THE

CALCUTTA UNIVERSITY

AND SCIENCE.

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1. *Lectures on Education delivered at the Royal Institution of Great Britain.* London: 1854.
2. *Of a Liberal Education in general and with particular reference to the leading studies of the University of Cambridge, by* William Whewell, D. D. London: 1845.
3. *History of the Inductive Sciences, by* William Whewell, D. D. 3rd edition, London: 1857.
4. *Philosophy of the Inductive Sciences, by* William Whewell, D. D. 3rd edition, London: 1858.
5. *Minutes of the University of Calcutta.* Calcutta: 1857-1864.

SOME years ago, the Managers of the Royal Institution invited seven eminent representatives of English Science to deliver a series of lectures on education. The list of lecturers comprised Dr. Whewell, Professor Faraday, Dr. Latham, Dr. Daubeny, Professor Tyndall, Mr. Paget, and Dr. Hodgson, and, the special subjects of the lectures being left to the choice of the lecturers, the majority confined themselves, as might have been expected, to an advocacy of the particular branch of Science which had been the special object of their respective studies. To this there were two exceptions. Dr. Whewell and Professor Faraday fitly commenced the series with lectures widely different in treatment, but both dealing with the broader and to us more important topics of Intellectual and Mental Education from a philosophical and general point of view; the former an experienced teacher, trained in the science and traditions of classic, mediæval, and modern but historic times, clinging fondly to forms of philosophy which are fast giving way before the more searching reasoning of Mill, but recognising liberally and frankly the elevating influence of modern Science: the other a man of our own age, a keen observer, bold and fertile in speculation, but a trained and cautious reasoner; not unmindful or unappreciative of the intellectual labours of a past age, but in the true spirit of a student of Physical Science, turning his gaze rather to the future than to the past, contrasting what *is* with what *may be*, pointing forward to the path yet to be traversed rather than lingering to measure the ground already passed over, and seeking to eradicate

those obstacles which yet bar human progress to its unknown bourne in the future.

We place these lectures at the head of the list of works referred to in this article, inasmuch as they appear to us to give the best exposition within a brief compass, of the objects to be fulfilled by a Scientific, as distinguished from a literary system of Education, and by the study of Inductive as contrasted with purely Deductive or Abstract Science. Admitting fully the important influence of each of these kinds of study on the training of the mind, we would draw attention to the fact, clearly enunciated in these lectures, that each class of studies exercises an influence mainly its own, and that the system until lately pursued at the great English Universities, and which practically ignored Inductive or Phenomenal Science, left untrained and uncultivated one at least of the most important faculties of the human mind. Were we dealing with English Education in these remarks, we might well be content to leave the matter in those abler hands which have already to some extent treated it; but as in medical science, the idiosyncracy of the patient modifies the action of the drugs and should influence the treatment of the physician, so in dealing with a phase of intellect kindred to, but not identical with our own, we must take note of the especial requirements of the Oriental mind, and adapt our system to our patient.

The present moment is well fitted for the discussion of the topic we have selected. The University of Calcutta has from the time of its foundation recognised the claims of Natural and Physical Science to form part of the University course in Arts, that is,—of the general cultivation of the mind, independently of special professional aims; but the means which, in a measure unavoidably, have been adopted to carry out its views, are such as have only tended to perpetuate the very evils, the mental narrowness and dogmatism, which a well-devised system should correct. During the past two years, the question of how to provide proper means of instruction in Physical and Natural Science for the under-graduates of the Calcutta University has been frequently discussed in the Senate, but beyond making a selection from this class of studies optional, a very important reform so far as it goes, nothing has been effected to improve the actual system. The chief difficulty encountered by the University appears to be, strange to say, to find men fitted for the task of teaching, and to provide such means of illustration as are indispensible to useful instruction. These difficulties are however, we believe, less than they appear to be, and there are other causes at work which we shall presently discuss, and which have operated to some extent at least, in retarding the general introduction of an

efficient system of instruction in Natural Science. We must, however, premise some general observations on a matter which lies at the root of the whole subject of Education, and a misconception of which appears to have operated in no small degree, to create those difficulties with which the University has had to contend, and at the same time to bring its teachings into undeserved discredit with those who criticise it from an European point of view and as spectators at a distance.

The only attainable object of general Education is, we take it, to afford the mind such a training in those years in which its powers are approaching maturity, that it may be fitted to turn the experience of after-life to the best account according to its individual grasp and capability. It is not practicable, even were it desirable, to pour into one human brain, whatever its natural capacity, all or even any considerable fraction of the mass of moral, physical, and æsthetic dogmas which experience has taught us to regard as ascertained truths, even leaving out of account all that goes to make up a literary education, the imaginative writings of ancient and modern authors, and the history, told by themselves, of those earlier races, on whose hard experience the superstructure of our own civilization is reared. The three or four years which are all that on an average can be devoted to collegiate study, do not suffice for the acquisition of more than a small amount of what may be known on any one or two selected subjects, and the really important conditions to be fulfiled in laying down an Art's curriculum, are—that such subjects be selected as will but train the mental powers,—and that they be so taught as to ensure this training. However trite these dicta may seem,—and they certainly make no pretension to novelty,—they are not the less disregarded by the majority of those engaged in school education in England; in obedience perhaps partly, to the unintelligent demands of a parental public, which is guided by little better than the traditions of its own youth; to a less extent, a similar disregard obtains here; but for this very reason it is the more imperative on an independent body, free from the trammels of tradition in its corporate capacity at least, freer perhaps than any similar body elsewhere, and charged with the responsible duty of directing the intellectual progress of the country, to conceive clearly the true aim and means of Intellectual Education. The evident tendency of the present day in England, is to fill a boy's mind with an *indigesta moles* of dogma called Natural Science, in addition to the time-honoured Classics and Mathematical Sciences; and probably a crude verbiage, called Modern Languages, unintelligible to any

foreigner, and insufficient to give access to the simplest literature in a foreign tongue. The result is what might have been anticipated: the boy goes forth to play his part in life, without judgment, credulous and ignorant: his memory may indeed have been strengthened, but it is equally likely to have been impaired by the process; and his other powers are little more developed by anything he owes to his schooling, than those of the young Bengali who has been taught to repeat *slokes* as the most meritorious accomplishment of life. Truly enough does Faraday point to the popular belief in table-turning; equally truly may we point to the more recent spread of spiritualism; to the quackeries that disgrace our age; nay, more important than all, to the widespread illiberality of Theological beliefs,—an illiberality shared by the Churchman, the dissenter, and the man of no creed,—manifesting itself in each in prosecution of dissentients according to the power of the sect,—as a proof of the failure of our system of education, to attain the important end of all education—that of enabling the man to play his part in the social system, and to do that which in him lies to act as an intelligent and responsible being.

We are far from believing that the body of educated and generally enlightened men who are entrusted with the administration of our University are capable of deliberately adopting the vulgar errors of the 'cramming' system as too frequently practised at home. But here it is not sufficient to discountenance that system; it is one so akin to the habits and traditions of the natives, that if any opening be left, they will assuredly of their own proper accord fall into it; and the only result of our teaching will be, to substitute one set of dogmas for another, and to leave the men more irreclaimable pedants than before. It is so much easier for the native to commit to memory whole pages of a given text than to master the ideas which it conveys, (which would oblige him probably to refer to other than his text books, and to exercise a good deal of thought and comparison in the process,) that if the former will enable him to pass his examination fairly, he will almost certainly as a rule content himself therewith. The examination once got over, the work has served his purpose, and in process of time, it fades away from his mind like a bad photograph from paper. It must, we fear, be confessed that the University has hitherto produced an undue proportion of such superficial graduates, and the causes which have permitted, even if they have not necessitated, such a result, are not difficult to indicate. We have sought to inculcate too much and too great a variety of matter, and we have taught nothing thoroughly. It is thought by some that every man of good education should know some-

thing of all the great branches of modern learning, forgetting that such is not possible even to Englishmen, studying in their own language, and trained from their earliest days in the society of educated men and women, from whom they have unconsciously gathered a large substratum of facts and ideas, to serve as a foundation for their College education, and to furnish much of the material which the latter combines and arranges. The native has no advantage of this kind. He has to master a foreign and totally dissimilar language to his own, before he can pass the threshold of his University career; the men with whom his childhood and youth are passed, are as a rule, ignorant of all that constitutes an European education, narrow-minded and unappreciative even of the nature of mental culture; and even if of a higher class of native society, trained in Brahminical lore, and the philosophy of a bygone age, they can but implant that, much of which the first step of his University course will be to eradicate, or which will remain a confirmed obstacle to the introduction of more modern ideas.

The mistake which lies at the root of the misconception above spoken of, is the tacit assumption that a man who has simply passed through an University career should be what is popularly meant by a well-informed man. This is only exceptionally the result among the graduates of our English Universities, and it is certainly unreasonable, in the face of all the additional obstacles which the native student has to contend with, to expect that such a result should generally be attained here. If we wish to make well-informed men among the natives, *i. e.*, men who possess a large amount of information on general topics, and who know how to apply and use that knowledge, we must not begin by giving them a slight and crude smattering of a number of heterogeneous subjects, and then launch them forth with an University degree in the hope that they will pursue a course of intellectual education for themselves in after-years. This will scarcely ever be the sequel. Such a taste for any kind of study as will lead a man to appreciate its pleasures, and follow it out for himself in his after-life, can only be *engendered* when he has so far mastered its elements as no longer to feel a sense of labour in its pursuit. No man can appreciate or enjoy any branch of knowledge until he has thoroughly familiarized himself with all its leading ideas, and gained such an acquaintance with it, as to have his interest awakened by the oft-recurring reminder of the existence of unknown fields beyond him. The commencement is always comparative drudgery. The first ideas gained stand strangely, and fixed as it were by an effort in the mind, and it is only by degrees that these become linked

together and interwoven by trains of connecting thought and fact, and form part and parcel of the mental fabric, a source of conscious pleasure, and a stimulus to further acquisition. The committal of a given quantity of matter to memory is, as we have remarked, an easier mental operation to many, to most minds indeed of ordinary calibre, than that assimilation of ideas and trains of reasoning, which is more properly distinguished as knowledge; but the act is one which brings little pleasure, and is rarely undertaken except under the stimulus of a definite object to be gained, whether for convenience and as conducive to an intellectual object, or with the less meritorious aim of passing an examination. If then we wish to impart to the natives the full benefits of European science, we must induct them more fully than is possible under the present system into some of its leading branches, and this can, as we have shewn, only be done at the sacrifice of variety.

As a consequence of the present superficial system, native graduates go forth from the Examination Hall, with little orno idea of how elementary and crude their acquisitions really are. The simple rudimentary text-books selected by the University, represent to their mind exhaustive treatises on their special or incidental subjects, and the really superficial acquaintance they have gained therewith seems boundless knowledge. And how are they to know otherwise? In their own native society they are looked up to as prodigies of learning; like Gulliver they stalk among Liliputians, and do not dream of the existence of a Brobdignag race. Hence the pedantry and shallowness so frequently noticed as the result of our University teaching; and hence its failure to instil thorough knowledge, and that cautiousness and sense of self-inferiority which is one of the most valuable results of real knowledge, and is most characteristic of its greatest masters.

We believe then that the true course which the University should pursue, would be to carry still further the reforms already effected to in some extent the case of Natural Science,—to contract the list of essential subjects of examination, to within narrower limits—to allow of selection to a greater extent than at present,—and to insist upon a thorough acquaintance with the *subjects* of examination, instead of with a particular book or books, treating thereon. This latter measure will render many of the Colleges now affiliated incapable of teaching more than a certain small selection of subjects, for it will enforce the substitution of efficient and special professorial teaching by lectures and class discussion, for the present school system with text-books, which practically degrades the professor into a

mere walking Lexicon,—an explainer of hard words. But the Colleges will gain in other respects,—they will be enabled to specialise their staff, and if they cannot compete with the Presidency College in giving their students so wide a selection in their curriculum, they will be the better able to hold their own point of quality, to the great advantage both of teachers and pupils.

The text-book system which has been necessitated by the variety of the course hitherto laid down, offers we believe one of the greatest obstacles to any sound education. No man can understand a subject fully by reading, however carefully, any given book—unless he brings to the task a considerable amount of thought and knowledge elsewhere gained. The text-books selected, are in many cases most rudimentary, and it is rare indeed that their subject matter can be so assimilated, as to constitute useful knowledge, unless the student compare and collate their statements with those of other writers, or with the views held by those who have paid special attention to the subject treated of. It is the mental activity which a course of given study induces in the student, far more than the mere mastery of the subject matter, that constitutes what is valuable in education. Much error of conception, much crudity of reasoning, are engendered at the outset of every course of study, and it is the process by which this is eliminated and corrected, that trains the mind and fortifies it against credulity, prejudice, and overhasty conclusion. Any one acquainted with the native intellect will scarcely fail to have observed how strong is its tendency to rely on and appeal to *authority*. It never attempts, *proprio motu*, to seek for fundamental principles or concrete facts by which to test the dictum of any acknowledged authority; rarely even does it allow its own experience to correct or question a venerated dogma: at the utmost it pits one authority against another and remains blankly without preference, or accepts that which comes recommended as the weightier by the common consent of public opinion. It is here that professorial teaching, if philosophical and undogmatic, is of most value: not merely to explain and comment upon the matter of the study, but to urge the student to think for himself; and to inoculate him with that habit of independent research and self-questioning which is the best corrective of hastiness and dogmatism.

In entering our protest against the text-book system, that is, against the practice of indicating one or a portion of one selected work as that which a candidate for the University degree must commit to memory and on a knowledge of the matter of which he will be examined, we by no means advocate the extreme step of leaving the elections of books of instruction to the students,

or to the affiliated Colleges, without control or restriction. Such a course would evidently be impracticable and absurd : but the University might with advantage limit its functions to the enumeration of those works best fitted to convey instruction on each subject of examination, taking care to include such a variety as will give a fair representation of different views on all important debateable points. Thus, to take an instance or two from those branches of Science with which it is our especial province to deal in the present article, we would include in such a list Dr. Whewell's Philosophy of Inductive Science on the one hand, and Mill's Logic of Induction on the other, and some acquaintance with the views of both of these writers should be required of all examinees in Mental Science. In Zoology, we would include both Owen and Darwin, and in Geology, Buckland, Lyell, and Phillips, giving preference in each case to the most eminent expositors of the rival views. It has been remarked by Dr. Whewell, that the only mode of understanding the definitions of a Science, is to learn its history ; to follow the conflicts of opposing views, and trace out the process by which in past time, prejudices of judgment and confusion of thought have been gradually eliminated, and clear and consistent conceptions established. But there is an additional lesson to be learned in such a study ; a lesson equally important to men of all creeds and professions ; to the administrator or to the savant : the lesson which may be learned from all history, if treated in a philosophical and large-minded spirit, and if the attention be not frittered away on stories of Court intrigues and battle-field slaughter, but which can nowhere be found more clearly and prominently indicated than in the history of the avowed search for abstract truth.

We, like our fathers, have to fight the old, old enemy—prejudice ; to learn that a thing is not necessarily true, because we have been accustomed so to regard it, that a man is not necessarily a bad member of Society, because he holds opinions different to those which are habitually transmitted from father to son in the nation or sect to which we belong. Is this an obsolete charge? Is prejudice in its grosser forms no longer the arch enemy of social advancement? Turn where we will,—to Theology —to Sociology,—to Politics,—to the calm dispassionate domain of pure intellectual science, to ethics or to physics,—do we not find prejudice rampant ; setting man against man, class against class, race against race? How many of our opinions do we hold as the result of calm and dispassionate research? How often do we enter on any discussion, with the pure and simple desire to get at the truth? Is even our so called 'science,' as held by most of us, anything more than a mass of dogma, which we have

accepted on the dictum or have stereotyped from the opinions of those whom we make our *gurus*? We hold ourselves to be vastly wiser than our forefathers, because we believe that the earth moves round the sun, while they believed that the sun moved round the earth, but can most of us give a single philosophical reason for our own view of the matter? And if not, in what respect as intellectual beings are better than they? True, we have matter more at our command, we have a greater variety of objects to pursue, and improved and more rapid means of gaining them, and we can emancipate ourselves to an extent undreamt of by them, from the trammels of restricted experience in space. We can flash the expression of our thoughts and wishes in a few seconds from continent to continent, and we can see more forms and phases of social custom in a couple of years than our ancestors could in a decade. But these achievements do but facilitate self-education; they do not compel it. The fool who has been sent to Rome, is not less a fool than he who has remained in his ancestral halls. The difference of the two cases is that of the swallow and the apteryx, not that of the sage and the boor. He 'who has seen the cities of many men,' only becomes a better and nobler being for his experience, in so far as he cultivates the faculty of unbiassed observation to discern, and a disciplined judgment to reason. To become an experienced man, he must first be an educated man in the sense in which we here use the term; he must start with a desire to learn, and with a deep and ever present sense of the fallibility of his own preconceptions. There are but few who have the natural gift of this self-knowledge; but many are capable of acquiring it; not indeed to its highest degree, as no man can be fashioned at will into that which is utterly at variance with his inherited nature, but still to such an extent as to make them wiser and better men; happier themselves, and more potent to confer happiness on others.

To this end, nothing is more efficacious than a study of history, —the history of men and opinions. But a mere record of plots, intrigues, and battles, with name, date, and circumstance duly elicited from old traditions, private memoirs, or state papers, after more or less controversy, will serve but little to the purpose. Whether Mary Queen of Scots, was virtuous, or how far the early history of Rome is mythical and allegorical, are proper and interesting questions for the antiquarian and historian, but may be profitably excluded from consideration in History as a means of Education, for, if our view be correct, Education of the Mind is the real object of University teaching, and History, Philosophy, and Theologies are mainly to be treated as means to that end.

The History of Inductive Science is a not unimportant chapter in the History of Human Error. The conviction that rest is the natural condition of matter and contradictory to that of Motion,—that Nature abhors a vacuum,—that antipodes are impossible,—were not less certain and self-evident to the most thoughtful men of antiquity, than are the distinction between necessary and experiential truths, the indestructibility of matter and force, or the invariability of the earth's motion to many philosophers of the present day. The thoughtless may laugh with scorn at the credulity of these old intellectual giants; and vaunt their own shallow superiority to the simple errors of antiquity. The thoughtful man will turn to the present day, and note one of the most eminent and philosophical of English naturalists, restating and insisting on the evidence of an avowedly erroneous picture, rather than admit the independent and unquestionably truthful testimony of a number of original observers to the fact that a monkey's brain is not so different from a man's as he had originally believed; or another not less eminent Englishman, eminent in intellect, however his adherence to an ancient faith may to the sight of some of us cloud the lustre of his merits,—decrying all Science, because it fails to attain,—that which the human mind is incapable of ever attaining—absolute and certain truth. Truly we see prejudice in high places. Are we so much wiser than our forefathers?

The History of man in his social and political relations, will ever remain one of the most important branches of the education of youth. Studied conscientiously and in a philosophical spirit, its influence will be more powerful and generally salutary than perhaps any other kind of mental discipline. The bearing of its lessons on our own experience are direct and apprehensible; while it combines in a great measure the charms both of Literature and Science. It is the storehouse whence must be drawn the materials for all Moral and Political Science, and it appeals to the imagination with all the vivid interest of drama on the grandest scale. But these are the pleasures and profit of the adept, not the tyro. It boots but little to commit to memory, the hard pedantic outlines of what *has been*, simply as a series of events that happened in a certain chronological sequence: to know for instance the names and order of the Roman Emperors, and which of them were the chief persecutors of the Christians, or to remember the dates of the Punic wars, and how many years the Long Parliament legislated. There are but the data of History treated as a Science,—data which must be familiar to the mind ere its reasoning faculties can be brought to bear on the study: yet they are in most cases all that the students of our

University ever master, or rather attempt to master, for their knowledge, when brought to the test of the Examination Hall, proves so inaccurate and fragmentary, that it is inconceivable that they should have treated History otherwise than a mere exercise of memory,—a disjointed skeleton of dry bones, the number and forms of which they know but imperfectly, while ignorant of their uses in the economy of the living animal.

In the University Calendar for the current year we find the following list of subjects of examination in History for the B. A. degree. 'India during the Hindu, Mahomedan, and British periods 'down to 1835. Greece to the death of Alexander. Rome to the 'death of Augustus. The Jews to the destruction of Jeru-'salem'; the text-books for these subjects being 'Murray's 'India, Schmitz's Greece and Rome, History of the Jews as in 'Taylor's Manual of Ancient History, Chapter 5, and Chapter '12, Section VII.' No philosophical treatise finds a place in the list; all such works as Taylor's Historical Evidence, Hallam's Constitutional History, and Guizot's History of Civilization being reserved for the examination in honours.

The undergraduate is thus furnished with the crude material; only in the exceptional case of his reading for the higher degree is he taught its use and purposes: the potter is furnished with a large store of varied clays, with his wheel and moulds; he is never taught how to fashion his ware. The graduate may tell you glibly enough of Baber and Aurungzebe, of Clive's defence of Arcot, of Wandiwash, Samiaveram, and Trichinopoly; with a certain scepticism of the facts he relates, he may even give you some account of Sampson's prowess, and David's pious self-humiliation in the matter of his census; but to what all these records may serve, except perhaps to the glorification of the Mahomedans, English, or Jews, he has on the whole no very clear conception. He has performed his task, and is content. Except for an occasional oratorical display at the Bethune Society, or a tag reference, more or less in point, for an article in the *Hindoo Patriot,* his acquirements are of no further service to him, and are wearily consigned to the limbo of things which have served their purpose.

We have adduced the B. A. curriculum in history, as affording a fair example of that tendency so common at the present day, to make education little more than an exercise for the memory, to the neglect of the higher faculties of the mind. Unfortunately the ratiocinative training that history is so capable of giving, does not to any appreciable extent follow on the study (as now pursued) of any other of the five subjects of examination. That of Language in its literary aspect, *i. e.*, with reference to its litera-

ture, and its subtler delicacies and distinctions of expression, affords work for the imagination and the æsthetic faculty, not for the reason; which in this field is first exercised when language is contemplated in its philologic relations, in which point of view it becomes simply phenomenal, and ranks with other inductive sciences: but in this point of view it is not treated, or but superficially treated in the University course, and indeed other branches of inductive Science are better fitted than Philology to exercise the mind in the processes of comparison, induction, deduction, and verification.

On the courses in Pure and Applied Mathematics we have but little to say; as laid down for the B. A. degree they deal with simple relations of number, space, and force, and are a necessary prelude to Physics, or the Sciences of the more complex phenomena of matter when we meet with force in its protean aspect, affecting our senses differently in such successive moment, thus eluding the grasp of mathematical demonstration, and forcing us to the *ultima ratio* of experiment to *prove*, so far as proof is possible, that which must be *assumed* in Pure Mechanics,—that Force and what we term Matter, (which is possibly a mere synonym for Force,) are indestructible.

Without any desire to criticise by implication the system pursued at the great English Universities, which in spite of the adverse opinion of many modern reformers, is, we think, better adapted to the English character, than the proposed German importation, which manufactures more *learned* than *wise* men, more *Gelehrte* than *Verständige*, we think the University has advantageously preferred and *applied* to a *pure* Mathematical Course. The native mind deals easily enough with mere symbols, but has to rouse itself to a considerable effort, to deal with quantity, as applied to force, &c. and to reason out problems, in which regard must be had to the *meaning* of a series of symbols, while submitting them to the strict logic of Mathematical analysis. We are informed by a gentleman engaged in this instruction in one of our chief Colleges, that the junior native students have the greatest difficulty in mastering this part of their course, a difficulty which is much enhanced doubtless by their imperfect acquaintance with the language in which they are taught, but which mainly arises from the constitution and habits of the native mind. Nothing can be a stronger proof of the value of applied mathematics as a mental training for the natives of India.

On Mental and Moral Philosophy we need at present say nothing, beyond what we have already remarked in our criticism of the Text-book System, and this;—that it might be

found advisable to omit the course on Mental Philosophy as a special subject, combining the Philosophy of Inductive Science (its most important division) with those Sciences which are its best illustration and exercise. Philosophical speculations are very consonant to all intelligent natives, but as in the case of Mathematics are only too apt to be regarded as simple abstractions, and somewhat wildly treated unless forced into application by external influences. This in the case of Morality must be the work of time; practical morality being like all other practice chiefly a matter of habit; as it is the most important of all teachings that we can impart to the natives of this country, so it must be of the slowest growth; the difference of our social habits and those of the natives keeps us so far apart, that we can do little more than instil the principles of Morality as a Science, and do our best to illustrate them practically by our own conduct in our dealings with them and each other. The seed thus planted must be left to grow by the strength of its own inherent vitality. It has done so elsewhere, and looking at its progress among those chiefly in contact with us, spite of the sarcasm of those superficial observers who would have all plants grow with the rapidity of Jonah's gourd, we think that India will in the end prove a not uncongenial soil. Our views may be thought Utopian, but if Ethics be, as we believe, a true Inductive Science, based on the Phenomena of Experience, we have sufficient faith in the power of truth to believe that it will eventually overcome the mass of prejudice and deficient perception at present arrayed against it, and in time even vanquish its more potent enemies, apathy and habit. We must only demand a considerable extension of the period Dr. Cumming has assigned for our labours.

For a practical application of Mental Philosophy nothing is better fitted than the Physical Sciences, and it is as an exercise of the ratiocinative faculties and the intellect, and not as a mass of experimental truths only or chiefly that these Sciences lay claim to a place in an University course. In the discussion which has been excited at home, by the proposition to introduce Natural Science more prominently into the curriculum of Cambridge, much ridicule has been thrown on the notion, that how to make a pump is a desirable part of the education of an English gentleman. With this view we entirely agree: it is not desirable. His time may be better employed than in studying the respective merits of the atmospheric and steam-engines as a specialty, but we consider that any man may profitably and usefully acquaint himself by practical study, with the modes of investigation which have been suc-

cessfully followed in the discovery of objective truth, and the kind of evidence upon which it rests. We doubt if Dr. Whewell's Philosophy of the Inductive Sciences could be appreciated by one who had not read the previous work on the History of those Sciences, or who had not at least a fair knowledge elsewhere gained of the Sciences themselves; and this for the very patent reason, that the Philosophy as a contribution to Mental Science has been based on the History, to which it stands in the same relation, as the Laws of Gravitation do to observations and calculations of the Heavenly bodies.

Another common objection to the general study of Inductive Science, by those who admit the importance of Induction as a mental process is that the inductive faculty being one of advance to the unknown, is, like the inventive faculty, a gift, not an attainment, and that therefore it cannot be imparted by any teaching. We might perhaps demur even to this view of the matter, and while admitting that, like the æsthetic perceptions and faculties, it is the natural endowment of men in different degrees; we might urge that like these perceptions it may be trained and strengthened, and that this is to be effected by means similar to those successfully pursued in other branches of education. Certainly inductive reasoning is not a rarer gift than a poetic imagination and power of expression, yet those who argue most stoutly against the teaching of the former, will be the first to urge the necessity of the general cultivation of the latter by the study of classic and modern literature. But this would be a very partial and imperfect view of the matter. The inductive process is a universal phenomenon of mental action; and is practically performed by us in every hour of our lives, in so far as it consists in jumping from particulars to a general conclusion. That it is so is only not apparent because, in practical social life, almost every generalization is immediately followed by a deduction, and thus the first part of the process is lost sight of. The juryman who has to draw a conclusion from evidence, unconsciously supplies a major term to the syllogism by which he reasons out the bearing of the evidence on the guilt or innocence of the accused, and therein as truly exercises the inductive faculty, as does an Owen when he argues that a fossil skull must have been that of a Ruminant, because it bears a pair of horn-cores. The difference is, that the one has verified his induction in a very different degree to the other, and had the former not the advantage of the trained experience of the advocate and judge to guide him, it is not very difficult to conceive that he would make frequent grievous blunders on points of inference as well as of law, not because he has

not known how to draw a general inference from particular facts, or to deduce his verdict therefrom, but because he has omitted so to examine and test his generalization, as to render it admissible in the argument.

Paradoxical as it may seem to some, Induction is the least difficult and prominent part of the discovery of natural laws. That which distinguishes the great inductive philosopher, a Newton, a Lavoisier, or a Darwin, from men of ordinary intellect, is much less the power of suggesting a general law, than the rapidity and accuracy with which he traces its consequences, and his conscientiousness in rejecting it when any weak point occurs in its verification. This and the power of analysis, of distinguishing the partial and independent facts of which any observed phenomenon is made up, are the chief characteristics of the so-called inductive mind. Now these processes are eminently susceptible of cultivation. Art can never supersede Nature here or elsewhere, but as any well-trained Artist learns by experience to detect at a glance a false proportion, or an unnatural curve, which would escape the notice of a tyro; so the man who is practised in the employment of the processes of ratiocination or analysis of fact acquires skill in detecting the weak point in a statement of supposed fact or inference from evidence, whatever be the matter upon which he has to judge. Large acquaintance with fact on the particular subject contemplated is of course necessary to enable him to exercise his power to any eminent degree, but the process is the same whether the matter considered is a phenomenon of physical science, or a legal enquiry.

Another faculty not less important to the man of the world is that of observation, of noticing rapidly and accurately the important points of an object or an event. This too may be trained to a considerable extent by the study of physical and natural science; but the experience gained is more special in kind, and therefore comparatively less valuable than the education of the reasoning faculties, because the value of an observation depends in great measure on the previous acquaintance of the observer with its subject-matter. It is in the main a rapid process of comparison and selection,—comparison with what is known, and selection for special record of that which is new or important. Still the experience is valuable, and the student may be at all events taught by habit, to guard against that chief stumbling block of the uninstructed, the failure to distinguish what is seen, and what is assumed or inferred.

We have already spoken of the value of all studies in Natural Science conscientiously pursued, in warning us against prejudice,

and making us wary of its insidious hold upon us. This office is performed to a great, perhaps an equal extent by other kinds of study, and we have adduced that of history as a prominent case in point. But alas! history itself abounds with prejudice! We can but look at the facts of the past through the media of other minds, and we must employ the judicial process to sift our evidence from its subjective error, before we can commence the treatment of its data as a Science. No human record, whether of history or of Natural Phenomena, is free from the possibility or even the probability of subjective error, and we have in the annals of Science almost as much bitter controversy and partisanship, although in a narrower field, as in the stormy arena of Political and Theological History. But in the former the phenomena themselves, the unfailing tribunal of appeal, are ever at our command. Only in rare cases, as in Astronomical observation, have we to deal with that which we cannot for ourselves examine. We are therefore more unshackled in our judgments, less influenced by the reflected feelings, the prejudices, prepossessions, and errors of others, and we can more accurately and impartially detect and judge the mental influences which marred the work of our predecessors. The past and present history of Science are instructive to all, not so much for the facts gained, as for the process by which they have been gained; for the great practical teaching of philosophy which they afford, and of which they are at once the basis and the test.

Such being as we conceive the aims and functions of Natural Science as a branch of Education, it remains to discuss the mode of teaching; how to make it a real training and exercise for the intellect. Dr. Whewell writes on this head :—'I should say 'that one obvious mode of effecting this discipline of the mind 'in induction is, the exact and solid study of some portion of 'inductive science. I do not mean the mechanical Sciences alone, 'Physical Astronomy and the like; though these undoubtedly 'have a prerogative value as the instruments of such a cul-'ture; but the like effect will be promoted by the exact and 'solid study of any portion of the circle of natural sciences;— 'Botany, Comparative Anatomy, Geology, Chemistry, for in-'stance. But I say the *exact* and *solid* knowledge; not a mere 'verbal knowledge, but a knowledge which is real in character, 'though it may be elementary and limited in its extent. The 'knowledge of which I speak must be a knowledge of things, 'and not merely of names of things; an acquaintance with 'the operations and productions of nature, as they appear to the 'eye, not merely an acquaintance with what has been said about 'them; a knowledge of the laws of nature, seen in special

'experiments and observations, before they are conceived in general terms; a knowledge of the types of natural forms, gathered 'from individual cases already made familiar. By such study 'of one or more departments of inductive knowledge, the mind 'may escape from the thraldom and illusion which reigns in the 'world of mere words.'

It can scarcely be disputed that the instruction hitherto given in the Natural and Physical Science portion of the University course has been little better than that here condemned by Dr. Whewell, a teaching of mere words, and such it still remains in the majority of the affiliated Colleges. If it be a necessity of their position that the system of text-book teaching in these subjects, without illustrative specimens or experiments, be continued, it would certainly be better to sweep the whole of the Natural Sciences from the compulsory curriculum of the University and make all optional, whether for the B. A. degree or Honours: we do not think however that this is *necessary*, and we opine that with moderation in the extent of our aims we may retain certain portions of Natural Science as an essential and valuable element of native education.

One branch of Inductive Science well and thoroughly taught, is in our view infinitely preferable to that vague smattering of three or four which was until lately the only possible result of our University system. The selection must in most cases be determined by local and adventitious circumstances, but we conceive that, among the stipulated conditions to be fulfilled by Colleges applying for affiliation, should be included the possession of means to teach one branch of Natural or Physical Science thoroughly and practically, up to a standard equal to that of other branches of the course. To facilitate this, it would, we think, be desirable somewhat to extend the list of optional subjects in Natural and Physical Science. These are at present four in number, *viz.* 1, Optics, with which is allied the Geometry of Conic Sections, as a sort of foreign make-weight; 2, Chemistry, Electricity, and Thermotics; 3, Animal Physiology and Zoology; and 4, Physical Geography and Geology. To these we would add 5, Botanical Physiology and Botany. With such a list to choose from, we conceive that no Educational Institution, fitted to give an University education, can find much difficulty in fulfilling the conditions of affiliation. The conditions would be two-fold, to provide *firstly*, proper teaching; and *secondly*, the subject matter of the study, by specimens or apparatus. Much is said of the difficulty of the first, and doubtless the plea would have been to some extent valid a few years since, when the Inductive Sciences remained unrecognised in the great English Universities, so that there might

have been some difficulty in procuring teachers of liberal education who had any knowledge of any branch of Science. This is however no longer the case. At Oxford and Cambridge for some years past, and at the London University since its establishment, the importance of the Natural Sciences has been fully recognised, and the pupils of Phillips, Sedgwick, Henslow, Willis, Daubeny, and Miller, not to speak of the graduates of the London, Scottish, and Irish Universities, and those who have studied at German Universities, are now sufficiently numerous, to make it a not very difficult task to procure men of philosophical attainments fitted to teach one at least of the sciences of the above list, and capable of taking part to a certain extent in other branches of instruction where required to do so. Of course we presuppose that the Principals of the affiliated Colleges have *a desire* to include these subjects in their course, and to teach them honestly and efficiently. Still, it is undeniable that the Instructive staff in Natural Science has been and is far less efficient than that of other subjects. In a report of the sub-committee* of the Syndicate dated February 1862, we read :—

'The Institution which from its ample resources has the 'best means of instructing in this subject [Physical Science,] 'is the Presidency College. But even there no professorship 'has been established solely for the purpose. There is a chair 'of Geology, which however has not been occupied for the 'first two years. Lectures in other branches of Physical Science 'are, we believe, given by the Professor of Natural Philosophy :— 'an arrangement which should only be accepted as a last necessity; 'as these two subjects are so different and extensive, that to ask 'a single Professor to take charge of both is requiring more than 'any man should be asked to undertake. Such then is the mode 'of instruction, in Physical Science, in the most highly endowed 'of the Affiliated Institutions. In some of the others we 'may say that it is not even attempted to be efficiently 'taught. The consequence is that the subject, which has very 'properly been made by the Senate a compulsory part of the 'B. A. course, is often left to the undirected resources of the 'students themselves. In fact, they are left very much to the 'text-books, with few or none of those aids, in the way of ex- 'perimental lectures, which are considered in other countries to 'be essential to a proper understanding of the subject.' The state of things described in this report is still almost unchanged. The chair so long vacant in the Presidency College is indeed now filled, and the branches of Natural Science which its holder

* Consisting of Dr. Duff and the late Mr. Scott Smith.

feels himself competent to teach have been wisely defined in the University Calendar by Syllabus instead of by text-book; wisely we may, because we believe the optional and alternative arrangement of these subjects now adopted, leaves him the only teacher who is likely to undertake experimental Physics or Geology, and the adoption of a Syllabus emancipates him from the thraldom of rudimentary treatises, while it does not affect the Professorial staff of the other affiliated Colleges. Zoology with Animal Physiology is still a destitute wanderer, and is likely to remain so until, in the fulness of time, a University Professorship may be established; while Optics, the subject allied with Conic Sections geometrically treated, under the queer cognomen of 'Mathe-'matics, pure and mixed,' is also defined by a Syllabus, but one which being adapted to the capabilities of the minor Colleges, does not include much that is necessarily experimental, and does not therefore necessarily fulfil that which we, following Dr. Whewell, regard as an essential, a practical teaching in the phenomena of *things*, as opposed to an analysis or synthesis of the words which represent them, the camel itself in its native desert, and not its imago developed from the moral consciousness.

Moved by the destitution of the Colleges in all matters of Natural Science, Mr. Oldham, in 1862, suggested a substitute for the vacant chair of Geology at the Presidency College, by making the Geological Survey the centre or nucleus of a School of Applied Science. It was proposed to transfer this Professorship to the University, and then to divide its emoluments among different gentlemen of the Survey who should be recommended by Mr. Oldham for Professorships in the different branches of Physical Science, they being afforded sufficient leisure to discharge the duties thereof. Thus, it was thought, *no additional expense* would be entailed on Government, while the Professorship would be placed on a wider and more useful basis.

There was doubtless much apparent advantage in this scheme. The two years' vacancy of the single existing Professorship in Physical Science seemed to render it probable that its re-occupation by a qualified Professor, was distant if not hopeless; while it is unquestionable that, among the gentlemen engaged on the Geological Survey, there are some fully qualified to teach both Geology, and several of the Sciences with which it is closely allied, and on which indeed it rests. The bait of cheapness too, of getting two pounds of labour at the cost of one, was tempting, for much as we may ridicule women for their love of bargains, we have found in our own experience, that corporate bodies of the ruder sex, even the paternal wisdom of Government itself, is not at all times proof against the allurements of a low price, in defiance of

the well known teachings of Political Economy. Doubtless the proposed substitute would have been better than nothing, and so, apparently, thought the Sub-Committee from whose report we have above quoted. Nay, we believe that even now, a modification of Mr. Oldham's scheme might be advantageously adopted, not indeed as a substitute for College teaching, but as a supplementary measure, and with a view to giving the students means of fuller instruction than it is possible for one man to give, whose attention is divided between two or more very distinct subjects. It is a lamentable sacrifice of available means that highly educated men of Science, having, as we presume from the nature and source of the proposition above quoted, time at their disposal, or which they might easily spare, and (in one case at least we know) trained in class teaching, should not be invited to give their aid in the Educational system of the country, when they possess in a high degree the qualifications, which it would appear, are so difficult to be obtained elsewhere. But as a *substitute* for the College chair the scheme was undoubtedly unadvisable: the professors of the Government Colleges have to act much as the College tutors of Cambridge, to work up their class, not merely by lectures, but by class teaching and frequent examination, and indeed with students unprepared by class teaching elsewhere, this is a most essential part of the process of instruction. They are accessible to their students at times other than those of class hours, and are always at hand and ready to give them explanation and assistance in any difficulty. But this requires the devotion of an amount of time and attention which could scarcely be given by gentlemen having other important duties to perform, and who would probably only be able in any case to give a few hours a week to their class during five or six months of the year; nor could they in any case be expected to feel that personal interest in the progress of their classes which can only be gained by frequent intercourse with the students and familiar personal knowledge of them. We do not think that these disadvantages would have been compensated by the greater variety of the instruction, however desirable the latter might be, if superadded to College teaching.

The objections we have above urged would appear at first sight to lie in some, though in a less, degree to the subsequent recommendation of the Syndicate embodied in a letter to the Government of India in June 1862, but which we believe has hitherto met with no reply; at least none appears on the published Minutes of the University, and certainly no action has hitherto been taken in the matter. They premise 'that the foundation of Lectureships or Professorships in relation with the

'University, though not under its direction, for the benefit on 'equal terms of the Students of all Colleges and Institutions, 'and of individuals, is an object in itself desirable;' that 'so 'long as any Professors thus appointed, are supported by grants 'of money from the State, it will obviously be proper that the 'direction of those Professorships should remain in the hands 'of Government,' and finally the Syndicate endorse the recommendation of the Senate, that a chair of Natural and Experimental Philosophy be founded by Government, leaving it to the Government to determine, under what regulations the instruction to be given by the Professors may most usefully be carried on.

The proposition thus put forward is essentially to the effect that the instruction of the proposed chair be open to the students of all the Colleges instead of those of one only. So far the change may be desirable; and if the instruction conveyed be of the same nature as that given in the Colleges, the only objection to be urged against the change, would be the difficulty which the students of different and widely scattered Colleges would find in availing themselves of the class instruction of a single Professor. This might possibly be arranged by the choice of some central building for the meetings of the class; but we would strongly deprecate any attempt to assimilate the teaching to that of the English University Professors; to restrict the instruction to lectures, until the Colleges shall be better provided with the counterparts of the Cambridge tutors, whose instruction, desirable in all cases, is especially so for the native students of Indian Universities. The value of College lectures and their peculiar characteristics are remarked on by Dr. Whewell as follows:—'Although in College Lectures, the 'views may often be as comprehensive and profound, and the 'learning as extensive, as are found in the Lectures of Professors 'in other Universities, it has been the practice in recent dis-'cussions on this subject to distinguish between College Lectures 'and Professorial Lectures; and the distinction is an important one, 'if it be understood as implying that, in Professorial Lectures, 'the student is a listener only, and is not called upon to show, by 'taking any part in the lecture, that he is a prepared listener. The 'distinction being thus understood, if we enquire whether College 'Lectures should be superseded by Professorial Lectures in our 'University, we cannot hesitate to reply, that such a change 'would be a grievous damage to English Education. Without 'at all denying the value of Professorial Lectures for their own 'particular purposes, (and for these purposes they are largely 'delivered and attended in the English Universities), such Lectures

'cannot take the place of College lectures, so as to produce their 'beneficial effects. These effects are * * * the hold which studies 'so pursued obtain upon the student's mind and character, in 'virtue of their forming part of a daily employment, which brings 'him into intercourse with his tutor and his fellow-students, 'placing before them a common subject of mental activity, dis-'closing to him their characters, instructing him both by their 'mistakes and their knowledge, and impelling him to study by the 'necessity of being constantly ready with his own share of the 'work. In Professorial lectures, on the other hand, the student 'is supposed to be induced to listen to the Lecture by the solid 'reasoning, extensive learning, new views or peculiar eloquence of 'the Professor; who follows out his speculations, unfettered by 'the necessity of connecting his exposition with the imperfect 'learning of his hearers.' The above remarks of the Master of Trinity have especial reference to his own University, but we believe they apply with even greater force to the Universities of India. In proportion as the students are unprepared by previous training, so is the class system more essential, and it will scarcely be contended by those who have any practical acquaintance with the recently matriculated undergraduates of our Colleges, that they present themselves with anything approaching the average preparation of their prototypes of Oxford or Cambridge. Generally speaking, their knowledge even of the language in which they are taught is most imperfect, and only in the second or third year of their course do they obtain that acquaintance with it, that would enable them to understand without difficulty the mere phraseology of the lecturer. They are in much the position in which the undergraduates of Cambridge would be, were all lectures in Mathematics, Theology, or Natural Science delivered in Greek.

It appears then that whether University Professorships be established or not, class teaching is indispensable, and this fact recognised, it becomes a matter for the consideration of Government, whether any of the Professorships established by it for the benefit of the Presidency College students, should be rendered equally available to other Colleges. If this can be done without inconvenience to the *alumni* of that College, it is desirable. If not, things had better remain as they are, and other Colleges should be required by the University and empowered by Government or their governing bodies, to provide efficient teaching in some one branch at least of Natural Science.

And this brings us back to the consideration of what are the real obstacles to the attainment of this end. We cannot believe, for the reasons we have given, that liberally educated men,

acquainted with Science, do not exist in numbers sufficient to supply all the wants of India; we hold that the real difficulty is a much simpler one and easier to deal with; it is subjective not objective. In point of fact it is not only in Natural Science Education that this difficulty presents itself. It is one which pervades many departments of Government at the present moment, and in none is it more prominently met with than in that of Education. We see some of the newly arrived Professors, qualified in every way for their work, throwing it up in disappointment, and returning whence they came, even to the hard struggle of English life, at the sacrifice of one or two years' labour, rather than remain in a career where all is a dead level, unhopeful and unremunerative. The older men are gradually dropping off, and indeed retire as soon as they have earned the pitiful pension, which is all they have to look forward to in life. New men come out but rarely to supply their places, and the Principals of our chief Colleges hunt about with jackal-like eagerness, (we trust they will eliminate everything derogatory in the comparison,) to pick up any stray men to be found in the country, to fill the vacancies on their staff. Even these can only be retained for a brief period; after a longer or shorter stay they find something that pays them better, with less drudgery, and once more the old hunt has to be gone through. We cannot feel very much surprised at this. It may not perhaps have struck those responsible in the matter, that any man fitted to undertake a Professorship in an Indian College, must be at least capable of passing the not very difficult competitive examinations for the Indian Civil Service, and that having regard to the respective emoluments of the services, he will probably select the latter: but such will, we think, generally be the case. Life in India is not generally regarded by candidates for Indian service in the light of a pleasureable jaunt, but rather a journey of serious business, and they will probably prefer a first class express to a parliamentary third, when both tickets are presented to them freely for their choice. If older and more experienced men than the candidates for the competitive examinations are required, —College fellows for instance,—we fail to see what peculiar attraction should induce such men to give up their standing, associations, and *parvum modicum* at home, for a bare pecuniary equivalent of the latter in India, and the toil and weariness of an Educational life under a tropical sun; to begin life again with advantages very inferior to those which they declined at an earlier period of their career. The Indian Government is at present in the Education department the *chiffonier* of English talent. We suppose it finds the system answer its purpose, but it must not be

surprised that it does not always obtain what it wants on the instant. It will not bid in the open market at market rates. It is trying to do that which is impracticable, because it will not recognise the laws of Economic Science. It wishes philanthropically to establish high-class education in India, but will not pay for men who are capable of the work. It passes large and telling Education votes, and gets great *Kudos* for its enlightenment and liberality, but it declines to sanction the details of their expenditure, and so an unexpended balance is carried forward to another year, and once more helps to make a good appearance in the Budget.

Such is the simple story of the difficulties of the Education department; and we must confess we regard them with little sympathy. They are only more manifest in the case of Natural Science, because Natural Science studies are still exceptional in the English Universities: men qualified in them are relatively, not absolutely, few in number; and the failure to obtain qualified Professors of any kind in proportion to the demand, is only exaggerated when we come to deal with the particular case of diminished supply. Let the Educational department be paid at rates equal in comparison to the work done to those of the Legal and Judicial portion of the Uncovenanted Service. Let the rules for pension be so far modified as to allow a man to retire after fifteen or twenty years with the means of living decently and educating his children, and we shall hear no more of the impracticability of procuring qualified men for Indian Professorships whether in Natural Science, Philology, or Mathematics.

The fulfilment of the second condition of efficient teaching in Natural Science, the provision of illustrations or of the subject matter of Science, is likewise a much easier matter than may at first sight appear. In the Report of the Sub-Committee of the Syndicate in 1862, this matter is commented on as follows:—'It will be apparent that proper instruction cannot be 'given in Physical Science, unless the lecturer has at hand 'Apparatus, Chemicals, and Specimens for illustrating his 'lectures. But these in India are costly, scarce, and except 'in one or two instances not to be had at the affiliated In-'stitutions. In fact, these Institutions could scarcely be expected 'to keep a suitable supply of articles so expensive and so difficult 'of preservation. They would only be required for the more 'advanced students, or those of the last year, a class which in 'all Colleges and Institutions must always be comparatively small 'in number. Moreover they would be superfluous, unless one of 'the teachers, connected with the Institution, understood well 'how to use them, a contingency which, we may observe, is not

'likely always to occur, as these persons are usually engaged for 'general branches of education, and are not likely to have acquired 'much knowledge of a subject which in a peculiar degree, requires 'the entire attention of those who hope to make progress in it.'

We may fairly concede that unless there is some one capable of teaching, it would be of little use to provide the materials of the subject to be taught, and so long as the independent Colleges are unable and the Government unwilling to pay for educated men to teach, it is useless to take any other steps to provide native students with the other means of learning something of Natural Science. In fact, it is useless to discuss the matter. We must assume that if Education is to be given, money must be spent, otherwise the incorporation of University bodies, and the importation of all the verbal paraphernalia of Colleges, Professors, degrees, &c. is a pretentious sham, the hollowness of which it is best at once to recognise. If the affiliated Colleges are only able to engage men of the rank of National Schoolmasters for their instructive staff, men who are required to have a smattering of everything and a special knowledge of nothing, better sweep away the pretence of our system, and call it what it is—a useful system doubtless, but not up to the mark of giving a University, *i. e.*, a liberal education.

The rules of affiliation demand that provision be made for the instruction of the students up to the standard under which it is desired to be affiliated. If this be not done, (and it appears not to have been done,) we are at a loss to understand why the Colleges should have been affiliated, or why, on the other hand, if the standard be really above that which it is reasonable to expect of Colleges which are still equal to giving a liberal education, the standard itself has not been altered to meet the local conditions. But the University after much consideration has arrived at the conclusion, that instruction in some one branch of Natural Science is *essential* to high-class education of the natives. This being recognised, the means should be found, or we should not pretend to high-class education. The alternative is simple: we can scarcely understand why it has not been stated long ere this for the consideration of a liberal and philanthropic Government.

The real fact is that the majority of the Colleges are *not* up to the liberal education standard as fixed by the University. Most of them have two or three competent tutors or teachers on their staff, but two or three are not capable of instructing thoroughly in the variety of subjects which the B. A. course demands. Let the University decide whether more restricted standards than those it has adopted are compatible with the mean-

ing of liberal education as implied by the B. A. degree,* and if it decide in the negative, let it adopt the bold alternative of withdrawing from the minor Colleges the privilege of affiliation which has been too hastily conferred.

On the supposition that Science is to be taught, and that a competent Professor be provided to teach it, the provision of illustrations of its subject matter is, as we believe, not surrounded by many difficulties. The observations of the Sub-Committee's report evidently contemplate one class of Natural Sciences only, *viz.*, the Experimental as distinguished from the Descriptive, and they are undoubtedly valid if Chemistry and Physics alone be considered. But even in Physics, there are certain branches well fitted for education, in which the apparatus, once provided, requires but ordinary care for its preservation, and entails no material expense in use. Light is amply supplied without cost by an Indian sun, and its analysis is an inexpensive operation, requiring at the utmost a little Quinine, or something equally simple. But although we hold that no real training in Science as an *end* can be given, without a broad foundation of Physics; and although as a *means* of Education, the Experimental Sciences are preferable to all others where they can be properly taught, an advantage due to their precision, and method of stern appeal to weight and measure, as well as to the fact of their dealing with force and matter in their universal phases; still those which Dr. Whewell terms the Classificatory Sciences, Botany and

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* In 1860, Mr. Reid, the Director of Public Instruction, North-West Provinces, urged on the Syndicate, the impossibility on the part of the majority of the Undergraduate Students, of preparing *thoroughly* all the prescribed subjects, and suggested that their courses should be specified for the optional selection of the Students. These were :—

1st Course.—English Literature, Mathematics, Ancient History, History of England and of India.

2nd Course.—English Literature, Mathematics, History, Mental and Moral Philosophy, and Economic Science.

3rd Course.—English Literature, Mathematics, History, Physical Sciences, and Economic Science,

And he remarked that a searching examination, in any one of the three courses, would entitle the successful candidate to rank among those who are held to have received a liberal education. He showed at the same time that the present standards are far in advance of those required of the 'Poll' examinees at Cambridge, or for the 'Pass' or ordinary B. A. of Oxford.

With the general tenor of Mr. Reid's representations we entirely coincide. The courses he has specified are not we think equal, but the main object of his proposed reform, the attempt to substitute efficiency in a few subjects for a smattering of many, has our most cordial assent. We are writing on Science, and we deem the study of Natural Science a very important part of liberal education, but we should be far from regarding it as a *sine quâ non.*

Zoology, are fitted to teach many an useful lesson, if they be not perverted in their methods to be made mere tags of moral illustration. Of the two, Botany has the great recommendation of simplicity, and of its materials being found everywhere in abundance; in sufficient variety at all events to serve for every purpose of illustration in the hands of a man who knows his subject. A garden with a *mali* or two will supply specimens enough to hand, and the apparatus required is but a few lenses and microscopes, (not necessarily costly articles at the present day,) with a certain number of diagrams. These are not requirements of so costly a character that Collegiate Institutions need shrink from providing them; nor are they such as render the proximity of skilled mechanics indispensable. There is but little difficulty here teaching Natural Science when entrusted to those who understand it. The 'Philisterei' of Indian officialism is the only real obstacle.

In truth the difficulties of high-class education are those of our own making. The Egyptians wanted bricks made without straw, and have become proverbial for their folly. The Indian Government, or whoever the responsible authority in this matter may be, goes a step further and wants its bricks made not only without straw but without brickmakers. There is the clay to be moulded; that it will provide in superfluity, but moulds and moulders it calls upon Providence to supply, and thinks it strange that they do not present themselves at the call. It contemplates great things in a hazy way; and looks for great results; but it hesitates to provide the means of their accomplishment or to ensure that the means are competent to the end. It is on the whole a well-meaning Government, but not a very wise one; and it is very fearful of spending its money on what it feels, but will not acknowledge that it does not quite understand. It employs a great many hands; we know not how many hundreds of doctors, engineers, financiers, and others, all learned men, and bearing on their brows the honourable wrinkles of many a well-fought examination. Cannot some of them improvise themselves into Professors? They used to turn their hand to any thing in the old times: and why should they be less versatile now? It cannot understand why all intellectual pursuits should have become specialized, so that a Pathologist should be incapable of making a Topographical Survey, or a Chemist unequal to taking charge of a Hospital, and it holds as monstrous unreason that the services of men who restrict themselves to a single special pursuit should command as high a market price, as those of the men of facile genius who will with equal readiness direct the operations of an army,

preside in a court of appeal, settle a system of revenue, or pronounce on a sanitary system.

For our own part, we are not sure that we have not been rather premature in setting up the *forms* of a University system in India, before we have the means of working it, and were we less isolated from the interests and sympathies of civilized countries, our pretentiousness would probably afford food for considerable ridicule to our neighbours. Being committed to the system, it remains but to exert ourselves to understand its needs and to carry it out honestly and thoroughly; but to do this, we must place the executive as well as the administrative departments of the work in the hands of the best men procurable. It is to the higher officers of the Education department that is entrusted the moulding of the next generation of the leading classes of natives, and according as they are hack-labourers, or men fitted for intellectual leadership, will be the result. Hitherto we cannot think our experiment has been very successful. The most successful branch of Education has unquestionably been that which is at once the most practical in character, the most thorough in degree, and the most highly paid in its staff. Among the graduates of the Medical College, are the best specimens yet produced of the influence of European teaching on the native mind. Let the general Education be entrusted to men equally carefully selected for their work, offer them equal inducements and means, and we cannot doubt that the returns will amply justify the cost.
