**On collegiate education, in relation to the inter-community of the sciences : being the opening address at the Queen's College, Birmingham, session 1866-67, the Rev. T.E. Espin ... in the chair / by David Nelson.**

Professor Nelson
with the compts of the author.

ON

# COLLEGIATE EDUCATION,

IN RELATION TO THE 12

# INTER-COMMUNITY OF THE SCIENCES.

BEING THE

OPENING ADDRESS AT THE QUEEN'S COLLEGE, BIRMINGHAM.

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## SESSION 1866-67.

THE REV. T. E. ESPIN, B.D., WARDEN,

IN THE CHAIR.

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BY

DAVID NELSON, M.D. EDIN.

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TO

THE RIGHT HONOURABLE THE EARL OF LICHFIELD,

PRINCIPAL OF THE QUEEN'S COLLEGE, BIRMINGHAM,

THIS ADDRESS

Is respectfully Dedicated,

BY

THE AUTHOR.

13, *Colmore Row, Birmingham.*

# COLLEGIATE EDUCATION,

ETC. ETC.

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Reverend Warden and Gentlemen,

As the Annual Addresses on the opening of the Session of the Queen's College are not considered to apply to medical men and medical students only, but to the Council, Governors, and friends of the Institution at large, I shall not confine myself on this occasion to medical topics alone; but shall rather range over the objects of the College generally, as a seat of mixed education, and show how from its foundation to the present time it has gradually but regularly extended its field of operations, so as to become more and more of the nature of a university, rather than remain as a limited school for special professional purposes. Such a result indeed was almost inevitable, not only from the mental instincts of its founder and persevering promoter, and the increasing wealth and magnitude and enlightenment of this town, now exceeding in many respects most of the capitals of Europe; but also from the fixed tendency of the present age to recognize a co-ordination of all branches of knowledge, thereby educing that highest form of philosophy whose business it is to show how each department of learning is inextricably connected and interwoven with all the others—the totality in the visible creation being governed by a unity of purpose which becomes the more and more apparent as we go on attempting to unravel the complexities of nature, separating them for our own convenience into innumerable divisions and subdivisions, yet without being able to find any strict line of demarcation by which any one of them could be severed

entirely from the whole. Indeed, that whole only appears as the infinitely many blended into one; and we no sooner begin to study one branch of knowledge than we find at every step the necessity of referring to innumerable others: so much so, that we cannot proceed to have what we might consider a thorough comprehension of even a mist, a cloud, or common air, or a drop of water, a blade of grass, a tree, an insect, a quadruped, and, far more, man himself, without finding each of them to be a more or less complex epitome of those various laws and powers of nature miraculously brought together and rendered subservient to the production of an individuality distinct from all other individualities, while yet it is composed of all this selfsame variety of different elements and co-operative forces collected together from the general universe, and imprisoned as it were for specific and temporary purposes within itself. So it naturally happens that the sphere of inquiry becomes more and more enlarged, until it is found to be inextricably involved in the meshes of a universal philosophy. Not that this universal philosophy, founded on a universal knowledge, can ever be thoroughly comprehended by any one human being, nor that we can abandon the useful regulation of a division of labour so necessary to the limited faculties of the human understanding; but still each inquirer within his own particular domain recognizes the enlightenment of that domain by numerous and distant scientific luminaries, lying far beyond its own special boundaries, their rays being ultimately lost in the heights and depths of the absolute infinitude where we can inquire no further into secondary or intermediate causes, and can only rest upon that last great deduction of the reason, namely, a primary or rather eternal intelligent Cause. In 1853, while delivering a similar kind of address, I took occasion to urge views to this same purport, observing that the main points of the argument would tend to prove that however separate the various portions of creation and of the sciences might seem to be, yet were they all blended in nature into one cosmic philosophy, such philosophy being an emanation of the will and wisdom of one Spirit, and that one Spirit being the one God.

Now when the projector and founder of this College, Mr. Sands Cox, first began his labours, they were certainly confined to the

cultivation of the medical sciences only: but while using the word *only*, we are not to suppose that he had any narrow scheme of education in view; for what do those medical sciences not comprehend? In the first place, before they can be entered upon with any proper advantage (and the spirit of the founder was completely alive to this), the mind of the student must first be trained to a due acquaintance with general literature and the mathematics, and to correct methods of observation, reasoning, and expression. Without such mental preparation, he would find himself engaged in a confused and almost hopeless field of labour; neither knowing how or where to begin his work, what to look for, or the nature, or even the names of his intellectual tools. It was a strong conviction of this kind which made Mr. Sands Cox seek to found his medical school upon a department of arts and general literature, and which has made him ever since systematically hold out a substantial encouragement to the acquisition of a broad general education, without which medical students could only be crammed with crude matters of fact, to become in after life mere plodding routinists and empirics; not to mention the material consideration, that without some such previous training they could not be comfortable in the society of gentlemen, and far less feel that they could rank as such.

But, so prepared, the student may, with good hope of success, proceed to master those special branches of knowledge which more immediately belong to his future professional avocations, and are indeed essential to their beneficial pursuit. Some of these are purely medical, but many of them are subjects of general, or rather universal interest. For instance, an acquaintance with the great mathematical and mechanical laws which govern the whole universe, and those celestial and telluric arrangements under which heat and moisture, seasons, tides, and soils, are regulated, is not only necessary to the physician in his capacity of a preserver of health and a curer of disease, but is of immense interest to all intelligent minds, and of incalculable benefit to the world at large; even though the vast multitude may be unaware of the admirable labours that have built up such a system of natural science, and perhaps forgetful of the beneficent Being who originally devised all such things for their good.

The prime object of interest in entering upon those natural sciences must necessarily be their connection with the laws of life, and the operation of such laws upon those systems of animal and vegetable organization which we see around us in such multifarious forms, and of which the human family forms the crowning glory—man alone, of all these innumerable groups, being the one reasonable creature who can observe, and mentally reflect upon the objects which he sees around him, and from the arrangement of them deduce inferences which carry his mind back into the mirror of Eternity; where he sees, certainly not a reflection of those objects themselves, but a dazzling light of wisdom unfathomable, which is so luminously expressed in the design that constitutes their inner life or secret cause of being, and bears witness of that God out of whose Spirit all those laws and contrivances have emanated: such preceding designing Power being the real essence of which the objects themselves are but the material manifestations, or visible shadowings forth.

Yet to these material manifestations, gross as they comparatively are in relation to their Divine Author, with what a profound interest are we drawn, whether we consider them individually, or in their complicated connections with one another. By the medical mind, while acting practically, all are made to converge towards one leading groove, having for its object as thorough a knowledge as possible of the human constitution, and of the various means by which that constitution can be influenced for good or for evil; but to every mind, and those especially who are being trained to the other learned professions, they possess an intrinsic interest, valuable on its own account alone, as elevating the soul far above the common sphere of every-day life, and leading it directly to the contemplation of divine truth and divine goodness. In this manner, how does the study of geology and mineralogy lead us into the vast field of past and present creations; as we view the results of the grand operations of fire and water upon our globe; the crystallization of the unstratified ancient rocks; the regular bed upon bed of the more recent stratified deposits; the wondrous variety of fossil remains contained within these; the upheavals of the crust of the earth by the internal fires; the consequent protrusion of the lowest rocks to the summits of gigantic

mountain ranges; the bubbling up of springs, so as to form immense upland lakes, as the sources of great rivers; the projection of molten matters from volcanoes; the agglomeration of salts, metals, and precious stones; the demarcations of land and sea; and the gradual formation of fertile soils—all these, as by a foregone design, having been made to minister so specifically to the happiness of mankind, whether as furnishing materials for building purposes, for clothing, for food, for medicine, for adornment, or for lofty contemplation.

How does botany, in like manner, arrest our attention and excite our minds; whether we consider the exact adaptation of the various plants to the various soils and climates; the mode in which the nutritive juices are elaborated from the dead elements of the earth; the towering majesty of the oak and cedar, as contrasted with the minute cryptogamic plants of land and water; the odours of the various flowers; the beautiful tints of the petals and leaves; the nutritious grains, the luscious fruits, the invaluable healing drugs, syrups, and liquors, all pouring from the bountiful lap of vegetative nature, and offered for our acceptance and benefit! In the words of a great poet, we may well exclaim—

"Where does the Wisdom, and the Power Divine,
In a more bright and sweet reflection shine?
Where do we finer strokes and colours see
Of the Creator's real poetry
Than when we with attention look
Upon the third day's volume of the book?
If we could open, and intend our eye,
We all of us, like Moses, should espy,
Even in each bush, the radiant Deity."

In anatomy and physiology how much more are our faculties struck with surprise, when we enter into the still deeper mysteries of animal and human life—mysteries, that is to say, so far as no thorough explanation can be offered of them, except as ultimate facts; yet as facts, plain and palpable to every sense, and not to be denied by the hardest sceptic! In this wise, we behold the exact adaptation of structure to function; while such structures and functions are perceived to be of the most complicated and abstruse character. We behold the process of digestion, by which the most unlikely materials, to all appearance, are elaborated into chyle and blood, circulated by a wonderful living apparatus through all parts

of the body, and its sundry components deposited with exactitude in their appropriate places—whether the bony matter replace the waste of bone; muscular matter, that of muscle, fat, nervous matter, molecules of hair, skin, feathers, fluid of the joints, each and all of them in health carrying forward their appointed purposes with unerring accuracy. We behold the perpetual action, whether the subject be asleep or awake, of that machinery, mechanical and chemical, by which the revivifying oxygen is inhaled into the lungs, while the deadly carbonic acid gas is being as constantly exhaled; and we also see the other similar processes of depuration by which all waste elements are expelled from the system, whether through the liver or intestines, or the kidneys or skin; so that there may be maintained an exact balance between the increment and the excrement of the framework. We see the sundry methods adopted for the preservation of individuals and the perpetuity of species. We see the astonishing contrivances for the exercise of the senses in the delicate structures of the eye, ear, nostrils, and palate. We see the wise mechanical arrangements in the varied forms of bone, joints, muscles, and tendons, each answering to the respective instincts and faculties of the various orders of living beings, ranging as they do from the microscopic monad to the gigantic developments of the whale and elephant, and including innumerable insects, reptiles, fishes, birds, quadrupeds, and races of men. In all this relatively infinite variety of structure and function, I say we find an endless field of contemplation, and an exercise for the highest faculties of our nature. To him who cultivates such study for its own sake alone, the reward is indeed great; but greater far to him who makes such a study subservient to his efforts for the benefit of society, and who seeks, by specially methodising his inquiries, to improve the condition of the human family, to cure or relieve disease, and maintain health, and in short, to ward off death to the latest possible moment, by assiduously becoming more and more acquainted with those intricate laws which specially govern the domain of life.

Within these two realms of botany and general anatomy, one instrument of inquiry has effected so much by enhancing the powers of human vision, that it would be a culpable oversight to omit the mention of it here. I mean the microscope. By its

agency, thousands upon thousands of the most minute plants and animals, with all their still minuter parts, have been familiarized to the understanding, and so afforded glimpses of their constitution and modes of action, even when almost the smallest molecules of matter first start into active being; the only things that baffle us being the ultimate atoms, and that invisible something which animates such atoms, and constitutes the mystery to which we give the name of life. When we come to consider the millions upon millions of infinitely small cryptogams and animalcules living and sporting in but a thimbleful as it were of water, and which at the same time fill the vast abyss of ocean, air, and every nook and corner of the earth, we are startled at the scene which is thus presented to us, and compelled to infer that, vast and sublime as may be the spectacle afforded by the infinitely great in the universe, equally astonishing is this apprehension of the infinitely small; and that, therefore, while the telescope lays open to view system upon system of the worlds of space, the microscope reveals to us system within system of the worlds of life, till we come to particles of matter utterly beyond the reach of our glasses, and which are yet very far from the ultimate theoretical atom. I say theoretical, but am very far from intimating thereby that there can be any doubt in the matter; for as sure as mathematical points and mathematical lines are facts to the reason, though the eye can never see them, so sure is the existence of such ultimate atoms. For take the compound atoms, such as those of chalk or starch; let them seem ever so infinitely minute, still they are further divisible; and could we suppose that we attained to the power of beholding such an ultimate compound atom, precisely at that stage when any further breaking up of its coherency would necessarily make it cease to be of its original specific nature, yet the compound ultimate atom of chalk would be resolvable into sundry ultimate primary atoms of oxygen, carbon, and calcium; while the compound ultimate atom of starch would be resolvable in like manner into sundry ultimate primary atoms of carbon, hydrogen, and oxygen. Nay, these so-called simple bodies themselves may yet, by fresh discovered powers of analysis, be reduced to still simpler forms of matter; nor do I entertain any doubt but that some future Davy, armed with an increased power of the electric battery, increased powers of pressure,

and additional control over the freedom and latency of caloric, shall evolve a much more intimate knowledge of such substances as sulphur, phosphorus, and carbon, with iodine, bromine, boron, and fluorine; not to speak of the possibility of what was once laughed at under the designation of the philosopher's stone, being proved to have contained the seed of a most important truth; so that there might be effected a transmutation of sundry metals into one another. Certainly the views entertained by many profound inquirers, relative to the allotropic modification of several of the so-called primary elements, point in this direction. Such views may not as yet have been absolutely confirmed; but still they afford a basis for future investigation, and for hope for further disclosures as to the metamorphic transformation of specific forms of matter, and the laws upon which such specific forms depend.

But not only in analysis may great progress be confidently predicted, but also in those synthetic processes by which the inorganic but yet organizable elements have been so arranged as to become, in their chemical aggregation, precisely similar to, if not identical with, well-known organic compounds. In this manner, not only have the colouring matters and odoriferous essences, such as may have graced the pre-Adamite world, been extracted from the seemingly inert deadness of the coal-beds,—and not only have the alkaloid bases of the vegetable and animal families been separated from the grosser materials of the organisms, and produced in the form of quinine, morphine, atropine, &c., as well as the saccharine and amylaceous classes of compounds, with albumen, caseine, gelatine, pepsine, pancreatine, hepatine, or choleate of soda, and various other such compounds, especially the ferro-albuminate of soda,—but there have been formed artificially, from the inanimate elements, and independently of the vital action altogether, such organic substances as formic acid, urea, glycocoll, kreatine, and kreatinine. If, therefore, the subtle skill of the chemist shall so progress in time as to make additional advances in this line of scientific conquest, and thereby enable the physician to have at his command not only such proximate principles of the human framework as can be extracted from other organized bodies, and turned to reparative account by appropriate nerve-stimulants, but shall also furnish him with the methods of producing such close imita-

tions of organic substances from the inorganic but organizable elements, then shall the art of medical conservation and cure have attained an eminence of grandeur and dignity more than ever conducive to the welfare of the human race. The facts above adduced, as to the power of the chemist in building up complex organic molecules from the more simple elementary atoms, and forming from the primary elements of dead matter materials entirely analogous to those hitherto produced within living bodies alone, proves that the expectation of further discoveries of that kind has a solid foundation in established fact; and that those, therefore, who are now striving in their secluded laboratories to attain such ends are not to be viewed as triflers or idle dreamers, but as pioneers of future discoveries, useful to the world even by the record of their failures, and in their success glorious.

Such, then, are the subsidiary sciences of medicine in all its numerous branches—medicine itself being the discriminative art, or the application of those composite faculties which we call judgment, under which all these sciences are used as means to a specific end; namely, the conservation or the restoration of health. The physician, as aspiring to be the interpreter of nature, views the structure of the living body in all possible detail of minuteness; he equally minutely observes the forms, qualities, and reactions of surrounding objects upon that body, and upon each other; he studies the effects of all such surrounding objects for good or for evil on the living body; he sees how quietly, beautifully, and happily the system works, so long as all such natural and healthy conditions are undisturbed. But, on the other hand, how sad and painful, and too often fatal, are the results when any necessary element is withheld, or any poisonous material is introduced. On such diverse subjects, all to be co-ordinated by the reason into one leading generalization of approximative truth, the processes of thought must necessarily be of a very complex character; and, therefore, it will be obvious that any one who would seek to render medicine a simple matter would only prove himself to be a simpleton indeed. But yet, because medical knowledge and medical reasonings are complicated, they are not therefore to be unwieldy, or slow of becoming realized in action. On the contrary, the medical practitioner must not only be a learned and

correct man, but he must, like the military or naval commander, also be very ready and prompt; quick in perceiving all the leading facts in a case, clear in discerning their relations to each other, and decisive in carrying out his purposes of treatment. While the divine, in the worst emergency, can at once comfort the departing soul with doctrines of a settled and dogmatic character, and leave the rest to God—and while the judge on the bench may defer sentence till he leisurely deliberates over every existing doubt in any difficult case,—the physician, in too many instances, can be allowed to do neither as the one nor as the other, inasmuch as there may be no settled rule, while but a brief delay may prove the cause of his patient's death.

Efforts to simplify medicine, in order to bridge over such difficulties, and make the practice hinge upon one single principle, or rather supposed principle, have been made in all ages, but they have always diminished in precise proportion as our knowledge of the sciences has become extended; so that not a single philosophic physician of the present time entertains any such visionary notion as the existence of a panacea, or one single method for all cases. We have had, in times past, the consideration of heat, cold, moisture, and dryness. We have had the consideration of exalted and depressed irritability, and its stimulation or subduction by means contrary or means similar; by active interference or by passive expectation. We have had advocates of the one principle of heat, as applicable to every disturbed condition of the system. We have had, for prolongation of healthy life, Sangradoism as to regular periodical bleedings, till it was asserted that men had died only because they had not been bled enough. We have had, and have, the crotchets as to vegetarian diet and medicines, as well as cold water, being each the one single means of cure. We have had the assertion that salt with brandy would rectify every disorder, and, on the contrary, that this very same salt was to be viewed as the forbidden fruit which first brought death into the world, and continues to maintain its irresistible power. We even now have a sort of semi-professional sect (for there must ever be some one or other of such things in vogue) who hold by the assertion that like universally cures like, and intermix that ill-based dogma with another simply absurd—namely, that the smaller, or,

rather, the more infinitesimal the proportion of the agent, the greater is its potency. Now the plan of curation by the rule of contraries is certainly more consistent with fact and reason; and it quite accords with daily experience, that to neutralize morbid acidity by alkalies, morbid alkalinity by acids, and putridity by antiseptics; to counteract the excess of heat by the use of cold; to abate exalted irritability by sedatives; to check excess of purgation by astringents; to rouse the dormant sensibilities and flagging energies by stimulants and tonics; to remedy the evil effects of habitual excess in eating and drinking by depurants, active exercise, and abstemiousness; and to repair the destructive consequences of prolonged over-labour and starvation by means of repose and generous diet,—are all of them proceedings perfectly consonant with fact and sound reason, and too patent to be denied for one moment. At the same time, I do admit that, within certain prescribed limits, the doctrine of like curing like is a true one; but—and I say this emphatically—only within such definitely prescribed limits. It is, in fact, a partial, though very far indeed from being a universal truth, and is recognized as such by the regular practitioner whenever it is required to be applied. It amounts to this, that where a reactionary effort is being made by nature to expel or overcome any evil agency, we are right in encouraging nature in such an effort, and, in so doing, apparently increasing the disorder for the time being. Thus, if any individual patient had over-indulged himself at table, and the natural consequences had ensued in regard to vomiting or purgation, surely no rational practitioner would seek to stay such throes of nature, so long as she was performing the useful work of expelling offensive materials; or if some more subtle poison had entered into the recesses of the system, and thereby given rise to febrile reaction, surely no one would seek to repress such reaction, so long as it was tending towards the elimination of such poison from the blood; nay, he would rather sustain and guide such reaction, so that it should proceed to its natural issue by depuration of the blood through the channels of the liver, kidneys, intestines, skin, or lungs. In fact, whenever natural reaction appears to be insufficient in force to effect its purposes, we encourage it in a variety of ways, such as by exhibiting emetics, aperients, expectorants, sudorifics, and diuretics

—in each instance exalting the symptoms, for the time being, by the application of means which produce results similar to those of the morbific exciting cause. But if such reaction be carried beyond that beneficial intent, so that not only the irritating agents have been expelled, but the violence of the symptoms have run onwards to a prolonged, useless retching, or exhausting diarrhœa or cough, so that the delicate tissues of the organs themselves are being destroyed and cast off in the struggle, who would stand by and see his patient succumbing under protracted discharges and ulcerations, or other similar results, without employing remedies which he knows are calculated to arrest the symptoms by direct counteraction? So far as he might already have gone in the encouragement of the natural reaction, he would have been, in a manner, employing like to cure like; but when once the stage of curative reaction had passed, and the continuous useless irritation on the denuded surfaces went on, to the further injury of the sufferer's body, then he must needs reverse his treatment, and protect nature against the excess of her own reactive energies. This is the precise limit of the partial truth: thus far, and no further, can it be carried with safety; and thus far, and no further, does any regular physician use it.

As to the other assertion, that the smaller the amount of the agent the greater is its force, it is so contrary to all established dynamical facts in the physical and moral world, that I treat it as a simple absurdity requiring no serious attention. I shall only observe upon it, that when certain persons talk at random, as they do, of the effects of the decillionth of a grain, they know not what they speak of. Humour is out of place in a college hall; but arithmetical computation is stronger here in its point of ridicule than all the wit in the world. For if we could only suppose any one person, beginning with Adam and living till the present time (which would comprise about 2,143,000 days), and further suppose that he had adventured to go on taking into his body as much as even say the ten-millionth part of a grain of any given material once every day, he would not as yet have consumed one quarter of that same grain; if twice a day, not half of the grain; if three times a day, he still would not have accomplished its disappearance by a long way; or if even four times a day, or one dose in every six hours

of that unheard of term of life, he would not have completed his task, but still would have one million and about four hundred and thirty thousand doses left, and he would require to live not far short of one thousand years more to finish the arduous undertaking, which reduces the supposition to a practical absurdity. The inference to be drawn from such facts as these may be confidently left to common sense; but if we even granted for argument's sake that such effects could be appreciable, it is evident that they must needs be interfered with, and endlessly counteracted by thousands of other such minute agencies in constant apposition with the human body. For wherever society is congregated, there is scarcely any chemical substance in nature that we are not absorbing into our systems at every moment of our existence, in every breath of air, and in every morsel of food. In short, such imaginations are sheer absurdities; first proceeding from the day-dreams of a disordered brain, and afterwards imposed upon the weak and thoughtless by the more crafty and designing—seeing that it were utterly impossible for any reasonable and properly informed person to accept statements so inconsistent with fact and common sense. Nevertheless we have a daily experience of this great truth so perpetually running through the chain of all past history, that we can with certainty predict that it shall ever continue to exist in that of the future; namely, that the collective human mind is so constituted, that there shall ever be a certain proportion of people ready to grasp at any irrational falsity, more especially if it be novel and startling enough, whether such falsity be in religion, in politics, in morals, or in medicine—the greater the absurdity the stronger being the faith in such persons; and unfortunately also, too often (for objects of self-interest) the less the faith the more the pretension to it by those others who, like false priests, know better than their dupes, but therein act so much the worse.

Rational and philosophic medicine can, of course, have no sympathy with such erratic and base proceedings. It is her part to be bound to no limited or ill-founded faith, but faithfully to pursue the track of truth, into which she can be guided only by a diligent study of nature in all her amplitude. By striving to arrive at deeper, wider, and higher general principles securely deduced from the accumulated and ever-accumulating facts of physiological,

pathological, and chemical science, which mutually illustrate one another, and by closely observing and reasoning upon the operation of appreciable external or internal agencies in health and disease, she finds herself seated upon a mental pedestal of true logic, from which she can calmly survey all the shifting phases of apparent facts, and which never deviates from the firm because self-rectifying axis of impartiality, let Proteus-like Nature seem to vary as she may in her endless changes of aspect. Locke observes upon this subject, that "the faculty of reasoning seldom or never deceives those who trust to it; its consequences, from what it builds upon, being evident and certain; but that which it oftenest misleads us in is, that the facts from which we conclude, the grounds upon which we bottom our reasonings, are but a *part*—*something* is left out which ought to go into the reckoning to make it just and exact; and that *something* is the constant pursuit of the philosopher." Thus it happens that while to the vulgar mind a new theory seems to displace an old one, and one hypothesis supersedes another and another, as we ascend into a higher and more numerous and extended array of freshly discovered facts, the spirit of induction and deduction always remains in the same relation to them; and the new revelations which are afforded to us in science are therefore not contradictions of the knowledge already acquired, but only new explanations or interpretations thereof, arising from a further comparison with multiplied contexts, and in reality an extension or expansion of the more ancient phase of truth, even as by protracted observation and comparison the ovule is found to expand into the grub, the grub into the chrysalis, and the chrysalis into the full-fledged butterfly. Even so with truth. Truth never impairs, but always strengthens her own strength. She is essentially fixed and unalterable in her integrity; but she is not only vast—she is necessarily infinite, and not to be comprehended in her fulness by any finite mind: and that logical faculty to which I have just alluded is but the spirit of reason so cultivated that the well-disciplined mind is enabled not only to see the more of her, but also to infer hypothetically a great deal that may not as yet be plainly seen, but which is yet often destined to be demonstrated in the course of advancing ages, when the eye that apprehended the faint light amidst the darkness is quenched in death, though the

soul that enlivened that eye continues to impart its influence to all that follow in the track of such researches.

This tentative anticipation of the as yet undemonstrated truth, is grandly illustrated by the views of the celestial system promulgated by Pythagoras, and with greater power of proof by Copernicus, but yet remaining to be thoroughly confirmed by Newton; by the like acute and profound views as to the circulation and ærification of the blood by Hippocrates, Aristotle, and more recently Servetus, though only ultimately proved by Harvey; and also by the firm conviction of Newton, deduced from the general law as to refraction of light, that water contained a combustible material; though the fact at the time, even as it stands now, as to water being perfectly opposed to fire, seemed so dead against his conclusion. Yet such conclusion was definitely confirmed in time; firstly and synthetically by Cavendish, who produced water by burning hydrogen in oxygen gas; and secondly and analytically by Lavoisier, who resolved water by extreme heat into oxygen and this same combustible hydrogen, even as it is done now by dint of electricity.

Medicine, then, does not pretend, any more than any other experimental and inductive science, to show forth the entire and absolute truth; for that is beyond all human power in any domain of knowledge. But her votaries are taught to imbue themselves with the love of approximative truth; and the very changes which she undergoes from time to time, in doctrine and in practice, are the best proofs of her watchfulness for new facts in science, and shows that she is above that narrow sphere of bigotry and prejudice in which sectarian dogmatists are tied down to their own favourite and settled delusions. It may be asked, Why not dispel such delusions by argument? But the attempt would be vain. Such persons appear to be blind to all evidence, and to be as insensible to the shafts of reason as other monomaniacs are known to be. They may be said to labour under that mental malady which our psychological physicians denominate the fixity of one idea; which idea either admits no other impression into the mind, or else swallows all others up, shaping them to its own purpose, and incorporating them with itself. True and false medicine, in fact, afford as great a contrast to each other as exists between the mathematical astronomer who

endeavours to explore this universe of suns and worlds, carefully noting the relative positions and influences of one star, or sets of stars, upon each other, ever ready, by fresh observations, to correct former errors, and ever rejoicing in the further elucidation of the field of truth, even while it dwarfs his former conceptions of it—as great a contrast, I say, exists between such an one, and that incredulous and yet over-credulous bigot who would stolidly sit, as his predecessors high in place have formerly done, upon the surface of the earth, and declare, in spite of clear demonstration, that the whole array of the heavenly bodies revolved round it, for the sole convenience of his own comparatively narrow abode, apparently fixed as is his own idea.

So much, then, for medicine as a branch of collegiate study; and I would desire, next, to make a few observations upon another department, namely, Law. In General Law, which is the science of human justice, though often, as we all know, labouring under as many perversions as medicine, or any other intrinsically beneficent pursuit, we have an equal illustration of the benefit to be derived from enlarged and liberal methods of study. When we consider the multitudinous interests of individuals, families, municipalities, principalities, and empires, by themselves, or in relation to one another, and the wondrously interwoven meshwork of human policy that connects all such together in a greater or lesser degree, we must perceive that, to bear all these several interests duly in mind, and allow each of them its fair influence exactly as they should be allowed—no more, and no less—requires an amount of knowledge of men and things, that is, as one may say, infinite. Not that any mind can here grasp all, any more than in other realms of thought; but yet, unless an effort be made in that direction, so as to endeavour to know as much as possible of the subject in hand, we cannot expect almost any progress to be made at all. At least there should be an acquaintance, I shall not say with all the details of any question upon which points of legal difference may arise between men, or bodies of men, in society; but, at all events, with those leading elementary principles which appertain to all matters of fact, or of evidence, or inference, and which are necessary even to the barest comprehension of such deeper explanations as may be afforded in courts of justice by the more competent scientific wit-

nesses, or other experts. Without such elementary principles, those explanations might only make the matter in hand all the more unintelligible; as if they were given in a language utterly foreign to the ear of the listener—words, in fact, which would not convey, but "darken knowledge." Nor can I do better here than quote from the Calendar of our College the words of the distinguished Mr. Warren, contained in his work on "The Moral, Social, and Professional Duties of Lawyers." He says: "For the purpose of not only disciplining the mind, but of preparing it to encounter hereafter cases involving scientific knowledge, it would be highly desirable for the future lawyer to be initiated into, at least, the elements of Mathematics, Mechanics, Chemistry, &c. Take down any number of law reports, and under the word 'Patent,' or 'Copyright in Design,' see what an intimate knowledge of scientific details appear to have been acquired and exhibited by Judge and Counsel, in dealing with the evidence of scientific witnesses, the validity of patents, and the sufficiency of specifications. The Latin and French languages are also indispensable. Look at the printed and written books, records, and documents—private and public—in both languages, which are continually the subject of examination by all concerned in the legal profession. So sensible has the Legislature been of the importance of securing persons of superior education to occupy this profession, that Acts have been passed offering great advantages to those who should graduate at universities, and reducing their period of legal pupilage from five to three years."

As to the engineering and architectural departments, it has always appeared to my mind, as well as to most other persons, that if there were any one course of special study more likely than others to be taken advantage of in this neighbourhood, this was that very one. When we consider the enormous amount of capital, both in money and land, that is in active utilization within this vast borough, and still vaster surrounding mining and manufacturing districts; when we consider besides the wonderful display of mechanical power and mechanical contrivance that meets us at almost every step; when we consider the subtle skill that is requisite towards the efficient working of all those motive powers upon their fulcra; and when, finally, we consider how much to the advantage of the heads and chief assistants in such gigantic ope-

rations would be the possession of a scientific knowledge thereof, not only in a mental, but in a monetary point of view, I confess that I feel deeply surprised at the comparative apathy which has attended upon this further effort of the founder for the benefit of his native town. There were, and that not very long ago, nay, there are in some places even now, persons to be found who view all the practical arts as almost antagonistic or inconsistent with theoretical enlightenment. But this error is now completely exploded in every quarter where science has penetrated at all. In the arts of war and navigation, in shipbuilding, engineering, mining, and metallurgy, in chemical manufacture, bleaching, dyeing, and even, last of all, in agriculture itself, though it depends so much on nature alone, it is now found that they who are destitute of all scientific acquirement must inevitably lag behind the advancing columns of enterprise, and appear as mere mechanical followers of a contemned mechanical routine. In stating this, it is not desirable to push the argument too far, and thereby endanger its acceptance. For it were needless to deny that there may, and does exist a vast amount of very skilful and adroit application of the ingenious devices of the more inventive men, by others who have only this practical handiness, as we may call it, without one ray of scientific principle, or perhaps even ordinary reflection. But of such mere handicraftsmen we are not now speaking, the consideration of their education as a body being quite out of place here. It is their superiors that are alluded to, those who superintend those extensive operations in which thousands of such handicraft labourers are subordinately employed, in addition to those Titanic forces of steam, fire, air, water, and chemical reaction, all of which, to be managed with full dexterity and economy, must be put under the guidance of scientific principle. It is well known that there are sundry gentlemen of this order in our neighbourhood who have not only acquired such accomplishments as those alluded to, but have passed through regular university courses, and obtained distinguished degrees; but it is also equally well known that there are a vast many others who have not done so, to their own detriment, if not pecuniarily, at all events as regards social position; and it must be repeated that it seems strange how science should be so much neglected by that class of persons in a place where

not only Dr. Priestly as a philosopher and divine, but Watt as an inventor and as a manufacturer of his own invented machinery, continues after death to reflect a glory upon it as the seat of his great operations—operations, the utility of which to this as to former and future generations, is wellnigh incalculable. He, be it recollected, was of no lofty origin by birth, but was simply a young man with a workshop, where, in the way of business as a mathematical instrument maker, he came in contact with certain students in mathematics and natural philosophy in the Glasgow University. From this contact with these young men, he was induced to seek for deeper philosophic knowledge within the class-rooms of the college; and being thus prepared for the labours that were congenial to his mind, he bent his attention to the augmentation of mechanical powers, and with an amount of success, as we all know, such as affords ground for a just feeling of exultation, not only to Scotland as his native country, and to England as his adopted one, but to all men of all nations, wherever such acts and their grand results can be appreciated. Let us, therefore, hope that, if not for themselves, at least for their sons and successors, more attention shall be paid to such studies in future by the gentlemen in question.

As to engineers and architects of any position in their professions, such scientific principles are absolutely necessary for them; and the wonderful monuments of such men's skill and genius are to be seen upon the face of every civilized country of present or past times. In our own unparalleled empire, in the present day, vast fields have been opened for the exercise of this kind of talent; and what with monumental memorials of great men, advancement in wealth demanding extension and improvement in building, and, above all, those gigantic works which characterize our docks, our harbours, and our railway tracks, with their stupendous iron arches, their viaducts and tubular bridges—all afford room and verge enough for any amount of skill and science that can be brought into play. But, even upon such men, I would urge that they should not confine their views to mechanical appliances alone—even though these be combined with those elegancies of design which Mr. Ruskin enforces with so much fervour,—but that they should carry their studies back into the past, as a chief means of esta-

blishing fame in the future. It is quite true that we have sometimes had a great deal of practical skill without much science or learning, but it has generally been barbarous and incongruous in taste, and accompanied with an inordinate and ill-founded self-esteem; whereas a better acquaintance with science and literature generally, and with the great productions of ancient and foreign genius—not to speak of the still more wonderful models in nature from which all such principles of beauty, harmony, and strength, are originally educed—would inevitably inspire the mind with a sense of personal humility, even while it really exalted it to the highest pitch of contriving excellence. Let us therefore hope, in this case also, that more attention shall be paid to extended studies in future.

Turning now to that theological department which owes its foundation, through the influence of Mr. Sands Cox, to the pious generosity of Dr. Warneford, the same or similar observations are applicable to the students in that lofty walk. There is no degree or variety of learning that should be considered out of place in such a pursuit. It may be true that, in certain ordinary ministrations of the clergy, as in sundry common duties in other dignified callings in life, the highest order of accomplishment may not be imperatively required; but certainly he will be most fit to maintain the usefulness and dignity of his holy offices who brings to the work all that can conduce to the most intimate knowledge of his subject, and to the powers of elegant expression and illustration with which he must urge those grand and divine doctrines which it is his mission to propound and explain to the world at large. And this observation applies not merely to literary pursuits, but to physical and metaphysical science; for in order to understand fully the accepted word of God, which is his chief guide, it is necessary to contemplate His works; and to contemplate His works aright, and intimately to appreciate them, it is necessary to have the assistance of the natural sciences. Allusions to the wondrous designs and the majesty of Creation are constantly recurring in the sacred writings, and form, indeed, the chief means of illustration by which the reasonable creature is brought face to face, as it were, with the Creator, and compelled to have a cognition of His living Essence wheresoever he may turn his eyes. Not that

such intellectual insight can be said to be necessary for that humble, saving faith, and self-denying, benevolent piety, which are the moral and spiritual means of attaining the Divine favour, even among the lowliest. But we are now considering what ought to be the accomplishments of the teachers of things divine, such as are trained in colleges and universities; for though literature alone may do a great deal for any one, it will certainly not do nearly so much as when such literature is combined with a due acquaintance with what are called the physical sciences; because these so-called physical laws and principles are, in their totality, only another name for the full and proper knowledge of nature; and nature being the great work of God, and the visible exposition of His attributes, it necessarily follows that so much knowledge thereof is equivalent to so much knowledge of God and His attributes. But, in studying nature, we find all the branches of natural science subordinate to, and dependent upon the mathematics, inasmuch as each involves a necessary precognition of number, size, weight, and form; and as such ideas of number, size, weight, and form, along with their external relations and applications, can be evolved only by a reaction of the mind upon material nature, and as the evolution of such ideas, in their internal relation to each other—that is to say, within the human mind—can be attained only by the reaction of the mind upon itself and its own thoughts; and also as such reaction of the mind upon nature and its own thoughts inevitably leads to the cognition of a congenerous Spiritual Essence infinitely above and beyond itself—which congenerous Spiritual Essence is God, a knowledge of whose Being is the one grand object of all our pursuits in learning, or the higher mental cultivation, but more especially in theology; and, finally, as such grand object cannot be well approached except by means of the above-described processes of thought, so such processes of thought are essential to such learning or higher cultivation in scholarship—which amounts to saying that a mere bald and dry knowledge of synonyme and syntax is comparatively a barren acquisition, in relation to that finer exercise of the faculties in those other real matters of which this literature is only the record. For even as ordinary books of history are but shadowy recitals of the actual thoughts and deeds

of individual men and nations, so all ordinary literature is but an ideal representation of the real things and thoughts which have filled and stirred into spiritual activity the minds of its authors. They, as authors, have thus drawn from the infinite resources of nature all the material, if not the spirit, of every idea of which they are possessed; so that all the beauties and sublimities of the painter, the poet, and the rhetorician, and all the grand results of the ratiocinations of the philosophers, are, after all, only unfoldings or revelations of the facts and essential principles to be found in the magazine of material nature and of life—modified, it may be, by the genius of the mental alembic through which they have passed, but certainly not, on that account, rendered any the more perfect, though some may be immeasurably better than others. It will thus be seen, I conceive, that one of the principal functions of the teachers in things divine is to trace to their primeval Fountain-head all those various rills of distinctive knowledge, the channels of which have, no doubt, been worked out by the keenness of the human intellect while pursuing this or that particular track of inquiry, but the original Source of all of which is traceable to, though hidden within, the bosom of the Deity. That the wisdom of Dr. Warneford practically recognised this principle, is proved by his institution of the Warneford Prize Essay, the great object of which was to illustrate the workings of those physical laws in relation to their Divine Author, so that proof might be multiplied upon proof as to the Being and attributes of the Godhead, such as would, of necessity, overcome the most obdurately sensuous mind, and compel it to gravitate towards the central spiritual Source of all secondary or derived being; not from a mere blind faith, but from a deep-seated, rational conviction that such faith was rooted in the truth—that eternal, unalterable, and only solid basis of truth which stands fast for ever like a rock, amidst the sea of errors.

But, besides these special and orderly courses of study in arts, law, engineering, medicine, and theology, for the purposes of the several professions, it would be well, I believe, if private individuals, without entering as students in any particular department, might yet attend lectures and other modes of instruction, in such classes as might either suit their respective avocations, or aid them in such pursuits as conduced to their intellectual recreation and improve-

ment. In this way, as already suggested, the wants of the community might be met, and many private gentlemen acquire knowledge in ancient and modern literature, in the higher mathematics, and in the study of general anatomy, natural history, physiology, botany, chemistry, and the applied sciences, such as would greatly conduce to guide them in their favourite occupations, or usefully engage their minds in the intervals of professional business. In the University of Edinburgh there is always, besides the regular students in arts, law, medicine, and divinity, a large number of private gentlemen—elderly as well as young—who derive pleasure and profit from their attendance upon such special classes, according to their tastes or objects in life; and who sit upon the benches of the lecture-rooms of various professors—such as those of natural history, natural philosophy, chemistry, botany, comparative anatomy, Roman law, music, scientific agriculture, and other such subjects as have never been embraced in their previous academical education; and, as the system works well in Edinburgh, there can be no valid reason why it should not work well here. There is but one thing necessary as a preliminary to such class attendances, and that is, that the gentlemen should matriculate as students, and agree to conform themselves to the rules of the College whilst within its walls; and to forward such purposes, if diligently and zealously carried out in all such departments, we might reasonably look forward to an appreciation of such efforts by the friends of sound education, and to the generous aid of the Government in maintaining and improving the library and the museum, which latter is admitted by all the most competent judges to be an excellent groundwork for future acquisitions, such as must confer immense benefit, not only upon the students of the College, but upon the whole community. When a seat of education, like to the Spartan or Roman matron, of a nobly trained family of patriots, sends forth her disciples in literature and philosophy into the general world, that general world becomes indebted to her in such degree as may be commensurate to the worthy labours of her academical foster-children; and, amongst the former students of this College, numerous names stand enrolled in this respect, as having performed good service to the commonwealth in their various callings.

How many there are in this town and neighbourhood, and all

over the world, who have acquired much reputation by their useful public exertions, as authors, professors, honorary hospital physicians and surgeons, and skilled private practitioners, all are aware, or can easily know; and, not to speak invidiously, but only introducing the name as arising out of a recent public performance, I may mention a former pupil of this school—Professor Bowman, of King's College, London, who, with a high previous reputation as a physiologist, has by the character of his late address in surgery, at the annual meeting of the British Medical Association, exalted that reputation to the highest degree, and so made it redound to the honour of his earlier instructors.

And now, gentlemen students, this brings me to speak more immediately of yourselves, your studies, and prospects in life. With regard to the studies, what has been already said is I conceive sufficient; the sum of it being this, that while you ought with a special degree of diligence to pursue those branches in which you are now engaged, with a view to arrive as near to human perfection as possible in the peculiar professional walks which you have chosen, you have still to bear in mind that there is scarcely, if any kind of knowledge that does not bear more or less upon those particular spheres of occupation, and therefore to be duly taken into account in all your professional pursuits and investigations. We have to congratulate those gentlemen who have striven successfully for the medals, certificates, and other marks of honour which have been this day awarded them by the Council; we have to render our meed of praise to those who have run the good race, though without success; and we also have to exhort all of you to maintain the spirit of honest and generous rivalry in well-doing: so that while to gain the prizes is a great honour, yet not to gain them is no dishonour, the essential moral merit lying in the spirit of the attempt, and not in the result. Besides these prizes, there are the future more valuable prizes arising from success in life. But here again we have to bear constantly in mind that the great merit is in deserving success, rather than in the attainment of it. Worldly success, when morally deserved, is, indeed, a great gratification; but when not so deserved, is, or ought to be, a source of shame to the possessor. Therefore let none of you be daunted or depressed if after per-

forming all that you may consider your duty, you fail to reap those material rewards in life which you might reasonably have expected to follow upon such endeavours. There are so many abstruse investigations leading to the greatest benefit to the world, which yet that world as a mass is quite unable to appreciate, except in taking advantage of the remoter practical results, that there is nothing to excite surprise in the fact that so many men of pre-eminent merit have lived and died neglected of the world. Such persons know this, and are prepared for it; the nature of their labours constituting, so far as it goes, its own reward of mental entrancement, and the ineffable deep and calm delight afforded by the first apprehension of new discoveries in fact or in principle. To you, gentlemen students, now in early manhood, naturally ambitious and aspiring, and perhaps looking forward with confidence to positions of fame and fortune, it is not needful to infuse incitement to vigorous effort, and glowing encouragement for hope. You are instinctively full of both. Neither is it required, on the other hand, that any endeavour should be made to lessen in your eyes the fair value of worldly position or worldly wealth. It would be a wrong proceeding, in fact and in principle, to do so; for such things are the precious fruits which the Divine Governor of the universe has ordained to spring from human fountains of honour, and from the bosom of the earth, under exertion of those faculties with which man is endowed for that express purpose. Let us, therefore, avoid adopting those views of certain self-misguided ascetics who affect to despise all wealth and all distinctions, and to live only for the benefit of others, while they punish themselves by a denial of not merely the luxuries, but even the common comforts of life. At the same time, while you steer clear of this extreme position of a benevolent fanaticism, and, on the contrary, make every lawful and generous effort to attain wealth and eminence in the world, be you ever prepared, if all such commendable efforts should fail, whether from simple want of appreciation, or from jealousy and positive depreciation at the hands of unworthy opponents, be prepared, I say, never to be disheartened or subdued in spirit; but having adopted such course as you may be convinced is conformable to your inmost conscience, follow it unswervingly, let it lead wheresoever it may. Should it

lead to apparent disaster, it is for you to institute a strict self-examination, and take counsel of the wise and good, if you can obtain that, inasmuch as the result might be due to faults of your own, or to lack of experience. But if after that you are made to feel that you must still cling to your convictions, then you must carry them out conscientiously, and without regard to consequences. For it is under conscience alone that you are responsible to God, and not for any errors in observation or judgment, provided you have used all due diligence to arrive at the truth. It is the more necessary to urge such principles in the present era of such racing after riches, and forgetting all higher obligations in the hurry of acquiring wealth, and that perhaps without any effort whatever, either of industry or invention, but only a sort of gambling and sharping in money speculations. Unfortunately, such precepts have been often too much neglected in the keen pursuit of trade, commerce, and such money speculation, and the custom of society has given a sort of tacit sanction to many proceedings in these pursuits that could not bear the light of the moral law without exhibiting sad blurs. But you, as professional men, stand in a very different position, and look to reap other rewards than this one of pecuniary profit. It is not for such a thing alone that any really professional calling is ever followed. It is not for this alone that the patriotic warrior by land or sea, be he peasant or patrician, perils his life. It is not for this alone that the devoted legislator or statesman sacrifices his ease, pleasure, and security in times of trouble and black political danger. It is not for this alone that the adventurous discoverer faces the desert, the storm, the ice-bound ocean, and the worst of deaths that he may perchance encounter at the hands of cruel and bloodthirsty savages. Nor is it for this alone that the clerical or medical visitant jeopardizes his health and life by contact with pestilential sickness, or in dangerous tracks of missionary labour, or on fields of battle where duties, not of warm excitement, but requiring the calmest judgment, have to be performed under the fire of the enemy. These, and such as these, feel themselves to be sufficiently rewarded in life, if they gain a good reputation, and enough to afford them a moderate maintenance, according to their respective conditions in society. But if such services should be

actually performed, and not duly recognized, but neglected, or even slighted with ingratitude, then you have but to remember for your consolation how many of the greatest benefactors of mankind have had to live in poverty and neglect, and die in destitution, though, it may be averred, never in despair—never in despair; because they have ever cherished, as all of us must seek to cherish, the bright assurance of immortality, that unfailing source of a self-sustaining energy which alone endures unto the end. The code of ethics, then, must be of a lofty standard with all those who seek to assume such duties and to perform them worthily. To shrink from maintaining the truth, because you might thereby damage your material interests; to abet a doctrine injurious to the community, even by a mere prudent silence, because it may happen to be for the time popular; or to withhold the knowledge of what is beneficial because the concealment thereof might add to your worldly pelf—all these, though tolerated in other vocations, are quite inconsistent with the duties of such callings as yours. It is well, when rank and riches follow upon the performance of such duties; but yet they ought to be followed out irrespective of profit, irrespective of fame, irrespective of the appreciation or gratitude of individuals or society. It is this high principle of the guidance of conscience, under God, that alone constitutes the essence of all right conduct, and which alone animated those great men to whom I have just alluded, namely, the disinterested, but perhaps neglected and even persecuted discoverers in science and the arts; the noble victims to the advocacy of justice, in various times and places; and the martyrs to fidelity to what they believed to be religious truth, all of whom, from the nature of their sacrifices, must, of necessity, have looked, not to the fleeting hopes of Time, but to that eternal, spiritual Source of all originative causation, from whom they knew they derived their being, and whose equity and mercy they felt sure would stand fast for ever. It is of such and to such, be they in lower or in higher degree, that the noble poet of the Seasons speaks, when he exclaims, in anticipative view of such futurity:—

> "Ye vainly wise, ye blind, presumptuous, now
> Confounded in the dust, adore that power
> And wisdom arraigned! See now the cause
> Why unassuming worth in secret lived,

And died neglected. Why the good man's share
In life was gall, and bitterness of soul.
Why the lone widow and the orphan pined
In starving solitude; while Luxury,
In palaces, lay straining her low thought
To form unreal wants. Why heaven-born Truth,
And Moderation fair, wore the red marks
Of Superstition's scourge. Why licensed Pain—
That cruel spoiler, that embosomed foe—
Embittered all his bliss! Ye good distressed,
Ye noble few, who here unbending stand
Beneath life's pressure, yet bear up awhile;
And what your bounded view, which only saw
A little part, deemed evil, is no more.
The storms of wintry Time will quickly pass,
And one unbounded Spring encircle all."

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