in form from the rest could be traced at the maturation division, and that this chromosome was always associated with the sex-character in the following manner. The female possessed an even number of chromosomes so that each egg received an identical number, including this particular sex-chromosome. The male contained an uneven number, having one fewer than the female, with the result that half the sperms received the same number as the egg including the sex-chromosome, and half were deficient in this particular chromosome. Eggs fertilised with sperms containing the full number of chromosomes developed into females, while those fertilised with sperms lacking this distinctive chromosome produced males. Morgan made the further discovery in the fruit-fly, *Drosophila ampelophila*, that certain factors controlling various somatic characters were located in the sex-chromosome. The inheritance of these characters and of sex evidently went together. The sperms of Drosophila are therefore conceived as of two kinds, one containing the same sex-chromosome as the eggs, the so-called X chromosome, and the other a mate of a different nature, the Y chromosome, which appears to be inert and unable to carry the dominant allelomorphs.

Instances of sex-linked inheritance are now known in many animals, some of which are strictly comparable with Drosophila; others follow the same general principle, but have the relations of the sexes reversed, as exemplified by the moth Abraxas, which has been worked out by Doncaster (Rep. Evolution Committee, iv., 1908), whose sudden death we have had so recently to deplore. Here the female is the heterozygous sex, and contains the dummy mate of the sex-chromosome.

(*To be continued.*)

The Department of Scientific and Industrial Research.

By J. W. WILLIAMSON.

THE Report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1919–20 [1] is of great interest to all those who are watching with sympathetic anxiety the attempt, embodied in the Department of Scientific and Industrial Research, to secure greater and better organised State aid for scientific research without subjecting the research worker to such Governmental control as would stifle his spirit and energies. The present report is the Committee's fifth annual report, and the Report of the Advisory Council which is subjoined, before proceeding to record the past year's work, takes the occasion to give a brief survey of its labours during the past five years.

The Government has entrusted to the Department during the past year new responsibilities. The Geological Survey and Museum of Practical Geology were transferred to the Department on November 1 last, and a Geological Survey Board has been appointed under the chairmanship of Sir Francis Ogilvie. At the beginning of this year the Cabinet decided that means should be adopted so to organise the scientific work that was needed for the fighting Services as to avoid unnecessary overlapping, to secure the utmost economy of *personnel* and equipment, to facilitate the interchange of scientific knowledge and experience between all the Departments concerned, and to provide a single direction and financial control for all work of a fundamental nature of civilian as well as military interest. It directed that the Department should establish a series of co-ordinating Boards, and that these Boards should include technical representatives of each of the fighting Services and of such civilian Departments as might be materially interested in their work, as well as independent men of science. Three Boards, one for chemistry, one for physics, and one for engineering, have been established, and these, with the existing Radio Research Board, form the nucleus of the scheme. These new arrangements are, obviously, an attempt to apply the principles of the co-operative conduct of research to Government Departments, and as the Advisory Council points out: "If firms competing with each other for existence can combine, as they have done, for their common benefit, it ought not to be more difficult for the members of a national service to do so merely because they are attached to different Departments of the Government."

[1] Report of the Committee of the Privy Council for Scientific and Industrial Research for the Year 1919–20. (Cmd. 905.) Pp. 120. (London: H.M. Stationery Office.) Price 1*s.* net.

The review of the past five years' work of the Department is a satisfying and promising record. The programme, it is explained, falls under four main heads: (1) The encouragement of the individual research worker, particularly in pure science; (2) the organisation of national industries into co-operative research associations; (3) the direction and co-ordination of research for national purposes; and (4) the aiding of suitable researches undertaken by scientific and professional societies and organisations.

Since the establishment of the Department, 136 maintenance grants have been made to students and 89 to independent workers, while 48 grants have been made to provide professors with research assistants of scientific standing. During the four academic years in which grants could be made, approximately 50,000*l.* was distributed in grants of the various kinds referred to, and it is anticipated that during the next academic year the distribution will amount to about 45,000*l.* The great majority of the grants have been made for work in the fundamental sciences. The Advisory Council goes on to say: "And here a word of explanation is needed in view of ill-informed criticism of our policy. No conditions are attached to the grants made to workers whose sole aim is the extension of knowledge, either as to the line of their work or as to the use to be made of the results. If they propose to make commercial use of their discoveries we require them to consult us, because at this point they are leaving the field of pure investigation. But, subject to this single condition, their tenure is as free as, and in some respects more free than, that of a scholarship, fellowship, or professorship."

With respect to the organisation of industries into research associations, the present position is that eighteen research associations have been established, and that five others have been approved by the Department and will shortly receive their licences from the Board of Trade. Of the 1,000,000*l.* fund it is estimated that the Department is committed at the present time to a total expenditure of nearly 450,000*l.* on account of the established research associations, and to a further expenditure of at least 120,000*l.* on account of those approved but not yet licensed. The total commitments out of the 1,000,000*l.* fund are expected shortly to reach 800,000*l.*, and the report observes: "It is clear that the sum placed at our disposal is not likely to be more than sufficient to aid the associations either formed or likely to be

formed." There is much sanity in the reply of the Advisory Council to the criticism, actual or hypothetical, that much greater scientific results of value to industry would have been produced if the 1,000,000*l.* had been spent directly upon research done at the National Physical Laboratory and other research laboratories up and down the country. "Had the million been spent on research directed by the Government itself, its effect upon manufacturers would at the best have been destructive of their self-reliance, and at the worst a free gift to their competitors in other lands." We agree. Critics of this side of the Department's activities do not seem to recognise that to throw responsibility for research on the industries themselves is the surest way to educate the industries to appreciate the difficulty and the value of research.

A word may well be said here as to the statement in the report that at the end of the five years' period the research associations "must be prepared to continue without subvention from the State." The general principle is undoubtedly sound, and in the case of industries with large aggregations of capital there need be little fear that, having set their hands to the plough, they will turn back when the support of the State fails. For them the five years is probably a sufficient period. But there are industries, relatively small when measured either by the capital available or even by their production, which are, nevertheless, of vital importance to the State—"key" industries from their character rather than from their size. For these it may be necessary that State aid should be prolonged for more than the five years' period if, for them, the benefits of this research movement are to be consolidated and extended.

On the question of the conduct and co-ordination of national research the report truly observes that if the scheme for co-operative research in the several industries is to be a permanent success, provision must also be made for dealing with certain fundamental problems which are of such wide application that no single industry, however intelligent or highly organised, could hope to grapple with them effectively. The first of these basic problems is fuel. The Fuel Research Board was appointed in 1917 under the directorship of Sir George Beilby. A brief account of the activities of this Board is given. It includes such questions as "Gas Standards and the Development of the Gas Industry," "Peat as a Source of Fuel," "Pulverised Fuel," and problems of the production and utilisation of alcohol for power and traction purposes. Other instances of these "national researches" briefly reviewed in the report are the conservation of coal and mineral resources, the preservation of food, and the research into building materials and construction.

In the section dealing with the aiding of suitable researches undertaken by scientific and professional societies and organisations it is stated that grants have been made for the work on hard porcelain at the Stoke-on-Trent Central School of Science and Technology, that on glass technology at Sheffield University, and that on technical optics at the Imperial College of Science and Technology.

In concluding its short summary of the first five years' work the Advisory Council well says: "A longer period for review is specially necessary in our case, for research cannot be expected to produce results at short and regular intervals. Indeed, the expectation that it will is a misconception which has stood largely in the way of its consistent use by manufacturers, and has strained the patience of a public apt to think that the placing of an Act upon the Statute Book and the creation of a new organisation are all that is necessary to reach a desired end. If art is long in comparison with life, science, in spite of all its brilliant achievements, is longer still." That truth needs to be ever in the minds of those who deal with research.

The University of Birmingham.

ON Friday last, October 8, a number of influential representatives of Birmingham and the Midlands were the guests of the University of Birmingham at a luncheon in the Great Hall of the University at Edgbaston. The Chancellor (Lord Robert Cecil) presided, and the object of the gathering was to make known the need for increased financial assistance for the University.

Funds are urgently needed "to extinguish the debt of the University (130,000*l.*); to pay the staff of the University a living wage; to provide the necessary new accommodation and staff for the existing departments of science, arts, medicine, commerce, and education; to provide in all faculties facilities for research urgently needed in the public interest; to meet the greatly increased cost of administration and upkeep; and to enable the University to maintain its position among modern universities."

The Chancellor in calling upon Mr. Austen Chamberlain to speak welcomed him as one of the Members of Parliament for Birmingham, as Chancellor of the Exchequer, and more than all as the son of his father. Mr. Chamberlain, speaking first as a citizen of Birmingham, outlined the history of the civic expansion of the city in the days of his father, when the strenuous efforts of the leading men succeeded in making Birmingham a worthy metropolis of the Midlands, their work culminating in the foundation of the University. Speaking for the Government, he gave expression to the surprise with which they had learned the extent to which the country had been dependent upon university learning for success in the Great War. Now he "would say to an audience drawn from a great business community centring in Birmingham that if such services can be rendered by university learning in war-time, is it not certain that those services are equally necessary to our prosperity as a nation, and the prosperity of this city and district, amidst the difficulties and developments which have followed on the restoration of peace? Upon the recognition as a great community of the national and civic importance of such an institution as the University depends the ability to hold our place among the cities of the kingdom and the Empire."

The Government was fully aware of the immense importance of universities, and ready to back its opinion of that importance. It had spent for many years immense sums on elementary education; it had spent considerable sums on secondary education; but all too little on university education. Mr. Chamberlain had undertaken, unless he was prevented by overwhelming financial reasons, to submit to Parliament for next year a grant of 1,500,000*l.*, and he had undertaken to consider—and though he could not promise, he hoped he might be able to do something in that direction—a further special non-recurrent grant in order to adapt the federated universities' scheme of pensions to the case of the older men who had joined and served the universities long before that scheme was in existence, and therefore on retirement would,