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Research and the Imperial Conference.

THE Imperial Conference which has just closed in London will be memorable for the new stimulus which it will give to the enterprising spirits of our age. Little of the earth's surface is left unmapped, but over vast expanses of the British Empire there are fields of endeavour which provide a new outlet for the adventurous. It has been the privilege of the members of the recent Imperial Conference to state these fields of endeavour. They have been able to indicate the enormous potential resources of the Empire and the infinite variety and complexity of the problems which confront its peoples. What is more, they have stated their belief that for the development of their resources and the solution of their problems they must depend upon science.

This general appreciation of the function of science is the outstanding feature of the recent Imperial Conference. It is probably unique in the history of the British Empire and has a deep significance. It substitutes a scientific basis for the attempt to find a political solution for Empire economic problems. Through it the people of the British Empire have been enabled to take stock of their enormous responsibilities, to realise the tasks before them, and to understand the means by which they can rise to the height of a wonderful opportunity. Lord Balfour, in his introduction to the report of the Research Sub-Committee, the most important produced by the Conference, states in unequivocal terms that if full use is to be made of the opportunity we must turn to applied science for aid:

"The Empire includes states and territories of the most varied economic capacity, possessing every gradation of climate and soil, every species of mineral wealth, subject in parts to special diseases with which only science can hope to deal; enjoying in parts unique natural advantages which only science can fully develop. It possesses distinguished investigators in every branch of research. It has therefore everything to gain from full scientific co-operation, yet we can hardly flatter ourselves that we practise this, either within Great Britain or throughout the Empire."

Various recommendations are made in the report regarding the organisation of research. Co-operation can best be secured, it is suggested, by the extension of the number of Imperial bureaux for special fields of investigation. The existing bureaux for entomology, mycology, and tropical medicine have greatly facilitated the interchange of results obtained in various parts of the Empire. It will be left to the delegates to the forestry conference which will assemble in Australia and New Zealand in 1928, and the Imperial Agricultural Research Conference, already arranged for 1927, to decide whether Imperial bureaux in these fields are necessary.

It is made clear that it is not assumed that any

organisation intended to serve the whole Empire should necessarily be situated in Great Britain. It is suggested, for example, in the event of it being decided to create an Imperial Veterinary Science Bureau, that this bureau should set up in South Africa, which is ideally situated for purposes of research into the diseases of domestic live-stock, being faced with a greater variety of diseases than any other part of the Empire. Although it is not suggested in the report, it is not improbable that the Agricultural Research Bureau, if decided upon, would be situated in Jamaica, for it is in connexion with the development of tropical agriculture that the greatest advances are to be expected.

Reference is made to the imperfect machinery for the interchange of information. As at present conducted, correspondence fails to meet the need for rapidity, and not infrequently, because of some gap or misunderstanding, fails to reach the best objective. Instead of complete reliance upon such bodies as the Colonial Office, the Imperial Institute, the specialised Imperial bureaux, as the channels of communication of information, it is suggested in addition that direct communication should be established between the various parts of the Empire, through the accredited representatives of special broad fields of research.

The parts of the report dealing with the present position of recruitment of staffs for the various scientific services in the Empire is, in effect, a reflection upon the educational training provided in the schools and universities of the Empire and upon the inducements offered in the scientific services. "The evidence before the sub-committee shows that there is a shortage of suitable candidates for most branches of scientific services supported by Governments." The report emphasises, moreover, that this shortage will become more pronounced as the development of the Empire proceeds, since the demand for highly trained scientific workers is likely to be accelerated with the rapid development which must be expected, particularly in the tropical parts of the Empire. Various reasons have been given to the sub-committee for the shortage. Most of them have been emphasised again and again in these columns. The shortage is attributed to "the inadequate appreciation of the importance and value of scientific research on the part of the public, of the Press, and even of Governments themselves; the uncertainty in the minds of men embarking on a university course as to the amount, interest, and continuity of the employment which will be available in their branch of science when they have completed their studies"; the increasing demand by private employers for university-trained scientific workers, and ignorance on the part of parents and educational institutions of the number and attractions of careers in the scientific services overseas.

The fact is that neither the schools nor the universities of Great Britain provide adequate facilities for training in the branches of science for which there is the greatest scope in the less developed parts of the Empire. There are too many chemists, too few geologists; too many engineers, too few biologists. For example, in one of the leading secondary schools in London, containing five hundred boys, about half that number are receiving instruction in chemistry or physics, but only two are taking biological subjects; and this is probably a fair indication of the instruction given in most of the secondary schools in the country. It is true that some may take up biological subjects at the university, but the general tendency is to persist in the special branches of study for which the schools provided facilities.

The difficulty can be overcome, but it will take time. It involves the staffing of schools and revision of curricula; it involves considerable expenditure on laboratory accommodation and equipment; it involves the overhauling of our educational administration and the removal of the anomaly of two departments of State competing in the sphere of secondary and higher education, namely, the Board of Education and the Ministry of Agriculture and Fisheries.

We endorse the opinion of the sub-committee, that the basic remedy for the shortage of scientific staffs "is the adoption of a settled policy in regard to the application of research to development in the various parts of the Empire." We can also whole-heartedly endorse the opinion expressed that the best inducements to offer students to take up appropriate lines of training are good salaries, satisfactory status, and proper recognition of their important function. If the best brains of the country are to be attracted to the scientific services, these services must rank at least equal in importance with the administrative and fighting services. They must be regarded as an indispensable part of the machinery of government and not as a luxury to be dispensed with in times of financial stringency. They must also be administered by men with a scientific outlook, which is almost impossible unless these officers have received a thorough training in the methods of science.

The sub-committee points out the desirability of interchange between members of the staffs of the research institutions and the scientific services in the various parts of the Empire. It goes further, and recommends that students should be trained for their scientific work in various institutions. Obviously it would be all to the advantage of the student if, after a course at a home university, he completed his training at an agricultural college in one of the tropical colonies. If the committee's recommendations are adopted regarding the interchange of scientific staffs, one of the

greatest difficulties in the way of recognising special merit of scientific officers will be removed. Even in the scientific services at home, an officer in a very small department has very little prospect of promotion unless he is afforded an opportunity, and possesses the ability after a long period of specialisation, to take up new work in another department. Unquestionably there are far greater difficulties in the way of interchange between members of scientific services than exist in connexion with the interchange between members of administrative services. But much could be done in this direction. The sub-committee appreciates the difficulty which an officer in a scientific service in a remote part of the Empire must experience in keeping abreast of the latest developments in his special branch of science. It recommends the provision of refresher courses for these officers. It also recommends that picked officers should be given every facility to hold travelling fellowships for study on the spot of the latest developments in their particular fields.

The report of the Research Sub-Committee illustrates remarkably the growing appreciation of science by members of the present government. For this welcome manifestation scientific workers owe a deep debt of gratitude to Mr. Ormsby-Gore, the Under-Secretary of State for the Colonies. He has travelled far in his quest for knowledge. In the two reports he has presented to Parliament, those dealing with East Africa and West Africa, were set out clearly the problems inherent in the development of our tropical colonies, and the rôle which science must play in their solution. Through these reports the attention of statesmen has been directed to the possibilities of science. They are now prepared to state, and find their colleagues from the Dominions in agreement with them, that "money devoted to research is not a luxury; it is rather a condition of survival, without which the Empire cannot hope to keep abreast of its competitors in the economic field." Not content with a pious expression of opinion, they "cordially approve of the projects of fostering a chain of research stations situated in appropriate centres in tropical and sub-tropical parts of the Empire, and commend this project to the sympathetic consideration of governments, institutions, and private benefactors throughout the Empire."

It is now the bounden duty of scientific workers to ensure that practical effect be given to all the recommendations in this epoch-making document. They have to equip themselves and train others for the discharge of the duties and responsibilities involved in the realisation of the immense and varied resources of a mighty inheritance, and in the promotion of the intellectual as well as the material well-being of the peoples of the British Empire.

The Significance of Animal Coloration in the Struggle for Existence.

Camouflage in Nature. By W. P. Pycraft. Pp. xiv + 280 + 36 plates. (London: Hutchinson and Co., Ltd., n.d.) 21*s.* net.

THE aim of this excellent book is to present, as the author states in the preface, "the essential features of the coloration of animals, and the various interpretations for that coloration which have been advanced by the sportsman-naturalist, as well as the man of science. . . ." Of the fifteen chapters, the first four are devoted respectively to an introduction, pigments, the infinite variety of coloration, and the evolution of colour-types; the fifth deals with rapid changes of colour in response to stimulus; the sixth to the ninth with protective coloration, both procryptic and anticryptic; the tenth with mimicry, Batesian and Müllerian; the eleventh with warning coloration; the twelfth with the coloration of young animals; the thirteenth and fourteenth with sexual selection; the fifteenth with colour aberrations.

The subject is illustrated by examples drawn exclusively from the animal kingdom, and it would have been an improvement to justify the title "Camouflage in Nature" by including the description of a few plants. The principle of cryptic coloration has been known to operate in the vegetable kingdom ever since Burchell, more than a hundred years ago, described a Mesembryanthemum and a sluggish grasshopper, both protected, in the same locality near the Orange River, by resemblance to rounded stones. Examples of cryptic and mimetic resemblance are of course extremely rare among plants as compared with animals, but are of great interest.

It may be doubted whether 'camouflage' is a convenient name for so comprehensive a subject, including the most varied uses of colour and pattern in the animal kingdom, together with the discussion of their evolution. The word originated in the military operations of mining and countermining, when the discharge of a smoke-cloud (*camouflet*) was employed to suffocate the enemy. The next step was the use of the smoke-cloud above ground as a screen, and from this the meaning of 'camouflage' was extended to cover all methods of concealment and also the appearances by which an enemy may be misled in judging of speed and direction. Camouflage in its original meaning would be applicable only to such protective devices as the discharge of the Bombardier beetle or the inky cloud of the Sepia, but its extended meaning may be fairly held to include all methods of concealment and Batesian mimicry. The inclusion of Müllerian mimicry is doubtful, while warning coloration is opposed to the