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Co-operation in Research throughout the British Empire.

ONE of the most useful discussions at the Congress of the Universities of the Empire held at Cambridge last year, the official Report¹ of which has been published, was on "Co-operation in Research throughout the Empire." The subject is so attractive and appropriate to the times in which we are living that one may be pardoned for overlooking how modern is the idea of co-operation in the field of scientific research. Diogenes living in his tub, and asking nothing of the kings and satraps of the world except to get out of the sunlight, represents the traditional conception of a philosopher. Newman, in the preface to his "Discourses on the Scope and Nature of University Education," insists on the necessary solitude of the scientific investigator. "The common sense of mankind," he says, "has associated the search after truth with seclusion and quiet." The greatest thinkers are men of absent minds and idiosyncratic habits. Pythagoras lived for a time in a cave; Thales refused the invitation of princes. Friar Bacon lived in his tower upon the Isis; Newton in an intense severity of meditation which almost shook his reason. Who among his contemporaries, we may well ask, could claim to share the labours

"Of Newton, with his prism and silent face,
The marble index of a mind for ever
Voyaging through strange seas of Thought,
alone"?

In Newman's opinion, to discover and to teach are distinct gifts, not commonly found in the same person. This idea may explain the tentative way in which the teaching universities of Great Britain took up the work of scientific research. In Victorian Oxford, the Rev. C. L. Dodgson—better known as Lewis Carroll, the author of "Alice in Wonderland"—ridiculed the claims of science to a place in university curricula. Science, he says, sat weeping at the gates. Oxford admitted her and housed her royally, adorning her palace with retorts and reagents and making it a charnel-house of bones. When the students sniffed at the sulphuretted hydrogen and turned away, science said: "Give me no more youths to teach; and pay me handsomely and let me think." Making allowance for the whimsicality of the author of "Alice in Wonderland," we may acknowledge a modicum of truth in this description of the origin

¹ Third Congress of the Universities of the Empire, 1926: Report of Proceedings. Edited by Alex Hill. Royal 8vo. Pp. xxviii+270. (London: G. Bell and Sons, Ltd., 1926.) 21s. net.

of scientific research at Oxford. The sister university organised its research work more deliberately; but only in recent years has scientific research received full recognition in our ancient universities.

As to the Government, nothing less than the greatest war in history was necessary to bring about active participation in this work. The bombs from enemy airships were actually dropping on London when the organisation of the Department of Scientific and Industrial Research was in progress. The Dominions—Australia, Canada, South Africa, and New Zealand—and India followed the example of the mother country. Not yet, however, as is shown by the discussion at the Universities Congress, have all the problems of co-operation in the field of scientific research found their solutions.

Sir Thomas Holland in his opening address to the Congress gave a résumé of the scientific activities within the Empire stimulated or organised during the War. Established streams of international exchange were altered by the War. For example, the output of wolfram in south Burma, the principal source of that mineral, was before the War sent to Germany, and the tungsten extracted therefrom, an important constituent of tool-steel, was rationed to English firms. Some precious months of intensive research under the compelling impetus of war were necessary to elucidate a satisfactory process of manufacture; but that, Sir Thomas Holland said, was only “one of the many shocks which followed the winter operations of 1914–15.” In the light of such an experience, the need for “official organizations for correlation and control” could scarcely be disputed. Their relations to British universities and industries are still in process of adjustment. Sir Thomas Holland was not disposed to accept Newman’s dictum regarding the independence of teaching and research. The highest teaching, he said, loses its vitality if unconnected with research.

Conversely, the question arises: To what extent and in what directions does research suffer if divorced from teaching? Sir Thomas did not suggest that there was any lack of co-operation between the Department of Scientific and Industrial Research and the universities, for the Department had shown a willingness to hand over problems to research workers in university laboratories and also to assist new researches proposed by university professors. But the establishment, at home and in the Dominions, of special research institutes, wholly divorced from

teaching, was a new development. Certain forms of research must be conducted on a scale beyond the capacity of the ordinary university or college. Research workers always have more ideas than they can readily develop and complete in practice, and there is a greater tendency to reserve a ‘claim’ in a general institute, the governing body of which may not be composed of critical specialists. This danger, however, is not apparent in Great Britain so far.

Sir John Farmer addressed himself to a problem of great Imperial interest—the work of the scientific officers attached to the agricultural departments in the Colonies and of the officers of the commercial agricultural enterprises which are growing up, especially in the tropics. These officers do their work in a solitude due to physical reasons, and Sir John Farmer’s appeal to the home universities to assist them by offering a welcome to the university laboratories during their visits to the mother country should meet with an enthusiastic response. For, as he said, no one has a better right to this hospitality than the man who has been coping with problems under conditions of difficulty which would astonish those who have been accustomed to the luxurious resources of some of the modern temples of science.

A good example of the importance of agricultural problems of the tropics was given by Sir Arthur Shipley. Last year we imported 60,000,000 bunches of bananas, each containing about 80 bananas, and thus the inhabitants of the British Isles consume about 100 bananas per head a year. But many of the plantations are derelict owing to the banana disease, and any one who could find a cure for the fungus which destroys the banana would make a fortune. It is to be hoped that the prognostication will be confirmed, though there are instances, *e.g.* the discoveries relating to the transmission of malaria, which would discourage over-confidence of financial reward. However, the colonial scientific research service has many attractions for the enthusiastic worker, as Sir John Farmer insists, and his appeal for “the fertilising effects of intercourse with others who are pursuing similar or analogous paths of scientific work” refers to a psychological aspect of the question of co-operation in research the importance of which it would be difficult to overstress. As a good example of co-operative research, he instanced the work of the Food Investigation Board, under the able direction of Sir William Hardy. Scientifically, the work is mainly rooted in Cambridge, with a smaller root system in London. The essence of its

success was to be found, he suggested, in the completeness of the chain of co-operation.

Dr. Andrew Balfour, Director of the London School of Hygiene and Tropical Medicine, also discussed the Imperial aspects of the question, emphasising the waste of time, money, and energy, "owing to the fact that in the great and important domain of tropical medicine men are, to a large extent, working in watertight compartments." Thanks to the Colonial Office, things are improving, and he commended also the work accomplished in India by the Scientific Advisory Board.

The important part which India is destined to play in the promotion of scientific research was well brought out by several Indian speakers. As Sir Jagadis Bose said, there has never been in India any real conflict between religion and knowledge. Those who pursued knowledge regarded themselves as dedicated to a sort of religious life. "In India," he said, "we combine all these qualities—inner vision, power of invention, control of our hands." India is determined to be the brightest jewel in the Imperial crown by reason of its contribution to the spiritual wealth of the British Empire. If the spirit of co-operation in research can be developed, the Empire will become, as Prof. Radhakrishnan said, "a spiritual whole" and thus serve the interests of humanity.

T. LL. H.

The Work of the British Geophysical Observatories.

Air Ministry: Meteorological Office. The Observatories' Year Book, 1923: comprising the Results obtained from Autographic Records and Eye Observations at Lerwick, Aberdeen, Eskdalemuir, Cahirciveen (Valencia Observatory), Richmond (Kew Observatory), and Benson. Published by Authority of the Meteorological Committee. (M.O. 279.) Pp. 371 + 12 plates. (London: H.M. Stationery Office, 1926.) 63s. net.

ONE of the important functions of the Meteorological Office is the maintenance and administration of the observatories at Lerwick, Aberdeen, Eskdalemuir, Valencia, Benson, and Kew, at which a considerable variety of geophysical work is done. The volume under review is the record of that work for 1923 and forms the second of a series which replaces certain sections of the well-known "British Meteorological and Magnetic Year Book." The evident purpose of the new series is the collection in compact form of all the work done at each observatory.

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The six institutions named differ in their aims and, apparently, in the power of their equipment to deal with the wide range now covered by geophysical investigations. Lerwick Observatory, opened in 1921, is as yet confined to terrestrial magnetism, and even for this subject the staff and equipment have been so restricted that the enormously important work waiting to be done there cannot be undertaken. Aberdeen is concerned solely with meteorology and has earned a high reputation in the study of cloud forms. Eskdalemuir is primarily a magnetic observatory, but includes atmospheric electricity, seismology (since removed to Kew), and meteorology. Kew, after a long and honoured record of research in terrestrial magnetism, is changing in character and its present functions appear to be somewhat indefinite. Benson has been occupied with work on the upper air, but has been closed on this work being transferred to Kew. Valencia is a 'first order' meteorological station and includes in its programme a weekly observation of the magnetic elements.

Such diversity of aim is explained by the historical development of each observatory, and chiefly by the circumstance that, in their origins, they are not all creations of the Meteorological Office. From one point of view it may be regarded as an element of strength rather than of weakness. The important matters are, first, that where their aims are common their results should be comparable; and, secondly, that in each subject of inquiry or record, its distribution among the observatories should provide an adequate representation of the area with which they are supposed to deal.

With regard to the first of these, the volume now under review gives ample evidence of the care taken by the Meteorological Office to bring its records to a common measure. Take, for example, the hourly readings of atmospheric pressure at Aberdeen, Eskdalemuir, Valencia, and Kew. In all respects, except that of height above sea-level, they are entirely comparable, and the inquirer is not maddened by doubts as to the exact position of the recording instrument, the times and methods of observation, the units employed, and the corrections applied. Nor is he referred for information on such matters to some former publication to which he may not have immediate access. The same may be said of records of temperature, humidity, sunshine, and rainfall at these four stations. Although it would be absurd to become dithyrambic over the thousands of columns of figures in these tables, they recall Gibbon's praise of the learned Lutheran's