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SOME PRESENT-DAY PROBLEMS OF ZOOLOGY TEACHING[1]

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IN coming before you to-night I wish first to express my appreciation of the high honor of being chosen to serve as vice-president of the section set aside for the zoologists in this great organization of American men of science.

It happens that, owing to the absence of our vice-president of last year, there has been introduced a new policy, that of asking the newcomer to give the annual address. When the readjustment is being made both the speaker and his audience are aware of some of the advantages of the older policy.

My predecessors in Section F have dealt with a widely varied list of topics. Some have discussed in a trenchant manner that special field of research which they have personally cultivated, others have dealt with more general problems or have surveyed the accomplishments of recent years in some particular field of zoology.

There is another aspect which is a very live problem in educational work, but which we are inclined to give scant attention. I refer to the ever-growing complaint regarding the teaching of the sciences. Perhaps its consideration might better be left to other groups, but I have had the temerity to choose for to-night this general subject and I shall ask your indulgence while I speak of "Some Present-day Problems of Zoology Teaching." Let me hasten to explain that I do not intend to suggest some new method of examinations, nor of mid-term or weekly or daily reports. Neither do I pose as an educational expert—my dis-

[1] Address of the vice-president and chairman of Section F—Zoology, American Association for the Advancement of Science, Cleveland, December 31, 1930.

cussion is frankly based by my interests in zoology and in the propagation of zoological interests in others.

Wherever zoologists congregate there is stress, and rightly, on the importance of research. It is the mainspring of any science, without which progress is impossible. Genuine interest in it is one of the most valuable aids to successful teaching in spite of insistent charges to the contrary.

Nevertheless, it is not the only means by which a science advances. Bacon, three centuries ago, in his classic volume "The Advancement of Learning," discussed not only the methods by which knowledge is to be gained but also the importance of making it intelligible to society at large. Indeed, our American Association for the Advancement of Science recognizes this popularization of science as one of its functions and is devoting an ever-increasing amount of attention to the problem.

Our interests, then, are dual, but there would seem little necessity of emphasizing before this group the importance of research. Your very presence at these Convocation Week meetings testifies to your interest it it.

Foremost among all the agencies for bringing about the diffusion of knowledge is classroom instruction. The entire group here present is concerned directly or indirectly with the teaching of zoology, however varied the proportion of time available for individual investigations. As teachers or as researchers we shall be more and more affected by some of the present-day trends in our colleges and universities. Their name is legion, and they are already doing much to determine the type of students in our classes and in our graduate schools. Perhaps some of you will not agree when I select as the most important three affecting our work those of (1) the changed view-point regarding the function of the university; (2) the position of laboratory work, and (3) those affecting departmental curricula. In discussing them, I shall treat of what I believe to be general rather than regional or institutional trends.

The one most vitally affecting our work and that on which the others are ultimately dependent is the remarkable shift which has come in the conception of the aims and function of the university. There have been and are to-day many attempts to define this function, but we may class them as (1) those which conceive of the university as the capstone of the educational system, obedient to public demands, and accepting any graduate of the secondary schools of the state, and (2) those which conceive of the university as a leader in educational ideals, accepting students who have demonstrated their ability for more advanced work, and not concerned with what Dr. Keppel has called the "period of extended infancy."

It is needless to say that these are diametrically opposed view-points and, however great the efforts on the part of those who are struggling to reconcile them, one or the other ultimately must give way. There will be lone schools which will stand against the current for a considerable period, but so inextricably are educational institutions interrelated that none can escape the influence of the dominant conception.

There can be no doubt that even to-day that dominant conception has become one of an unbroken system from the kindergarten to the graduate school, and already there are demands that its requirements and standards be adjusted to accommodate the hordes who must have a doctor's degree in order to obtain or to hold a position in our colleges. In many places the slogan is "Whosoever will may come and partake freely of the Pierian spring," and coupled with it there is not infrequently the implied suggestion within the institution that he should not be required to drink deeply, since the object of the universities is to "prepare the student for life,"[2] rather than to make a scholar of him. A recent writer has expressed clearly his own and a common opinion when he says, "The outside citizens are the ultimate deciders of school policies, they hold the purse strings, they own the schools. Educators are their employees."

I would not by any means imply that this policy is motivating all our state universities. There are certain notable exceptions and few, if any, have yielded altogether. On the other hand, I believe that it is a fair statement of the trend and that long before the swing of the pendulum is reversed, our endowed institutions, too, will be radically affected by it. Indeed, they are by no means immune to-day.

Many are the attempts to stem the tide. Probably the most in favor at present is the establishment of junior colleges which will care for not only those students who do not expect to continue beyond two years but also for those from the neighborhood who expect to go on to completion of the college course. Already there is ample reason to see that this will only double the difficulties. In general, the equipment, library facilities and teaching staff of these institutions are in nowise comparable to those of the universities. They are more lenient in accepting their students. The result is that there will exist the same gulf between their courses and those of the senior colleges that is now the source of complaint from the high schools. In the one as in the other case the proposed

[2] This slogan, so widely used, does nothing in the way of defining what is the best preparation our universities can offer. All conflicting viewpoints claim its guidance.

remedy will be that of lowering the requirements of the advanced work.

The effects of the movement are all-pervasive. The graduate schools are accepting more and more of non-resident study, or Saturday afternoon, evening and correspondence courses. This is despite the fact that one of the most valuable features of graduate study is the contact with seminars, library facilities and, presumably, the atmosphere of research. The requirements of two modern languages are being vigorously attacked and in various quarters the substitution of educational statistics for one or even both of the languages is a matter of routine. The largest of our schools of education has frankly waived the rule that the Ph.D. thesis must represent an original contribution.

I am not here discussing whether these changes throughout our whole university system are desirable or not—I am merely pointing out that they are rapidly coming about. Inevitably they affect our science courses and the rôle which our departments of zoology can play in the system of education. Are, first, our beginning courses and then our intermediate, and, finally, the advanced courses to become merely informational in nature, supplanting the old-time Chautauqua lectures, or are they to adhere to an ideal of giving all their students the best possible training under the limitations which exist and of developing and stimulating a scholarly attitude towards the subject?

Despite the antagonisms and, later, the evasions which prevailed in the latter part of the nineteenth century, it is no longer necessary for the proponents of science teaching to battle for recognition of their field by the schools and colleges. Some of the discussions of that period and particularly the essays and addresses of Huxley are well worth reading. It is as true to-day as it was in 1869 that "if the great benefits of scientific training are sought, it is essential that such training should be real; that is to say, that the mind of the scholar should be brought into direct relation with fact, that he should not merely be told a thing but made to see by the use of his own intellect and ability that the thing is so, and no otherwise."

Gradually the educational world came to accept the idea that the study of science deserved a place with the classics in the curriculum because it did bring the mind directly into contact with fact and strove to train it in the acquisition of first-hand knowledge. So fully has it been accepted that it is now the classics which are on the defensive and in all too many places are struggling for existence.

The driving force of the movement, then, was the stress on the value of the laboratory method. "If scientific education is to be dealt with as mere bookwork it will be better not to attempt it but to stick to the Latin grammar which makes no pretense at anything but bookwork" was Huxley's warning and in this country it was matched by Agassiz's "Study nature, not books"—a slogan which was not directed at books but at servile dependence upon them.

In those benighted days it had not been discovered that "the most evil influence in education" was the scholar and it was natural that the attitude of leaders in the colleges and universities should be manifested in the secondary school teaching of science. It must be admitted that the result was not always wholesome, though there is ample room for question as to whether the present-day tendency in the other direction affords a sound substitute.

Be that as it may, it is true that the more progressive high schools attempted to duplicate in so far as their finances permitted the equipment and the methods of the college laboratory. To be sure, there came from both college and secondary schools vigorous protests against the cost of such instruction. Years ago Youmans admitted that "of the two classes that may be taken generally as most ignorant of the science of their business—cooks and congressmen—it will cost at least ten times more properly to educate the former than the latter."

Still more serious was the fact that at times the newly created B.S. went into these schools with little idea other than to duplicate as nearly as possible the course which he had taken in college. Often he had little conception as to how to proceed until he had gotten an equipment of microscopes, sea urchins, dogfish, Grantia and starfish. The results were likely to be disastrous and the zoological departments of the colleges were to a considerable degree responsible for these misfits. As long as the majority of college departments of zoology were themselves ignoring the wealth of material in the local fauna it was too much to expect that their product would realize the potentialities of his environs or have any particular interest in the population of its fields and streams. As long as the college departments were insulated from the work of the secondary schools it is small wonder that their graduates had no idea of the problems which they would face if they were called upon to teach in these schools.

This situation, coupled with the acute problems arising from the crowding of our high schools, attracted an ever-increasing amount of attention on the part of those responsible for the development and administration of secondary education. To-day the validity of the claims for laboratory instruction is being challenged sharply and more and more there

is coming about a reversion to text-book instruction or to lectures—the incipient text-books—supplemented in varying degree by classroom demonstrations. This movement is rapidly extending to our colleges and universities where it is manifested in the increasing demand for survey courses in which the laboratory method plays no part. Forgotten are the arguments which opened up the curricula to the biological sciences. Must we consider this a retrogression? Perhaps they *should* be forgotten, for there is no more excuse for a static education than there is for a static science.

A considerable factor in the decreasing emphasis on laboratory work is unquestionably the economic one. The faculty of making a virtue of necessity is one of the beneficent anodynes afforded mortals. If it is found that it is physically impossible to provide space and equipment for the hordes of incoming students, and if the motivating educational philosophy demands that they all be welcomed, then it is to be expected that expensive types of instruction would be subject to particular scrutiny, and substitutes receive at least a very sympathetic consideration.

It would be unfair and superficial to assume that the question of expense is the only one involved or even, in most cases, that it is the primary one.

There never has been any agreement as to just the proportions in which lecture, demonstration, charts and lantern-slides and laboratory work should be mixed. We may individually have very definite opinions, but we do not have any satisfactory methods of tasting the concoction while it is stewing. We may believe firmly in a rigid application of the methods of Agassiz, but no advocate of large classes has yet offered a clue as to how such technique can be followed under the conditions which face us. Is there no approach to the problem other than that of observation and opinion?

The present century has seen the introduction of methods of psychological research which are influencing profoundly and will continue to influence our systems of education. They have emanated from a small group of thoroughly trained investigators, capable of self-criticism and motivated, as every scientist must be, by a desire to learn the truth and as nearly as possible the whole truth about their problems. They were great teachers, untrammeled by standardized methods, and capable of enthusing and stimulating the students with whom they come in contact.

Unfortunately, among their followers are not only many serious and careful workers but also zealots with scant preparation, whose chief efforts apparently have been devoted to criticism of our colleges and to attempting to carry over into the universities the methods and ideals of the public schools. The result has been that, instead of contributing to the improvement of teaching in the colleges through work that wins respect by its scholarly approach and tempered criticism, they have often antagonized, and have failed to receive credit for whatever of merit they may have presented. The constant iteration and reiteration of the claim that the worst teaching in the country is college teaching is an illustration of a type of mischievous and irresponsible statement which is doing nothing to better conditions. Neither is the assumption that there has not been in the past any constructive thought devoted to efficient presentation of the subject-matter of the sciences or that the whole situation can be revolutionized by a statistical study of the results of examinations.

However, none of this excuses a teacher of zoology from attempting to keep in touch with the real research work which is being done on methods of presenting his subject, or from constantly checking over and attempting to improve his work. When he reaches the stage of having no interest in such matters it would be better for himself and his institution if he could be retired.

If he be scientifically trained, as fortunately may still be assumed, he will not accept at face value every piece of experimental work which finds its way into the literature. Neither will he be justified in treating his students always as subjects for investigation. There are a few groups of peoples which have been more or less tacitly regarded as legitimate experimental material—condemned criminals, subject nations and men under rigid military discipline. To these we are now adding the students of our schools and colleges, but the teacher who regards his students in that light is no more able to do his best for them than is the doctor whose first concern in meeting his patients is the study of the action of some particular drug. There may be exaggeration and a note of irritation in the charge by a recent writer that "teachers instead of teaching are everywhere fetching and carrying for the investigators," but it is certainly normally the case that " in just the degree in which a teacher is an inspiration to his pupils he is unfitted as a collector of statistics."

To the present there has not been developed any adequate measure of the effects of laboratory work on the student. It is comparatively easy to measure the retention of facts in sufficient degree to pass examination, but no believer in laboratory work considers that its chief value is as an adjunct to the cramming process. To be sure it is quite as *passé* to con-

sider that habits of accuracy, sincerity and respect for scientific evidence could be inculcated through laboratory work as that any subject possesses abstract disciplinary value. I would point out, though, that Thorndike himself never took the extreme view which is often attributed to him but that he definitely taught that the results of training could be transferred and that even where this was much less than had previously been assumed it had a very significant value. Reference to "intangible effects" are anathema to many of the enthusiastic devotees of the new research and yet every earnest teacher knows that they can not be ignored. Their number will be reduced as the technique of investigation becomes refined, but we must agree with Archibald Rutledge that "it is exceedingly doubtful whether that mysterious whole which we term personality will ever yield to investigators, however patient, honest and meticulous in their searchings they may be." It is on this personality that the intangibles become inextricably impressed.

I have listed as a third topic certain trends in the setting up of departmental curricula. In not a few cases these are the antithesis of what I have already discussed. Perhaps they are defense reactions, more or less consciously developed. In any event they will affect in no little degree the future development of our subject.

In our large institutions of to-day departments are allowed a very considerable latitude in the fixing of the requirements for their major students, however much their introductory courses are shaped by demands for popularization. Apart from the fact that the elementary courses in high school and college have already done much to fix the student's ideals of work and his thought processes, this still permits of the development of a well-rounded departmental course for students who are particularly interested in zoological work. It is of the utmost importance that the responsibility be accepted and administered in such manner as to develop the student to the maximum degree.

Of the various ways in which this development may be hindered a not uncommon one is too great a stress upon some narrow field in which the teacher is interested. It is of great advantage to the young student to be associated with an investigator in the study of a section of a problem, if it is not at the expense of a breadth of preparation which will be essential to the success of that student when he leaves the university. There are cases in which a teacher who owes much of his success to his own broad training overlooks the fact that some of his efficient students are little more than expert technicians.

Again, there may be the mistake of setting up a rigid curriculum which either does not allow for sufficient recognition of the aptitudes and natural interests of the student or, on the other hand, so monopolizes his time as to make it impossible for him to take advantage of and learn to appreciate the cultural opportunities afforded by work outside of his specialty.

In all ages the greatest teachers have been concerned with the development of the individuality of the student. There is general agreement to-day that this is the highest goal of education, however much we hamper it by some of our practices.

The field of zoology is a broad one and capable of profiting greatly from the work of students of widely varying tastes and interests. The best development of the student demands that we treat him as an individual—a problem much easier of solution in the limited confines of a department than in the institutions as a whole. To set up a uniform requirement for all who are attracted to the field is no more justifiable than was the adherence to the single universal curriculum of the old-time college. This discarded policy was supported by arguments which are strictly analogous to those used in favor of rigid departmental requirements.

The monopolizing of the student's time, at the expense of his fuller development, is another danger to be avoided in this process of setting up an ideal program for making a zoologist. As soon as we start out on the theory that "surely anybody who is going to major in zoology should have . . ." we find that we have filled his undergraduate years with chemistry, zoology, botany, physics, mathematics, foreign languages, geology and special courses in zoology. Where have we allowed for the student's development of any appreciation of the literature of these foreign languages or of our own language, where for philosophy, history, sociology or the other fields of knowledge which, if not opened up in the undergraduate days, are very probably destined to be forever closed to him? Is there not a danger of unconsciously adopting a trade-school ideal rather than supporting that of *education* in contrast to mere *instruction*?

The science of zoology has made unparalleled advances during the past century. We owe it to the present to make the knowledge already gained more generally available and to stimulate the workers of the next generation to still greater achievements. If it seems, sometimes, that our educational systems are milling around in a confusing conflict of ideals and aims—of readiness to size upon anything new, and of conservatism—let us at least hope that there is a spiral upward movement and let us do our share to make it manifest in our chosen field.