slowly, that in the opaque ones quickly. As this ice thaws in a watch-glass under the polarising microscope, the lumps of quickly frozen white ice exhibit immense numbers of strings—arranged radially alongside one another—of spheres and lenticular masses, 0·01 mm. to 0·02 mm. in thickness, consisting of very nearly pure water. In each sphere there was a vacuous bubble 0·0006 mm. in diameter.

(27) Slowly frozen water showed, on thawing, similar strings of (liquid) spheres and lenticular masses (of larger size, viz. 0·04 mm. to 0·12 mm. diameter), normal to the surface of the block of ice. These spheres and lens-shaped masses had been formed out of solid or hollow cylinders, or long thin cones with local swellings or bulgings. Frequently lens-shaped masses bounded by two spherical surfaces lay in a thin, flat, spiral or warped foam-wall.

(28) The fibres and cylindrical or conical tubes, like the tubes filled with air, were formed out of thin layers of very viscous, oily liquid, which, as the cooling proceeded, separated out, normal to the surface, and under the influence of the surface tension rolled up, being unable, by reason of excessive viscosity, to form spheres or bubbles.

(29) When the thawing has gone on for a long time, fewer foam-walls and larger foam-cells, or glacier grains, appear in the lumps of ice. The strings of liquid spheres, normal to the surface, show an increase in the size of the spheres, caused by the coalescence of the small spheres in the doubly refracting mass of ice into larger ones. An increased amount of salt in the ice assists this coalescence. The tubes or strings of spheres could often be followed continuously through several glacier grains. The partition walls of the glacier grains, when illuminated, often show hundreds of small lens-shaped masses of the same or gradually diminishing size.

(30) By repeated fractional freezing and melting of the ice crystals formed, continually purer and purer ice is obtained, with increasingly large foam-cells or glacier grains. I have, however, not yet succeeded, even by repeated slow freezing, in obtaining ice free from foam-walls or from glacier grains.

(31) A block of transparent ice was cut through, as described by Bottomley, with a loaded wire loop. The loop was of steel wire, or of platinum wire previously heated to redness, and carried 2 kilograms or more. In no case was the plane of section transparent, but always opaque from the presence of solidified foam bubbles of oily salt solution, possessing refracting power different from that of their surroundings.

(32) Each separate glacier grain in artificial ice contains a differently orientated crystal of ice, the optic axis of which is very seldom normal to the surface of the ice. When in natural sea ice the optic axes of the separate crystals in the different grains are found to be normal or parallel to the free surface of the water, the separation of orientated crystals of ice may have been started by the contact-action of ice crystals or snow flakes falling on the surface of the super-cooled water, and swimming thereon in a horizontal position.

(33) The more slowly artificial ice has frozen, and the less salt it contains, the more transparent, rigid, and difficult to cut with a knife it is.

(34) Every block of artificial ice cleaves, on pressure with a steel point, along the diagonal and median planes, in which, as the ice crystals separated out on freezing, the mother liquor became more concentrated through holding the traces of salt dissolved in a continually diminishing volume of liquid.

(35) The planes of easiest cleavage in natural ice crystals (laminated structure, displacement without bending) are due to invisible layers of liquid salt solution which are embedded in the crystals, normal to the optic axis, or often in other positions.

(36) Ice crystals at temperatures below 0° consist of doubly refracting viscous liquid, and are intermediate between the soft crystals of serum albumen and ordinary crystals of quartz, felspar, &c.

(37) At the edge of Tyndall's liquefaction figures, while they are in process of enlarging, or on the bursting of the foam-walls of artificial ice as it melts, one often sees periodic vortex movements. These arise from a periodic capillary spreading out ("Ausbreitung") of the salt solution of the foam-walls at the boundary between pure water and air or vacuum.

(38) Tyndall and Huxley observed in white glacier ice transparent lenticular masses bounded by spherical surfaces. These were foam bubbles of water free from air, which were enclosed in a thin skin of oily salt solution and had solidified while embedded in such a skin.

(39) The blue bands in glacier ice consist of pure ice, while the white bands are composed of ice containing salt and air bubbles. They are formed by the periodical action of solar radiation and by changing pressure, or by the slow descent of the portions rich in salt, or by the slow ascent of air bubbles in the viscous liquid of the glacier ice.

(40) The ice of the snow flakes which fall on the upper part of the glacier becomes fertilised with inorganic salts derived from disintegrated rocks, and is, as it were, hatched out by the sun's rays, forming "névé" or "firn" snow and glacier grains, or foam-cells filled with ice in the glacier proper. The glacier ice travels on, rolling (or "wallowing") slowly downwards as a living river of ice. Its skeleton of liquid salt solution changes the while, and forms new and larger foam-cells, which, at the lower end of the glacier, perish, disappear, and flow away as the water of the glacier stream.

THE BRITISH ASSOCIATION.

SECTION L.

EDUCATIONAL SCIENCE.

OPENING ADDRESS BY SIR RICHARD C. JEBB, LITT.D., D.C.L., M.P., PRESIDENT OF THE SECTION.

University Education and National Life.

EVERY country has educational problems of its own, intimately dependent on its social and economic conditions. The progressive study of education tends, indeed, towards a certain amount of general agreement on principles. But the crucial difficulties in framing and administering educational measures are very largely difficulties of detail; since an educational system, if it is to be workable, must be more or less accurately adjusted to all the complex circumstances of a given community. As one of those who are now visiting South Africa for the first time, I feel that what I bring with me from England is an interest in education, and some acquaintance with certain phases of it in the United Kingdom; but with regard to the inner nature of the educational questions which are now before this country, I am here to learn from those who can speak with knowledge. In this respect the British Association is doing for me very much what a famous bequest does for those young men whom it sends to Oxford; I am, in fact, a sort of Rhodes scholar from the other end—not subject, happily, to an age limit—who will find here a delightful and instructive opportunity of enlarging his outlook on the world, and more particularly on the field of education.

As usage prescribes that the work of this Section, as of others, should be opened by an Address from the Chair, I have ventured to take a subject suggested by one of the most striking phenomena of our time—the growing importance of that part which Universities seem destined to play in the life of nations.

Among the developments of British intellectual life which marked the Victorian age, none was more remarkable, and none is more important to-day, than the rapid extension of a demand for University education, and the great increase in the number of institutions which supply it. In the year 1832 Oxford and Cambridge were the only Universities south of the Tweed, and their position was then far from satisfactory. Their range of studies was too narrow; their social operation was too limited. Then, by successive reforms, the quality of their teaching was improved, and its scope greatly enlarged; their doors were opened to classes of the community against which they had formerly been closed. But meanwhile the growing desire for higher education—a result of the gradual improvement in elementary and secondary training—was creating new

institutions of various kinds. The earliest of these arose while access to Oxford and Cambridge was still restricted. The University of Durham was established in 1833. In 1836 the University of London, as an examining and degree-giving body, received its first charter. A series of important Colleges, giving education of a University type, arose in the greater towns of England and Wales. The next step was the formation of federal Universities. The Victoria University, in which the Colleges of Manchester, Liverpool and Leeds were associated, received its charter in 1880. The Colleges of Aberystwyth, Bangor, and Cardiff were federated in the University of Wales, which dates from 1893. The latest development has been the institution of the great urban Universities. The foundation of the University of Birmingham hastened an event which other causes had already prepared. The federal Victoria University has been replaced by three independent Universities, those of Manchester, Liverpool and Leeds. Lastly, a charter has recently been granted to the University of Sheffield. Then the University of London has been re-constituted; it is no longer only an Examining Board; it is also a teaching University, comprising a number of recognised schools in and around London. Thus in England and Wales there are now no fewer than ten teaching Universities. Among the newer institutions there are some varieties of type. But, so far as the new Universities in great cities are concerned, it may be said that they are predominantly scientific, and also that they devote special attention to the needs of practical life, professional, industrial and commercial; while at the same time they desire to maintain a high standard of general education. It may be observed that in some points these Universities have taken hints from the four ancient Universities of Scotland—which themselves have lately undergone a process of temperate reform. The Scottish Universities are accessible to every class of the community; and the success with which they have helped to mould the intellectual life of a people traditionally zealous for education renders their example instructive for the younger institutions. With reference to the provision made by the newer Universities for studies bearing on practical life, it should be remarked that much has been done in the same direction by the two older Universities also. At Cambridge, for example, degrees can be taken in Economics and associated branches of Political Science; in Mechanism and Applied Mechanics; and in Agricultural Sciences. It certainly cannot now be said that the old Universities neglect studies which are of direct utility, though they rightly insist that the basis and method of such studies shall be liberal.

In looking back on the general course of this whole movement in England, we find that it has been steady, smooth, and fairly rapid. It has not been due to any spasmodic impulse or artificial propaganda, but has been the result of natural forces operating throughout the nation. Universities, and the training which they give, have come to count for more in our national life as a whole. It should be noted in passing that the missionary movement known as University Extension did not arise in the first instance from spontaneous academic action, but was a response to public appeals from without. It had its origin in memorials addressed to the University of Cambridge, in 1872, by various public bodies; and it was in compliance with those memorials that, in the winter of 1873, the first courses of Extension lectures were organised in the Midlands. Another fact of vital significance in the movement is that it has included ample provision for the higher education of women.

With reference to the present position and prospects of the higher education in South Africa, I tried, before leaving England, to acquaint myself with at least the outlines of the general situation; but it is only with great diffidence that I shall offer a few observations bearing on some of the broader aspects of the question. I trust to be heard with indulgence by those from whom I shall hope to learn more. At any rate, I can truly say that the question seems to me one of the deepest interest and of the gravest importance. Indeed, it does not require much insight or imagination to apprehend the greatness of the issues that are involved.

In the first place, it would be correct, if I am not mistaken, to say that in South Africa at large there is a genuine and a keen desire for efficient education of the highest type. A sound liberal education is desired for all who can profit by it, whatever their future callings are to be. But the practical and immediate need for the organising of the highest teaching is felt, I believe, more particularly in regard to three great professions—the profession of Engineering, in all its branches; the profession of Agriculture (including Forestry); and the profession of Education itself, on which the intellectual future of South Africa must so largely and directly depend. That the interest in the higher instruction is so real must be regarded as the best tribute to the efforts of those able and devoted men who, in various parts of this land, have laboured with dauntless perseverance for the improvement of primary and secondary education. Unstinted gratitude is due also to the University of the Cape of Good Hope. It is acknowledged on all hands that the University, as the chief guardian of learning in South Africa, has done admirable work in maintaining a high standard of general education. Certainly it cannot be regarded as any disparagement of that work if, as seems to be the case, a widespread desire exists that South Africa should possess an institution, or institutions, of University rank, which, besides examining, should also teach. That is a natural progress, which is illustrated by the recent re-constitution of the London University itself. I am not qualified, nor should I desire, to discuss the various difficulties of detail which surround the question of a teaching University. That question is, for South Africa, an eminently practical one; and doubtless it will be solved, possibly at no distant time, by those who are most competent to deal with it. I will only venture to say a few words on some of the more general aspects of the matter.

The primary needs of daily life in a new country make demands for certain forms of higher training—demands which may be unable to wait for the development of anything so complex and costly as a teaching University. It is necessary to provide a training for men who shall be able to supervise the building of houses, the making of roads, bridges, and railways, and to direct skilled labour in various useful arts and handicrafts. The first step in such a provision is to establish technical schools and institutes. Germany is, I suppose, the country where the educational possibilities of the technical school are realised in the amplest measure. In Germany the results of the highest education are systematically brought to bear on all the greater industries. But this highest education is not given only in completely equipped Universities which confer degrees. It is largely given in the institutions known as Technical High Schools. In these schools teaching of a University standard is given, by professors of University rank, in subjects such as Architecture, various branches of Engineering, Chemistry, and General Technical Science. There are, I think, some ten or eleven of these Technical High Schools in Germany. In these institutions the teaching of the special art or science, on its theoretical side, is carried, I believe, to a point as high as could be attained in a University; while on the practical side it is carried beyond the point which in a University would usually be possible. In England we have nothing, I believe, which properly corresponds to the German Technical High School; but we may expect to see some of the functions of such a school included among the functions of the new Universities in our great industrial and commercial towns.

Now Technical Schools or Institutes, which do not reach the level of a German Technical High School, may nevertheless be so planned as to be capable of being further developed as parts of a great teaching University. And the point which I now wish to note is this—that the higher education given in a Technical Institute, which is only such, will not be quite the same as that given in the corresponding department of a teaching University. University education, as such, when it is efficient, has certain characteristics which differentiate it from the training of a specialist, however high the level of the teaching in the special subject may be. Here, however, I pause for a moment to guard against a possible misconception. I am

not suggesting that the specialist training given in a technical institute, though limited, is not an excellent thing in itself; or that, in certain conditions and circumstances, it is not desirable to have such a training, attested by a diploma or certificate, instead of aiming at a University standard and a University degree. Universities themselves recognise this fact. They reserve their degrees for those who have had a University training; but they also grant diplomas for proficiency in certain special branches of knowledge. Cambridge, for instance, gives a diploma in the Science and Practice of Agriculture; and the examinations for the diploma are open to persons who are not members of the University.

But the University training, whatever its subject, ought to give something which the purely specialist training does not give. What do we understand by a University education? What are its distinctive characteristics? The word *Universitas,* as you know, is merely a general term for a corporation, specially applied in the Middle Ages to a body of persons associated for purposes of study, who, by becoming a corporation, acquired certain immunities and privileges. Though a particular University might be strongest in a particular faculty, as Bologna was in Law and Paris in Theology, yet it is a traditional attribute of such a body that several different branches of higher study shall be represented in it. It is among the distinctive advantages of a University that it brings together in one place students—by whom I mean teachers as well as learners—of various subjects. By doing this the University tends to produce a general breadth of intellectual interests and sympathies; it enables the specialist to acquire some sense of the relations between his own pursuit and other pursuits; he is helped to perceive the largeness of knowledge. But, besides bringing together students of various subjects, it is the business of a University to see that each subject shall be studied in such a manner as to afford some general discipline of the mental faculties. In his book on "The Idea of a University" Newman says:—

"This process of training, by which the intellect, instead of being formed or sacrificed to some particular or accidental purpose, some specific trade or profession, or study or science, is disciplined for its own sake, for the perception of its own proper object, and for its own highest culture, is called Liberal Education; and though there is no one in whom it is carried as far as is conceivable, or whose intellect would be a pattern of what intellects should be made, yet there is scarcely anyone but may gain an idea of what real training is, and at least look towards it, and make its true scope and result, not something else, his standard of excellence; and numbers there are who may submit themselves to it and secure it to themselves in good measure. And to set forth the right standard, and to train according to it, and to help forward all students towards it according to their various capacities, this I conceive to be the business of a University."

It may be granted that the function of a University, as Newman here describes it, is not always realised; Universities, like other human institutions, have their failures. But his words truly express the aim and tendency of the best University teaching. It belongs to the spirit of such teaching that it should nourish and sustain ideals; and a University can do nothing better for its sons than that; a vision of the ideal can guard monotony of work from becoming monotony of life. But there is yet another element of University training which must not be left out of account; it is, indeed, among the most vital of all. I mean that informal education which young men give to each other. Many of us, probably, in looking back on our undergraduate days, could say that the society of our contemporaries was not the least powerful of the educational influences which we experienced. The social life of the Colleges at Oxford and Cambridge is a most essential part of the training received there. In considering the questions of the higher education in South Africa it is well to remember that the social intercourse of young students, under conditions such as a great residential University might provide, is an instrument of education which nothing else can replace. And it might be added that such social intercourse is also an excellent thing for the teachers.

The highest education, when it bears its proper fruit, gives not knowledge only, but mental culture. A man may be learned, and yet deficient in culture; that fact is implied by the word "pedantry." "Culture," said Huxley, "certainly means something quite different from learning or technical skill. It implies the possession of an ideal, and the habit of critically estimating the value of things by a theoretic standard." "It is the love of knowledge," says Henry Sidgwick, "the ardour of scientific curiosity, driving us continually to absorb new facts and ideas, to make them our own, and fit them into the living and growing system of our thought; and the trained faculty of doing this, the alert and supple intelligence exercised and continually developed in doing this—it is in these that culture essentially lies." And if this is what culture really means, evidently it cannot be regarded as something superfine—as an intellectual luxury suited only for people who can lead lives of elegant leisure. Education consists in organising the resources of the human being; it seeks to give him powers which shall fit him for his social and physical world. One mark of an uneducated person is that he is embarrassed by any situation to which he is not accustomed. The educated person is able to deal with circumstances in which he has never been placed before; he is so, because he has acquired general conceptions; his imagination, his judgment, his powers of intelligent sympathy have been developed. The mental culture which includes such attributes is of inestimable value in the practical work of life, and especially in work of a pioneer kind. It is precisely in a country which presents new problems, where novel difficulties of all sorts have to be faced, where social and political questions assume complex forms for which experience furnishes no exact parallels, it is precisely there that the largest and best gifts which the higher education can confer are most urgently demanded.

But how is culture, as distinct from mere knowledge, to be attained? The question arises as soon as we turn from the machinery of the higher education to consider its essence, and the general aims which it has in view. Culture cannot be secured by planning courses of study, nor can it be adequately tested by the most ingenious system of examinations. But it would be generally allowed that a University training, if it is really successful, ought to result in giving culture, over and above such knowledge as the student may acquire in his particular branch or branches of study. We all know what Matthew Arnold did, a generation ago, to interpret and diffuse in England his conception of culture. The charm, the humour, and also the earnestness of the essays in which he pleaded that cause render them permanently attractive in themselves, while at the same time they have the historical interest of marking a phase in the progress of English thought and feeling about education. For, indeed, whatever may be the criticisms to which Arnold's treatment of the subject is open in detail, he truly indicated a great national defect; and by leading a multitude of educated persons to realise it, he helped to prepare the way for better things. Dealing with England as it was in the 'sixties, he complained that the bulk of the well-to-do classes were devoid of mental culture—crude in their perceptions, insensible to beauty, and complacently impenetrable to ideas. If, during the last thirty or forty years, there has been a marked improvement, the popular influence of Matthew Arnold's writings may fairly be numbered among the contributory causes, though other and much more potent causes have also been at work. When we examine Arnold's own conception of culture, as expressed in successive essays, we find that it goes through a process of evolution. At first he means by "culture" a knowledge and love of the best literature, ancient and modern, and the influence on mind and manners which flows thence. Then his conception of culture becomes enlarged; it is now no longer solely or mainly æsthetic, but also intellectual; it includes receptivity of new ideas; it is even the passion for "seeing things as they really are." But there is yet a further development. True culture, in his final view, is not only æsthetic and intellectual; it is also moral and spiritual; its aim is, in his

phrase, "the harmonious expansion of all the powers which make the beauty and worth of human nature." But whether the scope which Arnold, at a particular moment, assigned to culture was narrower or wider, the instrument of culture with which he was chiefly concerned was always literature. Culture requires us, he said, to know ourselves and the world; and, as a means to this end, we must "know the best that has been thought and said in the world." By literature, then—as he once said in reply to Huxley—he did not mean merely *belles lettres*; he included the books which record the great results of science. But he insisted mainly on the best poetry and the highest eloquence. In comparing science and literature as general instruments of education, Arnold observed that the power of intellect and knowledge is not the only one that goes to the building-up of human life; there is also the power of conduct and the power of beauty. Literature, he said, serves to bring knowledge into relation with our sense for conduct and our sense for beauty. The greater and more fruitful is the progress of science, the greater is the need for humane letters, to establish and maintain a harmony between the new knowledge and those profound, unchanging instincts of our nature.

It is not surprising that, in the last third of the nineteenth century, Arnold's fascinating advocacy of literature, as the paramount agency of culture, should have incurred some criticism from the standpoint of science and of philosophy. The general drift of this criticism was that the claim which he made for literature, though just in many respects, was carried too far; and also that his conception of intellectual culture was inadequate. As a representative of such criticism, I would take the eminent philosopher whose own definition of culture has already been cited, Henry Sidgwick: for no one, I think, could put more incisively the particular point with which we are here concerned. "Matthew Arnold's method of seeking truth," says Sidgwick, "is a survival from a pre-scientific age. He is a man of letters pure and simple; and often seems quite serenely unconscious of the intellectual limitations of his type." The critic proceeds to enumerate some things which, as he affirms, are "quite alien to the habitual thought of a mere man of letters." They are such as these: "How the crude matter of common experience is reduced to the order and system which constitutes it an object of scientific knowledge; how the precisest possible conceptions are applied in the exact apprehension and analysis of facts, and how by facts thus established and analysed the conceptions in their turn are gradually rectified; how the laws of Nature are ascertained by the combined processes of induction and deduction, provisional assumption and careful verification; how a general hypothesis is used to guide inquiry, and, after due comparison with ascertained particulars, becomes an accepted theory; and how a theory, receiving further confirmation, takes its place finally as an organic part of a vast, living, ever-growing system of knowledge." Sidgwick's conclusion is as follows: "Intellectual culture, at the end of the nineteenth century, must include as its most essential element a scientific habit of mind; and a scientific habit of mind can only be acquired by the methodical study of some part at least of what the human race has come scientifically to know."

There is nothing in that statement to which exception need be taken by the firmest believer in the value of literary education. The more serious and methodical studies of literature demand, in some measure, a scientific habit of mind, in the largest sense of that expression; such a habit is necessary, for instance, in the study of history, in the scientific study of language, and in the "higher criticism." Nor, again, does anyone question that the studies of the natural sciences are instruments of intellectual culture of the highest order. The powers of observation and of reasoning are thereby disciplined in manifold ways; and the scientific habit of mind so formed is in itself an education. To define and describe the modes in which that discipline operates on the mind is a task for the man of science; it could not, of course, be attempted by anyone whose own training has been wholly literary. But there is one fact which may be noted by any intelligent observer. Many of our most eminent teachers of science, and more especially of science in its technical applications, insist on a demand which, in the province of science, is analogous to a demand made in the province of literary study by those who wish such study to be a true instrument of culture. As the latter desire that literature should be a means of educating the student's intelligence and sympathies, so the teachers of science, whether pure or applied, insist on the necessity of cultivating the scientific imagination, of developing a power of initiative in the learner, and of drawing out his inventive faculties. They urge that, in the interests of the technical industries themselves, the great need is for a training which shall be more than technical—which shall be thoroughly scientific. Wherever scientific and technical education attains its highest forms in institutions of University rank, the aim is not merely to form skilled craftsmen, but to produce men who can contribute to the advance of their respective sciences and arts, men who can originate and invent. There is a vast world-competition in scientific progress, on which industrial and commercial progress must ultimately depend; and it is of national importance for every country that it should have men who are not merely expert in things already known, but who can take their places in the forefront of the onward march.

But meanwhile the claims of literary culture, as part of the general higher education, must not be neglected or undervalued. It may be that, in the pre-scientific age, those claims were occasionally stated in a somewhat exaggerated or one-sided manner. But it remains as true as ever that literary studies form an indispensable element of a really liberal education. And the educational value of good literature is all the greater in our day, because the progress of knowledge more and more enforces early specialisation. Good literature tends to preserve the breadth and variety of intellectual interests. It also tends to cultivate the sympathies; it exerts a humanising influence by the clear and beautiful expression of noble thoughts and sentiments; by the contemplation of great actions and great characters; by following the varied development of human life, not only as an evolution governed by certain laws, but also as a drama full of interests which intimately concern us. Moreover, as has well been said, if literature be viewed as one of the fine arts, it is found to be the most altruistic of them all, since it can educate a sensibility for other forms of beauty besides its own. The genius of a Ruskin can quicken our feeling for masterpieces of architecture, sculpture, and painting. Even a very limited study of literature, if it be only of the right quality, may provide permanent springs of refreshment for those whose principal studies and occupations are other than literary. We may recall here some weighty words written by one of the very greatest of modern men of science. "If I had to live my life again," said Charles Darwin, "I would have made it a rule to read some poetry and listen to some music at least once every week. . . . The loss of these tastes is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the emotional part of our nature." The same lesson is enforced by John Stuart Mill, in that remarkable passage of his Autobiography where he describes how, while still a youth, he became aware of a serious defect, a great lacuna, in that severe intellectual training which, for him, had commenced in childhood. It was a training from which the influences of imaginative literature had been rigidly excluded. He turned to that literature for mental relief, and found what he wanted in the poetry of Wordsworth. "I had now learned by experience"—this is his comment—"that the passive susceptibilities needed to be cultivated as well as the active capacities, and required to be nourished and enriched as well as guided." Nor is it merely to the happiness and mental well-being of the individual that literature can minister. By rendering his intelligence more flexible, by deepening his humanity, by increasing his power of comprehending others, by fostering worthy ideals, it will add something to his capacity for cooperating with his fellows in every station of life and in every phase of action; it will make him a better citizen, and not only a more sympathetic but also a more efficient member of society.

One of the urgent problems of the higher education in our day is how to secure an adequate measure of literary culture to those students whose primary concern is with scientific and technical pursuits. Some of the younger English Universities, which give degrees in Science, contribute to this purpose by providing certain options in the Science curriculum; that is, a given number of scientific subjects being prescribed for study with a view to the degree of B.Sc., the candidate is allowed to substitute for one of these a subject taken from the Arts curriculum, such, for instance, as the Theory and Practice of Education. This is the case in the University of Wales and in the University of Birmingham; and there are indications, I believe, that this example will be followed elsewhere. Considering how hard and sustained is the work exacted from students of science, pure or applied, it seems important that the subjects from which they are to derive their literary culture should be presented to them, not in a dryasdust fashion, not chiefly as subjects of examination, but rather as sources of recreation and changes of mental activity. From this point of view, for British students of science the best literature of the English language offers unequalled advantages. It may be mentioned that the Board of Education in London is giving particular attention to the place which English literature should hold in the examination of students at the Training Colleges, and has under consideration carefully planned courses of study, in which portions of the best English writers of prose and of verse are prescribed to be read in connection with corresponding periods of English history, it being understood that the study of the literature shall be directed, not to philological or grammatical detail, but to the substance and meaning of the books, and to the leading characteristics of each writer's style. If, on the other hand, the student is to derive his literary culture, wholly or in part, from a foreign literature, ancient or modern, then it will be most desirable that, before leaving school, he should have surmounted the initial difficulties of grammar, and should have learned to read the foreign language with tolerable ease.

When we look at this problem—how to combine the scientific and the literary elements of culture—in the light of existing or prospective conditions in South Africa, it appears natural to suppose that, in a teaching University, the Faculty of Education would be that with which literary studies would be more particularly connected. And if students of practical sciences, such as Engineering and Agriculture, were brought together at the same centre where the Faculty of Education had its seat, then it should not be difficult, without unduly trenching on the time demanded by scientific or technical studies, to provide such students with facilities for some measure of good literary training.

A further subject is necessarily suggested by that with which we have been dealing—I mean the relation of University to Secondary Education; but on that I can only touch very briefly. Before University Education can be widely efficient, it is indispensable that Secondary Education should be fairly well developed and organised. Secondary Education should be intelligent—liberal in spirit—not too much trammelled by the somewhat mechanical uniformity apt to result from working for external examinations, but sufficiently elastic to allow for different aptitudes in the pupils, and to afford scope for the free initiative of able teachers. It is a gain for the continuity of education when a school-leaving examination can be accepted as giving admission to the University. Such an examination must be conducted under the authority of the University; but there is much to be said in favour of the view that, under proper safeguards, the school-teachers should have a part in the examination; always provided that the ultimate control, and the decision in all cases of doubt, shall rest with the University. A system of school-leaving examinations for this country was earnestly advocated, I believe, by Mr. P. A. Barnett, who has achieved such excellent work for the cause of education in Natal. To discuss the advantages or difficulties of such a proposal, as they at present affect South Africa, would demand knowledge which I do not possess; and I must content myself with the expression of a hope that in days to come—perhaps in a not distant future—it may be found practicable to form such a link between the highest education and the grade next below it.

But the limit of time proper for a Chairman's address has now almost been reached. I thank you sincerely for the kindness and patience with which you have heard me. In conclusion, I would only say how entirely I share a conviction which has been expressed by one to whose ability, to whose generous enthusiasm and unflagging efforts the cause of education in this country owes an incalculable debt—I refer to Mr. E. B. Sargant. Like him, I believe that the progress of education in all its grades, from the lowest to the highest, is the agency which, more surely than any other, will conduce to the prosperity and the unity of South Africa. For all workers in that great cause it must be an inspiring thought that they are engaged in promoting the most fundamental and the most far-reaching of national interests. They are endeavouring to secure that the men and women to whom the future of this country belongs shall be equal to their responsibilities and worthy of their inheritance. In that endeavour the sympathies which they carry with them are world-wide. As we come to see, more and more clearly, that the highest education is not only a national but an Imperial concern, there is a growing desire for interchange of counsels and for active cooperation between the educational institutions of the Colonies and those of the Mother Country. The development of education in South Africa will command keen attention, and will be followed by earnest good wishes, not only in England but throughout the British dominions. One of the ideas which are bound up with the history and the traditions of our English public schools and Universities is the idea of efficient work for the State. Those institutions have been largely moulded, from generation to generation, by the aim of ensuring a supply of men qualified to bear a worthy part, either in the government of the nation, or in professional activities which are indispensable to the national welfare. In our own time, and more especially within the last thirty years, one particular aspect of that idea is illustrated by the closer connections which have been formed between the Universities and the higher branches of the Civil Service. The conception of work for the commonweal is in its turn inseparable from loyalty to those ideals of character and conduct by which English life and public policy have been built up. It is by the long and gradual training which such ideals have given that our race has been fitted to grapple with responsibilities which have inevitably grown, both in extent and in complexity, far beyond anything of which our forefathers could have dreamed. That training tends also to national self-knowledge; it makes for a sober estimate of our national qualities and defects; it quickens a national sense of duty to our neighbour. The munificence of a far-sighted statesman has provided that selected youths, whose homes are in this land, and whose life-work may be here, shall go for a while to England, shall breathe the intellectual and social atmosphere of a great English University, and shall learn to judge for themselves of the sources from which the best English traditions have flowed. That is excellent. But it is also most desirable that those traditions should pass as living forces into the higher teaching of South Africa itself, and that their spirit should animate educational institutions the special forms of which have been moulded by local requirements. That, indeed, has been, and is, the fervent wish of men whose labours for South African education have already borne abundant fruit, and are destined to bear yet larger fruit in the future. May those labours prosper, and may that wish be fulfilled! The sooner will come the day when the inhabitants of this country, this country of vast and still indefinite possibilities, will be able to feel, in a sense higher and deeper than citizens of the Roman Empire could conceive, *Cuncti gens una sumus* ("We are all one people"). If the work which lies before us, in this Section of the British Association, should result in contributing anything towards the promotion of those great objects, by helping to elucidate the conditions of further progress, our deliberations will not have been held in vain.