same breeds and much the same strain. There can be no conclusion drawn from the results so far. At the present time the egg production from all the pens is about of the same ratio. The fertility of the eggs is just as good where there are eight males running with 100 hens, as where the flock is fifty in number, and in addition to that, the fertility is equally as good as where we have ten females mated to one male in the old house. The fowls in the long house are being fed once a day with whole grain, wheat or corn buried in litter. They have in addition to this a hopper filled with a dry mash, composed of equal parts of bran, shorts, corn chop and oat chop. They also have a hopper of beef scrap. This plan of feeding is giving us about as good results in egg production as we have secured with any other method of feeding, and requires much less labor, ordinarily half an hour a day will feed the 225 birds.

We are trap-nesting this year over 500 individual hens. We have several objects in view in doing this. The foremost, of course is to select the hens that are paying, or those which are laying best, so that next year, or even this year, we will breed only from the hens that show average or better in egg production. There is a much larger number of poor producers than one is naturally inclined to believe. Another object we have in view, is that we may be able to set our experimental incubators with eggs from the same individuals, so that no matter how we run our machines, we know for certain that the eggs were the same in each incubator. We also wish to test the vitality of the chickens hatched in different ways, and it is necessary that we use

eggs from the same individuals for this purpose. In addition to the above we have the opportunity of studying the individuality of birds, not only as regards egg production, but as regards fertility and the hatchability of eggs, also as to whether a hen varies from day to day, or week to week in the vitality and strength of the germs in the eggs laid by each individual. At present, the indications are that many hens lay good hatchable eggs fairly constantly, while there are others that lay good eggs for a time and then the vitality of the germs appears to decrease. There are a few individuals that lay eggs which are very difficult to hatch under any circumstances, and some whose eggs are all, so far as we have tested, infertile. The ideal would be to get a hen that would lay a large number of eggs, whose eggs would hatch both under hens and in incubators. We have a few individuals, perhaps not more than one dozen good layers, whose eggs will hatch under nearly all conditions. At present there appears to be about the same percentage of undesirable eggs from heavy laying hens as there is from poor layers.

We are doing considerable work on incubation and brooding. We have been working on this question now for several years, and each year we are getting more interesting results. At the present time we are trying to study how hens hatch eggs, and how the different makes of incubators compare with hens. We have hens set under various conditions, as, earth in the bottom of the nests, and nests raised off the ground with dry straw or hay used only in the bottom of the nest, etc.

The incubators in the experimental-room are: "Peerless," "Chatham," "Model," "1906 Cyphers," "1905 Cyphers," "Hearson," "1907 Prairie State" and the open bottom "Prairie State." Other makes may be added from time to time, but at present, these represent most of the types which we have room to test. Of all these incubators, I do not think there is any one that has all the conditions that we find present under a hen, nor yet is there any one incubator yet tested that has as great a hatching power as has a good hen. In practically every test the hens have out-hatched the incubators. To raise chickens in large numbers, incubators are an absolute necessity. We are getting very fair results from the machines. Probably, all things considered, they would be more economical hatchers than the hens.

We are getting some very interesting results with incubators operated under very dry conditions as compared with those operated under moist conditions. As a general rule, we have found the air under the hens contains a much higher proportion of carbondioxide. By the use of moisture from milk and water we have been able to hold the evaporation in most of the machines about the same as that found under hens, and so far the vitality of the chickens so hatched is much more satisfactory than those hatched in air that is drier. In fact, the mortality among the dry hatched chickens has been very large, so much so, that these hatches would not be profitable.

We are also trying different methods of producing carbon dioxide. Some of these have not been very successful, but we have increased the quantity nearly one-half by the use of a bacteria growing in milk. Whether this is going to be of any practical benefit remains yet to be proven.

Last year we found that our chickens would grow much better upon new ground, than upon the ground tha. had

been used about the department for years, for growing young chicks. This year we are growing most of our chickens on absolutely new ground. There will be a few grown on the ground about the department which was used in previous years, but the most of this ground will be sown with a crop, the idea being to freshen it so that we can grow chickens to advantage on it again in a year or two.

We think it absolutely necessary when testing the vitality of the chickens hatched under various conditions to give them as good a chance as possible to develop. We are using part of the orchard near the Stone farm, also a portion of the corn field. The early chickens will be grown in the orchard and the later ones in the corn field. We expect to lose a considerable number by hawks, crows, etc., but what we lose in quantity we hope to gain in quality.

W. R. Graham.

THE MAIN BUILDING.

Department of Bacteriology.

AS the student begins a course in bacteriology, he enters into a field hitherto entirely unknown to him. He may possess a few vague ideas about "germs," and he knows perhaps that they are responsible for some of the phenomena of nature; yet little does he appreciate their real nature, and the fact that every phase of his daily life is influenced to a greater or less degree by these invisible but ever active forms of life. The student immediately asks, what are bacteria, and of what use is it to me to know of them?

The aim of any course in Bacteriology must needs be, first, to have the student gain a knowledge of the nature of micro-organisms and their development, then to show him the changes which they are capable of producing in various substances, and finally to apply the knowledge already gained in discovering for himself the real significance of these changes, and the intimate relationship of micro-organisms and their life processes to his own existence and surroundings.

As it would be absurd for a student to take up organic without first having had general chemistry, or to study physiologic botany before systematic training, so he would be entirely at sea in attempting to do anything with applied bacteriology without first taking up morphologic and cultural work, together with methods of handling micro-organisms. Hence the student begins with the gross anatomy of the different forms, and studies the histology of the cell, cultural characteristics in different nutrient media, methods of classification and differentiation of species, the preparation of culture media and the technique of cultivation and manipulation of different types of micro-organisms. As he carries out his morphologic studies, he finds that although these unicellular plants are many thousand times too small to discern with the naked eye, yet, with the aid of his high power microscope, he is able to see them as plainly as he sees the microscope itself. Further, by appropriate staining methods he is able to demonstrate parts of the cell, and he sees that in structure they are not unlike the individual cells of higher plants, or those of which his own body is an aggregate. He thus lays a foundation for more intelligent anatomical studies of plant and animal life. Beginning with the simplest form of plant life and studying the method of development and reproduction, he is able to gain a clearer conception of the development and structure of more complex bodies. A knowledge of bacteriology then may be said to be the foundation for further biological studies.

From his morphologic studies, the student advances to examine the physiologic phenomena of bacterial growth. Here again he discovers for himself facts regarding the metabolism of cells which are directly comparable with the physiologic processes of his own body. Here in the manipulation of single-celled organisms he is able to

study problems of nutrition and waste, apart from influencing conditions as always found in more complex structures.

He begins to realize, further, as he advances into the work, how these micro-organisms may perform functional changes of considerable importance to mankind. He notes that in order to cultivate certain micro-organisms he must furnish them with proper respiratory gases, feed them with particular kinds of food and maintain them at temperatures sometimes ranging within the limits of a very few degrees. With these facts before him, he begins to understand that the life of micro-organisms is more than that which is contained within the cell, because it involves so many other changes and acts in nature. He ascertains frequently that in order to develop a micro-organism it is necessary to have associated with it some other, or that some other form must precede or follow it in order to bring about certain results. Further still, he learns that if there is present one form or micro-organism, another may not develop. As he proceeds along these lines, there opens up to him the field of fermentation which involves the manufacture of ferments or enzymes by the cell, in larger amounts than is necessary to maintain the nutritive processes of the cell. The significance of these enzymes reaches out into organic changes of industrial import, and he learns that in order to maintain these industries it becomes necessary to establish certain favorable factors for the growth and development of the micro-organisms, for the production of these enzymes by the cells, and also for the elimination of other micro-organisms which may be of hostile utility. Following the actions of these micro-organisms, he becomes able to determine many products which are utilized in commerce, in the home, in fact everywhere by man. This field of fermentation expands as his knowledge increases, and he soon reaches the point where he is unable to determine limitations. He casts a glance into some of the physiologic phenomena produced by the manipulation of micro-organisms, and he learns that such products as agglutinins are made use of as diagnostic agents, that precipitins are utilized in determinative work. He sees how lysins are involved in the study of poisons, and appreciates the far-reaching benefits being every day derived by the human race from the study of toxins and antitoxins.

He learns the employment of sunlight as a disinfectant and a germicide, the influence of heat, cold, chemicals, the process of filtration and many other physical agents in their effect upon the life of micro-organisms. He reaches out into that region of communicable diseases, which in itself is more than a life study, gains some notions of surgical bacteriology, and imbibes some knowledge regarding the susceptibility to and immunity against contagious diseases. He obtains an intelligent view of serum-therapy and bacterial therapeutics, subjects which are becoming household words because of their value in certain diseases. He enters carefully into that realm of disinfection and antisepsis which should be familiar knowledge to every man. He gains wisdom in the study of water, the disposal of sewage, and the possibility of poisonous or infective foods. The student interested in dairying can easily establish the fundamental nature of bacteriologic study in the handling of milk and its products, and by an intimate knowledge can make himself a more useful, practical man in dairying.

Besides this, every student should be more or less familiar with many of the hygienic and bacteriologic problems arising in the management of milk, its fermentations, its uses and its values.

Every agricultural student should be acquainted with the changes wrought in the soil through the agency of bacteria; the decomposition of organic matter, nitrification, denitrification and nitrogen accumulation from the air; he should have a knowledge of the iron and sulphur bacteria, and those which in one way or another act upon the mineral constituents of the soil. He should recognize the necessity for healthy cattle and perfect cleanliness about his stables would he produce healthful milk free from the unsavory odors and taints in milk produced in filthy surroundings. He should know that when he goes to look at his neighbor's hogs, which have cholera, he is more than likely to carry the infection back to his own animals on his boots or clothing. He should be aware of the fact that an impure water supply may carry infection and death to his cattle and other stock. He should have knowledge of factors involved in the spread of plant diseases, and of methods for their control.

For the domestic science student, an intimate knowledge of bacteriology is of no less importance than for her agricultural brother. Place the young lady in possession of the knowledge which may be gained of this invisible world by handling a culture through its various manipulative stages, let her open her eyes to the avenues by which micro-organisms may travel, the power of rapid propagation, the ease of contamination, the necessity of sterilization, the temperature at which growth is best fostered, the food best adapted for their development, the influence of moisture, the various chemical changes they are capable of producing, and many other things arising from actual contact with them, and she must be a very stupid individual indeed if her mind does not immediately turn to the souring of the cream which she secured from the dairy, the poisoning of a certain family by the eating of canned meat, the damp cellar where everything smells musty, that pile of rubbish in the backyard which is emitting a malodorous breath, that failure in canning fruit, the boy who fell down while playing football, losing a patch of skin, and who is now nursing a case of so-called blood poisoning, that little girl who died a short time ago of lockjaw, or another who ran into the jaws of a rabid dog; her neighbor's family dying of tuberculosis. All these are subjects of her thought. Also she allows herself to meditate upon the sour bread she had for dinner, or the vinegar that so quickly spoiled the cider, the home-made beer which she made with roots, sugar and yeast—so temperate, yet so sparkling. She wonders when she goes home whether her mother disinfected the house properly after her little sister had diphtheria, or whether the pasteurizing of the milk for her baby brother is properly done. Every time she drinks a glass of water she feels the multitude of Lilliputians sliding down her throat; the meat which she eats is not so savory because she is told it has not undergone inspection.

Such are a few of the many lines upon which a study of bacteriology must be laid out, and in working out such a study the aim is not so much to place the student in possession of a great array of facts which may be stored away in his brain, as one stores away winter clothing to be taken out only when necessity calls for their use, but

rather to acquaint him with broad underlying principles together with a knowledge of how to apply them to every-day processes on the farm and in the home. If a student's mind is active and alert, his thoughts are comprehensive and every new item that is observed enlarges his views and renders him more useful to himself and to his fellow creatures. To him, the invisible living world, active as the visible, furnishing nearly as many problems as the visible, becomes a real existence. He can see a germ as clearly as he looks upon an elephant, and in his imagination he should be as able to note movements, efforts and effects, with the same readiness as the labors of the beast of burden.

After he leaves college it matters not whether he remembers the certain laboratory technique—he will retain those broad principles which will aid him in a thousand duties. The aim is to fit students for life, not for bacteriologists.

S. F. Edwards.

MASSEY HALL AND LIBRARY.

Forestry Department.

THE work of the Forestry Department consists in giving the regular lectures to the College students during the school term; the care and improvement of the wood lands on the college farm; the co-operative work in waste land planting throughout the Province, and the agitating by various means to bring about more rational treatment of the woodlands of the Province.

soon improve the existing conditions. The trouble lies in the fact that the owner is either careless about the outcome or thinks that it pays better to graze the land without regard to the future welfare of the woods.

The College farm contains much that is of interest in relation to tree growth. The ornamental planting on the lawns was done about thirty years ago, and demonstrates the possibilities in this

SHEEP PROTECTED BY SHELTER BELT.

This last problem can only be solved as the farmer comes to believe that the woodlot has a permanent place in the economy of the farm. To bring about this conception the department urges through press articles, correspondence, bulletins and through the Institute speakers the necessity of improving the condition of the woodlot. Any owner who protects his woodlot from stock grazing and does not overcut can

line. About sixty acres of the farm is devoted to plantations and woodlands. The plantations have given good results, showing what can be accomplished in from twenty-five to thirty years. A plantation of European Larch in the field south of the college grounds was planted about twenty-eight years ago on the site of an old gravel pit. This was regarded as waste land, and to-day many of the trees are forty feet

in height, and from six to nine inches in diameter.

The chief problem confronting the Forestry Department is that of waste land planting. It is desired to demonstrate throughout the Province the practicability of reforesting waste land which may exist in various forms as sandy, gravelly or stony soils, steep hillsides or other untillable soil.

The planting of roadside, ornamental or orchard trees is the form of tree planting commonly known to natives of Ontario. The cost and labor involved in such planting makes the idea of reforesting appear impractical. The Government is willing to give assistance in waste land planting, and the following system of co-operation is carried on as far as possible. The department as far as the means at its disposal will permit, will assist in replanting waste land. The applicant's land will be examined by an officer of the department to determine what is required.

The department will furnish free the planting material, but the person receiving such shall pay cost of transportation.

PART OF THE COLLEGE WOODLOT

The owner, on his part, must prepare the soil, plant and care for the trees, and do all the actual work in connection with the plantations in accordance with the directions of the officer of the department.

The owner shall also agree to provide reasonable protection for the plantation against stock or other harmful agencies.

No fruit or ornamental trees will be

sent out by this department, and all trees must be used for protection or wood producing purposes.

The department reserves the right to accept or refuse applications if in the opinion of the officer in charge the location is unsatisfactory. To carry out this work forest nurseries have been established to provide planting material. A nursery for the growing of hardwoods, such as ash, maple, white-wood, black locust, elm, etc., is in operation on the northern part of the Macdonald grounds. Another nursery for the production of evergreens, such as white pine, Norway spruce, etc., has been established about two miles from Guelph.

A brief description of two actual cases of waste land planting will give the reader some definite conception of the possibilities of such work. Two acres of waste sand land was planted with white pine, the plants were about ten to twelve inches high and were shipped one hundred miles by express at a cost of one dollar. The plants were spaced about five feet apart each way, so that it took about 1,742 plants for one acre. In this loose, light soil it took two men one day to plant an acre. The plants are small and can be placed in the ground very rapidly. It is in this respect that forest planting differs so much from the other forms of tree-planting, with which we are familiar.

LARCH PLANTATION.

At the end of the second year about five per cent. of the plants had died, and had to be replaced. In this soil no cultivation was necessary.

Another form of plantation was that on a rough, steep hillside. The plants cost the same, but the cost of labor was about doubled, taking four men to plant an acre in a day.

E. J. Zavitz.

The Teaching of English.

SOME of the uses of English as a subject of study, at an agricultural college or at any other institute of learning, are not far to seek. A good English scholar, that is, one who is widely and intimately acquainted with the meanings and uses of English words, and who has read widely among good writers, can learn a given subject with greater ease than can another person that, with the same natural ability, lacks a knowledge of English. And, furthermore, the good English scholar can with the same amount of knowledge make a better impression and stand higher in his classes and in society, than the other, because, through his acquaintance with correct usage of English, he can impart his knowledge more intelligibly and effectively.

Nevertheless, except indirectly as already shown, the study of English does not contribute to a mastery of agriculture, or to expertness in caring for or judging live stock. The direct uses of English must, therefore, be sought on grounds other than as a contribution to the main subject of study at an agricultural college. The expert agriculturist differs from the expert farmer in that, in addition to a practical acquaintance with farm work which the farmer has, he has an acquaintance with the principles or the science of agriculture. All who attend an agricultural college aim, or should aim, to be expert agriculturists. As such it is their ambition to be able, sooner or later, as opportunity offers, to defend the principles they hold, and to aid in the general improvement of farm practice. How are these things to be done? In one way, they are to be done through the public press; in another way, through public meetings, such as farmers' institutes. The student of agriculture aims, then, to be capable of writing and speaking effectively with a view to making his opinions and his practice prevail. Further, as an intelligent citizen and an "heir of all the ages," he should be able to understand and to enjoy the literature of his own language, that literature which, as a great critic justly says, is the chief of England's glories.

Here, then, we have the direct uses of English at this institution; for the agriculturist, to be able to write and to speak in support of the principles of agriculture; and for the citizen, to be able to make adequate use of the bequests of the great souls that have labored, and are laboring, in literature, to uplift the race.

The first object of the department of English is to teach young men

to write well. Those who come to this college for instruction, possess, upon entering, various degrees of attainment in this particular art. Some are already able to write thoughtfully, clearly, and intelligibly upon any subject of which they have knowledge. Some are devoid of any skill in expression, and display in their writing neither grammatical correctness, nor clearness, nor force. For example, we meet with grammatical errors such as the following:

"Here is found expressions which are coarse, rude, and even vulgar."

"A careful observer can generally decide which State of the Union their companion has been brought up in."

"She is first introduced into the play in a conversation between she and her brother."

"Of all the long list of able literary men which the nineteenth century there are few that surpass or even equal Thomas Babington Macaulay. Not only does his name shine as an author his fame as an orator, politician and statesman were almost as great."

Or we find such careless placing of words as:

"He seems to have been only able to understand, or see the benevolent side of nature."

Instead of, "He seems to have been able to understand, or to see, only the benevolent side of nature."

Or, such as these, bad in arrangement, and too wordy, and therefore, lacking in clearness and force:

"Some familiar sight or a sound may bring it back when we least expect it, as fresh as before, which we would gladly cast aside."

Instead of, "Some familiar sight or sound may bring the memory back, unexpected, and unwelcome, but as fresh as before."

And "In Ravenna, Dante is sleeping, although born in Florence, also Petrarch, a native of Florence, is buried in exile in Arqua."

Instead of, "Although born in Florence, Dante sleeps in Ravenna; and Petrarch, also a native of Florence, is buried in exile in Arqua."

Or the following sentence, which first of all appears to suggest that the city was looking down from the eminence; secondly, has unnecessary words; and thirdly, the word "it" appears to refer to "city," whereas it should refer to the site or ground on which the city stands. "Looking down from this eminence, the city would appear to be more or less in a hollow ,but as we approach the city, we find it is more or less hilly."

Instead of, "As we look down from this eminence, the city appears to lie somewhat in a hollow; but as we approach, we find the ground more or less hilly."

Occasionally we meet examples of unconscious humor, such as the following:

"There is not a place in Ontario where dairy farming cannot be carried on at an immense profit, so large is the water supply."

Not infrequently "impossible" compositions like this are furnished:

"As for the climatical conditions of Ontario they are all that could be desired, of coarse as in all other things, different people require different climates. Although almost every person enjoys the pleasant summer which is such, that little more could be desired. The weather being pleasant, and we seldom suffer from extreme heat. The great lakes tempering the climates. Although it cannot be denied that the winters are cold, but even that has its bright side particularly for the young people to whom it brings skating and games upon the ice, out of which much enjoyment may be taken. It also brings sleighing, and who does not enjoy a sleigh ride? Which is one of the most delightful features, of western winter, and can only be thoroughly enjoyed by those who have the opportunity of enjoying such a thing but seldom, yes, even the winter has its bright sides! In a place of residence, we also look to be surrounded with as many of the comforts and luxuries of life as possible, for instance good railways, which Ontario possesses, although it has but a few electric lines we expect them in the near future."

When students have got beyond the elementary principles of construction, such as grammatical rules and arrangement of words and of parts of the sentence, they sometimes attempt what is called fine writing, that is, using big words and metaphors, to decorate their compositions. This idea of dignifying their composition is a laudable one, but must be kept within proper bounds. The language should be in keeping with the subject, and the metaphors should be consistent. The young agricultural college graduate who announced his subject "The Fundamental Principles of Feeding Calves" violated good taste in choice of words; and the following are what may be called mixed metaphors:

"Walpole, a helmsman to prosperity, was openly and avowedly corrupt in his political dealings, corruption being, in his opinion, an essential to success. With his fall, the reins of power were transferred to his rival, Pitt."

"England had suffered from the arbitrary rule of George III. and her pulse went out in sympathy for the struggling French yeomen."

"Goldsmith is the final link which blends the old with the modern."

"Arising from the aftermath of the dissolute period which immediately succeeded the restoration, we find a surge of religious feeling, throughout the land, which ultimately reaches a focus in Methodism, as aroused by Whitfield and Wesley, the two greatest moral forces of the century."

The above illustrations have been all copied by me from essays

written by my own students. Any intelligent person reading them may see for himself the nature, and the scope, and the need of the work, we are called upon to do in aiding these young men to make of themselves good writers. The work is mainly criticism and suggestion, informing the students on points of good usage and proper expression, and correcting errors and faults of taste in the written compositions.

In the matter of speaking, much opportunity is afforded to those who wish to improve in this direction. Here, as at all colleges, there are many incidental chances altogether outside of the college curriculum, for cultivating the art of speech. The literary and other college and class societies are effectively organized under student control, and in the entertainment programmes ample provision is made for the aspiring speech-maker. The unique features are those on the college curriculum, and consist first, in seminary work, and secondly, in class-work formally devoted to the delivering of addresses by the students.

The seminary work may be carried on in any of the departments of instruction, and consists in assigning to each student in the class a topic chosen from the subject then in hand, and requiring later a paper or a talk on the assigned topic. Seminary exercise thus followed has the double advantage, to the student, of encouraging thorough preparation, of one subject at least, and of affording practice in speaking on a definite subject before a critical audience. I am not sure to what extent this double form of instruction is used in the various departments at the college. In some, I believe, it is frequently used with advanced classes, particularly in review. In the Department of English, no opportunity is lost for bringing students before the class, to read, to speak, or to answer questions.

In addition to this, as a special means of English instruction, classes in public speaking have now their regular place on the programme of subjects taught. The art of public speaking can be acquired in no other way than by continued practice, and the aim in these classes is to give the largest possible amount of practice to each student. Entire liberty is allowed in the choice of subject, the only conditions imposed being, that each should be ready to speak when his turn comes, as announced, and that the fixed time limit be not exceeded. The teacher's duty is light, but important. All that he can do, with advantage to the student, is to lay down a few principles at the beginning, and to criticize each speech. But the method and the spirit of the criticism are of consequence. Each speaker's qualities, of strength and of weakness, must be pointed out, but he must not be discouraged or made self-conscious.

There are obvious limitations to the usefulness of classes in public speaking. The larger the class, the larger the audience, and the better

the training for each speaker. On the other hand, the larger the class, the less frequently can each man speak, and, therefore, the less actual training he gets. At the best, no one student can hope to be given more than one or two chances to speak during the term. This in itself is very little indeed. To make the most of the opportunity the student should be very observant for himself, to note the qualities in other speakers that make for effective speeches. He should lay to heart the criticisms upon his own and other speeches. And he should supplement this formal class exercise by making full use of the various societies of the college. On the whole, it is evident that a large number of the students make a good use of these opportunities, and it is not too much to say that the average showing made, in society debates, in debates at home and abroad with other colleges, and in speeches delivered at the annual contests, is highly creditable.

There are but a few words left to say respecting the study of English authors. The opinion is sometimes expressed that more time might, with profit, be spent in composition and in public speaking in the English classes, and less time in the study of English authors. I am fully convinced, however, that we spend not too much time on authors. Before students can be good writers or speakers, they must be familiar with correct standards of thought and of expression. A critical study of the best authors furnishes these standards. The prevailing vices, both in writing and in speech among our students, are a commonplaceness of thought, vulgarity of expression, and a false taste that displays itself in "fine writing" and in bombastic oratory. There are no better correctives for these vices than a critical study of the best English authors, which furnishes new and nobler ideas and chaste diction, and teaches the student that language and style must be in keeping with the subject.

Blessings be with them—and eternal praise,
Who gave us nobler loves and nobler cares,—
The poets, who on earth have made us heirs
Of truth and pure delight by heavenly lays,
Oh! might my name be numbered among theirs,
Then gladly would I end my mortal days.

—*Wordsworth.*

J. B. Reynolds.

The Relation of Botany to Agriculture.

THE province of botany is the investigation of the structure, habits and life-processes of plants, with a view of determining exactly how they live and are related to each other and to their surroundings. Since so much of the farmers' work is dependent upon a knowledge of the conditions governing the growth of crop plants and weeds, it naturally follows that amongst the mass of information which has accumulated relative to the life of plants, there is much, that if sorted out and classified, may be of great value to him. It is the special function of the agricultural botanist to draw from botanical science such facts and principles as shall be of the greatest value to the practical agriculturist, leaving to one side much that may be of great interest to the purely scientific student, but not having any direct practical bearing on his daily work. Illustrative of special lines of botanical work that are of direct benefit to agriculture, we may instance the research that is now being done on plant-breeding; on the life-histories and dissemination of, and preventive and remedial treatment for, parasitic fungi; on the habits of weeds and methods of their extirpation; and on the establishment of properly equipped stations for testing the purity, germinative capacity and energy of farm seeds.

BOTANY AS A PART OF A LIBERAL EDUCATION.

Apart from this direct bearing of botany on agricultural practice, there is much in a well-ordered botanical course to furnish the intellectual training required for the successful prosecution of any work for which habits of close observation are needed. We do not wish for a moment to give the impression that we consider botanical work in class-room and laboratory to be in any sense a substitute for a practical agricultural training, but we do venture to assert that other things be-

ing equal, that man will grow the better crops who has the wider knowledge of the methods and facts of botanical science.

THE DEVELOPMENT OF BOTANY AT THE O. A. C.

The story of the origin of the Department of Botany illustrates the growth of the College and the advancement of science in general. Though the subject has already held an important place in the college curriculum, it was not until July, 1905, that a separate department was established. At the time the college was founded in 1874, and for many years afterwards, botany was included in the general course of natural history. In 1898 a Department of Biology and Geology was established, and this arrangement was continued until 1905, when, on account of the ever increasing demands upon the Biological Department by the students and the public, it was found necessary to sub-divide the work, with the result that the present separate departments of botany, and of entomology and zoology were created.

In the early days of the college when one man had charge of all the subjects pertaining to natural history, there was little or no equipment for the teaching of natural science. Botany, entomology, zoology, geology, physics and horticulture were all taught in the same classroom by the aid of a few crude charts and with a most meagre supply of apparatus. The Natural History Department at that time had its headquarters in the main college building, the classroom and laboratory being in what is now known as No. 1 Classroom. In 1892 when the present horticultural building was completed, the Natural History Department shared the laboratory and classroom with the Department of Horticulture. By this time considerable apparatus had been obtained and a herbarium established. With the growth of the college and the consequent increase in the numbers of students, and in the demands of the public upon the department, it was found that the laboratory in the horticultural building was far too small for the classes and investigation work, and for several years the Department of Biology labored under great disadvantages. In 1902, however, with the completion of the present biological building a new era dawned. Commodious laboratories and classrooms made it possible to give the proper amount of attention to laboratory instruction and investigation work. The possibilities for increasing usefulness are great, as with each succeeding year the farmers and horticulturists throughout the Province are becoming more alive to the fact that the successful grower of crops is the man who fully understands the physiological and pathological problems with which he has to contend in his daily occupation.

TEACHING AND INVESTIGATION.

Like other departments of the College, the work is twofold. There is the instruction of the students and the carrying on of investigation. This latter has been chiefly along the line of spraying for fungus diseases and treatment for weeds.

During the June excursions it carries on a line of instruction for our visiting farmer friends in the Information Bureau. In January, during the Short Course, it helps in the seed work by giving a short course on weeds.

HELP THROUGH CORRESPONDENCE.

For farmers sending in samples, it identifies weeds or weed seeds; makes germination tests for seed grain, advises in smut treatment, etc. For gardeners, it offers to identify diseases

of plants, and to suggest methods of control. For teachers and pupils it identifies plants, seeds, etc.

EQUIPMENT.

A lecture-room and two large laboratories are made use of for this work, and glass houses for physiological work are about to be erected.

In addition to microtones, paraffin baths and physiological apparatus for advanced and research work, the laboratories are supplied with microscopes and general apparatus for the use of students.

A good supply of material is kept on hand for student use, and the herbarium connected with the department contains a collection of Ontario plants, as well as many foreign ones, and an extensive collection of fungi, which can be used for reference.

The museum, which is also in connection with the department, contains many interesting and instructive botanical specimens.

OUR POINT OF VIEW.

As a rule, the students who enter our classes in the first year have had little previous training in botany. Our public schools have not yet done much in the plant side of the prescribed Nature Study, as teachers are not prepared to handle the work. The boy on the farm may have been directly or indirectly concerned for years in the growing of plants, but without stimulus and direction from a sympathetic teacher, many forms and processes have escaped notice. On the other hand, students who have had instruction in High School classes, have to start over again, or at any rate change their view point. Ours is a technical school for farmers and plants are looked upon as machines for extracting raw materials from the soil and air, and at the same time building it into finished products. The processes and organisms through which these are accomplished, the condition favoring or militating against these processes are our legitimate and most important study. It is not so much a question of what is the name or relationship of the plant, as what is it doing and how is it doing it.

BOTANY OF THE FIRST YEAR.

So long as the season permits, the study is carried on as far as possible out of doors where the plants grow. Excursions are made to field, garden, forest and roadside, with instructors to direct observation. Note books are employed for recording. Trowels are used for digging out hidden parts. Note is made of the plant's environment and its adaptions thereto. Returning to the laboratory closer examination is made of roots, stem, leaf, flower, fruit or seed, and the written record completed. This record is not considered as the be-all and end-all of the study, but as a guarantee of a personal introduction having been brought about between the student and the plant. The teacher has done his chief work in this. It remains with the student to cultivate closer acquaintance, when he goes back home if his mind has become alert and his interest aroused. In this way, in the fall months of the first year, is botany commenced. A preliminary acquaintance is made with the common plants of the common places.

BOTANY OF THE SECOND YEAR.

As in the first year, the work is as far as possible out of doors, and always practical. The work is much extended, however. Twice the time is allotted to it. Special attention is given to the collecting and identifying of weed seeds. Grasses are studied. Plants, such as smut, rusts, and mildew, that cause diseases in other plants are dealt with. Those that have an economic

value as food, forage, medicine, fabrics or timber are considered. Closer examination of structure is made and experiments are carried on to demonstrate life-activities. At the end of this work, a student has a broadened outlook regarding plants; world-wide in some particulars. He knows them as having family relationships, common vital processes, common diseases; as having many and varied economic values and uses. As a guarantee of this plant knowledge, he is required to present at the end of the year a collection of fifty pressed and mounted plants, twenty of which must be weeds and a collection of the seeds of twenty-five troublesome weeds.

BOTANY OF THE THIRD YEAR.

While the work covered in the first two years may be looked upon as complete in itself, it was only complete as a small part of a large whole. In the third year through laboratory and lecture, a broader and more systematic study is made along two lines—morphological and physiological, form and function. The microscope is put into the student's hands. He sees things closer. He sees smaller things. He gets nearer to the bottom of explanations. The formal botanical text book becomes one of his working tools. He sees plants as a scientist and not as an economist. He finds out that through the myriads of form there has been a remarkable progressive development from the simple sea weed to the complex flowering plants; that Nature has not been standing still, content with her handiwork. He asks, too, in experiment for fuller meaning of the plant life; he inquiries into the hidden mystery of how plants grow, how they get their food, how they make their products. He learns more of the foundations of agriculture in science. He is no less an agriculturist; he is that with broadened vision.

To round off this year's work in book and laboratory, there is a six-weeks' course in Nature Study. In this, there is opportunity for fixing out-of-doors, many of the matters of in-door study during the previous winter.

BOTANY OF THE FOURTH YEAR.

This is the year of specialization, and the botany is marked thereby. Hitherto all students covered the same work. Now the agriculturist confines his attention to grasses, forage crops and their diseases; the horticulturist makes a special study of flowers, vegetables, fruits and their diseases; the forester takes up the study of trees and their diseases, while the biologist concerns himself, in general, with all phases of the subject. The microscope and text book are more and more the student's working tools, although independent work into unrecorded places is undertaken, too. In each division, collections are made representative of the plants with which acquaintance has been made.

THE GRADUATE'S BOTANY.

With all this four years' training, it is not to be understood that botany is finished. The graduate may express his thanks that he is through with it. He is not. He may not be using his acquired technical knowledge of plants in his daily avocation; but his training in looking at and experimenting with plants, unconsciously shapes his future attitude towards them whether in field, forest or garden. His course in botany has been only preliminary, not completed. His post-graduate course continues while life lasts. He represents an agriculturist whose foundations are laid on science.

S. B. McCready.

Entomology and Zoology at the College.

THIS department was separated from the Department of Botany and Geology during the summer of 1905 in order that a better distribution of Biological work might be attained, and though, in consequence, only a young department, it is nevertheless already well equipped and doing good work. The course pursued includes instruction to students, and theoretical and practical investigations in Entomology, Zoology and related subjects.

The space occupied by the department comprises two laboratories, two offices, an insectary, and a class or lecture-room shared by the Department of Botany. There is also a store-room for chemical reagents and apparatus not in use, and a photographic dark-room used by the two departments in the Biological building. A large portion of the Museum on the ground floor is occupied by the Zoological collections, and the extensive library of the Entomological Society of Ontario, which is available for this department, occupies considerable space in the stack room of the College Library in Massey Hall.

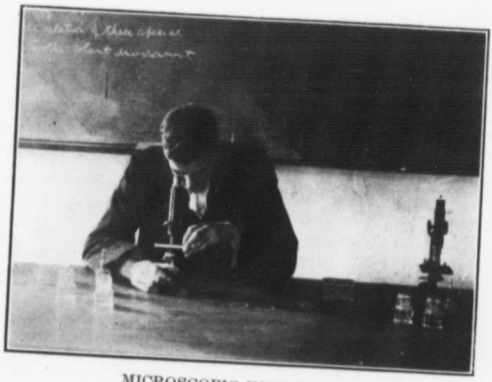
Laboratories and Class-Rooms.

There are two large laboratories in connection with the department, the Entomological and Histological. The Entomological is a spacious, very brightly lighted laboratory in the southwest portion of the building on the third floor. It contains seven large convenient work tables for investigation, dissection of specimens, etc. A row of large cabinets on one side of the room against the wall is filled with extensive collections for student work, two other cabinets contain reference collections, one of which is the valuable Gibson collection of Lepidoptera. An excellent enlarging camera also stands at one end of this laboratory for use in thesis or other investigation work. In this room lectures are given to the third year, and the practical work in Entomology, such as dissection, tracing out insects, etc., is performed. It accommodates about forty students.

The Histological Laboratory is on the opposite corner upon the same floor. In it the greater part of the more advanced work in Zoology, Histology and Animal Physiology is done. It is reserved mostly for the senior years, specialists, and departmental work. It is well equipped with paraffin baths, microtomes for section cutting, stains and other chemical reagents, and about twelve microscopes for use of students. In this room has lately been placed a splendid micro-photographic apparatus, manufactured by Leitz & Co., Germany, with which photographs of minute objects can be taken. A collection of bird skins for identification purposes in ornithology or bird study is also kept here for convenience of students. Two machines for the purpose of obtaining mites for zoological purposes are also in use. A large collection of zoological types for lecture and dissection purposes is kept in the adjoining store room. One of the Biological (Entomological) offices

also opens into this laboratory; it contains a number of valuable reference works and pamphlets on Entomology and Zoology. On the southeast corner of the building is the Biological class-room, which will accommodate about ninety students. It is equipped with a modern Bausch & Lomb projection lantern which can be used either for the presentation of lantern slide pictures upon the screen, or, by means of an ingenious device, may be used to project high magnifications of microscopic slides for direct demonstration purposes in anatomy, etc., and is a most important aid to lecture work. The department is equipped with a large number of slides for illustrating lectures in this way.

On the second floor is the office of the Professor of Entomology and Zoology, in which are many valuable Entomological works and extensive collections of Coleoptera and Lepidoptera. The dark room for photographic purposes is also upon this floor.



MICROSCOPIC INVESTIGATION.

On the ground floor is the Museum, in which there is a collection of mounted specimens of Canadian birds—a very complete and beautiful collection for purposes of study, each bird being named, with a card bearing information as to its habits and distribution in Ontario placed beneath it. There is also a somewhat smaller duplicate collection for class work, which may be handled to permit of more minute examination. A small collection of stuffed and mounted mammals occupies one case, and a small but extremely beautiful collection of shells another. A number of cases containing the large and extensive collections of the Entomological Society of Ontario, by whose transfer of headquarters the College has been greatly enriched in the way of reference collections, are kept in the Museum. Another cabinet contains a variety of objects interesting to biologists from the Island of Jamaica, which were collected by Mr. Jarvis during a prolonged visit, and from which much information may be gathered regarding the fauna and flora and native work.

The latest addition to the Department of Entomology is the Insectary. This is situated at the rear of the Biological building, facing south, and consists of two greenhouses, a student laboratory and a smaller department laboratory. These are constructed after the most modern types, and with all the latest improvements. They are not yet completed, but are expected to be ready for use during the coming summer, and

will constitute a most important aid to Zoological and Entomological work. In them aquaria and terraria will be set up and insect breeding carried on. In the winter plants infested with various insects and fungus diseases will be grown for the convenience of the students, and to enable demonstrations to be made in fumigation, preparation of spraying mixtures, and the application of sprays. During the summer months investigations in the life histories of various insect pests will be carried on, and their parasites and insect enemies studied.

The smaller laboratory will be chiefly used for advanced research work, and in it theoretical and practical problems affecting the farmer and fruit grower will be dealt with. The value and importance of this insectary for Entomological and greenhouse work can hardly be overestimated.

Lecture Work.

A great part of the time of the department is employed in lecture work. During the College year the following courses are given:

1. **Elementary Zoology.**—First year, winter term, two periods of lectures and one of laboratory work each week, covering the chief divisions of the animal kingdom and their principal characteristics, special attention being given to the species common in this country and those of economic importance as regards agriculture and horticulture.

2. **Economic Entomology.**—Second year, fall term, two periods of lectures and one of laboratory work each week. This course has afforded instruction in the external anatomy and structure of insects, their metamorphoses and life-histories, and an outline of their classification. Special attention has been given to those affecting farm, garden and orchard crops, and those of a beneficial character; and to insecticides and other methods of dealing with noxious species. From time to time the lectures have been illustrated with lantern pictures, enabling the whole of a large class of students to see details of form structure, ornamentation, etc., which could not otherwise be conveniently brought before them. During several weeks at the beginning of term an afternoon was spent in field excursions for collecting specimens and making observations, but when the weather became too inclement for out-of-door work of this kind the time was devoted to laboratory work.

3. **Systematic and Economic Entomology.**—Third year, both winter and fall terms, two periods of lectures and one afternoon of laboratory work each week. This may be regarded as the most important course in Entomology during a student's College career. A systematic series of lectures is begun in September and carried through both terms. The division of the class of insects into orders is first treated of and their characteristics described. Each order is then dealt with in turn, and the general classification into superfamilies, families and tribes is carefully taught; the more important genera and species are taken up in detail and much attention is paid to the life-histories of common forms and those of economic importance. The lectures are illustrated with diagrams and specimens, and occasionally by a series of lantern pictures of the more important insects belonging to the order under consideration. It is expected that by the end of the College year the students in this class will have acquired a sufficient knowledge of general entomology to be abe to know at sight to what order and family any common insect belongs,

whether it is noxious, beneficial or harmless, and, if of a destructive character, how best to deal with it. A knowledge of this kind cannot fail to be of immense benefit to all who intend to devote themselves to horticulture or agriculture in any of their branches.

4. General Entomology.—Fourth year, both winter and fall terms, six hours of laboratory work per week. This course is for those students who take the Biological or Horticultural options in the College curriculum. The work is of a much more advanced character than that of preceding years, and includes careful field observations as long as the weather permits, studying life-histories, making collections in special departments and doing systematic work in the determination of specimens.

OFFICE OF THE ENTOMOLOGICAL DEPARTMENT.

5. Systematic and Economic Entomology.—Fourth year, one afternoon each week in laboratory during the fall term and two afternoons in the winter term.

The fourth year specialists in Biology receive lectures in laboratory and field work. In the laboratory representative species are examined with special reference to parts employed in classification. In the lectures are discussed the principles of classification and the characters and relationships of groups, and the habits and life-histories of the economic species. In the field are studied the appearance and habits of the economic forms of animal life.

6. Vertebrate Histology.—In this course the students specializing in Biology receive lectures and demonstrations of the gross anatomy and the microscopic structure of the vertebrates. Especial attention is given to the methods of staining, imbedding and sectioning animal tissues. The material

equipment consists of microscopes, camera lucidas, microtomes, photo-micrographic camera and the projection microscope which is available for class demonstrations.

7. **Insect Histology.**—This course accompanies the course on vertebrate histology. Lectures and demonstrations are given on the anatomy and histology of the insects. Especial attention is given to the study of the mouth parts and the respiratory system.

8. **Physiology.**—The fourth year specialists in Biology receive lectures and demonstrations on elementary and experimental physiology of the human body.

9. **Advanced Research and Thesis Work.**—This is confined to students of the fourth year who prepare a thesis on some approved subject. The apparatus and literature of the department are at their disposal, but the student has to carry on the work to some extent without instruction. The production of a satisfactory thesis indicates a student's ability in theoretical and practical investigation.

Investigation Work.

This work is carried on by the department during the summer months when lectures are suspended. It may be divided into practical and theoretical, the practical consisting of experiments with insecticides and fungicides upon infested orchard or garden crops. The experiments are planned during the winter and early spring, so that they can be carried out on a definite system. At the same time systematic study and investigation are bestowed upon various families of insects. Much time is also devoted to correspondence in answering enquiries respecting injurious and other insects, the number of which is steadily increasing.

Entomological Society.

During the year 1905 an Entomological Society was organized among the students and incorporated as the Guelph Branch of the Entomological Society of Ontario. The meetings held were always full of interest. Since then the headquarters of the Society have been transferred to the College, which has now the inestimable privilege of using the large and valuable library of the Society and its extensive reference collections. The meetings of the Society, which are held in the College, are well attended, and a number of the students are much interested in this important phase of agricultural work.

J. S. C. Bethune.

The Manual Training Movement.

THERE never was a time in the history of Canada when there was such unanimity in regard to education. It is conceded by all that our system needs reform. No radical changes are required; what it wants is development of present possibilities and adjustment to new conditions. The demand is for practical, common sense education that will enable the future generation to earn a living, meet and solve the problems of life. But this can never be realized unless the child is given every educational advantage to make the most of his opportunities. This means that "the whole child must be put to school"—developed mentally, physically and spiritually.

The development and progress of Manual Training since its inception at the College has been phenomenal, owing to its various extensions and ramifications, and the quarters at the Macdonald Institute, where the work was first carried on, proved altogether inadequate. A generous appropriation by the Provincial Government has rendered possible the erection of a commodious new building in which all departments of the work are now carried on.

The building is a two-storied structure of red pressed brick on a limestone foundation, the roof being of slate. It is one of the finest on the campus. The predominating lines are vertical, relieved somewhat by the segmental discharging arches of the upper windows in the piers and the arched copings. It is well proportioned and on the whole a very pleasing structure, being 146 feet long by 64 feet wide. The first and second floors in the southeast wing are occupied by the carpenter. The basement contains the farm smithy, the painter's workshop, and rooms for storing lumber.

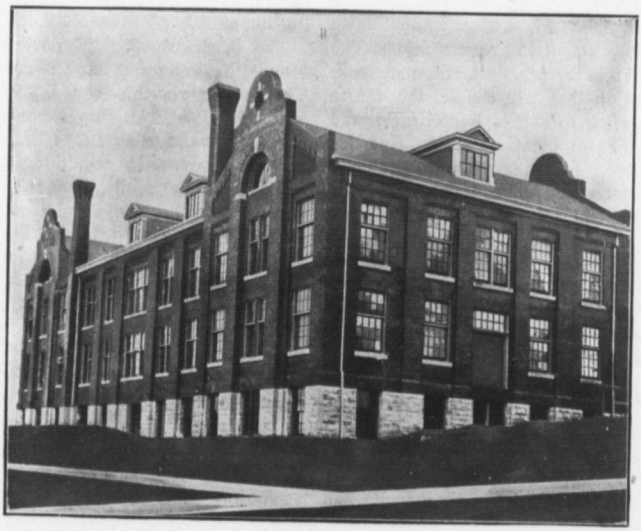
The northwest end is devoted to Manual Training and Farm Mechanics. The basement of this wing is fitted up with ten downdraft forges, connected with a blower and an exhaust fan, and power driven. In addition, it is equipped with anvils, swages, blocks and all necessary tools and appliances for smith's work. On the first floor are offices and store-rooms, and over the forge-room is the machine-room, containing two screw cutting lathes, power drill, power hacksaw, power grindstone, and benches to accommodate fifteen students at fitting, chipping, filing and sheet metal working. Above this room on the second floor are classrooms, fitted up for mechanical drawing and primary constructive work.

The basement of the central portion is used for storing farm machinery and implements. Over this, on the first floor of Machinery Hall and immediately above, is the wood-working room and stock-rooms.

The Machinery Hall is furnished with four gasoline engines of two to six horse power. It contains the most modern agricultural implements and machinery, separate parts of the same machines and engines to be used for purposes of instruction and demonstration. A large number of implements,

machinery and domestic utensils, showing the progress and development of farm appliances from the earliest pioneering days have been purchased by the Hon. Nelson Monteith, Minister of Agriculture, forming an excellent nucleus of a valuable and instructive collection.

The wood-working room is equipped with twenty benches, wood-turning lathe, grinstone, and a full equipment of hand wood-working tools.



THE MACHINERY HALL.

The work of this department is now dominated by five distinct aims:

1. A Course for Agricultural Students in Wood-working and Metal-working.
2. A Course in Farm Mechanics.
3. A Normal Course for the Training of Instructors in Manual Training.
4. Correlated Course of Manual Training with Nature Study.
5. Optional Courses in Wood-working, Wood-carving, Art Metal Work, Basketry, etc.

1. Agricultural Students' Course.

This department originated in the desire to give our young men such a training as would not only enable each individual in his own special occupation to know more thoroughly the fundamental principles of his calling, to wield more adroitly its special weapons and be able to apply more skilfully its refined artifices, but to achieve more quickly, proficiently and economically the aims of his life, whether it be agricultural, professional or commercial. It is organized so that with the other departments of the college it gives the student a general knowledge of what constitutes the basis of technical training. To know something of the mechanical construction of a gate; its balance on its hinges; the mechanical

action on the gate post; to understand the true mechanical principles on which a good plough is made and worked, as distinguished from a bad one; to know how to forge a bolt and thread it or to select the right grain in and kind of wood for a fork handle or a mallet, are of considerable advantage. In connection with the many sciences he has to learn, the young farmer will be the better through life for knowing than for not knowing the "nearly nothings" which can be learned in the workshop only. A general command over the use of one's fingers is a very important element of industrial efficiency. It can, of course, be developed by training, but the greater part of this may be of a general character and not special to the particular occupation, to be able to bear in mind many things at a time, to have everything ready when wanted, to act promptly and show resource when things go wrong, to accommodate one's self quickly to changes in details of the work done, to have always a reserve of force which will come out in emergency, these are the qualities which make a great industrial people. To give our students this needed adaptability, the new building just completed furnishes facilities for carrying on operations and give instruction along this line of work. To our success as a nation it is necessary that the young race of men who are to do the work should have passed through better training than their fathers and possess superior skill to the youth of other nations.

The instruction does not aim at the production of finished articles, though all exercises are embodied as far as possible in complete objects, but to inculcate principles, emphasizing the reason for doing work in the particular way which is the result of practical constructive experience. These principles involve exercises having values only as they have rendered educational service in the process of construction, or in their manipulation. In this way the student not only acquires conception of skill as such, but also the idea that correct results are only attained by the skilful application of a plan clearly thought out. The endeavor is to find the best plan, and the reason for its preference. In changing conditions of the thing in hand during its construction, there is a constant necessity for creating new means to meet new requirements and directive skill and logical processes thus evolved make Manual Training rise to the level of scientific or mathematical studies as a means of intellectual development.

The Manual Training.

First Year.

Woodworking:

Drawing.—Freehand sketches of simple objects—implements and parts of machinery. Geometric problems, isometric projection, working drawings of objects made in workshop.

Benchwork.—The use, care, sharpening, grinding and adjustment of the jack, smoothing block and jointer planes; chisels, gouges, brace and bits; rip, cross-cut, tenon and turning saws; simple joints—their construction and application. Simple, useful objects.

Timber.—Its preservation, principal varieties of wood and their leading uses. (Thirteen lectures.)

Second Year.

Metal Working:

Drawing.—Freehand sketches of implements and parts of machinery. Projection, machine details—bolts, nuts, screw threads. Working drawings of objects made in workshop.

Forge.—Fire and heat—tools, ham-

mer, chisel, fuller, swedge, their care and use. Typical processes—drawing, bending, forming, twisting and welding —making simple objects—gate hook, ring, staple, welded eye.

Machine Shop Practice.—Chipping, filing, cutting screw threads; hardening and tempering, cold chisel, nuts and bolts, hinges, etc.

Sheet Metal. — Soldering, forming, riveting—tin cut, funnel, etc. (Thirteen lectures.)

The making of an original model suitable to farm conditions.

Farm Mechanics.—This course will treat of farm implements and machinery—their construction, operation, adaptability, efficiency and durability: the effect of adjustment and condition of wearing surfaces and edges on draft, and simple repairs. Putting and keeping in adjustment and working condition ploughs, harrows, cultivators, seeders, mowers and self-binders; detaching parts of farm implements and power machinery, including grinders, pumps, fanning mills and gasoline engines; assembling and fixing of parts, testing, and getting machines into working order.

Normal Course.—It is arranged to give teachers, holding at least a second-class certificate from the Normal Schools, desirous to become teachers of Manual Training, adequate instruction in the various subjects comprised in the term "Manual Training." Its object is to familiarize the students as far as possible with materials, tools and processes commonly used in the mechanical arts. It is not intended to impart skill, which can only be acquired by extended practical experience, but to provide a medium of expression in the form of constructive work, and to call into use ethical influences that bring a sense of enhanced value to the worker, with the result that he feels he contributes something to the life around him. This course of study covers a very large and varied field of work. It is divided into:

1. Primary Constructive Work—Which includes paper folding, cutting, tearing and mounting. Clay modelling, thin carboard work, basketry, weaving and whittling in thin wood. Art—Hard and flexible point; drawing and coloring of leaves, sprays, buds, birds, insects and flowers; sketching, designing, black and white, color schemes illustrating various harmonies. Structure and function of the brush in defining forms by their masses.

2. Grade Work.—Thin and thick cardboard, wood-working, art metal work, drawing, freehand sketches, working drawings. Plane and solid geometry. Isometric projection, construction and constructive design, tools, their care, use and sharpening; analysis of the action of cutting tools; timber, its structure, growth, disease, seasoning; principal varieties of lumber, yield, trees and their economic values.

3. Metal Working—Materials, tools and processes; common work-shop materials, cost; malleable, cast-iron, wrought-iron and steel, copper and brass, zinc and tin, lead; the uses of fluxes, tallow, resin, zinc chloride, borax.

Machine Shop Practice — Tools, templets, lining out, drilling, drifting, chipping, filing, scraping, methods of unions, tapping and threading.

Lathe Work — Cutting tools for lathe; tools and tool angles, cutting, speed and feed, chuck and chucking, centering, slide rest turning, screw cutting. Forging—Care of fire and forge, tools, breaking, hammering, drawing, pointing, bending, shaping, punching,

twisting, welding, upsetting, hardening, tempering, annealing and brazing.

Sheet-Metal Work—Processes, with and without heat. Surface fusion—Soft soldering with copper bit, blow pipe, bunsen burner, silver soldering.

4. Theory and Practice of Manual Training.

5. Thesis.

Correlated Course for Nature Study Students.—This course includes woodworking, the making of such objects as are useful in connection with Nature Study and School Gardening—plant labels, flower sticks, garden reel and stake, germinating box, spread board, bird's nest-box, bee hive, sundial, insect cages, etc. Much of the primary constructive work and the art of the regular Manual Training Course is also embodied.

During these short courses we endeavor to make the course as practical as possible so as to lead the students to see and to realize the close relation between the hand and the head, doing and knowing, and that this kind of work secures most valuable results in many directions, as it furnishes a new field for perception, for when the child represents with pencil or brush or by construction, he learns to observe closely and to discriminate values which are involved in correct observation; it trains his hand and eye to cooperate with judgment and learns to observe, to test values in symbols; and trains his eyes and interpreting judgment to co-operate with hand and will in obedience. Form making of cardboard requires the projecting of plan, a judgment in use of material, laying out of work, cutting it, fitting it, and putting it together. This work involves the exercise or application of arithmetic. It is the handmaid of geography, of history, of literature. In them lie the satisfying activities for the child. These exercises give the utmost pleasure and prevent exhaustion by creating energy in accomplishing a result, getting the thing done. The child's interest is not restricted to the work of the objects, by means of which he makes his start in feeling, knowing and doing, but he has perhaps a greater interest in institutions of the social world, of which he forms a part. The start in knowing and doing is made here, as in the object world, by contact with experience in participating and interest in the forms or parts whose construction satisfies him, gives him pleasure, and whose purposes affect him. The adjustment of a block of wood to a specific place for a specific purpose is training definite and valuable. The folding, creasing and cutting of a piece of paper, making a definite form of a definite size for a definite end, is Manual Training as valuable as the making of a pattern for a piece of machinery.

Probably the greatest and most varied development that has taken place is along the lines of Optional Courses for the students attending the Domestic Science Department and others—plain carpentry, woodcarving, art metal work, basketry, and color work. The aim of this instruction is to give the student a training, an appreciation of the beauty that lies in simplicity and soundness of construction. Use and beauty are closely related, and it is not possible to have either in its highest degree without the other. In making useful things as well as possible, the pupils acquire a sense and a taste for the beautiful. Make a thing useful, and the useful will be beautiful in order to do it. The application of taste to home surroundings and every-day affairs; an inculcation of the harmony of colors and their happy combination in the home will do much to beautify the life and to dissipate the common idea that beauty of furnishing consists in profusion of decoration and color; that a tastefully-furnished and decorated home must be like a crowded furniture store and a blaze of glaring colors.

John Evans.

The Financial Statement for 1906 of

The Mutual Life Assurance Co. OF CANADA.

gives the standing of the Company at decennial periods as follows:—

Income.	Assets.	Surplus.	Business in Force
1876 $ 43,493	$ 81,105	$ 13,980	$ 1,634,156
1886 315,802	909,489	61,534	9,774,543
1896 760,403	3,392,697	201,579	20,001,462
1906 2,072,423	10,385,539	1,203,378	46,912,407

With a larger volume of business to be taken care of, the expenses of the Company for 1906, including taxes, were $10,224.36 less than in 1905, while the ratio of expense to income was the lowest of any Canadian Company.

R. Melvin, President — Geo. Wegenast, Manager

W. H. Riddell, Secretary

Geo. Chapman
General Agent - - McLean's Block
GUELPH