THE UNIVERSITY OF ADELAIDE.

COMMEMORATION DAY.

The annual Commemoration of the University of Adelaide was held on Wednesday afternoon, December 19, in the Library of the University, and proved a very gratifying ceremonial. Members of the Council and Senate assembled in the Museum wearing the academic costume proper to their respective degrees and offices, and walked in procession to the Library, followed by Professors Tate, Rennie, Ives, Boulger, and Bragg. The Chancellor (the Hon. S. J. Way) presided, and was attended on the platform by the Vice-Chancellor (Archdeacon Farr) and the Registrar (Mr. J. W. Tyas). There was a crowded audience, fully half of whom were ladies. The front seats were occupied by His Excellency the Governor and suite, Archbishop Reynolds, Sir Henry Ayers, the Chief Secretary, the Attorney-General and Mrs. Kingston, the Rev. A. Hannay, D.D., and Mr. Henry Lee.

ADMISSION TO DEGREES.

The Deans of the Faculties presented the candidates in their respective faculties to the Chancellor, who conferred degrees on the undernamed candidates:—

LL.B. Degree.—Francis Edward Knowles, Anthony James Alexander Hall, Albert Edward Jones, Richard Francis Dempsey, William Ashley Magarey, Henry Upton, James Taylor Mellor, and Douglas Comyn Scott.

B Sc. Degree.—Clinton Coleridge Farr.

B.A. Degree.—The first candidate for this degree presented was Miss Charlotte Elizabeth Arabella Wright, who was loudly cheered on ascending the platform. The CHANCELLOR congratulated Miss Wright on being the first woman Bachelor of Arts in the University of Adelaide. (Cheers) She was not the first woman graduate in the University, but as the first woman Bachelor of Arts he trusted she was the first of a long and illustrious line of bachelors of her sex under that Faculty. (Loud cheers.)

The other candidates on whom the degree of B.A. was conferred were:—Thomas Martin Burgess, Alexander Wyllie, Ernest Neville Marryat, George Alfred Fischer, Alfred Nicholas Hopkins, Judah Moss Solomon, Percy Norwood Knight, and Thomas Abram Le Messurier. Addressing Mr. T. M. Burgess, the CHANCELLOR said he did not wonder at the applause which greeted his advance to the platform. The degree which he had taken had never been excelled in the history of that University. He had passed with first class honours in classics, and he had passed first class in honours in mathematics. At Oxford that would be called a double first class, and he (the Chancellor) did not know why such a distinction should not bear the same name in the University of Adelaide. (Hear, hear.) Such success in his undergraduate career was no doubt only a precursor of even greater success in after life, and he (the Chancellor) asked him to do him the favour of accepting a cheque as a slight mark of appreciation of the success which he had shown at his examination. (Loud cheers.)

The following graduates of other Universities were admitted *ad eundem gradum*:—Sir Samuel Davenport, LL.D., University of Cambridge; Sylvanus James Magarey, M.D.,

University of Melbourne; Harry Swift, M.D., University of Cambridge; Christopher Bollen, M.B., University of Toronto; Thomas Borthwick, M.B., University of Edinburgh; Robert Humphrey Marten, M.B., University of Cambridge; William Henry Bragg, M.A., University of Cambridge; William Lowrie, M.A., University of Edinburgh; Montague Couch Wood, M.A., University of Oxford; and F. W. Pennefather, B.A., University of Cambridge. Addressing Sir Samuel Davenport, the CHANCELLOR said there was no incident connected with the Colonial and Indian Exhibition two years ago which gave the colonists of South Australia greater pleasure than the fact that the Queen and the venerable University of Cambridge deemed that Sir Samuel's services and his character were worthy of marks of high distinction. (Cheers.) Her Majesty had affixed the decoration, which he so deservedly wore, with her own hands on his breast, and the Orator of the University of Cambridge, in good Ciceronian Latin, declared that services of colonists like Sir Samuel were more enduring than trophies of monumental brass. (Cheers.) To-day they had the opportunity of ratifying that distinction, and showing that in South Australia at all events a patriotic, unselfish, and true-hearted gentleman was not without honour in his own country. (Cheers.)

The Dean of the Faculty of Arts presented to the Chancellor the John Howard Clark Scholar, Frank Sandland Hone; and the Dean of the Faculty of Medicine presented the winners of Sir Thomas Elder's prizes for physiology—Wentworth Rowland Cavenagh (student of medicine), and Matilda Beatrice Austin and Frederick Coleman (non-graduating students). The names of the successful candidates in the first classes of the Senior and Junior Public Examinations and of the senior division of the Public Examinations in Music were then read.

PROGRESS OF THE UNIVERSITY — TRIBUTE TO HIS EXCELLENCY.

The CHANCELLOR said — Your Excellency, my Lord, ladies and gentlemen: As we have to listen to the annual oration by Professor Bragg, and possibly to a few observations from His Excellency, I shall not detain you for many more moments than are necessary to bid your Excellency, the Hon. the Chief Secretary, the Hon. the Attorney-General, His Grace the Archbishop, and our distinguished visitors from England — Dr. Hannay and Mr. Henry Lee—as well as the other visitors who are present, welcome within the walls of the University, and to thank them for the honour they have done us by attending on this occasion. Your Excellency, I am sorry that this is the last time we shall have the opportunity of welcoming you at the annual Commemoration —at all events, in your capacity as Governor of South Australia. The first time you attended one of our Commemorations, was in December 1883, just five years ago. It is, I am sure, quite impossible for you to compare what you saw then with what we have witnessed here to-day, without being struck with the progress which has been made by the University of Adelaide during these five years. On the first of those occasions we admitted two of the students of the University to degrees; to-day we have admitted 19. At that time we had simply a Faculty of Arts and a Faculty of Laws, which had been established just twelve months before. Now, owing to the munifi-

cent liberality of our benefactor, Sir Thomas Elder—(cheers)—and to the liberality also of Mr. John Howard Angas, we have, besides, a Faculty of Science, a Chair of Chemistry, and a fully-equipped School of Medicine. We have also a Professorship of Music, and we have provision made for evening lectures, the usefulness of which will be much increased by the recent establishment of a School of Mines and Industries in this city. In 1883 we had 47 graduating students. We end this year with 105, besides 75 non-graduating students. And then, if we turn from the proper teaching work of the University to what we are doing outside our own classrooms in the way of examinations —if we compare what we did then with what we are doing now—I think it must be admitted that the results are equally satisfactory. In 1883 151 boys and girls presented themselves for examination in our matriculation and junior examinations. This year there presented themselves at the examinations which have been held by the University no fewer than 526 candidates, or, if we include the candidates who presented themselves at the popular examinations in the theory and practice of music, then these numbers reach 716. (Cheers.) I should have to trespass too long on your time, and I fear you would regard it as tedious if I were to attempt to explain in detail the full significance of these figures; but I think I may claim that they establish this one point, which I boldly affirm, that within the last five years there has been a great expansion in every branch of the work of the University. Your Excellency, like your predecessors, the lamented Sir Anthony Musgrave, who died last October, and like His Excellency Sir William Jervois, has ever since your arrival in the colony taken a warm interest in the welfare of the University. (Hear, hear.) You have attended and taken an able part in our successive Commemorations, and it is owing to your suggestions, to your influence, and to your exertions, that the University of Adelaide has the distinguished honour of being the first University in Her Majesty's Dominions in which a teaching Chair of the science of music has been established. (Cheers.) On account of that benefit which you have thus done to the University, it is a cause of satisfaction to myself, and I am sure it is a cause of equal satisfaction to all the members and friends of the University, that our generous friend Sir Edwin Smith has presented us with a portrait bust of your Excellency, which will make familiar to all successive generations of students one who has not only filled the high office of Governor of this colony with loyalty to the Queen, and with faithfulness to the people of South Australia, but who has done a signal service to this University. (Cheers). I wish your Excellency were staying longer amongst us, because if you were I know we should have your zealous co-operation in securing the permanent endowment of the Chair of Music. As I need not remind your Excellency that Chair is supported by contributions extending over five years which come to an end at the close of next year. I am sure that your Excellency will be gratified to know that the interest and usefulness of the Chair are maintained, and quite answer the most sanguine anticipations which we formed at its commencement. There have been all along about 25 graduating students. Further, at the examina-

tions, which, by a happy suggestion of Professor Ives, were established last year—the popular examinations in the theory and the practice of music—75 candidates presented themselves, then, while 194 candidates presented themselves this year, clearly showing that the step which was thus taken is having a very important influence on musical culture throughout South Australia. (Cheers). I venture also to mention a circumstance that I know will be gratifying to the late Treasurer of the University, Sir Henry Ayers, the fact that the revenue of the Chair is advancing. (Hear, hear). The fees received from students and candidates for examination during the year that has just closed, were nearly twice as large as they amounted to in any previous year, and amounted to £441. That sum is not sufficient to maintain the Chair, and it is therefore necessary, if we are to secure its permanent continuance, that it shall be endowed with some substantial amount. I confess that in my opinion the University of Adelaide is committed, and the colony of South Australia is committed, and unless we are to lose prestige among our neighbours, and to fall from the van to the rear; unless we are prepared to say that the students of South Australia, if they desire to obtain degrees in music, are to go to Melbourne or Sydney, or to any part of the world in which they can find what they want, it will be necessary for us to take earnest steps during the ensuing year for the purpose of obtaining a permanent endowment of the Chair of Music. (Hear, hear.) Your Excellency—As I have already said, we have to wish you farewell in your capacity as Governor to-day. I trust we shall see you in after years as a visitor to South Australia, and I know it will be a great gratification to you if, on such occasions you will be able to congratulate this University on the Chair of Music being, like our other Chairs, substantially endowed, and of great benefit to the community at large. (Cheers.)

His Excellency, who was loudly cheered, said—Mr. Chancellor, ladies and gentlemen—It was not my intention to have said any words to you to day; but what the Chancellor has said seems to invite one or two observations. I would in the first place express my most hearty congratulations to the authorities of the University and to the public of South Australia on the marked success with which has attended this University during the period I have been in the colony. I have listened with great gratification to the exposition given by the Chancellor of the work done in this University; and perhaps I may be pardoned for saying that none of his observations have been more agreeable to me than those which speak of the success of the Chair of Music. (Hear, hear.) I can bear personal testimony to the success of that Chair, under the able and learned guidance of the gentleman who has occupied the position of Professor, and I consider that that Chair has realized my most sanguine expectations. I think it would be a very great pity if that Chair were allowed to fall through from want of support by the public in offering the funds needed for its permanent establishment. The amount required for the permanent endowment is not very large, and I hope that before I leave South Australia I may be able to at all events take

some steps to inaugurate the collection of funds which shall go towards this object. (Cheers). Now, ladies and gentlemen, I have congratulated the Chancellor and the authorities of the University, and the public of South Australia on the marked and distinguished success which has attended this University so far. I will only say in conclusion that it has my most earnest and best wishes for its future success, and whether I return here as a visitor—which I sincerely hope I may do—or whether I watch its proceedings from afar, it is one of the institutions the success of which I shall watch with the greatest pleasure and interest. I leave you now with the assurance that the University will always have my best wishes for its continued prosperity and success. (Loud cheers.)

ADDRESS BY PROFESSOR BRAGG.

The annual address, which was read by Professor BRAGG, was as follows :—

There is nowadays a very general complaint that the education conducted in our English public schools and colleges is not practical enough, by which somewhat indefinite statement is meant that boys and young men, when they enter on the practical business of life, do not find that this education is the help to them that it ought to be.

It is my wish to-day to help if I can in the enquiry as to how far this complaint is true, in the making clear the nature of the defect in our manner of education, and in the determination of the best means of removing it.

I am aware that in venturing to address you on a subject of such difficulty I have not the warranty which is given by a long experience of teaching. I must rather speak to you as one who has lately been a student, who is familiar with the anxieties and doubts as to his future occupation which often beset the student nearing the end of his term of education, and with the humiliation with which he feels that all the time and cost and trouble have not opened out to him the wide field of useful employment which they should have done. I have felt then, and still do feel, that there is ground for complaint. I have tried to study the question, and, though I do not claim that what I have to say may be in any way conclusive, yet I hope it will be found suggestive.

It is quite true that when boys and young men have "finished their education" they have great difficulty in finding work to do which calls into play the faculties and suits the tastes that have been developed in them, and at the same time is remunerative. What they have learnt does not seem to be immediately applicable to their new conditions.

A boy leaves school with his mind stored with Latin, and mathematics, and history, and somehow they do not seem to lead to anything. They do not make of him at once a good farmer, or manufacturer, or engineer, or a successful producer of wines; there is still some further training for him to undergo before he can obtain a living. There are one or two obvious ways of doing this. He may, for example, enter a school of law or medicine, and as in these cases the previous school training is of direct value, numbers enter these professions, and they become overcrowded. Many boys, far too many, become office clerks, when they find that the most of what they have learnt is not of great use to them; it does not help them to advance, and if they do not advance they remain in a

position which is often unworthy of the time and trouble spent on teaching them. If a boy is apprenticed to an engineer say, or an architect or a manufacturer, or if he intends to be a farmer or a producer of fruit and wine, he has almost to begin his education over again.

There are a great many who say that this is because the subjects taught under our present system of education are not practical enough; they do not see any use in Latin, for instance, because Latin is not in common use in business; or in mathematics, because the majority of men get along without them. They have a somewhat confused notion that the difficulty would be ended by the introduction of a system of technical education under which a boy's training before leaving school would be such as to fit him directly for some particular profession or occupation.

But if a number of those who hold such opinions were asked to make definite statements of what they would consider a sufficiently practical curriculum, their statements when set side by side would be found to have very little in common; for the parent who intended his son to be a merchant would say that he would like to see arithmetic, bookkeeping, French and German, political economy, and so on the principal subjects taught; whilst he who was going to make his son a farmer would see very little use in French and German and political ecomony, but would rather his boy should be taught something of the chemistry of agriculture and animal physiology. And other men would think those subjects most practical which would be most directly applicable to their own individual cases. Evidently it would be impracticable to teach so many subjects at schools, to undertake such a comprehensive system of technical education. And, indeed, the evidence given by educational authorities, by manufacturers and employers, before the late Royal Technical Commission is conclusive as to the fact not only that it would be impossible to attempt this, but even if it were possible that it would not be desirable to do so. It is true that the enquiries of this Commission were limited to the discovery of what ought to be done in the way of providing technical instruction in the Government schools; still it is easy whilst reading the evidence to see how much of it applies to the manner of educating the boys of our middle classes. There is quite enough tendency at the present day to subdivide work—to give to each man one small circumscribed sphere of labour—in fact, to make a machine of him, and it would be wrong to encourage this tendency. Suppose in the manufacture of a watch one man were only taught to make mainsprings, and another only balance-wheels, and another only hands, and so on, and each were to know nothing of any part of the watch but what he himself made, it might be possible so to manufacture good watches at a cheap rate; but the imaginative and designing faculties of those men would all be wasted. They could not suggest any improvements in the manufacture of a watch, because to do so they would have to consider the effect of any alteration on the whole watch. Moreover, if any new and better system of registering the time on the dial-plate were introduced, some system which did away with the hands, then the man who made hands only would find himself thrown out of employment and

his skill valueless. He would oppose most heartily the introduction of any such improvement. Again, the cramping of the imagination and intelligence of these men, which would be the consequence of their having no inducement to design, would injure them—lower them intellectually and morally. I think you will see from this analogy why it would be deplorable to make a boy choose early the business he is going to follow, and to confine his attention only to such subjects as had an immediate bearing on this business. He might so become capable of doing very well a limited number of things following the rules he had been taught, and so long as the things he could do commanded a price he would do well enough. But nothing stands still nowadays; that way of conducting a business which is the right and profitable one to-day becomes the wrong and unprofitable one to-morrow. Other men's ingenuity and the developments of science are constantly making improvements. If a man is to succeed he must do far more than learn certain rules thoroughly; he must understand the principles on which the rules are founded, be able to understand new principles as they are published, and keep himself abreast of the times.

So it would be shortsighted to limit the education of a boy to those subjects only which would be directly applicable to the pursuit of any one trade or profession. The tendency of such a course would be to produce a man of narrow mind, incapable of self-development, unable to suggest improvement himself, and averse to them when suggested by others. Whilst a boy is at school his training should be purely a general one.

Nor does there seem to be much ground for hope that the gulf between the book learning of the school and the practical work of ordinary life can be bridged over by any comprehensive system of instruction in technical schools. In this colony, with its small population, there is not sufficient demand for technical instruction in any but one or two of the chief industries to render it possible or proper that technical schools should be provided to supply it.

Cannot we then draw from all the evidence on technical instruction which has been given before late Commissions, from all the discussion of the subject by eminent men, any lesson as to what may be done to make the education of the children of our middle classes more satisfactory and more serviceable?

I think we can. It seems to me that from all that has been said, and from all that may in many ways be observed, there is one obvious practical conclusion to be drawn; it is, that improvement is desirable not so much in the nature of the subjects that we teach as in the way in which we teach them. In Professor Ramsay's words, "The most urgent educational need of our time is to improve our national system of education throughout, to make it not more practical merely, but more thorough and more intelligent, more educative and less mechanical in its aims and methods." The truth is our present system of education may develop in the young generation the capability of fulfilling duties in certain traditional ways, but it does not so train minds that, having a knowledge of the tools that modern science provides, and judgment as to what may be done with them, they may strike out for themselves new kinds of work and new methods of working. It does not

develop power of observation, or of reasoning from observation, or of designing. We teach facts and rules instead of encouraging the student to discover the facts and rules for himself; there is too much teaching and too little educating. In consequence, the boy whom we have taught is a helpless individual; he can only set about earning a living in ways which no originality is required, and if he is given chances of self-improvement he makes a bad learner, because he has never had any practice in finding out things for himself. This is the great fault of the English system of education. There is good reason for supposing that this has been one of the most prejudicial of the causes that have hindered the development of industries in England; and if in an old country this fault is a source of harm, how much more must it be so in a new country like ours? Of what good is a man accustomed to follow rules, unaccustomed to experiment, and to think out the meaning of experimental results, and with no sense of the delight of striking out new ideas for himself—of what good is such a man to a colony where so much is new and so much undiscovered, whose facts are not the same as those of the old world, and where the old world's rules do not apply?

We ought to do our best, then, to educate in our boys faculties of observation, of reasoning from observation, and of applying the results of the reasoning; to train them to depend, in dealing with fresh facts, on their own intelligence, not on rules imperfectly understood; to join with the learning from books the learning from things, lest their mental conceptions become vapoury and unreal; to cultivate their originality, their ability to design, so that in all their own work and as directors and employers of labour in this colony they may display power of development and capability of sound enterprise.

If we are to educate so as to further as much as possible the development of these faculties it seems to me that many improvements are possible and desirable. Let me for example try and suggest how with this end in view we might modify our manner of teaching mathematics and physics.

The study of geometry is valuable on several grounds. In the first place it is right that everyone should know how to measure, and geometry teaches the science of measuring. Herein is its practical value, its utility. But the study of geometry is also of the greatest value as a mental discipline. It exercises the logical faculties, that is, teaches how to reason truly, and it also provides a grand field for the exercise of the faculty of designing, and in teaching geometry these are the two great points that must always be kept in sight. But I do not think there could be any more certain way of missing these points than by trying to teach geometry to beginners by setting them to work to learn the propositions of Euclid. Euclid has written a geometry in which the propositions are founded on a very few simple axioms, and, in the logical deduction of geometrical truths from these axioms, he has displayed methods of reasoning which are the admiration of trained mathematicians for their force and delicacy. But boys, with minds as yet but little trained, are utterly unable to admire or to grasp his principle; his propositions are to them mysterious and painful things; and their bewilderment causes in them a distaste for geometry, and a false idea of their own inability to learn it. When a boy, for example, is shown in the fifth proposition of the First Book of Euclid that the angles at

the base of an isosceles triangle are equal, he is shown in a very cumbersome way what is almost evident from inspection; and you are expecting from him a very large measure of faith in the ultimate good of what he is doing if you think he is going to be enthusiastic about proving that the angles are equal without asssuming anything but two or three axioms, when he can see it much better by drawing an isosceles triangle on a piece of paper, cutting it out, turning it over, and seeing that it still fits in its reversed position the hole from which it was taken. Euclid's way is very ingenious, but I do not think the ingenuity is of a kind likely to interest the boy. It will interest him when he grows a good deal older, but not when he is young—it is too abstract for him. He will like the concrete proof best, and there is a certain amount of ingenuity in it which will appeal to him. And if you, who are teaching him, cause him to do this with several isosceles triangles of different shapes and sizes, he will by actual experiment find that the angles at the base are always equal, and you can then draw from him the explanation that this fitting on reversal must always occur because the two sides are equal. In this way you educate him—you make him teach himself. You first make him observe facts, then make him collect them under a rule, then cause him to exercise his reasoning faculties in discovering the explanation of this rule.

If you set the boy to learn the fifth proposition as it is proved by Euclid, it is true that you give him a beautiful piece of logic to study, but he cannot appreciate it; hence you miss one of the two great points for which the study of geometry is valuable, that is the cultivation of the boy's logical powers; and since you frighten him with the amount and complexity of reasoning necessary to prove so simple a thing, you utterly take away from him any ambition to attack new questions for himself; and so you miss the other, the cultivation of his capacity for original and constructive work.

But if, only giving hints when necessary you lead a boy to observe the fact to discover a proof, experimental first and general afterwards, you teach him to think for himself; you show him that geometry is rather an easy thing than otherwise, and make him experience his own powers. The next little proposition you give him to do he will attack with a will, and with some experience in attacking. And if you build up a knowledge of geometry in this way how thorough it will be! The boy will have thought out most of it for himself, and the knowledge he will have discovered for himself will be a very different thing from knowledge merely taught him, with the necessity attached that he must think of it in the same way that Euclid did, whose logical faculties when he wrote his Elements were in a very different condition from those of a boy. If I may make a somewhat Irish remark, I will say that, if Euclid had had to learn his own Elements when he was young, he very probably would not have been able or inclined to write them afterwards, and that would have been a great loss to us.

It would, of course, be impossible for me now to give in detail a new system of teaching geometry, nor if I had time would I venture to do so, as I have had so little practical experience in teaching, but I hope I

have made clear by the example I have given the spirit of a system whose details each teacher could best work out for himself, a system which would train boys to think and design, and would be full of life as compared with the dead system of teaching rules imperfectly understood.

It may be said that there would be practical difficulties in examining boys so taught, but if we were to confess that a bad system of teaching geometry must be maintained simply on account of difficulties in examining, then indeed we should be making the examination our master instead of our servant. But there is no cause for any such confession. I am sure a geometry paper can be so set as to place the boy whose reasoning and designing faculties have been trained far above a boy who has merely learnt propositions, even though the former does not know a single proposition, and the second knows his Euclid from cover to cover. There has been published also by an Association of mathematical masters a Syllabus of Geometry. Perhaps we in this country could adopt it, and each teacher, while adhering to the sequence of propositions so established, could use either the text-book of the Association or any other he pleased; or again, as I think would be advisable in teaching beginners at all events, use no text book at all. The nearer we can get to making each boy write his own text-book the better.

Algebra and the analytical sciences in general are of less value as a means of training than geometry, but they are of course of great utility. A great deal of scientific work, especially of the higher kind, is completely dependent on the methods of analysis, and their study is an obvious practical necessity.

Now, the working out of a practical question by analytical methods consists generally of processes of two kinds, quite different in their nature and in their effect on the training of the mind. To the first kind of process belongs the grasping of the question that is to be solved, that is the exact conception of the data, the clear idea of the nature of the desired result, and the ordinary mental review of all the facts and reasonings which bear upon the question, and are known to the operator, and finally the expression of all these in the symbolical language of mathematics, generally in the form of an equation. Then follows the second process; the symbols are manipulated; in the higher mathematics this manipulation involves a certain amount of skill and ingenuity, but in arithmetic and algebra, that is, such parts of these subjects as are of easier nature, as are generally taught to young children, and as are included in our public examination schedules, the treatment of the symbols follows well-known laws, and often requires nothing more than mere memory on the part of the worker. The symbols having been thus treated there follows the retranslation of the result into a practical meaning, and this last process is of the same nature as the first. Now it is in conducting processes of the first kind that are brought into play some of those faculties of designing which are of so great importance, which tend so much to success in life; the clear understanding of the resources at one's disposal, orderly mental arrangement of those resources, a definite idea of what is to be attained, and the proper selection from all the resources of those which it is best to employ in the attainment. In processes of

the second kind the faculties employed are of a much lower order; clearness and good arrangement and attention are still required, but the things treated of are limited in number to the symbols in the equation, so that there is no exercise of judgment in selection, and they have for the time being lost all meaning, so that the effort of thought is confined to little more than thinking of what the rule says is to be done next. Consequently the first kind of process is of a much more educating nature than the second. But I do not think this fact is generally recognised; indeed, when those of us who examine in mathematics and arithmetic in our public examinations set questions intended not merely to test the capabilities of candidates for remembering rules for the manipulation of symbols, which may have very little real meaning to them, but to find out whether their higher faculties of judgment, comparison, and reasoning have been trained, we meet with complaints that our questions are not straightforward, but are of the nature of puzzles. To a person untrained to think, every question for whose solution he has not a rule ready is a puzzle. The mathematical training is emasculated if it be confined to the treatment of symbols without clear idea as to their meaning by processes which require no originality in their conduction. A mathematical training of that sort is worse than useless, for it leads to a narrow-minded dependence on rules. This surely is an evil habit to encourage, for in practical life we rarely meet with a question which any known rule will fit.

But whilst the mathematics, geometry in particular, can be so taught as to educate the faculties of observing and designing, the study of the natural sciences is most thoroughly and naturally fitted for this purpose. Whilst you teach chemistry or physics, or geology, or others of the sciences, you can train the student to observe and experiment, to compare and to