America is *Harvard, Pennsylvania, Cornell, Columbia, Yale, Michigan;* in South America—*Cornell, Pennsylvania, Columbia* and *Ohio;* in Europe—*Pennsylvania, Columbia, Harvard, Cornell, Yale;* in Asia—*Columbia, Yale, Cornell, Harvard, California;* in Africa *Harvard* leads, while in Australasia *Pennsylvania* alone has a good representation. The countries of North and Central America naturally continue to send the largest foreign delegations to the institutions represented in the tables of 1906 and 1907, but Asia has passed Europe, and South America has increased its delegation by 40 per cent. As for individual countries, there is no change in the order for Canada, namely, *Harvard, Columbia, Cornell* and *Yale; Pennsylvania* continues to have the best Central American representation; *Cornell* attracts the largest number of Cubans and of Mexicans, and *Pennsylvania* the largest number of West Indians. Of the North American countries, Canada sends the largest delegation—177—followed by Cuba with 47, and Mexico with 44. Counting only the institutions represented in both this and last year's table, the Canadian representation shows an increase of 13, while Cuba exhibits a slight gain and Mexico a small loss. *Cornell* leads in the Argentine Republic and Peru; *Pennsylvania* in Brazil and Chili; *Columbia* in Colombia and Ecuador. Of the South American countries, the Argentine Republic sends the largest delegation, followed by Brazil, the position of these two countries having been reversed since last year.

In the European countries that send ten or more students the order is as follows: France—*Pennsylvania, Columbia* and *Harvard;* Germany—*Columbia, Pennsylvania* and *Michigan;* Great Britain and Ireland—*Harvard, Pennsylvania, Columbia* and *Yale;* Russia—*Pennsylvania, Columbia, Cornell; Pennsylvania* leads in Holland and *Yale* in Turkey. England sends the largest number, namely 50, followed by Germany with 30, France with 22, and Russia with 19. Of the Asiatic countries, Japan sends 116, China 84 and India 39, both China and India having more than doubled their representation at the institutions contained in both this and last year's tables, while Japan's delegation has remained practically stationary. A number of residents of Asiatic Turkey were represented last year under Turkey in Europe, which accounts in part for a number of the changes affecting the respective representations from the two continents in question. *Harvard* draws the largest number of students from *China, Cornell* from India and *Columbia* from Japan. Practically all of the members of the Australian and New Zealand delegations in *Pennsylvania* are enrolled in the dental school, where most of this institution's foreigners are registered. In fact, the greatest percentage of foreign students enrolled in the universities of the United States is found in the professional and graduate schools; if these were omitted in the figures here given, the showing of the larger universities especially would be changed considerably.

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The Relations of the Engineering Schools to Polytechnic Industrial Education[1]

The impulses which caused the settlers of New England to found schools and colleges simultaneously with clearing the land for their dwellings seem to have universally affected the pioneers of this country,

[1] Address of president of the Society for the Promotion of Engineering Education, delivered at Cleveland, O., July 2, at the annual meeting of the society.

and the establishment of schools has played a notable part in their policy. The hardy frontiersman has seldom blazed a trail which schools have not promptly followed.

This regard for school education is not singular with the American people, but it has been singularly universal with them, and a comprehensive educational system has resulted which reaches even to the remote byways of the country. An educational system which meets the needs of the country, however, must be something more than a mere comprehensive school system in touch with the people. It must not only offer education in general, but it must also offer those special educations which are necessary for the fullest development of each branch of human endeavor and service. In satisfaction of this condition, the great variety of professional schools have been established—divinity schools, law schools, medical schools, schools for the professional engineer—and, on the other hand, trades schools of various characters. In the latter respect, however, this nation has been at fault. Some trades schools have been established and maintained, and manual training has come to be highly regarded—perhaps here and there too highly regarded in the high schools, though insufficiently established in the grade schools; but the development of trades schools has been insufficient to the country's need, and foremen's schools are still almost unknown.

A wise enactment looking towards the establishment of these schools throughout the nation was passed by the national congress during the period of the civil war, whereby each state of the United States was allotted an acreage from the national public lands in proportion to its national representation, the proceeds to be applied more particularly to instruction in agriculture and the mechanic arts, without excluding other subjects of study. This wise enactment, born in the midst of civil strife, has been the foundation of many of the great state universities which make a notable feature of various of our western states. The United States Congress of recent years has added continuing appropriations of money for the same purposes, but more particularly with the design of supporting agricultural research.

These appropriations have been used with wisdom and with great advantage to the nation and its people; but, as far as mechanic arts are concerned, the term has been construed liberally and the work of the colleges using these appropriations has been largely in the grade of professional engineering work, or trending in that direction. The demand for university-trained engineers has been marvelous and the "land-grant" appropriations have been insufficient to support more than one educational effort in this line, and in many states they have been insufficient to support even one fully, so that it has been excusable in the past for the state colleges and universities to limit their activities. The diversion of fine private bequests from their apparently intended use for the foundation of trades and foremen's schools, to a support of attempted professional engineering schools alongside of engineering schools already in existence, seems to me not so excusable.

In agriculture, the situation has been different. The individual farmer, as a rule, is unable to carry on extended and expensive experiments for the benefit of himself and his fellows, and the agricultural schools have turned their attention toward helping the individual farmers or dairymen by teaching them how best to carry on their trades. Some of our best schools of agriculture are what, in industrial lines, would be called foremen's schools, that is, they teach of the particular craft involved

and the way in which the craftsmanship may be most advantageously invoked and applied by a master craftsman in every-day employment. These agricultural schools also support courses of instruction in scientific agriculture which are of university grade, and they maintain extensive and well-manned departments of research which have returned uncounted advantages for the appropriations expended.

The agricultural schools have thus undertaken to cover a triple field: The field of the master craftsman, the field of the scientific or professional agriculturalist and the field of agricultural research; and, in the main, they are occupying each of the fields well. This is in great contrast to the situation of industrial education, in which schools for master craftsmen—*i. e.*, foremen's schools—are so few as to be almost unknown.

The lead of the agricultural schools arises partially from a lack of farsighted altruism amongst the agricultural people, who clamor for the expenditure of public funds to advance agricultural education in all its branches, and especially those branches that come close home to the individual farmers and dairymen, but are selfishly unwilling to see public funds expended in those lines which appear to immediately aid the manufacturers, who, allege the farmers, are able to help themselves. This line of argument springs from the idea that the prosperity of the country rests upon its agricultural resources; and any one who has lived, as I have, for years amongst the people of the fertile plains of the central west and northwest can not help but be convinced that this line of argument contains much of truth. However, it is false in its premises, because it fails to remember the unassailable fact that the prosperity of the agricultural interests and the concurrent contentment of the agricultural population are dependent in this country to an extended degree on the intelligence and prosperity of the industrial population. The interests of each—the agricultural and industrial populations of this country—are so bound up together, that only by friendly cooperation in most things, including the educational interests, can the highest welfare of either be conserved. It seems to me that it is of almost as much interest to the mechanic or mill foreman that the farmer shall be taught how best to perform his labor to bring forth the largest and best matured crops as it is to the farmer himself. And conversely, it seems to me that it is almost equally to the interest of the farmer and of the industrial foreman that the latter shall be afforded the best available training for the practise of his vocation.

Now, let us turn to consider the relative importance of proper education.

> Upon the subject of education, not presuming to dictate any plan or system respecting it, I can only say that I view it as the most important subject which we as a people can be engaged in.

What Abraham Lincoln thus said in 1832 is even more applicable to the conditions of our times. Only the education to be found in the elementary common schools was probably then in the mind of the speaker, and the extended school educations of a vocational nature, and especially of a professional nature, were apparently not within the purview of his experience; but these were not outside of his horizon, for he would have an extension of that education which leads to morality, sobriety, enterprise and industry, as is shown by another sentence from the same address:

> For my part, I desire to see the time when education—and by its means morality, sobriety, enterprise and industry—shall become much more general than at present, and should be gratified to have it in my power to contribute something to

the advancement of any measure which might have a tendency to accelerate that happy period.

The happy period referred to in this quotation has manifestly made its appearance, but it is right to give sober thought as to the effectiveness of its coming and whether much is not yet to be done to accelerate the period. It is particularly appropriate for us, of this society, to take this sober thought and give consideration to this matter on account of the close relation that engineering instruction ought to bear to the industrial affairs of the nation.

It is a question to be seriously considered whether the faculties of the engineering schools have yet duly recognized the responsibilities for the extension of the education through which comes "morality, sobriety, enterprise and industry," which rest on them because of their relations to industrial affairs. I believe that the agricultural schools, whatever their defects in altruism, have done better through more distinctly recognizing and assuming their part of such responsibilities.

The engineering schools, like their friendly rivals, the agricultural schools, have before them a field which may be divided into three parts—a triple field—two parts being semi-professional or completely professional, and the third vocational and subordinate to the others. The engineering schools have occupied only one effectively, though a few are now growing towards an occupation of the second.

These three parts to which I refer are the divisions of the educational scheme of the nation in which fall: (*a*) engineering research and the advanced professional instruction which is being given here and there to a few graduate students; (*b*) the engineering courses of study as they are now ordinarily planned; and (*c*) the instruction of artisans and especially instruction adequate to the needs of individual foremen or sub-superintendents, that is, master craftsmen.

The second of these educational divisions, in the order here named, it seems to me the engineering schools are occupying very well, but even here there is a lack of effectiveness which seems due to lack of correlation between the schools and lack of study of pedagogic history by those persons responsible for the direction of the schools. Reasonable independence and individuality in methods of teaching are due to the individual men who are experienced and worthy in each school, and the individuality of the several schools must not and can not be infringed; but, unhappily, in the past there have been contrasts of pedagogic views and professional ideals that can not be justified, for in these things (matters of judgment though they be) truth can lie only in one direction, however diverse may be the paths over which it may be approached. In harmonizing these differences, pointing out the better paths to follow, and bringing the professional work of the several schools into correlation with professional practise, and especially in advancing the interests of engineering research and advanced professional studies which go to the solution of those numerous great problems of engineering which can best be solved by men independent of commercial industrial control, but working in full harmony with the best engineers and manufacturers of the day, this society ought to have a large influence. I regret to feel that the society has not heretofore maintained a large influence in these directions, but these matters will be brought before you for discussion in connection with a resolution which I propose to later introduce and in connection with certain proposed constitutional amendments that will come before you.

It is therefore not to these that I am here attempting to particularly direct your attention, but it is to the third educational subdivision that comes distinctly within the purview of the influence and direction of the engineering schools, though preferably not within the scope of their curriculums. This is the instruction for artisans, and particularly the instruction intended for foremen and sub-superintendents.

The reports of the eleventh census give some illuminating figures in regard to the number of skilled workmen and the number of foremen in industrial pursuits. The figures must be admitted to be lacking in precision on account of the difficulty of drawing an exact line of demarcation between skilled and other workmen and the difficulty of phrasing an inclusive definition of the services that make a man of the rank of foreman, but the figures referred to are staggering in their indication of the magnitude of this problem in education.

As a further indication pointing in the same direction, but belonging distinctly in secondary instead of higher education, I will call your attention to the fact that the first Industrial Commission of Massachusetts pointed out in its report of 1906 that there are no less than 25,000 boys and girls between fourteen and sixteen years of age in the state of Massachusetts who are now in various kinds of juvenile employments or are idle, and all of them without any adequate trade education. The secondary industrial schools of the country are utterly without adequacy in numbers or extent to meet this problem in secondary education; and the schools suitably planned for the appropriate education and improvement of foremen are almost unknown with us.

I lay this latter fact at the door of the engineering schools, and hold that the members of the faculties are not guiltless unless they make adequate efforts to get filled this need in education for master craftsmanship in the industries, which comes within the purview of their influence and direction.

The governing boards of the engineering schools must divide the guilt with the faculties, if they continue their common failure to provide sufficient teaching force in the engineering departments, thus putting any effort which reaches beyond the routine of the department curriculum and touches the larger interests of the industrial body beyond the physical endurance of the individual members of the faculties.

The situation is better in our agricultural colleges.

Governing bodies have also been at fault heretofore by too close adherence to a standard for engineering teachers in which mere ability to impart information in the class-room, without consideration of any breadth of ambition, has held too predominant a place in the selection of men; and breadth of view in industrial affairs accompanied by clearness of judgment has had too small a place. I do not undervalue the technical ability to impart information in the class-room and assent that this should be properly given much weight in selecting men for the engineering faculties; but this ability, however largely developed and however fully accompanied by engineering skill, is far from sufficient to make an adequate member of an engineering faculty.

The acts of many governing bodies heretofore are in some degree excusable in consideration of the breathless growth of engineering schools which has seemed to make impracticable any pause for thought or consideration of needs beyond those of the day's pressing want of active teachers and

suitable appliances to give strength to their teaching. It seems to me less excusable that so large a proportion of the leading men in the engineering schools should neglect on their own part a due consideration and study of pedagogic history and the development of the lines of philosophy and sound pedagogic thought, which lead inevitably to broader sympathies and more comprehensive professional views. An engineer who has cultivated a correct professional spirit ought to promptly recognize and fully appreciate the importance of careful study of professional precedents of the best types, and if the engineer is also a teacher, he seems to be under obligation to take a comprehensive view of both sides of his vocation, the side of engineering and the side of education.

I believe that such views lead emphatically to the proposition that engineering schools are called upon to extend their influence so that they will continue their present work of education for the scientific engineer; advance the work of engineering research and advanced professional study; and also foster the establishment, maintenance and development of polytechnic schools for master craftsmen.

As instances of a start in the direction of such polytechnic schools fostered by the faculties of engineering schools, I will point to the Summer School for Artisans at the University of Wisconsin, and the Lowell Institute School for Industrial Foremen at the Massachusetts Institute of Technology. Certain courses of the Pratt Institute are instances of work successfully done in the same direction in an independent school, but even there the work is directed by men who have had experience in the faculties of engineering schools. Such schools supported by endowments or by the state could wisely be founded in each large industrial center, but in each instance the school government needs the combined interest, activity and support of the better manufacturers and of suitable members of the faculty of a great engineering school. It must always be borne in mind that these schools should equally assist the craftsmen, and the industries employing them, and thereby improve the fitness and promote the prosperity of the state.

In the first part of this address I have pointed out that the contrast between the hitherto development of farm and dairy education and industrial foremen's education is partially due to a certain trade selfishness of the farmers; but there are also two other active causes which are particularly strong in the eastern states. One of these is a hesitation on the part of associations of industrial workmen to give countenance to education which cultivates and strengthens the special aptitudes of each man and thus tends to accentuate and enlarge the differences between the abilities, usefulness and earning powers of individuals. This jealousy of education, notable on the part of some, is an unhappy phase of the development of civilization, but right-minded men soon find that appropriate and thorough education for one's particular work not only adds to earning power and ease and satisfaction for the individual, but it also reduces jealousies and tends toward a brotherhood which improves the condition of all workers. We are compelled by the inexorable facts of life to see that men are of different abilities, and nothing is gained by an attempt to deny or evade the truth. The best that we can do is to place each individual man, as far as may be, in the situation that he is best adapted to fill by ability and education. Then the advancement of any individual is a cause for the congratulation of all, for it makes new opportunities all along the line, for each individual to profit

by in proportion to his demonstrated abilities, education and experience, and his readiness to work in cooperative relations with his fellows. For these and many other reasons which show that education is useful to all the men who are willing to profit by it, the organizations and associations of workmen should not oppose, but should favor, the purposes of trades schools and foremen's schools. Happily, the more influential of such organizations are coming more and more to lend their favor to such schools.

This brings me to the second of the above-mentioned contributing causes to the contrast between the condition of development of the agricultural and the industrial schools. Relatively few men have come to large fortunes through agricultural pursuits, but those whose fortunes have been so founded have ordinarily discharged their obligation by extending their personal favor and aid to agricultural education, and through endowments given for the same cause. Indeed, large numbers of men who have only won a fair competency through agricultural pursuits have given liberally of their time and even of money for the encouragement and support of agricultural education, and have seen to it that the expenditures have been made in the manner most useful to the people.

I am sorry to say that the men who have made fortunes through the manufacturing industries and transportation have seemingly not proportionally supported industrial education. Some large endowments and bequests have been worthily bestowed where the income is used in engineering education, and a few endowments are directed toward the support of trades schools, but all that has thus far been done is wholly inadequate and disproportionately small in comparison with the annual returns coming each year from the manufacturing and transportation industries.

The men who have come to wealth through association with these industries seem to prefer to found great art galleries or museums rather than industrial schools. Galleries and museums have been proclaimed more widely, and their needs may have thus been brought more directly to the attention of those who have come to fortune through the industries and have money to bestow. In respect to that, while asserting that I will not take second place to any one in appreciation of the fine influences of art galleries and museums, I also insist that at the present juncture of education in this nation any man with a fortune to bestow can do a more pervading good by aiding the engineering schools to develop the work of engineering research, and by establishing schools for industrial foremen to be directed with the assistance and advice of the engineering schools.

Our communities maintain manual-training schools and here and there a trades school, and great professional engineering schools are maintained in the east by private endowments and in the great states of the west by appropriations from the state governments; but there still remains a gap in industrial education which lies between the elementary trades schools and the professional engineering schools of university grade. This gap must be filled and it will be filled promptly if the men who are and who ought to be members of this society do their duty. It is imperative to give to the thousands of young men who are to make the bulk of the corporals and sergeants of industry that education which makes for self-support in the best sense, makes for proper parentage, and makes for a good grade of thoughtful citizenship (to which foremen's schools may be directed in keen fashion), before the education which

lends figure and charm to a man's recreations (such as so fortunately comes from the art galleries and museums) is taken up. I believe that no use of money can bring greater returns to the state, or greater satisfaction to the giver who understands the educational situation, than large gifts for the purposes of industrial education that I name.

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SCIENTIFIC BOOKS

Stohr's Histology Arranged upon an Embryological Basis. By Dr. FREDERICK T. LEWIS. Sixth American edition from the twelfth German edition. Philadelphia: P. Blakiston's Son and Company.

At the close of the eighteenth and at the beginning of the nineteenth century, anatomy reached a high degree of development. Soemmering had completed his 'Bau des menschlichen Körpers' and Bichat had given us his master work—'Anatomie générale.' With the completion of the latter the scalpel reached its highest attainment. The microscope, so successfully introduced into anatomical studies by Malpighi and Leeuwenhoek, replaced to a certain extent the scalpel and histology began to occupy a prominent place in the medical curriculum.

In the development of this branch of anatomical study, Würzburg has taken a prominent place. The first name we meet, one now but little known, is Heusinger, called by Hessling 'unser histologischen Nestor.' Some thirty years later, Kölliker published the first and, in some respects, the best edition of his 'Gewebelehre' and now his place is taken by Stöhr.

'Stöhr's Histology' is well and favorably known to American students, not only in the German but also through the English translation. In the previous five American editions but little change has been made from the German. The present edition has been rewritten and 'adapted * * * to American needs.'

The idea of arranging the book on an embryological basis is excellent, but it has not been carried out as thoroughly as it should have been. The book is intended primarily for students of medicine. It is, therefore, eminently proper that human embryology should form the basis of the work. Instead of this, we find the rabbit, the chick and the pig occupying a prominent place; for example, of the five figures to illustrate the formation of the germ layers, only one is taken from a human embryo.

In reviewing an American edition of a German text-book, it is interesting to see to what extent American work is recognized. Kollmann in his recent 'Entwicklungsgeschichte des Menschen' has recognized very generously American work, and the prospectus of the new embryology by Keibel also shows a good American representation. In the American edition of Szymonowicz and of Böhm and Davidoff American investigation occupies a prominent place. Lewis has not been as generous and fails in many places to use available literature.

The work of Mall on the connective tissues is not given as fully as it should have been. Lewis still describes the so-called 'fenestrated membrane' as being perforated, though Mall has shown that this is not the case. No reference is made to the work of Bardeen on the histogenesis of striated muscle, or that of MacCallum on heart muscle. The work of Huber and De Witt on muscle spindles is passed over and no reference seems to be made to the work of Donaldson and his students on the nerves and nerve cells.

That Lewis should make his own work the basis of his description of the lymphatics is very natural and it justly deserves a prominent place, but some reference should be made to the excellent work done on the same subject by Miss Sabin, even though he is not in perfect accord.

The description of the vascular supply of the lymph nodes could be made clearer by using the diagrams of Calvert.

The work of Mall on the spleen is given scanty notice and is dismissed with the statement that Stöhr says: 'a division into lobules