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"*To the solid ground*
Of Nature trusts the mind that builds for aye."—WORDSWORTH.

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Science and Administration.

IN several recent pronouncements relating to widely different fields which touch administration, the importance of the acquisition of scientific knowledge and of the adoption of scientific methods have been strongly emphasised.

On Nov. 30, in the course of the Sidgwick Memorial Lecture on "Democracy", delivered by him at Cambridge, General Smuts directed attention to the fact that science is necessary to the modern State and should have its functional relation to the State; he stressed the point that to-day not only is a scientific spirit needed in human affairs, but also that above all it is this spirit which is called for in the administration of human affairs. A few days previously, dealing with matters relating to a narrower field, the Secretary of State for the Colonies sounded a similar note when paying a tribute to the value of anthropology in the administration of the affairs of a backward people; he urged the importance of the acquisition of a knowledge of this branch of science by young men proceeding to British Dependencies to take part in administrative work.

Again, there has just been published the valuable Interim Report of the Committee on Education for Salesmanship (H.M.S.O., price 4*d*.). Salesmanship is, as this Committee understands the term, "a prime function of direction and supreme management" and "embraces the study of the fundamental principles of commerce and the planning of policy based upon them". Consequently, the matters discussed in this Report cover an important area of the administrative field in commerce; where weakness has been shown to exist in this field it has been traced to "a detached and insular attitude

and unscientific practice" on the part of our business community. Not only does this Committee recommend that a "scientific study" should be undertaken of our commercial problems, but it also states that "the evidence of the Associated Chambers of Commerce emphasises the absolute necessity of expert knowledge by the salesman of goods of a technical description".

However, it is apparent that the views of the Associated Chambers of Commerce are not universally accepted in commercial circles, and that old-time prejudices are still alive therein. In some quarters, the view continues to be held that "too much knowledge may be a dangerous thing"; the expert has not yet come into favour there. Indeed, in such quarters, it is feared that in the field of salesmanship the technical dissertations of the expert may prove wearisome to the customer, and hence do more harm than good. It is perhaps for this reason that another way of meeting the situation has been suggested. It has been proposed to the Committee that where a machine, appliance, or article requiring specialist knowledge is being sold, the maker should attach his own expert to the staff of the agent, "so that the technical advice and service may be available on the spot": that is to say, it is seriously recommended that our manufacturers should employ two men to sell their products, where the shrewdest and most resolute of their foreign competitors employ but one, and that a highly qualified expert.

In view of the foregoing proposal, it cannot be a matter for surprise that, in the course of the remarks which he recently addressed to business men at a meeting held in London, the president of the Canadian National Railways should have felt himself compelled to point out that if Great Britain is to recover its industrial pre-eminence there must be an entire 'scrapping' of present-day commercial policies, methods, machinery, and appliances with the object of reducing the costs of production—he might very appropriately have added: and *above all of reducing the costs of distribution*.

It is a general question which the foregoing pronouncements raise directly, namely, that relating to efficiency in administration and the best form of staff organisation by which it can be attained under modern conditions, whether in the public services, industry, or commerce. Indirectly, these pronouncements point to the necessity for a thorough investigation into matters affecting the functions which should be assigned to the man of science and the technical expert, so that the boundaries of their spheres of responsibility may be readjusted with the view of meeting the new conditions which have arisen in all branches of human activity owing to the applications of science on every battle-front.

A study of administrative and management methods is a matter of supreme importance at the moment, because they are vital factors in the progress and welfare of our public services, which are increasing in many directions. It must be remembered that for many decades now a gradual change has been taking place in the character of the ownership of our industrial and commercial undertakings. With the growth in their size and the extension of their activities in relation both to the kind of business for which they are responsible and also the considerable area of the territory in which they often operate, individual and partnership ownership has been giving place to collective and corporate ownership. Where undertakings and enterprises have been incorporated under the provisions of statutes they have, for practical purposes, lost the status of a private business, in the strict sense of the term, and have instead thereof become in effect public services. Questions, therefore, affecting the methods of administration and the type of organisation adopted in them can no longer be considered to be merely matters of their own domestic concern: questions in relation to their control and management possess for the public an importance to-day which is only very slightly less than do questions connected with the similar aspects of administration bearing upon governmental and municipal activities and enterprises. In this connexion it is interesting to note that very careful consideration has been given in Germany to the problems of management and organisation in the case of the State-owned concerns which have been set up in that country since the termination of the War. The significant fact stands out that the directors who have been appointed by the German Government to control and manage these concerns are men who have been selected for these positions from among those possessing *expert and specialised knowledge*, and have full executive authority within the limits of the general policy laid down. The practice referred to provides a useful lesson and might with profit be imitated in Great Britain.

There are signs that there is an awakening in Great Britain, and there exists a readiness on the part of progressively minded men to overhaul our old-fashioned and out-of-date methods and practices. In order to stimulate this feeling into action, it seems to be alone necessary for some authori-

tative body to set the ball rolling by indicating the nature of the reforms which will best suit the new conditions which have come into existence with the invasion of science into every domain of human affairs.

The question which perhaps most immediately requires close and attentive examination is that connected with the proper constitution of the controlling bodies responsible for the management of government departments and of industrial and commercial undertakings and enterprises. These bodies are sometimes appropriately referred to as the 'directive organ', and, as is well known, it is in them that reside the power and authority for deciding not only what shall be the character of the administrative methods and practices to be employed in the organisations for which they are responsible, but they have also the final word on questions of even greater importance, affecting, as they do, the whole well-being and success in every sphere in which combinations of knowledge and effort are required, namely, on questions relating to the recruitment of the staff. On these rests the ultimate responsibility for determining what type of men shall be selected for particular positions, technical as well as administrative, and also what shall be the character of the qualifications which shall be sought for in the various classes of officials.

Non-technical administrators and directors cannot, obviously, be so well equipped for dealing with problems of the kinds referred to above as those who have been 'through the mill', and, owing to their scientific and technical training and practical experience, have therefore acquired an intimate personal knowledge of all the essential factors which are severally involved in the solution of particular problems coming under their jurisdiction, and, what is equally important, as to the nature of the qualifications required in those to whom should be entrusted the duty of providing the most satisfactory solution of any particular problem. Hitherto, a disinclination has existed in Great Britain to give men with scientific and technical qualifications—and also possessing other essential qualifications—seats on boards of directors, or to appoint them to the more important administrative positions.

The crippling influence of the harmful traditions and prejudices associated with a narrow policy of the kind here indicated requires to be got rid of; only if a change of spirit can be brought about in this matter is there any likelihood of effecting a real improvement in matters of the deepest concern to the nation. Desirable economies and other beneficial results would follow suitable reforms carried out in the administrative sphere; they can alone be secured by widening the scope of responsibility of the man of science and the technologists. It is essential that in the case of every 'directive organ' a due proportion of those forming it shall be men possessing scientific knowledge and technical experience, and further, that men with the qualifications here indicated shall be chosen more frequently than in the past for responsible administrative posts.

It has been suggested that the failure in the past to employ, to a sufficient extent, men of science and technologists in the directive and administrative spheres may have been due to the reluctance that these types of men have shown to undertake work in those spheres, or possibly to the absence of aggressiveness on their part in seeking for positions therein. If this has been the case, it is imperative in the national interest that such reluctance or passivity should be overcome by them; they should pay heed to the exhortation of Sir William Bragg, who, on the occasion of the opening of the new science building of St. Edward's School, Oxford (on Dec. 8), made a pointed reference to the needs of the day in the following terms: "There is a certain type of man who is badly wanted in this country at this moment. It is the scientific man who is also an administrator. We need men to-day who are not merely scientists, but who are also willing to take responsibility, to mix in the affairs of men, and to know something of the world."

There is another and an exceedingly important reason why men of science and technologists should play a larger and more important part than in the past in the directive and administrative spheres of responsibility. It is recognised by many who have studied the problem that one of the most pressing requirements of the day is that of narrowing the zone of separation between the workmen on one hand and those responsible for the directive and administrative aspects of the work on the other. Attempts have been made to secure this end. In the governmental sphere officers of the administrative branch have in some cases established direct contact with the workers, and in some industrial enterprises committees of directors have been appointed to preside over departmental operations.

However, there is evidence that the results in such cases have not been altogether happy. Non-technical administrative officers cannot hope to, and, as a rule, do not, hold their own in arguments

exchanged with workers in a technical field, and in these discussions there is often an unwillingness on their part to admit the errors in their views, and this necessarily still further strains the relations between these two groups instead of improving them; the workers naturally derive small comfort when, having got the best of an argument, they are told: 'But there is no logic in administration'. Similarly, interference with details of departmental operations by directors, particularly on the part of those who have no technical knowledge, can but be, and, indeed, has proved to be, harmful; it leads in the long run to inefficiency and loss. In situations of the kind referred to, experienced technical men would carefully avoid saying or doing anything mischievous.

Obviously, it is practically impossible to secure a proper bond of sympathy between the two groups, the directive and the workers, under modern conditions, where the control and management are vested entirely in the hands of non-technical men who are either ignorant of technical considerations or act without regard to them. On the other hand, there is every reason for supposing that the risks of misunderstandings between the several groups in an organisation would be reduced to vanishing point were technical experts who have prepared themselves for the rôle called upon to play a more prominent part than hitherto in the directive and administrative spheres. It is the development of a policy to secure these ends that will provide what is so essential to-day: a strong and effective link between science and administration.

History of Science.

A History of Science and its Relations with Philosophy and Religion. By William Cecil Dampier Dampier-Whetham. Pp. xxi + 514. (Cambridge: At the University Press, 1929.) 18*s*. net.

MR. DAMPIER-WHETHAM, in writing a general history of science, has undertaken what is, strictly, an impossible task. It is therefore very easy for any critic who cares to spend a day or two in a library to that end to pick holes in matters of detail. Taking the book as a whole, as in the first instance it should be, it is a fine and bold piece of work. The narrative is always clear and concise and the sequence orderly; it never degenerates into the dismal catalogue of names and dates which sometimes masquerades as the history of science. The mutual relations between scientific discovery and other phases of contemporary thought are generally well brought out, particularly the relations between science and philosophy.

For the early history of science Mr. Dampier-Whetham is in a more favourable position than his predecessor Whewell, thanks to the recent labours of scholars who have worked out special developments in special periods. But for the later history the task is much harder than in Whewell's time, when physics seemed to be advancing quietly and steadily on proved foundations and biology scarcely existed. Up to the end of the nineteenth century, discoveries and developments of thought can still be seen in perspective in relation to what came before and has come after; the wood can be distinguished from the trees. It is when the present century comes under review that the historian's task becomes really alarming because of the abundance and confusion of material. Yet the historian cannot stop earlier than the present day without cheating the reader of the most interesting part of the story. It is significant that 105 pages suffice for all the time before the fifteenth century; from the fifteenth to the end of the eighteenth, 111 pages; 130 pages for nineteenth century; while 150 are devoted to the present century. This division not unfairly represents the rate of advance.

Modern developments in physics are well and simply described. The story is of course the most exciting episode in the whole history of science. It seems at the moment as though the three main lines of modern research, field-physics, atomic structure, and cosmogony, are all tending towards a final synthesis which will lay bare the ultimate nature of the physical universe. We can all hear the mathematical hounds in full cry, and even as we run panting far in the rear, can share in the excitement of the chase. But with all the excitement it is hard to suppress a haunting fear that the end of this hunt may be like that of the 'Hunting of the Snark'. However this may be, the history of modern physics can be made intelligible; the task needs knowledge and skill but is not impossible, for certain main lines of advance are clearly marked out. It is when the other sciences come to be considered that the historian's task becomes really impossible. There is at present abundant activity in detail, but there are no clear lines of advance, so that we can only guess which discoveries are the important and fruitful ones and which are destined to be sterile, though at the moment they may loom large. The writer is bound to be guided by his interests and prejudices, and the reader in his turn will approve or disapprove according to