

SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE
OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION
FOR THE ADVANCEMENT OF SCIENCE

FRIDAY, APRIL 26, 1907

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MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

PRESENT-DAY CONDITIONS AND THE RESPONSIBILITIES OF THE UNIVERSITY¹

It is proper that the office which I have the honor of representing to-night should be a *cynosure*, but it is unfortunate when in connection with any office, be it never so exalted, there is a tendency to fall into the Malapropian error of confounding a *cynosure* with a *sinecure*. I presume that it is with a view to avoiding this danger that an address has become one of the recognized duties pertaining to the chairmanship of this society, and it is but natural that the address should consider some topic connected with our scientific activities. Arguing upon this line, I was tempted to accept this as an opportunity for proposing the toast of 'our noble selves,' and to discourse upon the remarkable growth of the scientific spirit in the middle west during the last decade and the part taken by the members of this association in that growth. I decided, however, that I could not do justice to such a theme, for although 'good wine needs no bush,' yet unworthy words may mar a good tale.

But while I may not linger upon so

¹ Address of the chairman of the Central Branch of the Society of American Naturalists at the meeting held at the University of Wisconsin, March 29, 1907.

enticing a topic, the circumstances of our meeting compel a word of tribute to the part played by the University of Wisconsin in the upward movement. Fifty years ago the state universities were almost wholly teaching institutions, colleges rather than universities, institutions influenced by rather than influencing the standards of the subordinate educational grades. Thirty years ago the foresight of President Gilman made the Johns Hopkins University an exponent of the university ideal, before then but imperfectly realized, but for which the times were ripe, and in the acceptance of this ideal the University of Wisconsin was no laggard. In 1887 she gave earnest of her ideals in appointing to the presidency Professor Chamberlin, active then as now in the advocacy of investigation as a function of the university and whose words, spoken on the occasion of the jubilee of this university, might appropriately be writ large over the portals of all our state universities—"Research in every realm of a people's legitimate interests is an appropriate function of the people's organized self, the state, and of the people's organized instrument of research, the state university." The appointment to the presidency, in 1892, of Charles Kendall Adams was a pledge that the movement towards the higher ideals should not be retarded, and under his administration and that of Professor Birge the growth of the university along university lines is evidenced by the increase in the number of graduate students from 3 in 1887 to 119 in 1903.

History repeats itself. The university movement began in Wisconsin under the presidency of an active investigator, an acknowledged authority in geology, and we may with confidence look forward to a maintenance of high ideals and a continuance of the progress towards their realization under the present incumbent of the

presidential chair, who has also enriched the literature of geology with the results of many careful and thorough investigations. And may we hope, Sir, that the duties of your high position may not deprive us of your active participation in investigation, and that you may continue to manifest your interest in higher university ideals by example as well as by precept. It is a privilege, and I doubt not for many of us an inspiration, to see for ourselves what the State of Wisconsin, under wise guidance, is now doing for higher education, and it is equally inspiring to note the promise the university holds out of continuing in the path of progress and of being in the future, as she has been in the past, a zealous foster-mother of productive scholarship.

In university education, as well as in other mundane affairs "the old order changeth, giving place unto the new." Time was when the sciences were but tolerated in the university curriculum, when the cultivation of the humanities was regarded as the only path leading to intellectual light. But this has all been changed and the sciences have come into their own. No longer do we find the humanists endeavoring to maintain a position of extreme pharisaism, nor is 'culture,' a term much abused and suggestive of the hot-bed or conservatory, regarded as obtainable only by a course in the humanities. No, all this has changed, and just as the dominance in higher education of the *literæ divinæ* gave place to that of the *literæ humaniores*, so the humanities have yielded to the scientific discipline or at least have been forced to admit it to a position of equality.

The causes for this are not far to seek. They are the result of the necessity for keeping the lines of higher education in touch with human interests, and never have these interests been so bound up in

the application and progress of scientific methods and discoveries as they are at the present time. The nineteenth century has been termed the age of science. How, I wonder, will the twentieth century be designated? For we are even now merely on the threshold of a period of scientific activity whose outcome is far beyond the ken of even the most imaginative seer. We must anticipate, nay, we must all rejoice, whether we be scientists or humanists, in the prospect of continually increasing scientific activity in the years to come and we must therefore look forward to a greater demand for the cultivation of the sciences in our educational institutions.

The developments in all departments of science in the last few years have been simply marvelous, and one does not need the shadows of even fifty years to bring into startling relief the enormous growth which has taken place not only in the extent and solidity of the foundations of science, but in the height, the adaptability, and, we may say, the elegance of the superstructures. I may be pardoned if, for emphasis, I introduce the personal element and state that even my span of life is coincident with that of the doctrine of natural selection, and that I can remember the interest and enthusiasm with which I read in my senior year at college the but recently published papers of Flemming and Peremeschko portraying the phenomena of karyokinesis and inwardly marveled that such observations, now the ordinary routine of an undergraduate course, were possible. Truly "the thoughts of men are widened with the process of the suns."

When one considers the relative recency of the discovery of the Hertzian waves and Röntgen rays, the actual novelty of our knowledge of radioactivity and of the ionic theory; when one notes the revival of the Mendelian law and the important ob-

servations on variation and inheritance which it has evoked; when one recalls the important contributions to our knowledge of the physiology and mechanics of growth which the modern science of experimental morphology has supplied; and, not to prolong the list indefinitely, when one reviews the recent advances in our knowledge of the principles underlying serum-therapy—how can it be doubted that we are but on the threshold of an era of scientific activity whose outcome will far transcend that of the century which has passed? The importance and far-reaching possibilities of the purely scientific problems now confronting us can not fail to stimulate investigation in all departments of science and must continue to attract, in increasing numbers, men who will find their greatest pleasure in the prosecution of science for the truths it will reveal. And, furthermore, the possibilities in the way of the practical application of the results of pure science, now seen as through a glass darkly, must create a continually increasing demand for men thoroughly grounded in scientific principles, who can make realities of the hopes which pure science awakens. So certain is this and so certain is the correlation between scientific progress and national development, that the fostering of scientific investigation must become, even to a greater extent than now, a question of national concern.

But even although the tendency is strong towards the maintenance of scientific institutes by the government and although we have already witnessed the application of private wealth to the establishment of special scientific laboratories, yet it is to the universities that we must chiefly look now and in the future for the maintenance in scientific work of the high ideals which are the life of scientific progress. For it is from the universities that the ranks of those who will serve in govern-

mental and private laboratories must be recruited, and upon the universities rests the responsibility not only of adding directly to the world's stock of knowledge, but also of supplying men capable of grappling worthily with the problems which may confront them and imbued with a proper sense of the dignity of science and of the obligations it imposes upon its devotees. The task of the university is, therefore, a double one and doubly serious, and it may not be amiss to enquire into some of the conditions necessary for the accomplishment of its task.

The prime necessity, the selection of men for positions on the staff who are competent as both investigators and teachers, need hardly be considered. It follows from what has already been said. But this much may be added, that a competent investigator, even though he be but a mediocre teacher, will do more to fulfil the ideal for which a university should stand, than will a competent teacher who does not investigate. Men there have been, like the late Sir Michael Foster, whose death we all deplore, who while taking but little part in actual investigation, have nevertheless by the healthful stimulus of their teaching created a school of ardent and brilliant investigators. But such men are *rare aves* and the zealous investigator by his enthusiasm and example will, as a rule, do more to raise the standard of scientific scholarship than will a non-investigating teacher. And, I believe that as a general rule the investigator will prove a more capable teacher than the non-investigator for the simple reason that he will be more apt to keep abreast with the progress of his studies and inclined to rely upon original sources for the information he imparts rather than to seek it in the more accessible text-books.

But, after all, this is a matter which

does not require special comment. The governing bodies of our universities are coming to recognize more and more the necessities in the case and the standards of fitness for staff appointments are rapidly rising. More serious is the failure of the authorities to perceive the conditions necessary for the full fruition of scholarship. It is a sad comment upon the ideals of a governing body when it bases its estimate of the value of a teacher upon the number of hours he devotes to actual class work and to service upon various academic committees. And yet how many of us have heard such a standard of efficiency advanced in all seriousness. A high grade of scholarship can not be maintained, investigations of a high order can not be carried on by men whose physical and intellectual energy is exhausted by the routine of the class-room and executive cares. I would not for a moment contend that even the most capable of investigators should be entirely relieved of his duties as a teacher, indeed, I am convinced that from his teaching duties an investigator may obtain much stimulation and inspiration, but I do protest against a competent man being so burdened with class-room duties that he but half fulfils the responsibilities of his position. It is neither good business policy nor good ethics. It is the office of the university not only to impart knowledge but also to add to it, and the one duty is as obligatory as the other.

But the blame for the non-fulfilment of both duties does not in all cases rest entirely with the university authorities. Frequently it rests with the teacher himself, who, in a desire, in itself a most laudable desire, to make his teaching thorough to the limits of his ability, overburdens himself with multifarious courses. Such an one is proving false both to himself and to his university; he is failing to fulfil his responsibilities. Far better were

it to teach thoroughly only the principles of his subject and to devote some of his energies to the advancement of knowledge in his chosen field. And this suggests a consideration of the effects of summer sessions, now so much in vogue, upon productive activities. I do not feel justified in giving at present an *ex cathedra* pronouncement upon the merits of summer sessions; they seem to make for both good and ill; but whether the benefits derived from them compensate for their ill-effects in other lines remains for the future to determine. If they can be conducted on lines which will suppress an imminent danger of superficiality and which will not interfere with the investigational activities of members of the university staff, by demanding that men who have already spent nine months of the year principally in class-room work shall devote to similar work an additional period of six weeks or more of the time they have for uninterrupted devotion to investigation, if these dangers can be avoided the summer session is justifiable; otherwise its influence is pernicious.

One of the allurements of the summer session is the opportunity it affords for a small addition to a diminutive income. And in the necessity for this lies one of the obstacles to greater scientific achievement in the universities. The *res angusta domi* do not conduce to that condition of equanimity necessary for good scientific work and many a promising investigator has had his ambitions quenched and his mind turned to the more pressing material necessities of life by the lack of sufficient recompense for his work. This is a matter, however, to which attention has frequently been called of late and, it is a pleasure to say, with some prospect of remedy.

I have already pointed out as one of the causes for the position scientific studies now hold in university education, the de-

mand for men trained in scientific methods. And, as is so often the case, the favoring current carries with it seeds of danger to true scientific progress. This danger is the commercialization of the university, and it is one which in this country, more than in any other, needs careful watch and ward. The university has been satirically defined as a place where nothing useful is taught and, taking the word useful in its intended meaning, I hold that the definition, intended as a reproach is an honor. What the university and university education should stand for is not utilitarianism, its function is not to turn out masters of the technicalities of this or that profession, but above all men with a sound training in fundamental principles. That the university should offer lectures and other forms of instruction in the history and theory of music or painting is right and proper, but that it should turn out expert pianists or finished artists is absurd. We may even look with equanimity upon courses in domestic science or on properly conducted commercial courses, but that the university should descend to the education even of good cooks or successful drummers is something horrible to contemplate. And so with the sciences. Let the first care of the university be to thoroughly educate men in the principles of the sciences, and worthy results will inevitably follow, but should the university become a technical school progress will be retarded. I do not mean to say that the practical application of scientific principles should be absolutely disregarded in the university; far from it. For the *argumentum ad rem* is often the most powerful means for pressing home a scientific deduction. But what I do maintain is that it is the teaching of the principles of pure science which underly practical application that should be the essential function of the university, its aim should not be to turn out engineers, archi-

teets, physicians, pharmacists, or dentists, but to furnish men thoroughly grounded in the principles upon which the successful and scientific practise of these professions depends.

All this will undoubtedly be regarded as purely academic theorizing by the Gradgrinds who arrogate to themselves the adjective 'practical.' But which is more practical, more beneficial to the individual and to the community which he serves, the education of an empiric or the training of a scientist? Surely there can be no hesitation in the answer. Montaigne said, long ago, 'To know by rote is not to know.' It would be instructive to test our university education by this standard and ascertain how far, by precept and example, it is, especially in the professional schools, following the straight and narrow path. To what extent is the desire for immediate financial success, and that on no modest scale, affecting the work of our students? Are our faculties yielding to this desire on the part of the students and in their teaching placing more stress on the application than on the principle? And to what extent is this same desire for financial prosperity calling our teachers from investigation to more lucrative employments and impairing their usefulness both as preceptors and as exemplars? I have not considered these questions as part of my theme, and will leave them with you for private consideration.

In the development of investigation as a prime function of the university, there is a danger, however, that its advancement may be pushed too rapidly, in the sense that men, too slightly grounded in the principles of their science, may be pushed into special lines of study and that university education may mean the training of narrow specialists rather than the development of broad, scholarly minds. Lowell said of Harvard that he "would

rather the college should turn out one of Aristotle's four-square men, capable of holding his own in whatever field he may be cast, than a score of lop-sided ones developed abnormally in one direction," and surely this is what each of us would wish for his alma mater or for the college in which his lot is cast. It is a short-sighted policy that forces or even allows immature men to enter upon investigation. It may increase the quantity of the productive work of the university, but the increase will be at the expense of the quality, and in the long run will redound to the credit neither of the university nor of the individual members of its staff. And, after all, the investigator is born, not made, and for the men who have not an innate aptitude for investigation,

Selbst Pallas kommt als Mentor nicht zu Ehren,
Am Ende treiben sie's nach ihrer Weise fort
Als wenn sie nicht erzogen wären.

All students can not be investigators in the ordinary sense of that word, but all should be trained along broad lines, trained to look to original and reliable sources for their information, trained to seek for the causes of phenomena and events, trained, in short, in the methods of the investigator. Only after a student has successfully undergone such a discipline, and surely the ordinary undergraduate course is none too long for its completion, should he be allowed to undertake investigation. The tendency to make a certain number of years of college training a condition for entrance upon a professional education in medicine is one of the most hopeful signs for the progress of that science, and fortunate are the schools now in a position to demand a complete collegiate course as a preliminary to the professional education. Let us hope that the example of the medical schools will soon be followed by other professional departments and that for all professional studies, including under that

title investigation, a broad foundation may be demanded as a prerequisite. Thus will the dignity and usefulness of the professional schools be increased and thus will the university fulfil its trust by giving to the service of the state sons strong to withstand the wayward blasts of popular superstitions, keen to search out and expose their fallacies, and strenuous in laying secure foundations for advancement in literature, science and the arts and in fostering their development and application.

J. PLAYFAIR McMURRICH

UNIVERSITY OF MICHIGAN

*THE CHEMIST AND THE COMMUNITY*¹

ON April 18 of this year there occurred at San Francisco a vast catastrophe as the result of which more than 1,000 people are said to have lost their lives while 250,000 were rendered homeless in the midst of a conflagration involving an area of six square miles and a property loss of at least \$300,000,000. On April 19 there was run over and killed in the streets of Paris a simple, unassuming, absent-minded man. The Boston *Herald* in an editorial comment upon the two events said that it might well be questioned whether of the two the accident in Paris did not in its broad relation to the welfare of mankind constitute the greater calamity. This was an amazing thing to say of the death of any man, even of one so preeminent in attainment as Professor Curie. Let us consider why it was said and upon what basis it may, if at all, be justified. It was said in tacit recognition of the fact that the quality of intellectual leadership is one of the rarest and most precious possessions of our race and that the world can better afford to lose a city or a province than one of its great investigators, philosophers or teachers.

¹ Read at the general meeting of the American Chemical Society, on December 27, 1906, at Columbia University.

One pregnant thought, one flash of insight from a master mind, has often done more for the advancement of mankind than all the toil which built the pyramids. The result of the researches of Professor and Madam Curie has been as you all well know to change our whole conception of the material universe and to bring within the reach of our perception stupendous natural forces the existence of which had not even been suspected. The effect has been even more far-reaching for with the farther vision has come new views of what life is and of our relations to this greater universe, such views for instance as those put forth by Sir Oliver Lodge in his recent 'Life and Matter.'

In the accounts of the war between Japan and Russia frequent reference was made to the parties of chemists who far ahead of the main army were testing water supplies and posting notices which warned the oncoming troops where danger from polluted water must be avoided. It seems to me that this little vanguard well typifies what the chemist should stand for and where he should be found in his relations to the community. He is or should be essentially a pioneer rushing forward and serving the community in the best sense in serving science.

It has doubtless occurred to some of you that chemists as a professional class do not have that direct and strong hold on the regard of the community which has been established and is well maintained by physicians, lawyers and ministers. The reasons for this are not far to seek. The work of the chemist deals with things and in carrying on this work he is rarely or never brought into such direct and vital personal relations with individual members of the community as the family doctor who presides at birth, the lawyer who conducts affairs, or the minister to whom one turns in times of stress and trouble. Moreover,