Humanism in Technical Education.[1]

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VERY few questions have been more discussed than that of education, and the reason for it is quite obvious; for educational methods are as varied as the students who have to be educated, and perfection can be reached only when a system is designed to meet the special circumstances of each individual. Some plants want pruning, others require fertilising, to produce their best results. One pedagogue thinks discipline should be the cure for all students' evils; others preach the importance of making the work attractive. The clash of ideals is heard most in our technical schools. One authority wants full-scale machinery, another says that the college workshop is merely a misleading caricature of a commercial factory. We are told that the student of science and technology can never become an educated man without a dose, and a fairly large dose, too, of the so-called "humanities"; he must always be narrow otherwise, if not absolutely lopsided, and can never be prepared in an institute of science and technology efficiently to undertake the full duties of citizenship.

In a community of science workers discordant notes are similarly heard. One presses for pure science as the main requirement of the practical technologist; another urges training in purely technical methods. The practical man thinks he has used a very hard word indeed when he calls the science student a theoretical idealist, a dreamer. The student of science pretends to despise the practical man as a mere rule-o'-thumb worker, often, however, because he fails to grasp the principles which underlie, and the long process of expensive research that has evolved, the so-called rule-o'-thumb. The doctrinaire student of science very often is, as some one has said of the early riser, conceited all the morning and stupid for the rest of the day.

It is, however, impossible to lay stress on any one truth without apparently being unfair to some other truth. Somewhere between these extremes the maximum of truth is to be found. It is too often so that where science is taught, the student is crammed with the facts instead of trained in the methods. The product of the science class is sometimes handicapped by what Prof. Huxley, the greatest of my predecessors at South Kensington, called "precocious mental debauchery"—the result of too many bouts of book-gluttony and lesson-bibbing.

I do not intend this evening to follow up any of these apparently divergent doctrines. We have learnt now, if we never appreciated it fully before, that a country cannot defend itself in war, or fight the relentless battles of peace, without science and technology. But the technologist will not remain only an expert in the workshop. He has duties as a citizen and must face relations, and competitive relations too, with other human beings, with most of whom he is unable to communicate in technical terms alone—the technical terms that he learns in the class-room. To be appreciated, he must understand and be understood by others: he wants the "humanities."

Now what is meant by the "humanities"? A dictionary will tell you that classical learning is intended by the same word that we also use for a study of the dispositions and sympathies of man. Sure enough, the study of classical literature once had this meaning. Late in the middle ages the study of the classics revealed to the world the long-buried wisdom, especially of the Greeks—their art, their religion, and, more important, their science. That discovery gave rise to the great movement which we speak of generally as the Renaissance—the revolt of intellect from previous feudalism and theological bondage—resulting not only in the revival of literature, art, and that religious freedom which is generally known as the Reformation, but in the development also of scientific curiosity, what, to avoid the secondary meaning of curiosity, we now call research. It gave us the Copernican for the Ptolemaic reading of the solar system; it gave us also in practical form the mariner's compass and, with the exploratory spirit which accompanied it, the discovery of the Americas, of South Africa, India, and the Far East; it gave us the invention of gunpowder and that of paper and printing, which facilitated the distribution of the new learning to a wide world.

How many of these developments, which succeeded one another with the speed of a revolution, were due to independent origin and from other sources, and how many were quickened by the rediscovery of buried philosophies, we need not stop to inquire; but it is obvious that what would otherwise have been but slow combustion developed, because of this discovery, at the speed of an explosion. That discovery was specially the discovery of humanism in Greek literature. Greek literature acted on medieval scholasticism like nitric acid on a combustible cellulose; cotton was converted into gun-cotton.

The lesson to be learnt from the Renaissance is strengthened by a consideration of what happened afterwards to classical studies. With the passage of time, classical learning like an organism went through a period of vigorous youth, vitalising the world with new energy and new ideas, until it reached the stage of adolescence, and, with it, specialisation.

That is the life-history of every organism. With specialisation the study of the classics became narrowed to its linguistic, grammatical, and purely rhetorical aspects: its main object became obscured and stricken with a formalism and a pedantry that "has given us false ideas, and the narrow spirit of a mutually admiring coterie, that wrote Latin and Greek verses to one another and to no one else. It has engendered a wild form of pedantry that regarded a false concord or a false quantity in Greek, not at all as we should regard a similar mistake in French, but as a shock to the higher order of things, which deserved scorn and reprobation when committed by a man, cruel punishment when committed by a boy."

These are not the words of a prejudiced and jealous scientific man, but the judgment of a distinguished classical scholar, the present Vice-Chancellor of Oxford. Reviewing the situation in this way before the Congress of Universities in 1921, Dr. Farnell pleaded for the revival of humanism in classical studies, and I wish similarly to direct attention to the importance of humanism in science and technology, for we also are exposed to the very same danger that Dr. Farnell says has now nearly strangled classical scholarship in our public schools and younger universities. We can thus learn something from the classics; we can profit by their mistakes, knowing that it is never so easy to recognise our own as the mistakes of others.

[1] From an address delivered at the Sir John Cass Technical Institute on January 31.

During the middle two quarters of the nineteenth century, science went through what we might call its Renaissance period. In its philosophical aspects, it was a revolt in part against a widespread misinterpretation of theology, and, in educational policy, it was a revolt against the dominance of what we regard as a perverted and senile form of the classical humanities. We do not object to the humanities, but to that devitalised residue of the humanities that is without humanism.

I am not now going to discuss the relative merits of science and classics as educational media, but I want to bring home to you the danger of defeating the very end of science itself. Scientific men are also liable to succumb to that form of pedantry which in classics exchanged humanism for grammar and rhetoric, and that homologue of pedantry in most religions which tends to kill doctrine by ritual. Do not let us claim that science can give mental training as good, when really we mean as bad, as that afforded by classics. You may remember what Huxley said of Peter Bell, whose dead soul, according to Wordsworth, saw nothing in Nature:

> "A primrose by the river's brim,
> A yellow primrose was to him,
> And it was nothing more."

Huxley asked if Peter Bell's apathy would have been roused one whit by the information that the primrose is a dicotyledonous exogen, with a monopetalous corolla and central placentation. This additional information would have added no more to the humanising influence of the primrose on Peter Bell than any form of exegetical analysis of a Greek text in exchange for Greek philosophy and Greek art.

Let us take an illustration from one of the departments of this Institute—that of metallurgy. The syllabus of this subject refers to "Bessemer and open-hearth plant and processes." A fair summary of what I, as a junior student, had to learn under this head would be as follows: "The original Bessemer process, as conducted in a ganister (silicious) lined converter, does not effect the elimination of phosphorus from the pig-iron; but by using a basic (dolomitic) lined converter, Thomas and Gilchrist found it possible to eliminate the deleterious element that affects the quality of the resultant steel, so it is now possible to use a phosphoric pig-iron for steel making." Later, coming under the influence of a professor with a wider outlook of the world, I learnt that this so-called basic process changed the whole of our international relationships. It opened up the enormous phosphoric ores of Germany, Belgium, and America. It resulted, therefore, in a challenge to British supremacy in the steel business. Just think of what that meant to railway development, shipbuilding, machinery, and dozens of dependent industries! Obviously, realisation of this, to me, quite unforeseen meaning in a purely technical fact opened up a new world of human interest.

Who was Thomas and who was Gilchrist? Those were the first questions that occurred to one. Thomas, I found, was a magistrate's clerk who attended evening science classes at the Birkbeck, a college having an object similar to that of the Sir John Cass Institute, and named for the same good reason after its founder. Gilchrist was his cousin, and he proved to be much more interesting to me, for he was an old School of Mines student and a Murchison medallist.

Thomas and Gilchrist made, by their invention, a greater impression on the history of civilisation than any two Prime Ministers we have ever had, a greater influence than the sum-total of that exercised by one devoted to optimistic militancy and his counter-irritant, the apostle of tranquillity. Thomas had what the great Mr. Gladstone described, in reviewing his memoirs, as "an enthusiasm of humanity." I am ready to assert that a review on these lines of the way in which the basic process of steel-smelting has affected history, especially when so touched with the human relations of the two men to whom it is due, is all that is necessary for the student. He will soon satisfy his own curiosity about technical details; he will soon be studying the question himself in the library and the workshop.

This stirring of that form of curiosity that Dr. Johnson called "the thirst of the soul" and "the characteristics of a vigorous intellect" will give human, living interest to a student's work. The teacher's task is three parts done and faithfully fulfilled when he has inspired the student sufficiently to impel him to find out the rest for himself. Nothing appeals to a man like humanity.

In a thoughtful paper read before the Congress of Empire Universities in 1921, Prof. Cecil Desch advocated the adoption of the historical method in science teaching. But history consists of innumerable biographies. As Emerson said, "There is properly no history, only biography." History, divorced from biography, can be as dull and deadening as either Greek grammar or descriptive technology The educational balance is not secured by requiring students to attend a formal course of classics or history as well as of science. That would be merely to double the offence. A physician does not apply a counter-irritant if he can get at the seat of the disease. It is not separate courses of history and science—a mechanical mixture—that are wanted, but the history of science itself, that is, a chemical compound. Giving two separate doses of two unrelated subjects to act as mutual correctives is equivalent to giving a man a metallic sodium pill with a sniff of chlorine gas, when what he wants is merely a pinch of common salt.

But for the power unwisely given to examiners to make or mar a student's career, I would like to try the experiment of covering a syllabus of, say, metallurgy or chemistry by lectures on biography alone. I believe students could be trusted to fill in the historical frame-work on their own account, and to find out for themselves all that is required in the way of technical details. They shall succeed, of course, in varying degrees just as they do now; but whether they succeed partially or wholly, all shall be better men for having made an effort inspired by a natural and healthy curiosity; they shall have had the very training which lays a sure foundation for what the scientific man calls research; and what the scientific man calls a training for research is the very kind of training which qualifies a man to face the problems of after life, when every difficulty that the student has to face after he has left the institute shall have no apparent resemblance to any question previously treated, either in the lecture-room or the laboratory. Every problem that the student meets with afterwards shall be a piece of new research to him.

Sir Richard Gregory, in his address to the British Association last year, defined education as the "deliberate adjustment of a growing human being to its environment; and the scope and character of the subjects of instruction should be determined by this biological principle." I agree, and as the technical student's environment will be human beings, with little or no familiarity with his own pet technical terminology, he wants to go into the world with a full appreciation of the human aspects and importance of his special subject.