

EDUCATION AND NATIONAL LIFE.¹

ONE of the rare and valuable fruits of the sanguinary struggle in which the civilised nations of the world have been engaged since the summer of 1914 is to be found in the awakening of the public mind, at least in this country, to the consideration of the causes which provoked it, and in the disposition to search out the remedies which in the future will make such convulsions impossible of occurrence.

The grave events which still await a satisfactory solution have moved to serious reflection the leaders of the national Church, who two years ago, when the issue of the struggle hung perilously in the balance, felt called upon to ascertain the causes which lay at the root of the great upheaval of civilised humanity and to suggest the remedies. Five influential committees, under the direction of the Archbishops, were appointed to consider the subjects of the teaching office, the worship, the evangelistic work, and the administrative reform of the Church, and, finally, the question of Christianity and industrial problems, in which was included the place and functions of education, with which we are chiefly concerned.

Having regard to the history of educational enterprise in this country, the results of the labours of the twenty-seven able and influential men and women who constituted the last-named committee, with the Bishop of Winchester (Dr. Talbot) as chairman, assisted by the Bishops of Oxford, Peterborough, and Lichfield, together with the Master of Balliol, can only be characterised as revolutionary, so striking is the breadth of view they exhibit, and so complete the admission that education is meant for all the children of the nation without exception of class or condition. Education is "to assist human beings to become themselves . . . is the witness of equality . . . the foundation of democracy . . . and is, in short, the organised aid to the development of human beings in a society." This is the keynote of the admirable report issued by the committee on December 19, 1918, with its well-grounded and clearly stated argument and the fruitful suggestions it offers for the radical reform of our educational methods, incidences, and aims. "There must be," it states, "diversity of educational methods, because there are diversities of gifts. The basis of differentiation should be differences of taste or of capacity, not differences of class or of income. The manual worker needs a liberal education for the same reason as the barrister or the doctor: that he may develop his faculties and play a reasonable part in the affairs of the community." The basis of such an education, it strongly pleads, must be laid in the elementary school, from which all attempts at specialisation should be rigorously excluded, and it further contends that the only sound foundation for technical training is to be found in "the cultivation of mental alertness, judgment, and a sense of responsibility by means of an education of a general and non-utilitarian character."

The report laments the causes which have done so much to hinder the development and diffusion of education during the great industrial epoch, with its materialistic aims and subordination of human faculties to the exigencies, or alleged exigencies, of industry, and among them does not fail to cite the strife and lack of accord of the various religious bodies. It looks to an education, wisely conceived and universally applied, for the effective solution of domestic and international problems by peaceful means. The committee cordially welcomes the provisions of the Educa-

tion Act of 1918, especially those which are concerned with the physical welfare of children and young persons, and would make mandatory the supply of nursery schools by the local education authorities. It looks forward to the time when the compulsory school-age will be raised to fifteen, and even to sixteen, but recognises that this cannot be expected until the rewards of industry are more equitably distributed and the great working class placed in a position of less anxiety and with the means to enable it to realise a healthy and vigorous life. Fuller opportunities, it is urged, should be provided for the higher education of specially capable children, and the educational system so organised as to raise to a higher level the moral and intellectual standard of the whole people.

Much stress is laid upon the necessity for the better payment of teachers and for more consideration for their status, having regard to their important services to the State. The report strongly approves the proposals contained in the Act for the establishment of compulsory continued education of young persons up to eighteen engaged in employment, but would extend it from eight hours per week to twenty-four out of a working week of forty-eight, or for a corresponding proportion of the month or year according to the special necessities of the case. The main aim of such education should be to develop the physical and mental capacities of the children and to strengthen their character. Even in the continuation schools it is thought desirable that a vocational bias should be given only in the later years of school attendance. It is noted that there is a wide and increasing demand for education of a non-vocational character among adult men and women which should, it is considered, be encouraged in every way possible, and that such opportunities of education should form part of the normal provision of the community.

The report, which is signed by all the members of the committee, quotes with approval Milton's definition of education as "that which fits a man to perform, justly, skilfully, and magnanimously, all the offices, both private and public, of peace and war," but contemplates a much wider application of it, in that all men and women must be included within its scope according to their capacities and powers. A useful bibliography accompanies the report.

SEA-STUDIES.¹

OF the four papers contained in the part of the Bergen Museum Year-book before us, the one of greatest scientific and practical importance is perhaps that by Mr. Torbjørn Gaarder entitled "Die Hydroxylzahl des Meerswassers." The extent of the concentration of hydroxyl ions in sea-water has a great influence on the physiological processes of marine organisms; as Loeb and Herbst have shown, a certain concentration is necessary for the development of echinoderm ova, whether fertilised or not. In a word, the productivity of a sea region depends largely on the concentration of the hydroxyl ions. It becomes, therefore, of importance to study the variations of sea-water in this respect, and to discover the factors on which they depend.

Mr. Gaarder discusses the various methods used for estimating this concentration, which he calls the hydroxyl-number, and enumerates the radicals normally present in sea-water which may affect it. Of these the most important is carbonic acid, which serves as a buffer against the factors that change the hydroxyl-

¹ "Christianity and Industrial Problems." (London: S.P.C.K., 1918. Price 1s. net.)

¹ "Bergens Museums Aarbok, 1916-17." Naturvidenskabelig Raekke 1 Hefte. (Kristiania, 1917)

number. Thus marine plants (by assimilation) and all marine organisms (by respiration) respectively lessen and increase the concentration of carbonic acid, and so exert considerable influence on the inversely related changes of the hydroxyl-number in any body of water. The carbonic acid is also affected by the carbonates and bicarbonates brought into sea-water from the land or dispersed over the sea-floor. As a result of the successive chemical processes, the hydroxyl-number becomes greater when the sea-water dissolves carbonates from the bottom deposits. Consequently the bottom water should have a larger hydroxyl-number than that of the superjacent layers. Organic life acts on the hydroxyl-number, not merely through the carbonic acid, but also through the carbonates. By removing the calcium and magnesium carbonates from the sea-water it lowers the hydroxyl-number, but gradually, as the organisms die, the organic material and the carbonates are carried down through the deeper layers to the sea-floor. The effect of the atmosphere seems to be confined to readjusting in the upper layers the balance of carbonic acid disturbed by plant assimilation. The chemical changes consequent on an influx of fresh water have as their final expression a reduction of the hydroxyl-number; in other words, the salter the sea, the greater the hydroxyl-number, and the more alkaline the water. The concentration of oxygen in sea-water is, by reason of the vital processes mentioned above, inversely proportional to that of carbonic acid, and therefore stands in direct relation to the hydroxyl-number.

The principles thus worked out by Mr. Gaarder from theoretical interpretation of previous observations have been applied by him to the fjord-waters of western Norway, and have there found both confirmation and extension.

Of the other papers, Mr. J. A. Grieg's inquiry into the age of starfish individuals collected from various localities in the North Sea and North Atlantic is not without its practical bearing. It is found that in any given spot the starfish, like the brittle-stars, are represented only, or in great majority, by the product of a single year. The length of life of a starfish is usually about four years. The species as yet investigated, however, do not appear to include the forms of chief economic importance.

Dr. J. D. Landmark contributes a well-illustrated discussion of the valley system at Dale, in Bruvik; and Prof. G. O. Sars describes, under the name *Urocopia singularis*, a new member of the Copepod family Lichomolgidae, which, unlike its confamilials, lives, not near the shore, but in the open sea at some distance from the bottom, and, presumably for this reason, has its caudal rami broadened into oar-blades

RESEARCH ORGANISATION IN INDUSTRIAL WORKS.¹

Introduction.

NO plans for the future development of industry are now considered complete unless they provide for scientific research, and although this is necessary to a greater or less degree in all industries, in no industry is there such scope for research as in the highly technical electrical industry.

During the past few years there has been a great deal of research directly controlled by or associated with industry. For instance, while universities and technical colleges have in the past conducted research,

¹ From a paper on "Planning a Works Research Organisation" read before the Institution of Electrical Engineers on January 23 by A. P. M. Fleming.

only a fraction of which has been directed to industrial requirements, the tendency is for an increasing proportion of the research carried out in such institutions to be of an industrial character. Various other laboratories and organisations, together with scientific and engineering societies, have either conducted or financially supported research in connection with their interests.

In a national sense, the Department of Scientific and Industrial Research with its large Treasury grant is endeavouring by the establishment of research associations to develop means whereby co-operative research can be established in various industries, with the initial assistance of Government funds.

Many of these laboratories will provide new industrial knowledge for the common use of those able to make use of it, and, while there is need for them, the individual manufacturer invariably has his own immediate problems, for which he requires special provision directly under his control. In such cases he has to consider whether he should establish his own research organisation or whether he can be efficiently and suitably served by research associations, university or other laboratories. Whatever facilities are available, it is clear that in many instances it is advisable for firms—particularly large ones—to establish research organisations in connection with their own factories.

1.—Functions of the Organisation.

The function of an industrial research organisation in its broadest sense is to acquire and to apply all the knowledge and experience which can assist the advancement of the industry, since it is only by the application of new knowledge and experience that progress is made.

It is necessary to draw a clear distinction between research work in pure science and industrial research. Both are essential to industrial progress, the former being directed towards widening the boundaries of knowledge, formulating principles, and revealing relationships that are the raw material of the latter, which is generally directed towards the solution of some specific industrial problem or towards meeting some industrial need.

The justification for undertaking research in pure science in a research laboratory associated with an industrial concern lies in the almost inevitable industrial applications which follow rapidly in the wake of a new scientific discovery, and it should be noted that the functions of the man of science, industrial worker, and manufacturer are equally necessary in rendering the ultimate product of a new discovery available to the public. It is questionable from the economic point of view, however, whether the majority of works laboratories should undertake such research, since only a fraction of the new knowledge produced is likely to be of value to one particular works. Much of this work, therefore, must be carried on, as hitherto, by men of science working in private, university, co-operative, or national laboratories. On the other hand, in very large laboratories in complex industries, particularly where special products resulting from discoveries can be manufactured, the undertaking of research in pure science may be of very great value.

Research laboratories partly or wholly supported by industrial firms may be broadly classified according to the particular interests they are intended to serve, as, for example:—

(1) Industrial research laboratories self-contained and serving one particular works.

(2) Central industrial laboratories each forming the scientific focus of an industrial organisation comprising several works, often in different industries, and linked up by control laboratories at the individual works.