bration of the corpuscular groups is very different from that of the waves, there is no absorption, and the light passes through unchanged. But at or near synchronism the group is set in vibration and causes the electric displacement to lag behind the voltivity. Hence, the group being set in vibration, and being in a magnetic field, it must, as was first pointed out by the writer,* and later by Lorentz, rotate. But this rotation is not a *cause* of the light rotation, but an effect.

Reginald A. Fessenden.

THE WORK OF THE SOCIETY FOR AGRICULTURAL EDUCATION.†

During the sixties in the Agricultural College, with which I have long been connected, one professor taught classes in agriculture, animal physiology, veterinary, breeds of live stock, stock feeding, farm crops, civil engineering, and was superintendent of the farm. In recent times this work has been placed in the hands of a dozen or more persons. I need not enumerate similar instances of the recent division of labor as exemplified in our universities. This is a day of specialists and the end is not yet.

The American Association for the Advancement of Science, which we shall attend here next week, when first organized had no sections, but the members all met together as long as the meetings continued. By degrees, as you all know, they increased till there are now nine sections, each with a full quota of officers, not to mention some sub-sections.

Recently, as though this was not enough, there have been formed a considerable number of distinct organizations, the programs of some of which contain much the same range of papers, presented mostly by the same members as those in the parent society.

Meetings during this week and next will be held here by fifteen affiliated societies.

In December, 1898, nine separate societies met during the same week at this university, and nearly every paper presented would have been received by some of the sections of the American Association.

The Fifth Congress of American Physicians and Surgeons was held at Washington, D. C., on May 1st, 2d and 3d. Fourteen distinct societies joined in the triennial Congress.

In much the same way journals occupying special fields of science have multiplied.

Previous to 1880, a number of American societies were organized for the discussion of agricultural topics and those of a kindred nature. For several reasons most of these survived only long enough to hold from one to three meetings.

In 1880, at Boston, a new plan was tried, viz, that of organizing the Society for the Promotion of Agricultural Science, consisting of twenty-one persons. It was the determination of its members to strive for papers of genuine worth and make no effort to draw crowded houses or to make a great display in any manner, whatever. The Society after continuing for twenty-one years has demonstrated beyond question that it is entitled to live and has important work to perform. In all, up to this time, there have been only one hundred and ten members. Those who have continued active, have been too conservative to suit a very few who were impatient for large numbers and more display. To most of us, it seemed of first importance to become acquainted with each other and learn the peculiarities of the members. Some men are restive and never remain active in any society for a very long time. Such may be expected to drop out and others will be elected to fill the places left vacant. Had

* *Elect. World*, May 18, 1895.

† President's Address at the Twentieth Meeting of the Society for the Promotion of Agricultural Science.

the membership been offered to all who sought it, there is little doubt that the Society would have scarcely survived long enough to hold ten annual meetings. As it is the membership has gradually increased and is larger than ever before, with other capable men ready to seek admittance. The Society was never so strong as it is to-day and the chances are that with wise management it will long continue to strengthen.

Every person who has long been an active member of any of the societies above mentioned, and many others, must be aware that a few persons in each need to continually exert themselves to prevent the death of the Society.

Probably there is no exception to the general rule that, a society like a business enterprise, before meeting with any marked degree of success must pass through some trials, metaphorically, must have the mumps, the chicken pox, measles, whooping cough, the grippe, after which, if it stand the strain well, it may be ready to engage in successful work.

In 1887, Congress began appropriating to each state and territory $15,000 a year for conducting experiments in agriculture. During the same period, the U. S. Department of Agriculture has rapidly extended its work, covering almost every conceivable field of agriculture and even some beyond its limits. The chiefs, and assistants and students are usually most capable and number all told over 600 persons.

The work performed by the Department is stupendous, covering a range of topics in a most creditable manner, and the value to the country is beyond estimate. To facilitate the work of experiment stations, including the agricultural colleges, and a small number from the department of agriculture, an annual conference of delegates is held once a year. Not only are the traveling expenses of these delegates paid, but the proceedings are printed and widely distributed by the government. Some have said, "Why isn't this an ideal plan, and why cannot these delegates from college and station perform all that it was intended should be done by the Society for the Promotion of Agricultural Science?" Here is the answer: (1) The presidents of the colleges and the directors of the stations are almost the only persons who attend these conferences oftener than once or twice in five years or more, and most of those who perform the experiments are never sent to the meetings. This scarcely gives any opportunity for the experimenters and professors of the colleges to maintain a continued interest in committee work and in other respects. For these reasons and others, a considerable number of them have become discouraged and advise standing by the Society for the Promotion of Agricultural Science. (2) Not two-thirds of our members are connected with any experiment station in the United States, and therefore, are ineligible as delegates to the meetings. (3) The time for holding the meetings of the station delegates comes at a season of the year when the teachers are busy in laboratory and class room. (4) Other reasons at this time need not be given.

It is not only a pleasant privilege, but a duty, even a necessity for teachers of various sciences and arts in agricultural courses to meet occasionally for acquaintance, each helping the other. Every year new subjects are developed and new and improved methods are discovered for demonstration. He who does not continually exert himself, will soon fall behind the race. No where is this more apparent than in agricultural colleges and experiment stations, for their work is of recent origin.

As athletics in these times interests nearly all students in a university, so the modern trend of agricultural education interests every one of our members. We are all in-

terested in aiming to shape good courses in agriculture, each championing his own department.

Almost any one in short order can place on paper groups of studies for each term of four years and call it a course of study, but to begin at the right end, experimenting and working out all the details of each topic, assigning reasons for each, before generalizing, classifying and grouping into courses requires much time, patience, skill and mature judgment. Nor can we ever expect to secure a uniformity in courses of study for different colleges. These must vary in different states to correspond to the demands of the people, the views of the faculty, and the special fitness of the members of the faculty for teaching certain topics. For twenty-five years I have been at work adjusting courses in agriculture to suit the views of myself and many new men as they entered the faculty from time to time. No two professors of agriculture or horticulture think alike. Besides great advances are all the time being made. There have come along one after the other or by twos and threes during thirty years, a host of new things, each clamoring for a place in the course, such as plant histology, parasitic fungi, the botanical study of grasses and other forage plants, the critical study of weeds from various stand points, forestry, the use of insecticides and fungicides, soil physics, stock feeding from the scientific side, growing beets and making sugar from them, making butter and cheese with scientific explanations for every step of the process, and smallest of all, though by no means of least importance, the little microbes as helps and hindrances to agriculture.

Some of our members are especially trained for the work of adjusting courses of study from time to time, to keep up to date, but to plan a course of study in agriculture which shall remain satisfactory and up with the times for more than a year or two at a time will be as disappointing as to attempt to deliver a course of lectures that shall not need remodelling in many particulars every year or two.

This is the way President Eliot put the question in his annual report for 1888–1889:

"A problem has been pressing upon every member of the board, old or young, experienced or unpracticed. During recent years every college teacher has been forced to answer anew the personal questions—What can I best teach, and how shall I teach it? Every man has really been obliged to take up new subjects and to treat them by new methods. There is not a single member of the faculty who is to-day teaching what he taught fifteen years ago as he then taught it. Each teacher has had to recast his own work, each department repeatedly to modify and extend its series of courses, and the faculty as a whole, to invent, readjust, and expand the comprehensive framework within which all these rapid changes and steady growth have taken place."

Notwithstanding all this, we must keep diligently studying to perfect even for the time, a schedule of studies, approaching nearer and nearer the ideal, though we never attain perfection.

University extension work has become a familiar phrase. Some professors and assistants in universities now devote all their time to the subject, while others devote a limited portion of time. The entire contents of magazines dwell on extension work.

In 1857, the first students entered the oldest agricultural college now in existence in this country. That was 43 years ago in April last. Such colleges had no pattern to follow, no men trained to the work; most of the farmers from the start were confident that such institutions would prove of no value; it was entirely against tradition. The colleges dwindled with a very short roll of students with no end of ridicule. What

was to be done? If the farmers would not send their sons to the colleges nor encourage their support, it was only a question of a few years when all such enterprises must be abandoned. Congress had made liberal endowments. If the farmers will not go to the colleges, then the colleges must go to the farmers. It was a matter of necessity. University extension is the taking of the university or college to the people, when the people cannot or will not go to the college or university.

According to H. B. Adams in the *Forum* for 1891, page 510, "The movement originated in the year 1867 in academic lectures to the school teachers and working men of the North England by Professor James Stuart of Cambridge, now member of Parliament."

A course was given in Great Britain by some of the professors in Cambridge University in 1873.

So far as I know the following account explains the origin of extension work in this country, at least its connection with agricultural colleges. On August 30, 1871, the trustees of the Illinois Industrial University, now known as the University of Illinois, passed a resolution that the regent and corresponding secretary be authorized to make such arrangements for holding, during the coming winter, Farmers' Institutes, at the University and in other parts of the State, as they might find advisable. Several institutes were held that year and others in succeeding years. The circular said, "We want to bring the live practical men and the live scientific men together that all may be benefited."

The regent of the University, Dr. J. M. Gregory, was the leading spirit in starting institutes in Illinois. Early in 1876, Michigan Agricultural College held her first institutes. Note that Illinois University began University extension two years before Cambridge in England. The rapid increase in the number and efficiency of institutes in most of the northern states is a subject familiar to all of you. A generation of objectors to good Agricultural Colleges has passed away and their places are occupied by those who are attentive and enthusiastic. Praise and support of the agricultural college has taken the place of apathy and criticism, and extension work has done it. More recently, beginning in 1888 to 1890, a considerable number of universities and colleges in this country have undertaken extension work in variety. Perhaps some of them saw the benefit that followed such efforts, made by the agricultural colleges. Itinerant instructors have been employed to work among manufacturers of butter and cheese in Canada and Wisconsin. In New York, special schools, enduring for a week, for giving instructions in horticulture, were held in many country school districts.

Extension reading courses are accomplishing something. Almost every plan conceivable has apparently been tried to arouse and attract men toward better methods in agriculture as aided by a scientific education. One of the most recent of these movements in agricultural education is the introduction of what is known as 'Nature Study' or 'Elementary Science' in the rural schools. We are most fortunate at this meeting in having with us an honored member who is brim full with experience and enthusiasm concerning this important subject. We are eager to listen to what he shall say. I am sure that I voice the opinion of every member of this Society when I say that we all favor a liberal education. None of us could dispense with mathematics, one or more languages and other substantial knowledge to be acquired in completing a course of study in any college in the land. Mathematics, Latin, rhetoric, history, physiology, English literature, political economy, ethics, chemistry, zoology,

botany and other branches of learning are placed in college courses, not necessarily because some of them give a better training than others, but because their study trains the person in different directions. A good course of study for the mind is comparable to a symmetrical training for the body, one develops many mental faculties, the other many of the muscles of the body. As the last echoes of the conflict between the champions of the classics and the natural sciences have not yet died away, will you permit me to refer briefly to the subject at this time? The opinions of educated men who lived eighty or ninety years ago are not to be taken in evidence in the matter, as there was no natural science in those days comparable to that of the present day. Nor can the opinions of philologists be taken without some degree of allowance, as their judgment is liable to be biased and one-sided, unless they have also had the benefit of a thorough training in botany and zoology for at least three years. They claim much for a study of Greek or Latin continued for four to five years, while they do not see great advantages in studying botany and zoology for one or two years. I will try to point out as fairly as I can some of the peculiar training afforded by three selected types of studies, viz, Mathematics, Latin and Botany.

(1) The utility of the study of mathematics is granted by every educated person. (2) There is no substitute for mathematics as a training in exact reasoning. (3) By this study a student learns to use concise language. (4) A clear statement is given, and step by step an inevitable conclusion is reached which is clear and accurate. (5) Here we find excellent examples of deductive reasoning.

The study of Latin (1) cultivates and strengthens the memory. (2) The faculty of attention or mental concentration is developed, that is, the successful student learns the significance of genuine study. (3) The perceptive faculties are well trained. (4) The study of Latin should lead to clear and concise speech and help to a better understanding of English. (5) Latin has an obvious etymological value, helping to understand the meaning of many English words. (6) It gives a training in the use of synonyms. (7) Latin cultivates the power of interpretation. (8) It exercises skill of a peculiar kind to observe all the shades of meaning of each Latin word in a long and intricate sentence and then translate it into clear and elegant English. (9) It requires the most discriminating use of the eye, mental alertness, the imagination, and the judgment. (10) There lies a thought clothed in Latin words; it is to be expressed in correct English. (11) The study enables one to get some of the best thoughts at first hand.

The advantages claimed for the study of botany are: (1) There is nothing better for training the powers of observation. (2) The comparison of one plant or one part of a plant with another cultivates the power of inductive reasoning. (3) In learning the definitions of new words, the memory is strengthened, the vocabulary enlarged. (4) There is nothing better to train the power of precise and brief description in using each word with a definite meaning. (5) To follow successive changes that take place in shape, proportion, size, color, as seen in one plant from seed to maturity, develops the observation, powers of description, and the judgment. (6) By experimenting to learn the results that follow changes in temperature, light, moisture; by mutilating or removing certain parts, many facts may be obtained enabling one to arrive at certain correct conclusions. (7) To become acquainted with the minute anatomy of plants by the aid of sections made in different directions and seen with a compound microscope cultivates the imagination as well as

the powers of observation and reasoning. (8) The preparation of materials for examination trains the hand to precision as well as the eye and the judgment. (9) "In studying botany a student gains in analytic and synthetic powers," T. C. Abott. (10) "It is the best system of practical logic, and the study exercises and shapes at once both the powers of reasoning and observation, more probably than any other pursuit," Asa Gray, who possessed a good knowledge of mathematics and Latin as well as of botany.

What shall I say of the value of training acquired by studying bacteria and lichens, by experimenting to demonstrate that certain fungi, like wheat rust and many others, assume two distinct forms on each of two different host plants? Here is need of extreme care to eliminate all sources of error. Facts are at length acquired (not given) and correct inevitable conclusions reached.

Take one step into the domain of horticulture. Selecting the parents and crossing one species or variety of plant with another, with the view of securing new and improved sorts, command the use of the eye, hand, imagination, keen judgment, and the experience of experts.

In selecting and matching apples suitable to exhibit at a fair, the eye, the sense of smell and taste and feeling, as well as the judgment are called into action.

Mathematics starts with definite indisputable facts to demonstrate a proposition.

Latin is based on usage and authority, not on proof. In botany the facts are first to be discovered and then a truth demonstrated. This is the process of reasoning in a large per cent. of all practical matters of life. Linguists claim that the student should devote four to five years to the study of Latin, while one or two years is considered ample time for botany. Let the student devote a year or two to Latin and four or five to botany and then make the comparisons.

You might naturally expect me to quote a few statements from Herbert Spencer. Here they are, old, but good:

"The education of most value for guidance, must at the same time be education of most value for discipline." "One advantage claimed for that devotion to language learning is that the memory is thereby strengthened. But the truth is, that the sciences afford far wider fields for the exercise of memory." "And when we pass to the organic sciences, the effect of memory becomes still greater." "While for the training of mere memory, science is as good as, if not better than language; it has an immense superiority in the kind of memory it cultivates. In language the facts are in a great measure incidental; in the acquirement of science, the connections of ideas correspond to facts that are mostly necessary. While the one exercises memory only, the other exercises both memory and understanding. A great superiority of science over languages as a means of discipline, is that it cultivates the judgment to a greater degree."

"The learning of language tends further to increase the already undue respect for authority. Quite opposite is the attitude of mind generated by the cultivation of science, which appeals to individual reason. Every step in a scientific investigation is submitted to the judgment. It exercises perseverance and sincerity." "In all its effects learning the meaning of things, is better than learning the meanings of words." I may have made a mistake in making this digression, but it is now all over.

I think the most thoroughly educated people are now agreed that the method of pursuing a study is of more importance than the selection of a subject. They believe that botany or zoology well taught, for the same length of time, affords as much discipline and culture as Latin, Greek or philosophy. But you may weary of this.

The programs of our meetings always announce some papers which have a scientific bearing on agriculture, forestry or some kindred line of business. As our members are specialists, it is fitting that we have each year a number of addresses of a general nature, such as summaries of progress, methods of experimenting, methods of teaching certain subjects, short syllabi of courses of study, and new points of general interest. These will be understood and will interest all, and will be likely to provoke a general discussion by the members.

The work of this Society during the past twenty years has apparently had a marked influence on the selection of subjects for discussion in some of the societies of this country. As an instance of the practical tendency of these subjects, if I may so express it, I cite you the admirable address of Vice-President Gage a year ago before Section F, of the A. A. A. S. at the Columbus meeting on 'The Importance and Promise in the Study of Domestic Animals.' Here are two sentences: "It is most earnestly believed, however, that in the whole range of zoology, no forms offer a greater reward for the study of the problems of life, especially in the higher groups, than the domestic animals. The importance of the study cannot be over-estimated from a purely scientific standpoint, and certainly if the prosperity, happiness and advancement of the human race are put in the count the subject is of transcendent importance."

Reference of a like nature might be made to numerous programs of scientific societies, to courses of study in colleges and univerties, to contributions to the best scientific journals of the day, but no argument on the subject is needed at this time, for the reason that no observing person can be found in this audience who does not already recognize the truth of the statement that I have last made.

I thank you for the high honor of choosing me president for a third time, and congratulate you on the excellent prospects for a successful meeting on this, its twentieth year, and predict that a long and useful career yet remains for the Society for the Promotion of Agricultural Science.

W. J. Beal.
Agricultural College, Mich.

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*THE BRITISH ASSOCIATION.**

For the second time, after a lapse of 27 years, the British Association will meet in Bradford in the beginning of September. Not a few of those who attended the first meeting are still alive, some of them being among the most distinguished of our living men of science. There is no doubt that a certain number of those who attended the previous meeting will again be present in Bradford next month. They will notice a very great change in the town; it has grown enormously; it has been to a large extent rebuilt; and it has been raised to the dignity of a city, while its population has probably doubled. Bradford will have much to show to those who are interested in the many practical applications of science. There will be abundant hospitality, receptions, dinners, a smoking concert, excursions to places of interest in the neighborhood, and other forms of entertainment for those—and they are many—who regard the annual British Association meeting as a gigantic picnic.

The meeting of 1873 was presided over by Professor A. W. Williamson, the distinguished chemist, whose presidential address consisted mainly of a review of the progress of chemistry up to that date. The advance in this, as in other directions, since then has been enormous. The president selected at the previous meeting had been the late distinguished physicist, Dr. Joule, but owing to the state of his health he had to forego the honor of presiding at the first Bradford

* A forecast from the London *Times*.