would be better done if men had familiarised themselves with the models of these process which are furnished by sciences. I do not mean that a boy knows he is doing all these these things; but he is doing them visibly. And when he applies the analysis of logic to the processes of his mind, he will find that he has been thinking logically, though unconsciously so.

Thinking is learnt by thinking; and it is my strongest conviction, as it is my daily experience, that boys can and do learn to think,—learn all the varied operations of the mind we sum up in that word,—by the study of science. A more vigorous school of thought, and a habit of the mind less inclined to the faults of dogmatism on the one side, and deference to authority on the other, with more reverence for truth, and more confidence in knowledge, is the natural product of scientific instruction.

And again, how perfectly does science illustrate what the attitude of the mind ought to be towards the unknown and unrevealed. It shows the methodical advance and conquest of knowledge over ignorance, and marks where there is uncertainty on the border ground between them; it exercises its judgment on the degree of uncertainty, and casts longing looks into the darkness beyond. But it never mistakes the penumbra of uncertainty for the full light of demonstration.

Moreover, taking education in its broad sense as the training of all the powers that go to make up the man, I would point out how much science contributes towards increasing the powers of the senses. All science is based, some one has said, on the fact that we have great curiosity, and very weak eyes; and science gives men a marvellous extension of the power and range of the acuteness of those eyes. "Eyes and no eyes" is the title of an old story; and it scarcely seems too strong a way of marking the difference between the powers of perception of a cultivated naturalist, and those of the ordinary gentleman ignorant of everything in nature. To the one the stars of heaven, and the stones on earth, the forms of the hills, and the flowers in the hedges, are a constant source of that great and peculiar pleasure derived from intelligence. And day by day do I see how boys increase their range of sight, and that not only of the things we teach them to see, but they outrun us, and discover for themselves. And the power, once gained, can never be lost. I know many instances of boys whose eyes were opened at school by the ordinary natural science lectures, who have since found great pleasure and constant occupation in some branch of scientific study.

And I would add that whatever may be defects of a purely literary education, which I obviously do not intend to discuss, they cannot be remedied by mathematics alone. Mathematics are so often thought, by those who are ignorant of them, to be the key to all reasoning, and to be the perfection of training, and so often spoken of by proficients in them as mysteries that it is worth the labour of half a lifetime to understand, that it is worth while to remember that after all they are only compendious and very limited methods of applying deductive reasoning, assisted by symbols, to questions of which the data are, or are supposed to be, extremely precise. They no more *teach* reasoning in the ordinary sense of the word than travelling by railway fits a man for exploring in Central Africa. And hence, while I set a very high value on arithmetic and geometry in all education, it is not because they supply the place of science, however, and are indispensable to its study. (1)

It will be observed that in this sketch of the grounds on which I urge the claims of natural science to be admitted into the ordinary course of a school education, I have omitted some points which are obvious enough. There is for example the very great pratical utility of the knowledge; and if boys cannot gain enough knowledge at school to enable them to solve the scientific problems that may meet them in their later life, yet it is something to know that they are scientific problems. It is something, to know enough to know that others know more; to be able to say that this must be referred to a chemist, and this to a geologist.

And again, there is the very great increase of interest that an acquaintance with the elements of sciences gives to an educated man. An age of progress is an age of exceeding interest to those who can follow it intelligently.

And it seems only reasonable that schools should at least have the power of discovering special abilities.

And the presence of science side by side with literature is a protest against the narrowness which overvalues one branch of learning and despises others Co-operation is necessary to secure a happy co-existence of these studies. Each alone becomes conceited; and conceit is the most fatal enemy to progress.

The advance also of science depends to some extent on the number as well as the genius of its students. How many rare and precious fossils, how many singular phenomena have been lost to the world, seen by blind eyes! How many gas-lamps might have trembled at sounds before a Lecomte observed under what conditions the ball-room lights responded to the tones of a violoncello!

And the extent to which the methods of science have affected all other studies, the existence of social and economical *science*, and the relation of science to religious thought, make it absolutely necessary that it shall be no longer excluded from a liberal education.

The narrow range (to recapitulate) of our existing curriculum invites extension, and natural and physical science claims admission on all grounds that render intellectual education in itself desirable. The natural interest boys take in it, and the effort it consequently induces them to make, the dignity of the ideas it unfolds, and the exactness of the knowledge that it is built upon; its value in practice and in philosophy; the extension it gives to the range of intellectual perception and consequent intellectual pleasure; the truth-seeking habit of mind, and training for an intelligent contemplation of the world that it imparts; and above all the completeness of the illustrations and models of the art of thinking that it affords in a form that attracts and retains the attention, and almost unconsciously trains the student in habits of logical thought,—form a body of arguments that seem unanswerable for introducing science into our schools as a branch of liberal education.

There are several objections brought forward by those who think more or less on this matter, and they reduce themselves to three: which urge respectively the worthlessness, the inhumanity, and the discursiveness of the study of science.

All that may be said on the worthlessness of science as a means of education in schools is before the world in the evidence given by Dr. Moberly, of Winchester, before the Public Schools Commission: to which I refer the reader.

The inhumanity of science is urged by some who feel that in order to train men, education must deal mainly with the feelings, the history, the language of men; that our relation to men, past and present, is more intimate, more important, and more elevating than our relation to the objects and forces of nature. Granted; and it proves that an education in science alone would be not the highest; but it is really no argument against a proper and moderate use of science as a means of educating certain faculties, such as the logical, which are very important for a true study of men, and yet are not best trained by a study of language, and literature, and history. This, however, does not go to the bottom of the matter. Many have a kind of instinctive fear, not so much of the inhumanity, as of the inhumanising influence of science. And this instinct has, I believe, a real foundation. It is not simply false, that there is an inhumanity about science. The vague impression that reverence, faith, belief in the unseen and the spiritual, and in truths derived from

(1) It is singular that the Mathematical Tripos is so uncientific, and the Natural Science Tripos at Oxford so unmathematical. At Cambridge a man may get the highest honours in mathematics and natural philosophy and have never seen a crystal, a lens, an air pump, or a thermometer; and at Oxford a man may get his First in natural science without knowing the Binomial Theorem or the solution of a triangle. Surely these are mistakes.