and its dependencies, and constitute our reliance not only in the ordinary work of the service but in times of special need.

CONFERENCE ORGANIZATION.

I have deemed it necessary to give this somewhat extended account of the organization of the service, both that our aims and methods may be understood and that I may the more readily explain a proposed method of making these annual conferences of practical utility. It might be advisable to appoint on special committees members of the conference especially interested in the several subjects to be considered by these committees, said committees to remain in organization during the year and to receive for further conference with the Surgeon-General such matters as might be pertinently referred to them by him. The titles of these committees would find their analogues in the several divisions of the bureau. The reports of these committees could be read to the full conference at its annual meeting, and, if adopted by the bureau and the conference, would have a force and influence which would naturally result from the conjoint action of the national and state authorities. I would suggest tentatively the following committees: First, on Scientific Research and Sanitation, second, on the Prevention and Spread of Epidemic Diseases, third, on Morbidity and Mortality Statistics, fourth on State Legislation, fifth, on Education. In addition to these, there might be special committees on certain specified diseases, namely, cholera, yellow fever, plague, smallpox, tuberculosis, leprosy, typhoid fever. To these committees might be committed such resolutions as may be offered here, but the adoption of any resolutions by this conference, it seems to me, should not be until after a report thereon had been made by the special committee to which it is referred.

It is believed that the above plan is at least worthy of trial. It would give real aid and would stimulate the members of the committees in an investigation of the subjects confided to them, and might produce a uniformity of effort, a coordination of work in different parts of the country, which now does not obtain.

WALTER WYMAN.

U. S. PUBLIC HEALTH AND MARINE-HOSPITAL SERVICE.

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*THE GENERAL EFFICIENCY OF TECHNICAL EDUCATION.**

DOUBTLESS when an alumni address became a part of our commencement program, it was intended that it should be directed more especially to you, gentlemen of the graduating class, and should be in the nature of a professional welcome from one of your older brothers. You were to be welcomed into the ranks of the engineering profession by one who, not so very long before, had passed through the same strenuous preparation which you are just finishing and who had since become a successful engineer. Unfortunately, I have no such claim to your attention, having wandered from the true faith in which we are all trained here, and it is, therefore, impossible for us to meet on the common ground of your future labors. Instead, it has seemed a not inappropriate thing for us to examine briefly your past work; more specifically, to consider the general value and efficiency as a preparation for life, of the technical education which old Rose has given you, and to compare its general influence and value with that of the very different, so-called 'liberal' education which the regular college or university gives.

Technical and liberal educational sys-

* Alumni address at the commencement exercises of the Rose Polytechnic Institute, June 11, 1903.

tems have radically different ends in view and proceed by quite different methods. The one is specific and definite, preparing men for special fields of activity; the other broader and more general, aiming to give men good ideals, good ambitions, a properly balanced judgment and well-trained mind—items of equipment which are sure to be useful to any man in any walk of life. It has been said that one trains men to live, the other to earn a living. If we accept this as roughly defining their respective characteristics, then it is evident that a combination of the two is the ideal to be sought after. At present, however, it is usually a question of one *or* the other, and colleges of engineering and of liberal arts are coordinate parts of our universities—a fact somewhat grudgingly admitted by those representing the older learning. I think we shall find good reason for their attitude.

In comparing things so different, it is important to select the best points for comparison, and it is obvious that we need not consider matters of purely technical significance. That is to say, when it comes to designing a bridge, it is evident that as a preparation no amount of Latin or history can be considered as an efficient substitute for a course in graphical statics. But it being impossible to foresee the exact future of any student, there is left considerable scope for general strength and adaptability which even the most technical educational method must take into account and seek to provide for. Comparison between liberal and technical training may well be made, then, as regards just this point, the success with which they fit men to grow and to adapt themselves to new and more exacting conditions. But there is another consideration. Every man owes something to himself and to the community which cannot be paid by even the best executed professional services. He owes it to the community that he should be willing and able to discharge successfully the responsibilities which in one form or another are sure to fall upon him; and he owes it to himself and to the community that he should see more in life and get more out of life than lies within his purely technical horizon. It is, therefore, again appropriate to inquire as to the relative success with which the two educations aid men in satisfying these last-mentioned demands, which are essentially general.

It is usual to conceive of any educational scheme as having two fairly distinct aims, which President Hadley has called training for knowledge and training for power—perhaps an unfortunate choice of words in view of the adage 'Knowledge *is* power.' But the meaning is clear—teaching to *know,* and teaching to *think* and *do.* To these should be added a third, less easy to define—teaching to *appreciate,* that is the cultivation of the tastes. The traditional liberal education of the last century was largely an education for power, that is, the stress was laid on mental discipline, training of the memory and logical faculties as contrasted with the imparting of knowledge. The subjects studied, however, largely classical literature and philosophy, naturally and unavoidably fulfilled in a measure the third requirement above mentioned. The characteristic feature was, nevertheless, the hard drill along certain well-defined lines, the infliction on all students of certain definite tasks. At present, however, a liberal education means quite a different thing. The one-sidedness of the old scheme, together with the great increase in the number of possible subjects of study, has led to what seems an almost equally one-sided development in the other direction—namely, the universal preponderance of elective over required studies. It is as if the college or university should greet the prospective student with the

statement: "Here is our collegiate bill-of-fare; a fine array of courses with which, if you choose properly, you can satisfy your proper appetite and at the same time be disciplined as we know you ought to be disciplined. However, help yourself to what you want—we shall interfere only in case of violent indigestion." In spite of traditions to the contrary, then, and in spite of ample opportunities for hard work, a liberal education may come to consist too largely of the imparting of information and cultivation, with not enough mental discipline, and not enough hard work. Indeed, student opinion, quick to detect a weakness and caricature it, has already adopted the name 'culture-course' for an easy-going snap.

The above à la carte scheme, if you will allow the term, contrasts strongly with the table d'hôte service universally found at technical institutions. These have, by a curious paradox, fallen heir to the rigid disciplinary method of the old schoolmasters. As we all know, there is very little latitude in a technical course, once the general aim of the course is decided upon; much of the work requires a good memory, and more important, clear thinking—and students are forced to do it whether they like it or not. The student, in his laboratory work, is constantly confronted with problems the solution of which develops self-reliance and independence, and there is opportunity for him to try his hand at 'knowledge-making.' There is, therefore, little need to worry about the efficacy of technical training as regards *power*, except in one important particular. Training for *power* aims not at the production of the graduate who shall be most immediately successful in the particular work which he first undertakes, but rather one who shall have, as has been said, the greatest capabilities for growth. This means that principles rather than details should be taught; that an independent, self-reliant grasp of a subject should be given, rather than facility in special methods. The recent graduate, thrown for the first time entirely on his own responsibilities, frequently resents this, and is disposed to argue that he should have been taught all the details of the particular machine he is first called upon to design or the special points of the particular lighting system he first has under his control. But he soon learns the short-sightedness of such a policy. Again, any extended engineering career involves extended and varied intercourse with men; to be successful in this demands character and knowledge of men and institutions. There is little of the formal training of the engineer which directly aims to satisfy this demand; and while it is also true that much of it must come from association rather than from formal teaching, still the value in this respect of a curriculum based on the so-called humanities is amply shown by the output of the English universities and the older and more conservative institutions of this country.

Turning now to the other two groups into which we divided the aims of education, we find, of course, that the technical training is here much less efficient. The knowledge embodied in the course is almost entirely special and technical, such as forms a necessary basis for the discipline already outlined. The general or 'humanities' side may be represented only by a relatively small amount of two modern foreign languages, a little economics or political science and English. A narrow basis, surely, for the broad activities, the general intercourse and the contact with men which are features of a successful engineering career. It is a pity that men whose disciplinary training has been so well calculated to bring out their best abilities, to train them for control and leadership,

should in any way be hampered by a narrow outlook or ambition. It has been said, on the other hand, that since engineers deal more particularly with materials and physical relations rather than with men, it will never be demanded or expected of them that they should have any particular knowledge of men or of human institutions, such as is necessary in other more humanistic professions. In other words, that an engineer will be just as successful whether he be a broad man or a narrow man, since all the public wants him for is to build a bridge or a railroad, or perform whatever other special service he is fitted for. This is too narrow a view, for two reasons: (1) The educational level is rising, and the engineer must at least keep pace with the general improvement. (2) Engineers are taking such an increasingly prominent part in the life of the country—engineering undertakings are so closely allied to questions of public policy, public economy and social order, and the matter of immediate utility is so closely involved with that of permanent value and fitness—that the public can not afford to intrust its engineering undertakings to any but broad men.

If technical training is deficient as regards broad knowledge, it is still more so as regards the culture side, which is left practically untouched. Moreover, there is very likely to be a desire on the part of the students still further to reduce the time spent in such work, the argument being that it is not sufficiently 'practical,' and doesn't 'pay.' I believe it does 'pay,' even in a commercial sense—but what if it does not? Is there nothing there worth having except for the profit it will bring? The word we have used to represent this side of education—culture—is in bad repute even among those representing its best phases. To some it means a veneer, a smattering of music, art or literature; a sort of young-ladies'-finishing-school halo of accomplishments. Again it may imply a somewhat exclusive but genuine learning and an air of condescension toward every-day life and work. Both mistaken notions, of course. What the word should imply is a genuine interest in something for its own sake, and a determination to know and appreciate the best there is of that something—whether it be literature, music, amateur photography or tennis. The broader the interest, the greater the intelligence and the self-sacrificing labor necessary to appreciate and attain the best, just so much broader and more thorough is the culture which it represents. Matthew Arnold put the matter in a compact and surprisingly practical form when he defined culture as 'the disinterested pursuit of perfection'; it is a point of view, an attitude, a motive which has its influence on every action.

It is apparent, then, that technical education as at present understood is strong in the matter of the discipline of the mind and will; it will help a student to think clearly; it will give him self-confidence and self-control, and teach him the virtue of and necessity for work. It is equally apparent that the system is weak on the side of broad general knowledge and cultivation, and there can be no doubt that this is a serious defect. There are three possibilities for improvement. The first is to devote more time during the technical course to subjects of a general character. It is doubtful whether this can be done to any great extent in view of the constantly widening technical field; but I believe some improvement could be brought about, and at least we as alumni should be cautious in urging or suggesting any reduction in the minimum time now allowed. Again, the burden of providing this part of the engineer's education may be pushed down on the preparatory schools. This means

raising the requirements for admission, that is the general as distinguished from the technical requirements. The student's preparation in the high school or academy should be complementary rather than introductory to his later work, those subjects being omitted which will be thoroughly taken up in the college course, in favor of languages and other subjects which can not be so well studied later. But this rearrangement and extension of the preparatory course must not involve any material increase in the entire time required to obtain the bachelor's degree, for our graduates, as compared with those in Germany, are quite old enough under the present arrangement.

Finally, student activities and intercourse which make up the characteristic college life furnish an opportunity of supplying the general training which is lacking. Indeed, if the statements of some over-enthusiastic college presidents be accepted, to the effect that participation in college life is the chief end in attending college, we might logically conclude that the differences between a liberal and a technical education could be entirely made up by the proper introduction of dormitories, fraternities and a reasonable amount of hazing. Without going so far as entirely to deny the value of the regular curriculum, we must admit that intercourse with fellow students and participation in various student enterprises may be of tremendous benefit, if these activities are rightly directed and carried on, and such activities, particularly along lines very different from the routine work, should by all means be encouraged. This encouragement can be the more freely given because student enterprises are far less likely to be carried to an extreme among engineering students than among others, simply because they have less time for such things. This simple fact of having plenty to do, effectively answers, almost before they are raised, many of the questions which are most difficult to deal with in connection with student life at other institutions of a different character. For instance, outdoor sport with you has not entirely ceased to be play, and the view still finds favor that athletics exist for the benefit of the students, rather than that the student body exists to 'root' for a winning team.

In ways like these will it become more and more true, let us hope, that the engineering graduate has had the essential features of a liberal education in addition to his professional training. That such is not the case at present should be frankly admitted. The danger is that the graduate should not realize the limitations of his training, and should not in the future be at all interested in making up its deficiencies; that his judgment as to the values of an education be based too largely on the consideration as to whether or not it 'pays.' Such a one-sided point of view is, I am glad to believe, rare among us. We are all proud of the good name of our alma mater; we appreciate that the rank of an institution is in large measure determined by the success of its graduates; and we are earnest in our endeavor to win such recognition in our specialties as shall be worthy of, and if possible bring additional honor to, old Rose. But do we fully grasp the fact that we are called upon to be broad men as well as specialists, and that there is a sort of success to be attained quite distinct from our professions? I trust that we do, and I hope that the R. P. I., without losing in the least its good repute as a trainer of expert engineers, may more and more be known as a trainer of men.

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