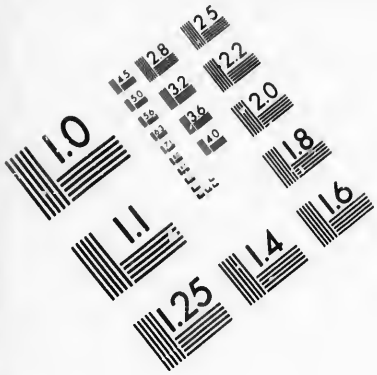

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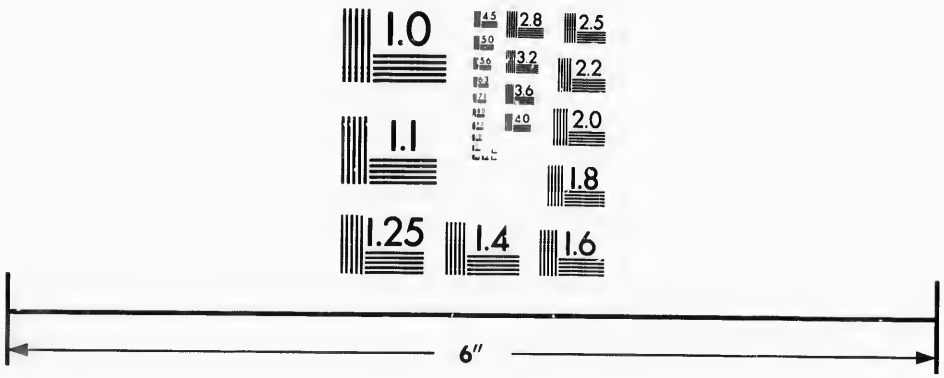

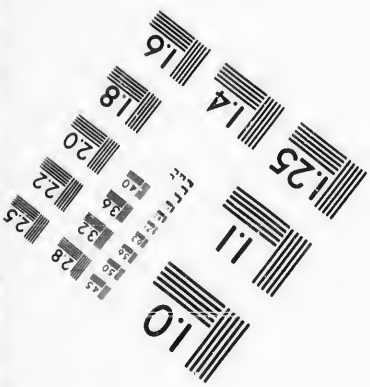

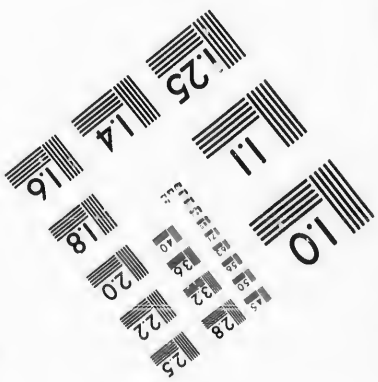

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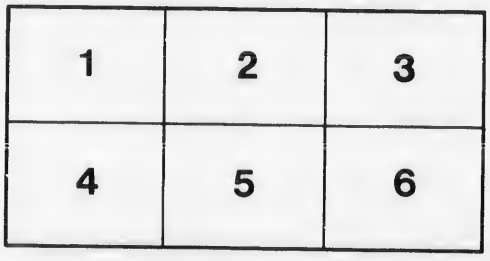

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ADDRESS

ON THE

ELEMENTS of EDUCATION.

Given at the Encænia, King's College, Windsor, June 24, by Professor How.

LAST August witnessed gatherings in England and America in commemoration of an event of the highest importance to mankind, though it is most directly interesting to the chemist, for he turns naturally towards assemblages of fellow-workers who met to celebrate what may be termed the birth day of chemistry. It was on the first day of August, 1774, that Priestley discovered oxygen, and it is not too much to say that though there was some chemical art before this date, there could have been no science of chemistry, so that the name Centennial of Chemistry was appropriate to the celebrations held last year. When the most rapid glance is cast over the interval of 100 years, it cannot fail to be seen that topics of the deepest interest presented themselves to the working chemists of both sexes and of many lands, among whom I was glad to see mentioned at the American meeting one of our old students. It is not, however, on the chemical subjects then discussed that I intend to discourse briefly on this occasion. Priestley was much besides a chemist; he was not even a chemist first; it was not chemistry that drove him from England to die in Pennsylvania, but his theological and political views, which, though he was a most truly moral and religious man, were obnoxious to a mob and some prejudiced parties in those intolerant and excited times, and I am led to refer to him, because among his other writings he had an essay on Education, which was mentioned at the Centennial as one which might be used by a modern educational reformer, who, without discarding the old training, asks a hearing and a place for the new. "It seems to me," he says, "a defect in our present system of public education that a proper course of studies is not provided for gentlemen who are designed to fill the principal stations of *active* life distinct from those which are adapted to the learned professions." He evidently thought with Milton that it was better

> "Not to know at large of things remote
> From use, obscure and subtle, but to know
> That which before us lies in daily life."

"So remote," he adds, "is the general course of study at places of the most liberal education among us, from the business of civil life, that many gentlemen, who have the most liberal education their country can afford, have looked upon the real advantages of such an education as very problematical, and have dispensed with it in their own children." The comment on this was that, "published 110 years ago, it displays such a distant forecast, that it needs only a little modification to be of practical utility today."

Presently dawned the Revolutionary Age, and in the din of war the voice of educational reform could not be heard. The struggle for independence and the rise of the Republic beside us; the outburst of the French

Revolution; the fate of Louis XVI.; the Reign of Terror; the career of Napoleon, filled the minds of men. It was not till the blood of millions had dried up and war had ceased to be the occupation of the greater part of the peoples called civilized, that any thought could be given to such a trifle as improvement in teaching anything except the all-important art of killing. Not that education was forgotten, in England at east, for on this day it must be mentioned, in commemoration according to Statute, that George III. founded this University in 1788, when the political sky had cleared for a time.

But the methods pursued were still the timehonoured and restricted systems which excluded all science but mathematics, and about the middle of this century only began that movement which has resulted in what we see now in the educational world when natural and experimental science are indispensable elements in every good scheme of education. Those who have not looked into the question would be surprised to find how short a time ago the strictest of old views prevailed at the public schools and the universities, especially in England. Oxford indeed has achieved for itself a reputation of the most conservative character. It was Macaulay, (the historian, not our respected chief, who, I think, would hardly speak so unkindly of our prototype,) who said of it, in reference to a period of great reaction in favour of Charles II., divine right, and so on, "It is scarcely necessary to say that, in this hot competition of bigots and slaves, the University of Oxford had the unquestioned preeminence. The glory of being farther behind the age than any other portion of the British people is one which that learned body acquired early and has never lost."

Some 350 years ago the introduction of Greek and Mathematics, the "New Learning" of the period, was vehemently opposed. The king himself had to summon one of its fiercest opponents and enforce silence on his pulpit tirades, and when the preacher alleged that he was carried away by the Spirit —"Yes," retorted the king, "by the spirit, not of wisdom, but of folly." Speaking of to-day, perhaps the brilliant satirist would have given a somewhat different statement, for great changes have been effected even there, the New Learning of our time has forced an entry, and the teaching of Oxford is now more broad and university-like than it was; more in unison with that of other great seats of learning; more adapted, in fact, to the wants of the people for whose benefit it originated 1000 years ago.

It was doubtless the expressed feeling of dissatisfaction with prevailing systems of education that led the British government about twelve years ago to appoint a commission "to inquire into the revenues and management of certain colleges and schools, and the studies and instructions given therein." A very brief notice of some of the details gone into may not be without interest and value. There were series of questions addressed to the several authorities of the great public schools—Eton, Westminster, and the rest of them—and of those connected with my present subject, was one asking whether physical science was considered in determining the rank of a boy in school; and another as to the provision for the teaching and study of it. In the whole 97 pages of evidence from Eton I could not find the words Physical Science. The same is true as regards Winchester, St. Paul's, Merchant Tailors', and Shrewsbury. At Charter House, chemistry was taught, at option, to a considerable number of boys. At Harrow no branch of physical science formed part of the regular course, but every quarter a voluntary examination, open to the whole school, was held in some one branch, and efficiency rewarded. At Rugby, natural philosophy was taught four hours a week; a laboratory was open every day but Monday, for six hours at least. The foregoing are the old public schools; there are three large new schools, called colleges, at which science is more freely brought forward. At Marlborough, chemistry is taught, and the head master, in reference to the question—"How far is it possible to give a really good public school education on any other basis than that of

instruction in the dead languages?" said, "I do not believe that we are at present in a position to answer the question finally and decidedly, for the experiment has not been fairly tried, but I may state briefly my own opinion. While I should deliberately prefer, as the best education, where attainable, that mixture of careful study of the language and substance of the great writers of antiquity, with modern reading and mathematics, which I attempt to combine in my own teaching, yet I believe that a thoroughly sound education may be given, and at the same time the advantages of public school life enjoyed by boys with whom, for various reasons, a different plan is pursued by having a large space devoted to mathematics and science, and a thorough study of French and German substituted for classics." At Wellington, classics form the main body or trunk of the education, on which all other parts (though not provided or considered as extras, but as integral parts of the work) have been engrafted. This has grown more important in experience; not less so. This seems not to suffer from the variety of interest, which, within careful limits, and with a certain freedom of choice, the work presents, and while, as a rule, success in classics is attended with success in other subjects, there are not wanting instances in which the first success and encouragement which have "brought a boy out" and improved his classical work itself, have occurred in some other branch. Chemistry is taught as a lesson and practically, and duly examined upon. At Cheltenham "natural science has fair scope in the Modern Department, and is efficiently worked. To it we look for the cultivation of the observing and inductive faculties," and the Principal who, however, does not conduct the Modern Department the whole course of which comprises mathematics, Latin, English, history, geography, French, German, Hindustani, English language, and literature; physical science, drawing, fortification, and surveying, said further, while having more confidence in the older classical system—"but I still think that the existence of our Modern Department gives far greater perfection to the system of education, and far better scope for the various ability and knowledge of our boys than could be possible, if only the classical system prevailed. I feel sure that it gives a true education, and not mere instruction in various subjects." As the great majority of the students at Oxford and Cambridge were sent from the schools just noticed, it was natural the commission should ask the opinion of the teachers there what were the results of their observation as to what proportion of young men had acquired any knowledge of natural science, or spent time profitably upon it, and how far the great prominence given to classics and mathematics at the Universities affected the teaching at the schools, and also whether the earnest prosecution at the schools of what are termed modern subjects would tend to give a higher value at the Universities to honours taken in those subjects. Of course there was great difference of opinion when the questions were answered at all, and in several instances they were not; some were altogether opposed to interfering with the old system. others had doubts, but some on the other hand were most decided in their expression of opinions favourable to teaching science and other modern subjects in schools, and giving them proper rank in the Universities. An Oxford man said boys should be, "when of somewhat mature age, put through one or two courses of physical lectures, on the principles of mechanical and chemical science. Their minds could not fail to be enlarged by work quite new to them, and by facts which would connect their work with the world around them.' As for the University, he said, "the average work done at Oxford was scarcely worth the name, and we should act wisely, both for the University and the men, were we to give a freer scope, and allow some part of the work done here to bear practically on each man's special line of life." One Cambridge man was much more critical in his remarks, and thought "it is what is usually called Physics or Experimental Science which is best suited for school work. Mechanics and hydrostatics treated experimentally, the sciences relating to heat and electricity, and

chemistry." These appeared to afford an exercise of the greatest possible variety of mental powers.

Having gone first to the heads of the chief educational establishments from whom it was only natural to expect a decided opinion in favour of the old classical system, the commissioners desired to hear from men who had distinguished themselves as teachers of science, what they thought on the matter, and so they called upon a few men eminent in various sciences of observation, classification, and experiment. The first of these was Dr. Carpenter, a well known writer on Physiology, and Registrar of the London University. He dwelt upon the fact that the matriculation examination at this place included as much classics as the middle class examination of Oxford and Cambridge; but he maintained that the training of the faculties by the study of classics and mathematics alone or combined was very imperfect, and that there ought to be a change of plan according, not only to objects in life, but to mental peculiarities; and he strongly advocated beginning with some science of observation very early in life, because any right system of education will take up faculties in the order of their development, and the observing faculties of the young are keen and very readily trained, while a grown-up person or youth after a certain age makes up badly for neglect of the exercise of the faculty of observation. He had been acquainted with several gentlemen who had passed with distinction through a course of public school and university training, and who confessed to him with regret their inaptitude to understand any scientific subject whatever—their want not only of the knowledge, but of the mental aptitude, which arose from not having studied any science when young. He told a curious anecdote about teaching absolutely nothing but classics, as was formerly done at Eton. A young man had gone through the complete course there, and it was found accidentally that while he was intelligent in other respects, he had not only never learned his multiplication table, but he did not know there was such a thing as a multiplication table. He was buying several pairs of silk stockings in a shop, and to find out how much he had to pay, he was adding the price of one pair to the second pair, and that to the third pair, and so on When he found how much easier it would be to work by the multiplication table, he applied himself to master it, and learnt it off in the course of a few days with the keenest pleasure.

Sir Charles Lyell, the geologist, said that since all branches of natural science are so closely connected, if the elements of any one are to a certain degree mastered, it will train the mind in the same way and be the same exercise as any other, and afford a very useful training which to a certain extent the study of the classics will not supply. He thought the great reason why there was no attempt to furnish science at the public schools was because it was slighted at the universities as inferior to classics. A merely elementary knowledge of chemistry and natural philosophy should be included in every matriculation examination, because it is of immense importance that these subjects should be recognized, as if there is not some idea, he would almost say some respect for, these things implanted at an early period, there is a great disadvantage in after life, and this is a reason why so few persons of rank and influence are enlightened patrons of these branches. He mentioned the false idea among those who have never been grounded in them, that they are comparatively trifling, and do not require the same searching mind and the same severe study as the classics; and he thought too that the reasoning power and the judgment are more cultivated by these subjects than by the exclusive study of the classics. He dwelt particularly on the fact that scientifically instructed men, such as surveyors and mining engineers, had to be sought in Scotland and Germany, in which last country you would find at a gymnasium or second-rate school, a teacher exclusively of science. He showed that the middle classes of England (educated, not at public, but at private schools) had greater knowledge of science than the upper, and that there was a dangerous want of sympathy between the better

informed working classes of manufacturing districts and the church clergymen, educated at the University, on this account.

Michael Faraday, the chemist, did not speak as an educated man, in common language, but he found it strange that the natural knowledge accumulating for fifty years should be left untouched, and that no sufficient attempt should be made to convey it to the young mind growing up and obtaining its first views of these things. He dwelt most upon the state of mind he found in various classes—want of judgment especially—which he set down to the total absence of scientific training. Going to a stratum of life not touched by former witnesses, as officer of the Trinity House, he found it very difficult to get men of ordinary intelligence, prepared by instruction, to do any thing at all out of the way. Thus men could hardly be found fit to look after a common lighthouse lamp, still less an electric light; while in France, were men at less wages, able to give a reason, or supply a correction, or act for themselves, who were selected from a class that had had instruction. The want of judgment in natural things he found in those learned in literature as well as the unlearned; indeed, it was the highly-educated men he found going to him again and again and asking the most simple questions in chemistry or mechanics; and when he spoke of such things as conservation of force, permanency of matter, or the unchangeability of the laws of nature, they could not comprehend them. Many of those instructed persons were as far from having the power of judgment of such things as if their minds had never been trained. He found them greatly deficient, not in their own studies, but when taken into the natural sciences; they had no peculiar aptitude for grasping a new subject; he found the same grown-up mind going back to him with the same questions over and over again; he had told the same person a dozen years in succession that water was composed of oxygen and hydrogen. Such minds are not prepared to receive or embody these notions, and that is where you want education; to teach them the A B C of these things. He thought that exclusive attention to one set of studies during early life so far gives the growing mind a certain habit—a certain desire and willingness to accept general ideas of a literary kind, and to say all the rest is nonsense and belongs to the artizan—and by that habit the mind is really injured for the reception of other knowledge. It takes up the impression that a certain kind of knowledge—he called it the real knowledge—the knowledge of things, is of no importance. The first thing to be done to obviate such a state of things was to give scientific teaching an assured and honoured place in education; and he thought one-fifth, certainly, of the time given to study should be devoted to the attainment of natural knowledge.

Then came a botanist, Dr. Hooker. He thoroughly advocated the teaching of botany in schools as the readiest, simplest, and most practical means of training the observing and reasoning faculties. He thought it very undesirable that a boy at school having faculties of a particular kind should have them wholly neglected. Taking the case of one who had a taste for natural science he thought nothing could be more destructive to his whole education than the neglect of his peculiar faculties. If he had no turn for languages, his place in a classical school would be very low down, and it would be morally injurious to him, and tend to impair his self-respect to be regarded as stupid because he had no taste for languages. The school-time of a great chemist affords a case in point. Towards the beginning of this century, at a German school of the old type, where pupils were gauged solely according to their proficiency in classics, there was a boy who was the acknowledged dunce of the school; sneered at by his companions, and denounced by his master as little better than an idiot, his declaration that he intended to become a chemist was received with a general outburst of contemptuous laughter. But the boy knew his own speciality. His success in chemistry was yet more decided than his failure in classics; and when he passed away from our midst, he left the name of Justus Von Liebig, second to none in the annals of science.

The next to give evidence was Professor Owen, the anatomist. He thought science should be taught in schools; he advocated some branch of natural history, because its value would be in improving the powers of observation, and enabling the mind to grapple better with all the ordinary business of life, so far as the faculties of arrangement, classification, and order are concerned. On these grounds he preferred it to chemistry; this would educe powers of a different character, though perhaps of a higher order, as the appreciation of cause and effect. He thought the same teacher should not teach both chemistry and natural history.

The Astronomer Royal followed with evidence chiefly directed to mathematics. He was from Cambridge, and was severe upon the examiners there, who rather perverted those who may have been well instructed. He read part of a letter from some eminent Austrian, who said he had admired much in England, but there was one black spot, "the school-rooms at Eton," defined to be the teaching there. He thought classics should certainly form the basis of education, but the elements of mathematics and a considerable knowledge of physical sciences should be added, at public schools, and that at universities, sound demonstrative mathematics, with a strong tendency to applied science, should constitute a large part of the education.

Then came the full and most interesting evidence of Dr. Acland, Professor of Medicine at Oxford. They were living in a period of transition with regard to education; he and others had succeeded in making great changes at Oxford, by promoting a wider sphere of education, and introducing scientific subjects, and providing that these should lead to scholarships and other emoluments. He thought that physics, chemistry, and physiology (used in a very general sense) should be the fundamental scientific subjects for pass men at the universities, and the two former for schools. Physical sciences exercise the memory in a higher degree than anything else, according to his view and knowledge. No one had been turned out of Oxford with scientific attainments for the last twenty years without being thoroughly grounded in classics. They had even then at Oxford, he thought, almost everything that could produce the desirable education in physical science, excepting the good will of some of their classical friends, which he still desired. When he was asked if it was not the case that many clergymen, however learned, had not the influence over farmers and others which they would otherwise have if they were intelligent in those subjects in which the farmers were intelligent, he said he supposed in human nature it must be so, and begged leave to add that one great reason why Oxford had gone to the labour and expense of increasing its means of scientific study, was from the sense entertained there of the importance to the clergy and upper classes of England of more extended knowledge, in order to retain their proper relations to the lower and middle classes who have this knowledge.

"Now have I toiled through all," and laborious as the work has been to me, and tedious no doubt the details to you, I trust my effort is not without use as bearing on the system pursued here. If people will patiently and fairly examine our late Calendars, I think it will be allowed that our system is in accord with the average of the views which I have set before you, and that it is entitled to the confidence of those who wish for a sound education to be imparted to the youth of the Province. Let it be remembered too that our numbers of teachers and taught do not bear such a disproportion as prevails in some institutions of great pretentions, where, by the way, it is not one of the things boasted of, and where also the time of teaching in the year is much shorter than with us. It is true we have not

> "The murmuring of innumerable bees,"

but we do not fear any comparison in the industry of our workers, the soundness of our instruction, and the real value of our results.

I crave one moment more to touch upon a feature in our system of much importance—it is the work done with the hands—the things of which our students may say "*ea*

nostra voco quæ fecimus ipsi," our drawing, surveying, and practical chemistry. The propriety of adding manual work to book work in institutions of learning is daily becoming more openly acknowledged; Agricultural Colleges, Technical Schools, the Cornell University to wit, and so Priestley's idea is being carried out to an increasing extent.

Why should not Nova Scotia have its Agricultural College, and why should not this University, acting on the suggestion of one of our liberal benefactors, Dr. Cogswell, add an agricultural branch to its system of education? The governors of colleges have a solemn trust, and it behoves them to consider the form of education in every light, and to make provision for every element necessary to produce a real system of instruction for a people. At the Centennial in Philadelphia last year, much stress was naturally laid upon this point, and a president of an agricultural college said, referring to the well-known fact that it is not sufficient to have spent a certain number of years in a college or university in order to secure a respectable education, "an English friend, himself a university graduate, once remarked to me that he could point to artizans in workshops in England with better trained minds, as evinced by greater power of following up any connected train of thought, than could be found with many persons who had spent years at the time-honoured universities of Oxford or Cambridge."

Here is material for thought and for action. The single and double-headed educational idols have been demolished, and this part of the nineteenth century has seen too much to respect any system as complete which does not consider the whole man in its culture. It is a noble ambition to devise a real scheme of education adapted to the many-sided wants of our time, a privilege to aid in carrying it out. The removal of mountains of prejudice is slow work, one must be content with partial success, and, to borrow once more from the Laureate—

> "Still achieving, still pursuing,
> Learn to labour and to wait."

NOTE.—A University Sermon had been preached by Rev. G. W. Hodgson, M. A., a Governor of the College, upon the religious spirit in which the work of education should be carried on. The Rev. the President had delivered an Oration in the Hall, shewing how, when read in the light of Christianity, admirable lessons may be read in the Pagan Classics. The Rev. the Vice President had discoursed most pertinently on the necessity of including religious instruction in university training as in our system.