THURSDAY, OCTOBER 18, 1917.

RESEARCH AND THE STATE.

IT was remarked by Prof. W. J. Pope, in an address to which we referred last week, that if suitable provision had been made by the State for the pursuit of scientific research twenty years ago we should have been saved from the horrors of the present conflict. He asked why the Government did not then make the experiment which it has now undertaken by the establishment of a Department of Scientific and Industrial Research with an endowment of 1,000,000*l*. The answer to the question is that our statesmen have never had sufficient knowledge of science to understand its relation to national advancement or sufficient faith in scientific discovery to believe that provision for it would ultimately benefit the community both industrially and politically. The public mind has been awakened to the essential value of research in all progressive industries, and every manifesto recently issued by organisations concerned with the future development of British trade insists upon its importance. Principles which have been persistently urged in these columns by a couple of generations of scientific men are now being proclaimed from the housetops and are heard in the highways, with the result that our political leaders are beginning to follow them.

There is much reason for satisfaction at this change of front, even though it be at long last. The official attitude is now vastly different from that of the Lords Commissioners of H.M. Treasury in 1872, when the British Association asked for a grant of 150*l*. to complete the reduction of tidal observations upon which the association itself had expended four times that amount. Their Lordships, after giving "anxious attention" to the memorial, regretted that the sum required could not be appropriated out of the public funds of this sea-girt isle for tidal investigations, because, if the request were granted, "it would be impossible to refuse to contribute towards the numerous other objects which men of eminence may desire to treat scientifically." Such was the position of State support of science in England in 1872; and the example shows how much remained to be done to bring about the change represented by the establishment of the Department of Scientific and Industrial Research.

Prof. Pope asked why this department was not instituted by the State twenty years ago, but he should have said more than forty years, for one of the chief recommendations of the Royal Commission appointed in 1870 was that a State Council of Science, presided over by a Minister of Science, should be established. The Commission was appointed with the seventh Duke of Devonshire as chairman and Sir Norman Lockyer as secretary, while among other members were Huxley, Sir G. G. Stokes, and the first Lord Avebury. The whole position of science in the United Kingdom was surveyed in the volumes of the Report of the Commission issued from 1871 to 1875; and it was the unanimous opinion of the Commissioners that a special department of State should be entrusted with the duty of promoting the scientific interests of the country. The suggested Council of Science was not intended solely to look after the interests of purely scientific research, but to bring to scientific tests, and advise upon, all Government projects in which scientific principles are involved. The great majority of the witnesses examined upon this point were entirely in favour of the establishment of a Council and Minister of Science.

The decided conviction was also expressed by the Science Commission of 1870 that one of the most efficient methods by which the Government could further research in this country was by the establishment of public laboratories for the pursuit of investigations in connection with the varying and ever-multiplying departments of physics, chemistry, biology, and other branches of science. Even at that time great laboratories had been erected at Berlin, Leipzig, Bonn, Aix-la-Chapelle, Karlsruhe, Stuttgart, and other places at the expense of the State, and special provision had been made in them for original scientific research, while nothing of the kind was done in our own country; and thus the main sources of new trades and improvements in manufactures remained undeveloped. The view then taken, and not altogether unknown even at the present time, was that the more science was left to itself the better for it. Mr. Gladstone, indeed, termed the intervention of the State as "interference" with science, calculated to discourage individual exertion, and so obstruct discovery and progress. A completely different view was taken by Lord Salisbury, who, in his evidence before the Science Commission, remarked: "Research is unremunerative; but it is highly desirable that it be pursued, and therefore the community must be content that funds should be set aside to be given, without any immediate and calculable return in work, to those by whom the research is to be pursued."

We have waited more than forty years for this necessary endowment of research, and the country has lost incalculable millions because no statesman had sufficient foresight to take heed of the

warning and advice of scientific men at a time when profitable action was clearly indicated.

After the publication of the Report of the Science Commission the Government had no excuse for neglect to remedy the evils brought under its notice. It was remarked in NATURE of March 26, 1874: "If means are not forthwith taken to organise our public museums and institutions for scientific research and instruction on some intelligent system, to supplement their lamentable deficiencies, and make them as widely beneficial to the advancement of science in all its departments and conducive to the highest instruction of the public as they are calculated to be, it can no longer be set down to ignorance, but to an utter disregard of the highest welfare of the country. In this direction the Government has a chance of distinguishing itself and winning for itself an enduring and worthy popularity; let it lose no time in showing its wisdom by appointing a responsible Minister of Education, whose duty it will be to keep all our public scientific and educational institutions up to the highest pitch of efficiency, to re-organise them upon some common basis, and to see that the progress of research in all branches of science is not hampered by the want of adequate means for its pursuit."

It is scarcely necessary to remind readers of NATURE that though the case for national care of scientific research was stated as convincingly as it could be by the leaders of science forty years ago, politicians turned deaf ears to their pleadings. It is true that a grant of 1000*l.* for scientific investigations was included in the Estimates from 1855 to 1881, and that in 1876 a further grant of 4000*l.* was voted for the payment of personal allowances to men engaged in research, but this latter grant represented the whole response of the Government to the recommendations of the Royal Commission on Science. Since 1882 the grant of 1000*l.*, which was provided under the Vote for Learned Societies, has been discontinued, and that of 4000*l.* has remained unaltered, except that it is now administered by the Royal Society instead of by the Science and Art Department, to which it was originally allocated.

In 1894 the Council of the Royal Society asked H.M. Treasury to increase the amount of this grant for scientific investigations, but without success. Men of science were not sufficiently organised, or did not possess the necessary political power, to force the subject of provision for research upon the attention of successive Governments until the desired ends were achieved. The first attempt to awaken the public to a sense of national danger on account of neglect of the subject was made by Sir Norman Lockyer in his presidential address to the British Association in 1903. Then, as thirty years earlier in the Report of the Science Commission, a convincing case was presented for the State endowment of universities on a scale which would make our facilities for highest education and research comparable with those of our chief competitors. As a natural outcome of this appeal, the Treasury grant to universities and colleges in England and Wales was doubled in the following year, and further increased later, until it reached the present amount of about 200,000*l.* a year instead of the 28,500*l.* available in 1903. But even this increased subsidy is less than the ordinary annual State endowment of Berlin University alone, while the total of the Government subsidies to universities in Germany is as much as 1,500,000*l.*

It is clear, therefore, that, though much has been done, the nation must be prepared for a further increase of expenditure upon scientific and technological education and research if we are to make good our shortcomings in the past. Mr. Fisher, President of the Board of Education, speaking at Cardiff on October 10, said that the way to establish a strong and powerful university was to get great men, and that not a bad way to secure these was to pay them well. The opportunity has come to ensure that generous provision is made for such assistance to university work as well as to establish a system of education better than that enjoyed anywhere else in the civilised world; and it is the duty of all who believe in these factors of national progress to support the efforts now being made to strengthen them.

The work of the British Science Guild in these directions has been of great national advantage. Inaugurated in 1905 to convince the people "of the necessity of applying the methods of science to all branches of human endeavour, and thus to further the progress and increase the welfare of the Empire," the Guild has been in the forefront of all recent movements for promoting the development of education and industry by the application of scientific principles. Early in its history it directed attention to the need for increased provision for agricultural research, and presented a memorial on the subject to the Prime Minister. The Development Act of 1909 gave the means of supplying this need; and the result is that during the year 1914–15 the total amount distributed by the Board of Agriculture in the form of grants for agricultural education and research was 92,000*l.* instead of the 16,000*l.* available ten years ago. Another State endowment of research was provided for by the National Insurance Act of 1911,

and under this the sum now available for medical research amounts to about 55,000*l.* annually. There is finally the block grant of 1,000,000*l.* made to the Department of Scientific and Industrial Research, which has much the same functions as those of the Council of Science adumbrated by the Science Commission of 1870.

We have good reason to be satisfied that the importance of research which was urged by scientific advocates for so many years without effect is now being recognised by the State; and that the lead thus given is being followed by our manufacturers. What has now to be guarded against is the administration of the funds by executive officers who do not possess sufficient scientific knowledge to prepare promising schemes of work or have not that close sympathy with scientific aims which places the original investigator above all other men in national value. The managing head of every council or manufactory which depends upon progressive science for its maintenance and development should be an expert in science and not an administrator only. The official mind is unwilling to believe that broad scientific knowledge may be combined with administrative capacity; and the result is, as Prof. Pope pointed out in his address, the more a man knows of scientific subjects on which he is engaged in a Government department or industry, the less likely is he to be given charge of them. Whatever provision is made for research by the State or in private industries cannot produce the fullest advantage until this unreasonable principle of appointment has been abandoned and the power of action is placed in the hands of men who can draw up the plans of a scientific campaign, and be given the responsibility of carrying them to a successful conclusion. Until this military method is applied to the scientific services, no machinery provided can be used to its utmost efficiency.

BEETLES AND DRAGONFLIES.

(1) *The Fauna of British India, including Ceylon and Burma. Coleoptera. Rhynchophora: Curculionidae.* By Dr. Guy A. K. Marshall. Pp. xv + 367. *Coleoptera. Lamellicornia,* Part ii. (*Rutelinae, Desmonycinae, and Euchirinae*). By G. J. Arrow. Pp. xiii + 387 + plates v. (London: Taylor and Francis, 1916–17.) Price 15*s.* each vol.

(2) *The Biology of Dragonflies* (*Odonata or Paraneuroptera*). By R. J. Tillyard. ("Cambridge Zoological Series.") Pp. xii + 396. (Cambridge: At the University Press, 1917.) Price 15*s.* net.

(1) THE imposing series of monographs on the fauna of India, published under the authority of the Secretary of State, has been enriched by these two volumes now contributed on important groups of beetles by Dr. Marshall and Mr. Arrow respectively. The Curculionidæ, or weevils, are dominant insects in most parts of the world, often forcing themselves on the attention of mankind by the damage that they cause to vegetation. In the volume now issued Dr. Marshall gives a general introduction on the family with respect to structure, life-history, and habit, and deals systematically with the two extensive sub-families Brachyderinæ and Otiorrhynchinæ. In the introductory section there are clear descriptions with figures of those modifications of the jaws and body-skeleton that are of classificatory importance, and a brief account of larval and pupal structure, with illustrations of the early stages in three genera. Dr. Marshall comments on our lack of knowledge about the life-histories of the vast majority of these beetles; nevertheless, he has brought together much interesting information about the habits of various Indian species. It is not generally known, for example, that a white excretory substance which builds the cocoon of certain Larini in the pupal stage "forms an article of commerce in the East, being largely used both medicinally and as a food." The systematic part of the work contains careful diagnoses of 342 species, illustrated by means of a hundred excellent figures.

Mr. Arrow's volume is the second devoted to the large group of the Lamellicorns, which includes the conspicuous stag-beetles and chafers and the highly interesting dung-beetles. It deals with three sub-families of chafers, including the Rutelinæ, to which belongs the common British "garden chafer." Nearly four hundred Indian Rutelinæ are described; many of them are adorned with brilliant colours, and the appearance of these can be judged from a coloured plate. Four other plates give structural details of the male reproductive armature, the systematic value of which among insects is becoming increasingly recognised. Some of the genera have an enormous number of species; Mr. Arrow describes 181 different kinds of Anomala, but he wisely refrains from attempting to divide this huge genus on characters derived from the study of a local fauna even so extensive as the Indian, because such characters "invariably break down when applied to other species or faunas than those upon which they are founded." The Euchirinæ, with which the volume concludes, are large chafers which climb about on trees, feeding on sweet exudations by means of specially modified jaws; the males possess forelegs of abnormal length and puzzling structure.

(2) Dragonflies are among the most interesting of the smaller orders of insects, and accounts of their structure and life-history may be found in many general works on entomology. But never before has the group received such detailed and well-balanced treatment as Mr. Tillyard has given in the handy volume now published as one of the "Cambridge Zoological Series." Students of the anatomy and development of insects are much