[Continued from last week.]

AGRICULTURAL EDUCATION.

ADDRESS OF PRESIDENT ABBOT, OF THE MICHIGAN STATE AGRICULTURAL COLLEGE,

Before the House of Representatives of the Michigan Legislature, March 4, 1875.

COMBINING LABOR AND STUDY.

It seems to me that there is little hope of returning students home from a college to a farm in any considerable numbers, if they are permitted to pass their college years without manual labor. I think I see in the retaining of habits of daily manual labor, in the interest which studies and labor may be made to shed upon each other, the beginning of the remedy for this abandonment of the farm by young educated men. It certainly does not lie in the fact that the occupation of a farmer does not afford scope for thought, and a field for the employment of the largest fund of knowledge. Except in the more constant contact with other men, ordinary trades and manufactures and commerce offer no such delights for the man of taste as those that the farmer is privileged to enjoy; the labor is not harder, and is more varied; and the profits compare well with the average returns for any kind of labor. But labor has not received due honor.

Man is the creature of habit, and the customs of the world are against receiving an education and then farming. The college has tried to withstand these tendencies, and one of its best means is its labor system.

The following are the principle features of the labor system as existing at the Michigan State Agricultural College:

1. All the students labor, except when exempt on account of physical disability. This is the requirement of the law of the State, which also prescribes the time—three hours daily—as a general rule. I attach much importance to this rule. The agricultural colleges of Maine and Iowa have nearly similar provisions. Massachusetts requires six hours manual labor a week, excepting however one-third of each year, and still one other third of the senior year, when no labor is required. The other colleges require no labor, but several of them furnish it when applied for. It is sometimes asked why it is not as well to let students labor or not as they may choose. So far as labor is requisite in order that they should know how to do things, they might as well be excused from the practice of surveying and of chemical analysis as of farm and garden work. Very much they can indeed learn at home, if they come from farms—some do not come from farms—and many things are done here that may not be done on ordinary farms.

But there is much in the atmosphere of a peace that determines the habits of those that resort to it. Certain colleges are noted for certain characteristics of its students. If a student goes into a college where almost none work, he will be apt to do as others do, if he can. If the general aspect of the institution is one that looks toward the professions and literature, the ordinary young man will turn his face and bend his steps in the same direction.

An agricultural college should exert a different tendency. For this reason it should be separate from other schools where labor is not required. Labor should be demanded of all, that its good influences in maintaining habits of daily labor, taste for rural pursuits, and imparting skill, should be general, and create the proper feelings toward it, in all who are connected with it.

I believe this object has been accomplished at the college. I listen to the orations of seniors and juniors who are permitted a large freedom in what they advocate. I mingle with them at their work, and I have never known students study books in any institution with greater general faithfulness than they labor here, and the way of speaking of labor is appreciative, and honorable alike to students and the institution.

2. The regular hours of labor are from 1 to 4 o'clock each afternoon, except Saturdays, when it is furnished only on request. As a matter of fact, five-sixths of the students do request it. This arrangement leaves the entire forenoon for study and classes, and gives time for complete rest after labor before the study of the evening.

Some years ago the students were divided into three divisions, the first division going to their work immediately after breakfast, a second division at the end of three hours, and a third in the afternoon.

The present plan gives a better part of the day to study, when the mind is fresh. Three hours work, which a mature man would not mind, is a tax on the vital energies of an immature, growing boy, that is apt to make him sleepy or inert afterward. The plan enables us to work the boys more in groups under proper leaders and officers. Some of the students are unaccustomed to work, many are young, and it is essential to their good habits, as a general rule, here, as in everything else, that they do their work under the lead of some one who knows how to do it. The arrangement of lectures and work under this system is more readily made.

The change was made years ago. It was explained to a committee of the House of Representatives, and the additional cost of the plan was shown. It was approved by them, and by many succeeding committees, and has worked with us much better than the other plan.

3. The officers of the college work with the students, and personally superintend the work. It is a matter of my personal knowledge that the professor of agriculture and the professor of horticulture go out to the three hours daily work with quite the same regularity as the students, and stay through the three hours. There are besides, two foremen on the farm, both excellent practical farmers, and a foremen on the gardens; and the foreman of the greenhouse, when not needed in the house, always works with the students outside. All of these are part of the educational force of the institution. It is in this oversight and leadership that the pupil finds it to his educational advantage to work. To one who looks upon the college chiefly as a farm, and the students as so many hired men, this may seem a waste of force, but to any one acquainted with the demands of education it will not appear so. Efficient schools are those that are well supplied with competent teachers. The university has four professors and instructors in chemistry, and has, I am certain, none too many. Our farm is a large factory, where the students are scattered out of sight of each other, and busied with more various processes than go on within the chemical laboratory, and we, too, have none too many to look after the working habits and instruction of our pupils.

4. The labor of students is intimately connected with the subjects of their lessons. Lectures are not infrequently given in the fields, or yards where the stock is kept. The principles learned from books find their illustrations in the field or workshop; and on the other hand, what students observe while at labor stimulates them to the study of principles.

While the freshmen and seniors alternate between the farm and horticultural departments, the sophomores work the entire year on the farm and the juniors on the garden. This gives the superintendents opportunity for somewhat of a more systematic instruction in the two departments, and enables the students to keep informed of a whole years' continuous plan in the two departments.

The teamsters employed by the month do not labor where their work will forward farming oprations most, but where they will make best preparation for the students' labor, and the labor of students is very varied. They help take care of the stock, they milk and feed the cattle, drive the teams, run the machinery of different sorts, tend plants and harvest crops. Scarcely anything is regularly done by the hired help, except the main charge of cattle is with the herdsmen, whom the students assist, and the care of horses is with hired men chiefly. The improving work is done in good quantity by the students themselves, and especial care is taken to make the labor various. Students are not kept at the labor they can do best, but are changed from one kind of work to another. Besides these farming operations they do surveying and planting, they graft and bud, they often have special plats of some vegetables under individual charge; they repair tools and make fences and gates. They lay out and construct drains and repair buildings. The piggery is almost entirely their work, so is the inside work of the horse barn and the fitting up of the windmill.

Such a system as this differs essentially from that of a simple manual labor school, which (as is often stated) have always been failures.

Do students shirk their work? But very little. Never more than students are accustomed to shirk lessons here or elsewhere. Most of them are accustomed to work on entering; most of them need the seven or seven and one-half cents an hour allowed for faithful labor. The variety of kinds of work, the relation of it to their studies, the presence and interest of their instructors, serve to interest them in what they do. The best scholars are usually the best workers.

DOES THE LABOR OF STUDENTS PAY?

Pay how? or what? This is a college and every thing pays that is not too costly as a means of illustration, or of instruction, or of securing [illegible] college buys large museums to aid the student in his study of geology or zoology, or mineralogy, and the expenditure pays by furnishing means of study. So with the chemical laboratory, the library, etc. It is the same with the botanic gardens, the varieties of stock, fruits, nurseries, vegetable gardens, farm crops, implements, meadows, pastures, and the furniture of a college like this. They "pay" by being means of illustration, complementing the lessons of the text book and lectures. They pay by being a place on which he practices what he is afterwards to do.

Since a chemist's knowledge is more accurate after he has had practice in the chemical laboratory, therefore, here students work a half year in the chemical laboratory, three hours a day, after they have had their half-year's course of chemical lectures. The surveyor's knowledge is more to be relied on if he has actually used the compass and level, surveyed lands, calculated contents, and made plats. Students receive such practice here. In the same way they have practice in grafting, transplanting, the use of farm and garden implements, and in the manual operations of farm and garden. The college thus imparts the practical knowledge it was established to teach. If the labor teaches, gives familiarity with mechanical, botanical, horticultural and agricultural principles, and bestows practical skill, so far as such a limited exercise as three hours' work a day in varied labor can go, in so far it does pay like any other expenditure for sustaining an educational institution.

The labor system is, of course, not without its expense to the institution. Tools and teams are required in greater numbers than on a farm of equal size, especially as almost all the students work at one time. Three hours labor of a boy varied to give him instruction is not worth so much as a third of nine hours of continuous work applied where it would be most profitable. It is limited also to a set time; and ends, unless great loss would accrue, irrespective of the condition of the work. Besides, labor has to be planned for a large force for three hours, succeeded and being succeeded by a very small one. To make the labor educational requires also the constant superintendence of skilled professors and foremen, who must be paid.

But all education is costly. No student in a public institution of learning pays his expenses. Buildings, libraries, museums, laboratories, instruction, are all the free gift of communities or individuals to the students. Technical instruction is costly. And if the expense of our labor system be reckoned up and taken as educational, it will not be found to be more expensive by the hour than chemical, mining, mechanical instruction usually is.

The college is sometimes compared with a medical school or a law school, and it is asked why we should pay for what the students need educationally. The cases are not similar. In a medical school a student hardly does more than try his hand at dissection; he may plead a case or two in a moot court. But with us labor is a daily thing; it is three hours at a time, and it is valuable to the institution. If you count in the expenses of carrying on the labor system, the wages of the foreman, the interest in additional tools and the like, students' labor is no profit. So if you count the antecedent expenses without which dissections and moot courts could not be, they may be found to be expensive. But if these are counted among the necessary expenses of the college as an educational institution, as I believe they should be, then the labor of students is worth to the college all we pay for it. It is continuous productive labor. I think a student in a laboratory who earned something every day from year to year by his analyses would desire a share of the profits. The plan of paying wages is quite general, but not universal, with the agricultural colleges.

When the institution was first started sixteen cents an hour was paid as the highest wages. President Williams, in his first report to the board, April 1, 1858, says of the college: "A paramount object is to enable the student to support himself by his own labor while acquiring his education," and he adds, "Whether the student, by three hours' labor in summer and two and a half in winter, could board himself, is not sufficiently tested, nor can it be till the farm is thoroughly subdued." I think he was convinced that the students' labor would not enable them to pay their board, for before he left he suggested a plan to the board. This was the plan afterwards adopted, of having the long vacation in the winter so as to afford students an opportunity to teach.

Subsequently wages were still further lessened, as it was thought the labor was of more value to the students educationally, until the maximum wages now are eight cents an hour for the regularly required work of students.

The winter vacation, the small wages received for work, the plan of boarding at cost—a requirement of law—does place an education in this institution within the means of many who could not or would not otherwise furnish it to their sons.

Many students pay in but about $70 a year to the college, and many of them still less; some of those who work Saturdays have only from $45 to $60 to pay in for a year of board and instruction and all college dues.

EXPERIMENTS.

To experiment for the sake of discovering knowledge, and to teach, that is, to impart existing knowledge, are distinct things. Both are necessary in agriculture, as in other arts of life. They are not necessarily connected in an agricultural college, for the larger number of agricultural colleges have no farms for field and feeding experiments. Most of the European experiment stations of Europe have no college in connection with them. Doubt has been expressed whether instructions and experimenting can go well together. Thus Prof. Hilgard, late of the University of Michigan, now of California University, says: "It is my opinion that in not a few instances the educational interests have suffered by being subordinated to, or even too closely co-ordinated with, the experimental work."

In my opinion experiments should be conducted every year at our Agricultural College, and a little farther on I will endeavor to show why. But at present I ask which purpose is the main one, experimenting or instruction of students? To say that one purpose is the main one, is not, of course, to say the other is not of very great importance; but if one purpose is comparatively the main one, which is it?

If we can judge of the various enactments of Congress and the State, the college is primarily one for instruction of students. The debates in Congress and in our own State, the addresses made at the opening of the college, the example of other institutions, all indicate the same. The good to be expected from it is, primarily, the theoretical and practical instruction of students. Medicine is a science whose underlying principles are but little better known than those of agriculture. There is abundant need, and abundant opportunity for original investigation in the healing art. But from its schools we look first for education of young men in medicine. In civil engineering much original investigation is still required. The strength of materials, the laws of fluids flowing through channels, and other subjects afford abundant room for experiments; but from the schools of civil engineering we expect primarily the making of civil engineers, capable of using what knowledge there is to be imparted in the science. Keeping up with the advance of knowledge in any department, giving instruction to classes by lecturing, superintending practice, is considered usually a sufficiently laborious work for a corps of professors in any institution, and the world is glad if here and there one takes upon himself to add to the sum of human knowledge.

Nothing was more natural, however, seeing the many problems that agriculture presented for solution, than to hope that the union of professors, laboratories and farms might result in a rapid advance of the art, and the speedy establishment of its principles. Such expectations, however, were opposed to the whole history of the advancement of science. Its growth is slow, and I hesitate not to say that more is often hoped for from a single college in a few seasons than all the colleges of the earth could accomplish if they tried nothing else for the same time.

ROUGH EXPERIMENTS.

Experiments may be divided for my purpose into two kinds. The first I shall call "rough experiments." They are such as have determined that dent corn can adapt itself to our climate, that osage orange will make hedges in Illinois prairies, that sorghum is not profitable as a sugar-making plant with us. These and many other results have been gained by repeated trials made by enterprising farmers here and there, who have read of some one else's success and have risked the trial for themselves. The peculiarities of a soil, or a season that makes success or failure, are eliminated by the repetition of the trials, until at last a settled conviction pervades the community regarding something, useful to be known. By such trials and the observation of skillful, practical men, the practice of farming has grown into its present shape.

More will have to be done in the same way. New crops, new varieties of old ones should be tried. And the more frequent the trials, the more exact the detail of the practice, the more intelligent the observer and operator, the more valuable will be the results of these rough experiments. [illegible] ment of this sort that the college can hardly try one for the farmers. It must rather be only one of several who try the experiment. For the climate of Central Michigan differs from that to the East, or West, or North. Soils vary, and an experiment tried here would have to be tried also in other localities before it would settle the value of any seeds or practice.

This, too, is not an age when diplomas and colleges impose on men. They listen as willingly to George Geddes and "Walks and Talks" as to the professors of Yale and Harvard. So far as one experiment of this sort goes, an enterprising farmer can try it as well as we. The college should help in these, because it should join in whatever helps forward the progress of agriculture. But, perhaps, more rough experimenting could be accomplished by a small appropriation to, say, a half-dozen vigorous farmers' clubs. The libraries, apparatus and professorships of the college look to other purposes in addition to taking a proper share in these rough experiments.

EXACT EXPERIMENTS.

The other class of experiments I shall call "exact." They do not differ in kind from the rough experiments, but only in the care with which every element is observed and recorded.

The aim of the experimenter is to ask of nature, so to speak, one question at a time, and only one; to put the question clearly, and take the answer exactly, adding no inference of his own. He may infer, he will do so, no doubt, but the inference is his gratuity—each man may add his own. In all sciences this questioning is a matter of extreme difficulty. "Rightly to question," says Lord Bacon, "is the half of science."

In agriculture, exact experiments are of extreme difficulty, and can almost never conform to ideal tests.

President Hitchcock, of Amherst, says he had been trying experiments in chemistry for twenty years, and added: "I do not know of any so delicate as the farmer is trying." Liebeg says: "When the practical man does attempt to apply scientific teaching he is almost invariably a sufferer. He seems altogether to forget that man does not become intuitively acquainted with scientific teaching, which, like the skillful use of any complex instrument, must be learned."

These difficult experiments seem to be easy, and invite trial at incompetent hands. And so Appleton's Cyclopædia says truthfully: "In agricultural reports and periodicals are thousands of reports on the value of manures, with most conflicting statements and a chaos of results." The Hon. Amasa Walker, the distinguished political economist, who, as Secretary of Massachusetts, collated the agricultural returns of the counties of the State in 1851, said, "They are all chaos; they do not prove anything."

It is upon accurate experiments that agriculture must depend, for a change from an undeveloped art into the standing of a science.

Exact experiments demand a large outlay of money. Lawes & Gilbert have spent $15,000 a year in field experiments that have almost uniformly borne good crops. The universal testimony of those who undertake these investigations is to their costliness. Such experiments come slowly to their results. They would weary out those who wait for results. Bussey Institute, the agricultural school of Harvard University, with its farm and seven professors, is prosecuting admirable field experiments. Some seventy experiment stations in Germany, chambers of commerce in England, George Ville in the Jardin des Plants in Paris, Mechi, Lawes & Gilbert, Johnson of Yale, and all the experimenters of the world, would no doubt feel well repaid if the combined efforts of all together could elicit one new fact, and firmly establish it each year. They will altogether fail of such rapid progress. "It takes ten years, at least," says President Clark, of Amherst, "to establish one agricultural fact."—[Mass. Agrl. 1872-3 p. 182.

Accurate experimenting taken alone does not serve as an illustration of farming. The results come too slowly to the student; he needs the example of ordinary good farming before him, where the results appear from year to year.

Dr. Thomas Anderson, the chemist of the Highland and Agricultural Society, who has been an authority in experimental chemistry for years, lays it down as a rule, in accurate experimenting, that the field to be used should be divided into plots, treated exactly alike over its whole extent, and the growth and produce of each plot separately examined for two years before the experiment upon it begins.—Agricultural Transactions of Scotland, 1861-5, page 116. Then for the effect of one manuring you must wait several years, and repetition then is requisite. I give, as an example, a case taken from the New York *Weekly Tribune* for February 10, 1875, where a man burned a quantity of brush on sod ground. A corn crop, an oat crop, and one clover crop, showed no effects, but the third year the clover stood double on the portion where he had burned the brush. The writer pertinently asks, "Had I applied a different kind of fertilizer on my clover, would not the last applied have been likely to receive all the credit?"

COLLEGE MUST EXPERIMENT.

Although experiments are not the main object of the college, yet they are a very important object. There are abundant reasons why we cannot afford to do without them.

That the progress of science is slow excuses no one from efforts to further it. Rough experiments it should do to some extent, because it should help along and illustrate all the movements that aid farming, and because at slight additional cost it can perform them. But it should particularly show examples of that rigid experimenting which is costly from minuteness of care and valuable in proportion to its extreme exactness. It ought to possess the means and skill for teaching the determination of questions to the utmost attainable degree of precision, so that its graduates and students may go out qualified to help agriculture to become a science.

Not that these same graduates in their farm experiments would be as minute, generally, as the example given them. But they would be more exact, would understand the conditions present, and of those lacking more accurately, and interpret the results more consistently with the conditions of the experiments. Field and feeding experiments enough to afford ample means of study, and excite enthusiasm, as many, indeed, as the limited means of the institution admit of, should be carried on. The rest of the farm and stock would afford illustration in study, and serve, as I shall by and by show, another indispensable purpose.

In such experiments the college has already shown its skill. Great pains were taken to make the experiments exact. There has been debate as to comparative value of small and large plats; most exact experimenters using small ones. We have combined the advantages of both small and large plats. Eight small plats fertilized with bone dust make quite a field taken together, and are in the aggregate no smaller because interspersed with eight of Berry's superphosphate and eight of Baugh's superphosphate, and still more of plats unmanured. The intermingling of one considerable field with another, like the black and white squares of a chess-board, reduces the error of inequalities of soil, which mere sight and handling cannot detect.

Although for reasons that seem sufficient to the honorable board of experienced farmers and others that have the college in charge, these experiments have been suspended for a few years, the college is ready to resume them, and must do so for educational, if no other purposes.

Again, a deadening influence would fall on faculty and students if we had no experiments. None are qualified for the high office of instructors in science who are not in spirit investigators also. Truth seekers are a brotherhood, and although scattered throughout the world, here and there one, feel the subtile influence called *esprit de corps*, and help each other. Mr. Atwater, an acute observer of the experiment stations in Germany, seems to put the enthusiasm the stations awaken as not the least of their good influences. Students catch the spirit of their masters and carry it through life.

Again, the world is in need of accurate observers, of those who in common operations of life distinguish between what they know and what they think they know. The simplest statement an educated man can make of what has passed under his observation is apt to be crowded full of his theories, his inferences. It is one of the last attainments of a disciplined mind to be able to distinguish the fact from the inference and to state it clearly. Lawyers know this. Men like Liebig know this.

Now, it is hoped that the Agricultural College will serve this very purpose, of sending back to their farms men who have this discipline, and who will use it for the good of the State; men who, from their scientific training, from their habits of observation, will distinguish better than they otherwise could do, just what it is that they endeavor to tell. They will take moisture into account when they weigh, will describe the feed from which manure is made when they tell the effects of manuring, and in a hundred ways, even though not professing to experiment, will be genuine experimenters. I look eventually for great good to come from their efforts.

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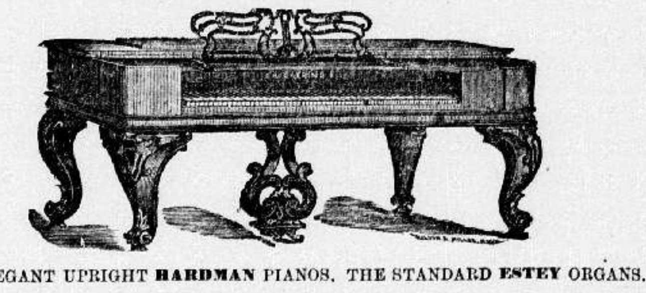

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