

## DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

REPORT FOR 1948-49

THE annual report of the Department of Scientific and Industrial Research for the year 1948-49\* includes the report of the Committee of the Privy Council, over the signature of the Lord President of the Council, that of the Advisory Council, over the signature of Sir Ian Heilbron, and the summary of work. If anything, the one hundred and fifty or so pages of the report occupied by this summary, ninety-five of which are concerned with the work of the research associations, give an even more impressive picture of the contribution which science is making to the national welfare in every department of life, social as well as industrial, than was given by the pre-war reports. The accounts of work are naturally less detailed than those given in the reports from the individual boards or institutions published separately, but the composite picture makes the report a reference book the value of which is enhanced by the details of the assessors and members of research boards and committees, the lists of establishments and research associations and of publications issued during the year which are included among the appendixes.

Of the net expenditure of £3,273,109, annual grants to research associations amounting to £959,625 represent the largest single item, besides which special grants amounted to £59,317. Expenditure on the National Physical Laboratory was £689,528, against which £253,311 was received for work done for various boards and committees. Net expenditure on building research was £233,179, on road research £214,676, on fuel research £147,405, on food investigation £141,135, on forest products research £84,710, on radio research £51,798, on water pollution £39,773, on pest infestation £33,571 and on mechanical engineering £17,972. Of the gross expenditure of £101,260 on the Chemical Research Laboratory, £39,584 was covered by receipts; receipts amounting to £18,308 covered more than half the gross expenditure of £36,002 on fire research projects. Net expenditure on hydraulics was £8,501 and on the Geological Survey and Museum £142,728 (gross expenditure on the latter, £167,687). Net expenditure on headquarters administration was £79,237, on headquarters intelligence £32,109, and on headquarters overseas liaison £31,483. Research contracts accounted for £45,450 and grants for special researches for £268,379.

Grants to students, etc., amounted to £160,598, and in a further appendix details are given of these grants in comparison with previous years. Of the 736 grants to students-in-training, compared with 498 in 1947-48, 270 were in chemistry, 283 in physics, 61 in biology, 43 in engineering, 40 in metallurgy, 20 in geology and mineralogy, and 19 in mathematics and astronomy. Of the twenty-three senior research awards (compared with twenty-five in 1947-48), twelve were in chemistry, six in physics, two in mathematics and astronomy and one each in biology, metallurgy and engineering. Grants for special investigations numbered 99 as against 83 in 1947-48 and were distributed as follows: 48 in physics, 21 in chemistry, 11 in engineering, 10 in biology, 7 in mathematics and astronomy, and 2 in geology and mineralogy.

\* Department of Scientific and Industrial Research. Report for the Year 1948-49. (Cmd. 8045.) Pp. 260. (London: H.M. Stationery Office, 1950.) 5s. 6d. net.

From the summary of work it is possible to do no more than select examples to illustrate the manifold ways in which the work of the Department contributes both to national welfare and industrial efficiency. In the clay areas of the south of England widespread damage to dwelling-houses has been caused by seasonal movements accompanying the drying shrinkage of the clay beneath the foundations. Detailed study of this problem by the Building Research Station has pointed to the need for placing foundations on shrinkable clays at a depth of at least three feet below ground-level and the importance of not planting fast-growing trees near the houses. The Building Research Station has also studied the parallel problem of damage to industrial structures such as brick kilns, boilers, etc., caused by the drying shrinkage of clay due to penetration of the heat used in the industrial process. A new kiln built to a design incorporating a series of transverse parallel arches in the foundation has given a small rise in temperature of the foundation soil after a year of service, indicating that the system is satisfactory. Considerable attention has also been given to floor surfacing materials, while a systematic large-scale study of the properties of bricks from the many sources in Great Britain has been completed for the National Brick Advisory Council. Besides work on the structures and strength of materials and on the efficiency of buildings, a branch laboratory of the Station has been opened at Thorntonhall, near Glasgow, to provide, besides information services and facilities for investigation, an exposure site for duplicating tests on building materials under different weather conditions.

Of the work of the Chemical Research Laboratory, that which aims at the husbanding of material resources, particularly key materials, such as metals, and the work on metallic corrosion deserve mention here, as well as that on the utilization of indigenous raw materials, such as the extraction of gallium from flue dust and the separation and utilization of tar constituents, and the investigation of potentially interesting new processes and materials, like high polymers and plastics. Of high industrial importance also are the researches leading to fundamental reference data, or which develop new methods and techniques. Among the results obtained, the field of fire research may be mentioned; work here has included studies of fires in inflammable liquids, the development of a smaller apparatus for determining the 'figure of merit' for foam compounds, the development of an improved helmet for firemen and investigation of the fire risks of the gravity warm-air system in modern buildings, and of the behaviour of water-spray extinction systems.

Food research has included the improvement of the quality of frozen meat imported from the southern hemisphere, the collection of whale meat for human consumption and fundamental research into the behaviour and properties of whale meat. The poor condition in which most of the 'white' fish catch is at present landed is under investigation at the Torry Research Station, Aberdeen, where a fresh assessment of the possibilities of freezing at sea is under way. Special attention has been given to the preservation of eggs by oiling, while work at the Ditton Labora-

tory, near Maidstone, has demonstrated that there are a number of English varieties of dessert apples, besides Cox's Orange Pippins, which might be grown commercially on a large scale in Britain and have the requisite storage properties to enable the home market to be supplied with dessert apples for a much longer period than at present. The feasibility of storing potatoes in warehouses, instead of in clamps, has been demonstrated, and methods for improving the quality of broccoli reaching the consumer have been indicated. Fundamental work at the Low Temperature Research Station, Cambridge, has established a striking correlation between the ascorbic acid concentration and the concentration of sucrose in potato tubers, while ascorbic acid has also been shown to vary in cress seedlings with the nature of the medium in which the seedlings are grown.

The chief large-scale project in the Forest Products Research Laboratory is the continuing series of tests upon Colonial timbers, particularly upon those of West Africa and British Guiana, aimed at finding means of replacing timbers traditionally obtained from 'hard currency' areas and finding substitutes for specialized timbers now scarce. The Physics Section has studied further the fundamental constants of timber and its constituents, and reports have been issued on the natural durability of timber and the preservation of mine timbers. At the Fuel Research Station research work on domestic heating has been advanced as rapidly as staff and equipment permitted, and a calorimeter building has been constructed containing four 'cabinets', about the size of ordinary living-rooms, in which various types of domestic heating appliances can be examined. Other work has been concerned with the complete gasification of low-grade fuel, underground gasification of coal, smoke elimination and increasing the availability of water-tube boilers for continuous steaming. The Geological Survey and Museum has touched on such important matters as water supplies and the exploration of radioactive mineral deposits. Although the Hydraulics Research Station has still to be set up, under the Hydraulics Research Board major studies with the aid of scale models have been made of the River Forth, Rosyth Dockyard, and of the training works required to keep the deep-water channel in the Wyre estuary alongside the proposed wharf at Burn Naze and to maintain a navigable channel between Burn Naze and the sea.

When the Mechanical Engineering Research Organization is fully developed at East Kilbride, the laboratories will have a staff of six hundred, including a hundred scientific officers organized in seven research divisions, covering the properties and strength of materials; mechanics of solids, stress analysis and vibration; mechanics of fluids, including hydraulic machinery; lubrication, wear and corrosion; mechanisms and engineering metrology; mechanics of formation and machine shaping of materials; heat transfer and applied thermodynamics. Research on size effect in fatigue, complex stresses at high temperatures and the strength of screw threads is already being carried out for the Board at the National Physical Laboratory, and the Board has also given encouragement and financial support to a number of new researches at universities. Among other work at the National Physical Laboratory may be mentioned the investigations on the aerodynamic properties of suspension bridges, with particular reference to the proposed bridge over the River Severn, on the provision of a radio service of

standard frequency transmissions, on quantitative criteria of the definition of optical instruments, on the development of methods for producing test objects of accurately specified contrasts with the view of meeting the needs of photographic lens manufacturers for resolution tests at low contrast, on the metallurgical problems associated with the production of useful power from atomic energy, on engineering standards, on ship design and on a new design of ion source for the mass spectrometer.

Outstanding features of the work of the Pest Infestation Laboratory during the year were the large-scale experiments with methyl bromide, which have indicated that completely effective fumigation of silo bins full of grain can be obtained by circulating the fumigant through the grain by means of suitable equipment. Measurements of the toxicity to insects of DDT smokes and of the films of DDT formed by deposition of the smoke on building surfaces showed that deposits on the floor were twenty times as heavy as on the walls and ceiling, and contained about 66 per cent by weight of DDT against 12 per cent. A patent has been taken out for a type of packing which has so far shown itself to be proof against insect penetration, while good progress has been made in dealing with the problem of blowflies in slaughter-houses.

A major part of the programme of the Radio Research Board is concerned with the study in all its aspects of the propagation of electromagnetic waves under the conditions met with in practice and over the entire radio-frequency spectrum now available. The study of the characteristics of the ionosphere at high frequencies has continued, as well as of the propagation of very short radio waves through the lower atmosphere and the problem of atmospheric noise arising from thunderstorms or other disturbed meteorological conditions. The post-war work of the Road Research Laboratory on road materials and methods of road construction shows clear trends to an increasing study of road-making plant and machinery of all kinds; this includes a more intense study of road maintenance problems, chiefly in the direction of increasing the life of sprayed surface dressings and their bituminous carpet coats, and the development, by full-scale experiments, of the most economical form of surfacing for the prevailing traffic and soil conditions in any locality, and the best use of locally available materials. A special joint committee has been formed with the Ministry of Supply to study soil problems, notably those concerned with the negotiation of bad ground by military vehicles, the provision of emergency airfields in forward areas and the construction of military roads by soil stabilization. Road safety investigations have dealt with the problem of dazzle, the testing of brakes and pedestrian crossings. Water pollution research has related to the treatment of sewage, the control of filter-flies and the repeated use of sea-water for cleansing shell-fish, as well as the treatment of industrial waste-waters.

Space does not permit citing further examples of the interests of the Department, from the work of the forty research associations, some of which are making their own independent contributions in fields from which illustrations have already been given. In the field of food research, for example, the British Baking Industries, the British Flour-Millers and the British Food Manufacturing Industries Research Associations are carrying out highly important work. Some of the research associations are now



operating on a considerable scale; the British Iron and Steel Research Association last year had an income of £368,189, while the British Coal Utilization Research Association, the British Cotton Industry Research Association, the British Electrical and Allied Industries Research Association and the British Shipbuilding Research Association all had incomes exceeding £200,000. Besides these, however, only the British Rayon Research Association (£187,501), the Wool Industries Research Association (£121,907), the Motor Industry Research Association (£108,720), the British Ceramic Research Association (£114,530), and the Parsons and Marine Engineering Turbine Research and Development Association (£104,058) had incomes of more than £100,000. Beyond this no more can be said than that the accounts of the work of the research associations are admirably written, and present a most convincing picture of the value of their contribution to industrial efficiency and national welfare.

The Department is to be congratulated on a report which fully maintains, if indeed it does not surpass, the standard of the pre-war reports; and it is welcome news that the Advisory Council has made arrangements that will enable future reports to be presented within a few weeks of the end of the year to which they relate.

## ELECTRON MICROSCOPE OBSERVATIONS ON THE SPERMATIZOID OF *FUCUS*

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**T**HE brown seaweed, *Fucus serratus*, is such a familiar object both on the shore and in class rooms that a preliminary note on the structure of its spermatozoid as revealed by the electron microscope may not be out of place.

The accompanying micrographs have been taken with the new Philips's electron microscope, recently installed in the Botany Department of the University of Leeds with the aid of a grant from the Department of Scientific and Industrial Research. The material had been killed with osmic vapour when swimming very vigorously and was preserved in formalin diluted with sea water. Before mounting it was washed in distilled water, then dried on a 'Formvar' film and shadowed with uranium. A single complete spermatozoid is shown in Fig. *a*, with enlarged detail of the body and front end in Figs. *b* and *c*.

As regards the body (*a* and *c*), this is shrunken and somewhat distorted by the drying. Its internal structure cannot be investigated in this particular specimen, though most of the gross features of its general shape are significant.

The membranous appendage with the 'thumb-mark' pattern (*c*) is one of the most interesting of these features. Its presence, though not the details of its shape and markings, can be readily demonstrated with the light microscope if fresh spermatozoids are killed with osmic vapour and examined at once. It can then be seen as a transparent beak-like organ curving away from the base of the flagellum at the front end of the body. This attitude is, how-

Electron micrographs (at 80 kV.) of a spermatozoid of *Fucus serratus*, shadow-cast with uranium: *a*, a complete cell ( $\times 3,200$ ); *b* and *c*, consecutive portions of the front end of the same specimen ( $\times 16,000$ )

