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The Worth of Knowledge.

O fret not after knowledge!—I have none,
And yet my song comes native with the warmth.
O fret not after knowledge!—I have none,
And yet the Evening listens.

KEATS.

IN the course of his presidential address to the Education Section of the British Association at the recent Southampton meeting, Mr. W. W. Vaughan, headmaster of Rugby School, remarked that an agricultural labourer who had left school at thirteen years of age is often a better-educated man, in the best sense of knowledge, than a city clerk or other black-coated worker who had passed through a secondary school course before entering office life. Those who are familiar with the countryside and farm labourers know that much truth is contained in Mr. Vaughan's observation, but they know also that it is a dangerous doctrine to preach because of the excuse it gives to farmers and parents to secure the release of children from school at the earliest possible age in order to put them at work in the field. It is easy to suggest that a child who leaves school for outdoor work at ten or twelve years of age may be learning more than he would in a village classroom, but this is the kind of reasoning that leads to the exploitation of child-labour; and, in Great Britain at any rate, the State has rightly decided that every child without exception, whether in country or town, must now remain at school until at least the age of fourteen years has been reached.

There are, of course, many social reasons for this necessary condition, and among them is the value of discipline. Knowledge itself, especially that often contemptuously called "book-learning," may, as Keats expressed in the lines from his sonnet on "The Thrush," quoted above, be of little actual worth as a means of gaining or giving delight to life, yet, like the gift of mercy, it can be twice blessed if rightly used. There is one joy in seeking after knowledge and another in arousing interest in others in the beauty and promise of the new world revealed. What is worth having is worth sharing, and it is because of this conviction that we continually urge support and encouragement to effort made to create and foster wide interest in scientific achievement.

This is one of the objects of the British Association, and we believe that the annual meetings do much to fulfil their purpose in this respect through the publication in the newspapers of summaries of the presidential addresses, lectures and selected papers. It is, however, in no captious spirit that we suggest that much more remains to be done if the service of science in modern life is to be understood through the meetings

of the Association. In the first place, there should be no misapprehension as to the constitutions of the audiences for which the president's address and the addresses of the sectional presidents are intended. Members of the lay public are invited to join the Association, but the presidential addresses are almost invariably unintelligible to them; and so are most of the papers. There are no doubt people like the lady who said she did not understand a scientific lecture she had attended, yet she liked the sound of it, but it is scarcely the function of the Association to titillate the ears of passive listeners.

We are of the opinion, however, that the addresses of the president and of the sectional presidents are better read than heard, and on this account we are glad that they are again available in volume form.[1] The first part of Prof. Lamb's presidential address deals with the absorbing topic of the nature and purpose of science in general, and we hope that it will be widely read and discussed, for such remarks, so admirable in form and substance, not only provide scientific workers with justification for the faith which is in them, but also tend to "clear the air" of any lingering feeling of hostility between them and those whose labours are purely humanistic. The addresses of the sectional presidents cover a very wide field, almost the whole gamut of the sciences. Many of them deal mainly or exclusively with recent advances in specialised departments; others, like those on engineering and anthropology, are throughout historical; and again others, like the addresses to the educational and economic sections, discuss problems which are of perennial interest. In every case the standard attained is high, the contribution notable, and if we have any adverse criticism to make, it is that, from the point of view of the lay reader, too many of the addresses are concerned with specialised and recondite topics to the exclusion or subordination of matters which are of more obvious interest and importance; in other words, they may appear dull to the average man.

The meetings of the British Association are most useful in bringing together workers in many branches of science. In recent years the institution of joint discussions on border-line subjects has increased their utility; and of late there has been a noticeable levelling-up in the scientific value of the papers presented; all of which is to the good. The problem, therefore, consists in realising a harmonious balance between the requirements of the specialist and those of the lay public. It will, we believe, be generally admitted that addresses and papers should not, as a rule, resemble those which are given at ordinary meetings of specialised societies: the treatment should be broader and more in touch with human welfare—not necessarily material welfare.

From this point of view, some of the addresses and papers contributed to the recent meeting are open to criticism. About one-half of the addresses printed in the annual volume are obviously written by the specialist for the specialist. Although subjects relating to education (upon which nearly every other man claims to speak with authority) and to economics lend themselves more readily to popular treatment than others, it has been repeatedly shown that even in very recondite branches of science it is possible to introduce matter which appeals to the man of average intelligence and education. As examples in point, we may refer to the addresses given this year to the physiological and psychological sections. The physiology of muscular exertion and the theory of intelligence do not at first sight appear inviting topics to the non-specialist, but the manner of treatment as well as the matter treated secured in these cases extended notices in the daily papers. Prof. Parks' address on the cultural aspects of geology was also framed in a manner likely to appeal to a wide audience. We do not, of course, wish to plead for a stereotyped form of presentation, and we are well aware of the great difficulties inherent in popular exposition, but we do urge that the interests of the Association would be better served if greater use were made of its unique opportunities for securing the infiltration of scientific learning into all classes of the community.

Possibly the specialisation of scientific work must prevent the proceedings of the sections from making more than a sectional appeal. If this be so, then the Association must be regarded chiefly as a professional organisation, like the British Medical Association and similar bodies, neither desiring nor expecting members of the general public to attend its meetings. Even then, we urge that more serious attempts should be made to improve both literary and oral exposition in presenting papers. We plead for a style of composition and exposition suitable at least for a general scientific audience, even if the lay public is left out of account. It is surely a reflection upon scientific training that so few who represent it are able to address a public or any other audience in a manner which will command attention or stimulate interest.

A few lecturers of this kind are available, and the Association does its best to secure them for the public lectures delivered to citizens, and to children, at each annual meeting. These lectures are not intended for members of the Association, and arrangements for them are in the hands of the Local Executive Committee. In these days of many kinds of entertainment and obtrusive advertisement, it is obvious that

[1] The Advancement of Science, 1925. London: British Association, Burlington House, W.1. Price 6s.

wide publicity should be given to the citizens' lectures if good attendances are to be secured. This was not done at Southampton, with the result that the attendances at both these lectures and the children's lecture were far smaller than the lecturers or their subjects merited. Any good lecture agent would have secured large audiences for these lectures if they had been business undertakings, but as they were not, very few people in the town or neighbourhood were aware of them. This is not the way to further the purpose of the Association "to obtain more general attention for the objects of science."

The History of Telephony.

The History of the Telephone in the United Kingdom. By F. G. C. Baldwin. Pp. xxvi+728+75 plates. (London: Chapman and Hall, Ltd., 1925.) 42*s*. net.

THIS large book on the history of the telephone in the United Kingdom gathers together in a single volume an immense amount of valuable historical research on the development in Great Britain of one of the epoch-making inventions of electrical science. The invention of the magneto-electric telephone and the reproduction by it of articulate speech at a distance is a striking example of the solution of a technical problem, long recognised as possible of solution, attacked by several inventors with very little success, yet finally accomplished by a stroke of genius in the very simplest manner.

The speaking telephone, far more than many other electrical inventions, may be credited to a single inventor, in that Alexander Graham Bell was the first to discover a method, imperfect though it was, of translating the changes of air pressure constituting speech wave sounds into corresponding changes of electric currents in a line wire, and the conversion of them back into sound waves at the receiving end. This use of what was then called an undulatory current in a circuit never completely opened made possible the electric transmission of speech as compared with the transmission of mere musical sounds. Like many other inventions, Bell's success came as a kind of accident in the manipulation of an appliance called a harmonic telegraph which was not originally intended or hoped to function as a speaking telephone. Mr. Baldwin sketches in brief outline in his first chapter the stages by which Bell was thus led to success.

The remarkable thing about the Bell magneto telephone, with its steel diaphragm, having such a limited number of modes of vibration, is that it should be able to transmit intelligible speech sounds at all. It is probable that a large part of its success depends not so much upon its own intrinsic powers as upon the wonderful ability of the human ear to guess from a mere suggestion of a speech sound the intellectual meaning which that sound is intended to convey. The true air wave-form, with its complicated outline, is in fact very imperfectly reproduced by the telephone receiver diaphragm, but a mere hint enables the trained ear to interpret it.

Bell's invention, though effective as a receiver, was a very ineffective device as a transmitter, and if it had not been supplemented by the invention by Edison of the carbon transmitter, and by Hughes of the microphone, it is highly improbable that it would have fructified into practical utility or even passed beyond the stage of a scientific curiosity. The combination, however, of the variable resistance or microphonic carbon transmitter and the induction coil as a means of translating sound-wave motion into electric current variation, together with Bell's magneto-receiver for effecting the reverse transformation, gave a completely practical and simple solution of the telephone problem.

In his second chapter Mr. Baldwin describes the early operations and subsequent union of the Bell and Edison inventions and the early stages of invention in connexion with the evolution of a telephone exchange. But for this latter conception, which originated in America, the use by the public of the electric telephone would have been extremely limited. The pioneer work of the original Bell and Edison Telephone Companies in London, in establishing rudimentary telephone exchanges, is described by Mr. Baldwin in his second chapter, and also the story of the initial litigation between the Companies before the United Telephone Company was formed.

Chapter iii. opens with an account of the important litigation started by the Crown against the United Telephone Company to enforce against it the rights gained through the Telegraph Acts of 1863, 1868, 1869, under which the State purchased for about 10 million sterling the business of the pioneer electric telegraph companies. These original telegraph companies conducted their operations with diverse kinds of signalling instruments, and before long there arose a movement for "nationalising," as it is now called, the new methods of intercommunication. In order to prevent the Government monopoly being infringed by the possible invention of new types of electric telegraph, the Acts were drawn in such general terms that, when the telephone inventions made it possible to establish commercial exchanges worked for the convenience of "subscribers," the question was before long raised by Post Office officials, alarmed about their monopoly, whether the telephone was a telegraph within the meaning of the Acts.

The case was tried by Mr. Baron Pollock and Mr. Justice Stephen in November 1880 and decided against