SCIENCE

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*FROM HIGH SCHOOL TO COLLEGE.**

OUR system of education, as it exists today, is based on the earnest conviction of the people that American boys and girls should be compelled to go to school to get the foundation of a good education, and should have the opportunity to continue their studies in secondary schools and colleges if they so desire. It is only in the states west of us that the college and university are a part of the system of free education of the state, but here also there is such ample provision by the older colleges for free tuition for needy students that one no longer regards poverty as a barrier to the higher education.

But the college and university will always be for the few favored ones who have the time as well as the aptitude for advanced study. For the masses the high school remains the capstone of our educa-

* An address delivered at the dedication of the new buildings of the Central High School of Philadelphia, November 22, 1902.

tional fabric, and by reason of the extent and variety of its curriculum, broader indeed than the college course of fifty years ago, is not inappropriately called the 'people's college.'

The improvement of the high school, as an educational organization, has been brought about by many agencies. Physics, chemistry and biology have appropriately found a place in our schools, as they have in the lives and thoughts of all intelligent people. The progress in educational methods and in the facilities of instruction, particularly in the laboratories for practical work, has also strengthened the courses of study and brought a great intellectual stimulus into the pupils' lives.

But there has been another agency at work, outside the high school, namely, the advance in college entrance requirements, and the throwing back upon the schools studies formerly pursued in the college. Whether this was a wise measure on the part of the colleges it is now not worth while to discuss, since it is an accomplished fact; it has, at least, increased the value and dignity of the high school course to such a degree that the graduates of our best-equipped and best-manned high schools are as well prepared for their life's work as were the college graduates of the middle of the last century.

The college after having thus put upon the schools an additional year's work, has not been as liberal as it might have been in recognizing the efficiency of this work. Most of our larger eastern colleges still insist on their own entrance examinations. This makes a break in our educational system which affects unfavorably the high school course preparatory to college, inasmuch as this course is then too apt to have for its aim the successful passing of examinations rather than a serious preparation for advanced work. This is an old and much-discussed question, and I touch upon it now to assert my conviction that it is practicable to throw such safeguards around the system of certification that the diploma of graduation, accompanied by the personal statement of the principal, will become much better evidence of a boy's fitness to enter on college work than a few days' written examination can be. Entrance examinations show but little more than that a boy had or had not, on the days of examination, writing under peculiarly trying circumstances, a certain knowledge of mathematics, history, language and science. Whether or not he is likely to prove a diligent student, with tastes and aptitude for his work, the college gets no indication from the examination papers, and seems to be indifferent to these qualifications.

The western states find no difficulty in articulating the high school and college in their educational system, but in the eastern states, in addition to the supposed difficulties in this articulation, there seems to be also a feeling that the dignity of a college is better maintained by insisting on its own examinations, a notion which rests on a mistaken idea of the reason for the existence of colleges. If the time of the examination were extended, so that the college could determine by actual experience the fitness of the applicants to undertake profitably college work, there would be a rational basis for an opinion as to this fitness. Why should not all secondary school graduates, who are vouched for by the principals of these schools, be admitted and given a trial until the Christmas vacation? In other words, let the entrance examination extend over three months instead of three or more days. At the end of this period (during which there will be every incentive for the earnest boy to prove his fitness) let those who show they are unprepared, through lack of knowledge or aptitude or industry, be returned to the school

whence they came or advised to abandon a college career. This plan would not necessarily result in the overcrowding of the freshman class with poorly prepared or immature boys, for the consequence to the principal of a high school of having boys thrown back on his hands would be too serious. The character of the work which secondary schools are doing in teaching and training young men should be more fairly judged than is possible by a few days' written examination. Let us hope that some method may be devised, that this may be accomplished and the good work of the schools find more abundant recognition.

Although the high school offers an admirable preparatory course for college, this course is not its primary object, which is rather to give to boys and girls during the years of adolescence a broader view of life than they are capable of comprehending in the grammar school period, and an intellectual stimulus which shall abide with them in after life.

Many elements enter into its efficiency. The location of the school and the building itself has much to do with it. Bright, large, well-ventilated rooms and cheerful surroundings, such as these great new buildings possess, have a notable influence in promoting good teaching and quick apprehension. Its efficiency is further closely connected with the completeness of its equipment—its laboratories of chemistry, physics and biology, and its libraries. But far above its material possessions rises the teacher as the most potent influence for good work. My experience is probably not different from many other college officers, in observing that the principals of many poorly equipped schools send boys to college with a uniform stamp of high scholarship which many of the richer and better equipped schools fail to equal.

It is often said that the purpose of the school is to make good citizens by giving the pupils a sound foundation of general and useful knowledge and by guiding their young minds in the ways of truth, justice and righteousness. To the idealist in education it is character-building that should be kept in mind in all the teaching and discipline of the school. And when one reads the current educational literature he is almost led to believe that this result can be brought about by purely pedagogical methods, and that the millennium must arrive in the course of another generation. In this conception of education are we not putting on the schools the responsibility which belongs to the family, the society and the church? The instruction which we give our youth in history, civics and ethics is necessary for the intelligent citizen who wishes to do his full duty in civil life, but it does not supply the incentive to make him do his duty. This is sufficiently obvious, and yet it seems necessary to say it from time to time to tone down the rhapsodies of the theorists in education over the purposes and possibilities of public schools.

Character is the result of heredity and environment. To apportion the relative values of these influences in any case is no easy matter. If a school boy proves incorrigible it is generally attributed to heredity; if he becomes tractable, to environment—so easily do we let ourselves be persuaded as to the beneficial effect of our influence.

Three results we have a right to expect from our schools, namely, that the students shall acquire a certain amount of useful knowledge, that they shall become genuinely interested in one or more of the subjects they have been studying, and that they shall learn to think for themselves. The first can be accomplished under almost any system of teaching. Grammar, history and the descriptive sciences can be taught

like the multiplication table, and often are, but it is only when subjects are pursued with interest that they become permanently profitable. And this leads directly to the question, shall the elective system be introduced into the high schools? The answer is so far simple, that a choice must necessarily be made among the great number of subjects available, but how that choice shall be made is not so easily answered.

The most sensible solution to this much-discussed problem of high school curriculum would seem to be the selection of a certain course of study by the boy or his parents, and the prescription of the studies within the course by the faculty. The development of interest is properly made the corner stone of our modern educational system, but in our efforts to attain this end we are in danger of overlooking the fact that side by side with interest should be the consciousness of power and mastery. The latter are not acquired by following the lines of least resistance.

The likes and dislikes of a school boy should not be taken very seriously in laying out his course of study, since they are too often founded on ignorance of the real nature of the subjects he would elect or reject. The interest that is developed in a subject, as the result of hard, patient study, is of infinitely more worth than the interest which rests on a passing fancy. The former is associated with a feeling of conquest and power, and with a sense of having gotten to the bottom of things; the latter is too often an interest which is satisfied with what is on the surface.

The current drift of educational thought is towards the perfection of methods and of systems of teaching. It is one of the happy signs of the times that teachers of all grades and of all degrees of experience are trying to tell their brother and sister teachers how this and that subject should be taught. A happy sign, in that it gives evidence of the deep and absorbing interest on the part of the hosts of men and women throughout our country engaged in this noble work. And yet these sincere and devoted souls, who have their daily reward in the bright and responsive faces of their pupils, generally overlook the fact that their success is not due so much to their methods as to themselves. Teachers are born, but they can also be made, not by studying rules and routine, or by the imitation of the ways of others, but through the inspiration which comes from patient, loving service.

'The whining school boy—creeping like a snail unwillingly to school' is not unknown in our day, but sympathetic treatment and bright surroundings have done much to take the terror from the school associated only with the task and the rod. Carlyle makes his hero in Sartor Resartus say: "My teachers were hide-bound pedants without knowledge of man's nature or of boys' or of aught save the lexicons and quarterly account books. How can an inanimate mechanical gerund-grinder, the like of whom will, in a subsequent century, be manufactured at Nürnberg out of wood and leather foster the growth of anything, much more of Mind, which grows not like a vegetable (by having its roots littered with etymological compost) but like a spirit by mysterious contact of spirit; thought kindling itself at the fire of living thought? How shall he give kindling in whose inward man there is no live coal, but all is burnt out to a dead grammatical cinder? The Hinterschlag professor knew syntax enough and the human soul this much: that it had a faculty called Memory, and could be acted on through the muscular integument by appliance of birch rods."

The ideals of education, looking to the development of the whole man, find full expression in the philosophers of the six-

teenth, seventeenth and eighteenth centuries. For the attainment of these ideals private tutors stood in the place of the school teachers of our day, and education was necessarily confined to those who could afford this luxury. The ideals of to-day are not lower, but they are more difficult to attain in the class-room where the teacher has two score or more pupils at one time. It is the inevitable dilution of personal influence as classes increase in size which prevents the school of to-day from becoming the power for good it might be if the teacher's strength were not exhausted in hearing and marking recitations and maintaining order. There are not, I fear, many school boards that would appreciate the suggestion of increasing the teacher's efficiency by limiting the number of his pupils. This efficiency is in inverse proportion to the number of pupils; perhaps it might be safe to say the square of the number, so rapidly does the personal influence decrease when a limiting number is overstepped. Thus does penuriousness, combined with ignorance, on the part of city councils and of school boards, often defeat the cause which they profess to maintain.

Two tendencies are now distinctly marked in our higher education, namely, the demand of the professional schools that the baccalaureate degree shall be required for admission, and the willingness of the colleges to shorten the time in which the baccalaureate degree can be obtained. There was a time, not very long ago, when theology was the only profession for which the A.B. degree was considered necessary. Now law and medicine are demanding this preparation, and it will not be long before engineering and the related technical pursuits will claim recognition of their professional character. And on the educational horizon we see the rise of a new profession—commerce—which will doubtless in its turn demand a similar recognition.

Two influences are at work in requiring the baccalaureate degree as a preparation for law, medicine and engineering; one is to give a greater dignity to these professions, and the other is the conviction, based on experience, that narrowness in education is accompanied with a narrowness of outlook which prevents a full development of a man's powers in his special line of work. By this increased requirement we are brought to face the practical question whether there is a gain in professional equipment to compensate for the time consumed; for nearly half a lifetime may be consumed (including the apprentice years) in getting ready for life's work.

It is this question, which carries its answer with it, that has led colleges to abridge the time within which the A.B. degree can be had, some by condensing the four years' work into three, others by admitting professional studies into the last two years, and still another by deliberately casting off two years' work. The significance of the A.B. degree has been so far modified in American colleges in the last generation that it no longer implies any definite course of study. It is, therefore, meaningless for the professional schools to insist upon it as a necessary preparation for advanced work. What these schools really need, and what they should require, is satisfactory evidence that the applicant possesses the necessary knowledge and the necessary maturity to undertake profitably the work involved. It may well be that a high school graduate would prove by these tests to be better prepared to enter schools of law and medicine than many a college graduate. The faculties of the professional schools should not try to evade the responsibility which belongs to them of ascertaining by some tests the fitness of the applicants to undertake their work.

By making the possession of the A.B. degree the only test of fitness many a well-prepared man will to-day be rejected and many a poorly prepared man admitted. Should we not arrive at a conclusion satisfactory to both college and professional school if a six years' combined course should lead both to the bachelor of arts and (in the case of the law) to the bachelor of laws? Let me here quote briefly from a notable address by Mr. John H. Converse, of this city, delivered on Founder's Day at Lehigh University in 1896:

"For an institution proposing to do full university work, I would formulate a course of five or six years as might be required. For one half or more of such course let the curriculum deal, as at present, with the humanities, the sciences and all that makes for the broadest education properly so called. At a fixed period, say at the end of three years, let the student elect the professional, business or scientific course which will, as far as possible, qualify him for his proposed life work. The general course should thus eventually branch out in various directions such as theology, engineering, medicine, architecture, law, chemistry, agriculture, business, transportation. To accomplish many of these specialties to-day in connection with a college course requires six or seven years. A combined university course, such as is suggested, would, therefore, be an economy of time. It would measurably avoid duplicating some subjects which are common to both a college and a professional course. The degree finally conferred should recognize the general culture as well as the special training and would, therefore, differentiate such a curriculum from that of an ordinary professional or technical school."

This may well be called the ideal professional education, and could be entered on at the age of eighteen and completed at the age of twenty-three or twenty-four. But I still hold that graduates of our best high schools should not be denied admission to professional schools if they can prove their fitness as regards both knowledge and maturity.

The attempt to readjust our educational system in the interest of professional education meets with vigorous opposition from those who fear that it means the passing of the college, with all its good traditions and aims. I do not think their fears are likely to be realized. For a large number of those who intend to enter on professional life this shorter cut is necessary. But there will always remain a not insignificant remnant who, for love of study, will lay deep and broad the foundation of knowledge based on the humanities and on the physical sciences. The choice spirits whose lives are brightened with the finest products of ancient and modern thought and learning will always be with us to keep up the tradition of pure scholarship in our colleges and universities. And there will still be many who, having the time and means to take the lengthened course, will enter the professional schools after the full college course, and the professions will still be graced by men whose technical knowledge is based upon ripe learning and culture.

One more aspect of college and university life needs to be considered. The vital and essential part played by the lengthening of the period of infancy in the development of the human race, first pointed out by Mr. John Fiske, has been happily made use of by Dr. Nicholas Murray Butler in expounding the 'Meaning of Education.' But, it may fairly be asked, is the artificial prolongation of this period of irresponsibility, which wealth has made possible, been accompanied by increased benefits to the race? Does it not rather result in enervating than in strengthening of

power and purpose? It is a significant fact that the college graduate of the middle of the last century was about four years younger than the college graduate of to-day. Many of the great men of the nineteenth century, men whom it is our delight to honor as representing what is best and highest in private life and public service, were graduated at seventeen or eighteen years of age. Has there been a corresponding gain in maturity and in intellectual and moral force in the graduate of to-day to compensate for the additional years of study?

The American college at the beginning of the twentieth century stands for what is highest and broadest in learning and scholarship and research. Never before was such an opportunity offered to the earnest and thoughtful student, and never before has there been such a large number to avail themselves of this opportunity. The college of to-day is an infinitely greater power for usefulness in its increased facilities for instruction, both material and intellectual, than the college of fifty years ago, and yet its graduates, taken as a whole, can not be said to excel the product of the older college in intellectual force, maturity of judgment and integrity of purpose. If I am right in this assumption, may we not find the explanation in the fact that there has been grafted on to the life of the older college a new and different life, which concerns itself more with the incidental advantages of a residence at college than with those which are connected directly with study? The social features of modern college life are esteemed by many to be of greater benefit to a young man than attendance in lecture room and laboratory. From the academic atmosphere in which he lives he absorbs much that resembles, if it does not actually partake of the nature of culture, and the pastimes and sports relieve pleasantly the monotony and drudgery of the class-room. If, while enjoying these careless years, enough scholastic credits can be gained to secure the degree, the college career may be said to be crowned with a fair measure of success. It will not be denied that three or four years, such as I have depicted, may be a good thing for many a young man who has not the aptitude or the moral purpose to pursue a serious course of study. He has, it may be, acquired a certain familiarity with the amenities of life which makes him an agreeable and acceptable member of polite society.

But, let it be asked, is it fair to burden an institution of learning with young men of this kind, and thereby try the patience and tax the strength of the teachers who make up its faculties, young men whose college records show a series of failures supplemented, after many trials, with the conventional passing grades? What an amount of vigorous life and energy of the teacher would be set free and available for study and research if all the students were at least earnest in their work, and how much more efficient would be their teaching.

But more important than the effect on the teachers is the effect of this life on the student himself. Are not young men unfitting themselves for the serious business of life by acquiring the habit of putting off duty for pleasure? There is nothing in the business world—in factory, store or counting-room—corresponding to making up of deficiencies or the excusing of absences. And does not the college which makes this provision for the lazy and neglectful become a party to the demoralization of character by encouraging habits which have to be eradicated before a man can become a useful member of society?

Why should it be considered unreasonable that a college should insist that those

who come within its walls to enjoy its great privileges should, as a condition of their remaining, be required to perform their daily work to the very best of their ability? "Would you," I think I hear it said, "make prigs and pedants of our young men, and take all the joy out of their college days? Life has enough sadness and tragedy; let those days at least be bright and sunny." No true pleasure was ever taken out of life by bringing a sense of duty and responsibility into it. The tragedies of life come from the neglect of duty and from the pursuit of pleasure in which no sense of responsibility abides. The careless optimism which expresses itself in 'boys will be boys' may apply to children in the lower schools, but is demoralizing when applied to men in college.

This great training ground for the higher service should maintain a standard of robust, manly character as well as of fine scholarship if it is to be a power for good in the community. When the college shall inculcate and demand that duty must come first, then all the incidentals of college life—its social pleasures, its pastimes and its sports will take their proper place and contribute normally to the symmetrical development of the whole man.

In considering the list of distinguished men who attended this great high school in their youth—distinguished in the learned professions and as scholars, philanthropists and captains of industry, of whom the city and state and nation are proud, what conclusion can be drawn as to the part which the school played in these successful careers? I think the only answer we can give is that in any school or college the good influences exerted are in direct proportion to the opportunities afforded. The prodigality with which knowledge is disseminated in our modern high school may seem like a reckless waste from the standpoint of a school board, but it is in virtue of the availability of these great and varied resources for the pupils that its great usefulness lies. Many of the pupils pass through this wealth of opportunity unaffected by it, and the little knowledge which adheres to them will be quickly lost, notwithstanding the most cunning devices of teachers to entrap their intelligence and interest. But there will always be a goodly number whose souls will be kindled by the divine fire if the right thought come at the right moment to their unfolding minds. Why should the science of numbers kindle this fire in some minds and extinguish it in others? Why do some feel the lightning strike when certain facts in science, with the generalization drawn from them, come to their consciousness? We may study the child's mind and prescribe the appropriate mental nutriment for each stage of its development, but there will always be some who refuse to be classified and remain the despair of the psychologist.

Liberal and even lavish outlay in curriculum, in equipment and, above all, in teachers is needed, that the young minds with their diverse aptitudes and tastes shall open under the most favorable conditions, and receive from the teacher and the subject an inspiration which shall last them through life.

The opportunities in equipment and curriculum offered in this school in the first decades of its history may seem to us now very humble and restricted, but there were good teachers in those days, as the results amply prove. To-day we have a great building—a noble monument to the Philadelphia Board of Education—provided with all the aids to teaching that experience has proved valuable, and a faculty of instruction of which the city and state may well be proud—a strong, safe and scholarly president, and a live, aggressive and inspiring body of teachers. That its

power for good may be in proportion to these great resources is the prayer of thousands of alumni, whose pride in its past is their hope for its future.

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AMERICAN SOCIETY OF ZOOLOGISTS. II.

An Experimental Study of the Spawning Behavior of Lampetra wilderi: JACOB REIGHARD, University of Michigan.

An attempt was made to extend Gage's excellent account of the spawning behavior of the brook lamprey, as given in the 'Wilder Quarter Century' book. Space does not permit more than a statement of results, which were obtained under the auspices of the U. S. Fish Commission:

1. Fish were numbered and a record kept of their movements and the behavior of fish removed from the nest and then released was observed, but *no constant relation was found between individual* fish and individual nests.

2. The *location of nests is determined* not by the form or character of the bottom, but by the existence beneath or in the midst of the running water of small masses of water at rest, such as occur in depressions of the bottom or behind or in front of obstructions in the stream. Small glass plates set on edge across the stream on a perfectly level bottom have such inert masses of water above and below them and, although the plates are invisible, the lampreys build nests above and below them, and this on any sort of bottom in which there are stones large enough to serve them for attachment.

3. *Sex recognition* appears to be a reaction of the male to a reaction of the female. Males, females with eggs and spent females were marked so as to be readily distinguishable. Attached males when seized by other males at once release their hold and the two fish separate. Spent females seized when attached behave like males. Females containing eggs, if seized by males while attached, retain their hold and begin at once to 'shake.' The male reacts to this movement by throwing his tail in a loop about the body of the female and then 'shaking' with her. The shaking consists in a rapid vibration of all the body behind the branchial region.

4. The loop formed by the tail of the male is always thrown accurately into the notch between the first and second dorsals of the female. In the female at the breeding season, but not in the male, the second dorsal is œdematous and is believed to serve as a support for the tail of the male during spawning. The small anal fin found in the breeding female, but not in the male, may have the same function.

Some Experiments on the Growth of Oysters: OTTO C. GLASER, Johns Hopkins University. (Introduced by Caswell Grave.)

The occurrence of elongated oysters on the edges of marshes and reefs in waters supporting profitable beds is a well-known but puzzling fact to the culturalist who sees such different results under similar conditions.

Among the explanations given by other workers, excessive crowding seemed to the author to be the only one borne out by his observations, but to test this view more carefully a number of experiments were made.

In one, young normal oysters were subjected by imbedding in cement to lateral pressure, and exhibited after thirty days a slight elongation, and the scolloped anterior edges common in elongated oysters.

In another experiment, to find if oysters liberated from an oppressive environment would change in shape under other conditions, it was discovered that, after forty-