

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, INDIA

THE Council of Scientific and Industrial Research, India, was established in 1942 to administer the Industrial Research Fund, created to foster industrial development in India. The Council was charged with the promotion and co-ordination of scientific and industrial research in India, including the institution and financing of specific researches and with encouraging the utilization of the results of such researches. Its functions also include the establishment or assistance of special institutions or departments for specific studies of particular industrial problems, the award of research studentships and fellowships, the establishment and maintenance of laboratories, workshops, institutes and organizations for further scientific and industrial research and their utilization, the collection and dissemination of information and the publication of scientific papers. The development of the Council's work and its present activities are clearly and attractively set forth in a volume just issued by the Council* and which does ample justice to the energy and foresight which the Council has brought to bear for the past twelve years on problems of scientific and industrial development in India.

The development of the Council's work from that of the Industrial Intelligence and Research Bureau established in 1935 is described in an introductory chapter, including an account of the work of the Research Planning Committee appointed in 1943 and of the First Reviewing Committee of 1947, out of the recommendations of which came the National Research Development Corporation (1953) and the Board of Engineering Research (1950). The general organization of the Council, its advisory bodies and laboratories is outlined in the second chapter of the volume, and this is followed by a concise account of the work which has been carried out or is in progress in the laboratories for which the Director of Scientific and Industrial Research is responsible. The next hundred pages of the report are occupied by an account of the research programmes of the various national laboratories, which include the following (dates of opening given in brackets): National Physical Laboratory of India, New Delhi (1950); National Chemical Laboratory, Poona (1950); National Metallurgical Laboratory, Jamshedpur (1950); Fuel Research Institute, Jeelgora (1950); and the National Botanic Garden, Lucknow (1953). The total is brought to fifteen by the following institutes dealing with particular branches of applied science: Central Glass and Ceramic Research Institute, Calcutta (1950); Central Food Technological Research Institute, Mysore (1950); Central Drug Research Institute, Lucknow (1951); Central Road Research Institute, Delhi (1952); Central Electro-Chemical Research Institute, Karaikudi (1953); Central Leather Research Institute, Madras (1953); Central Building Research Institute, Roorkee (1953); Central Salt Research Station, Bhavnagar (October 1954); and the Central Electronics Engineering Research Institute, Pilani (1953). Not all these laboratories are fully working yet, as may be judged from the dates of opening.

This impressive record of work carried out or projected mainly during the past five years is followed by an account of the extensive investigations

which have been or are being sponsored by the Board or the Council of Scientific and Industrial Research through its various research committees in such varied fields as scientific instruments, radio research, the ionosphere, high-altitude research, artificial rain, the measurement of geological time in India, gas turbines, the dyestuffs industry, biochemistry, malaria chemotherapy, pharmacology, the vanaspati industry, essential oils, plastics, and atomic research. Special committees have been appointed from time to time to deal with specific problems such as synthetic petrol, power alcohol from bagasse, research and development of gas turbine and jet propulsion engines in India, and low-cost housing.

Two chapters on the patent activities of the Council and the means taken to assist the utilization in industry of the results of the investigations it has sponsored and on the publications of the Council are followed by a brief note on the Indian National Scientific Documentation Centre, established at New Delhi in 1952 under the administrative control of the Director of the National Physical Laboratory. Besides some notes on the way in which the activities of the Council are financed and on its other activities, such as the co-operative research associations and the fellowships and scholarships instituted by the Council, the volume includes full lists of staff and of the personnel of the several boards and research committees, of research schemes, of patents and patent applications on behalf of the Council and of publications, including a classified bibliography of scientific and technical papers during 1940-53.

Simultaneously with this volume, the report of the Second Reviewing Committee*, constituted with Sir Alfred Egerton as chairman to report on the activities of the Council during the past five years, has been published; while the development of the Council's work has clearly been influenced by the experience of the Department of Scientific and Industrial Research in Great Britain, it is equally clear that there has been no slavish copying but that attempts have been made to shape both the organization and activities in accordance with Indian needs and conditions. The Reviewing Committee records the considered opinion that the twelve very fine modern laboratories which have been built are well sited and designed and have been well equipped at a very reasonable cost and that, except for certain important developments to which the Committee directs attention, they cover a range of research in science and industry which appears to be adequate for the next four years, although expenditure on research in India is far from being on the scale of highly industrialized countries, such as the United States or the United Kingdom. Recurrent grants to the Council from the Central Government have increased from 1,100,000 rupees in 1942-43 to 17,350,000 rupees in 1953-54, recurrent expenditure increasing from 695,611 rupees in 1942-43 to 12,928,765 rupees in 1952-53.

The policy of the Council in establishing these national laboratories and institutes has, in the Committee's opinion, been fully justified; the directors have been well chosen, the staffs are keen and are doing good work. The Reviewing Committee does not recommend any reorganization, but it makes some suggestions to improve the efficiency of operation and co-ordination. For example, the

* Council of Scientific and Industrial Research, India. *A Review*. Pp. 142. (New Delhi: Council of Scientific and Industrial Research, 1954.)

* Report of the Second Reviewing Committee of the Council of Scientific and Industrial Research. Pp. viii+93. (New Delhi: Council of Scientific and Industrial Research, 1954.)

directors should be given as much freedom as possible in administration, with more time to exercise scientific guidance; the number of research committees—at present twenty-five—should be kept within bounds, and committees should be terminated when their work does not warrant two or three meetings a year; and further consideration of the relations between the national laboratories and institutes and the universities is recommended so as to ensure that the whole scientific organization operates in concert.

There are sensible suggestions for co-operation in this field, including the interchange of facilities and of staff and welcoming the establishment of a University Grants Commission to provide grants for ensuring salary scales to attract staff of high quality, and the Committee stresses the importance of encouraging research at the universities and higher technological institutes. Emphasizing equally the importance of co-operation with industry, it recommends that the liaison officer at the Council's headquarters should be responsible for furthering all such collaboration between the Council's institutes and laboratories and other research organizations. Special attention is directed to the need for closer co-ordination and co-operation between the Council and the medical and agricultural research services, and more active co-operation with government departments is also recommended to facilitate utilization of the results of research carried out under the Council. For the same purpose, as much help as possible should be given to the National Research Development Corporation, and the institutes should be assisted to establish pilot plants.

The Reviewing Committee favours the establishment of further research associations where the size of an industry would justify this procedure, and it is obvious that, with regard to the utilization of research results, the dissemination of information, development and the formulation of research programmes, experience in India is not dissimilar from that in Britain. The Committee's remarks as to the way in which the Council could give the measure of direction to the research done under its aegis necessary to ensure that it is related to India's needs and to the general advance of science are of considerable interest. Ideas, it recognizes, must come mainly from the centres of research and, as research programmes, or less formally, they are discussed at meetings of the Council's research committees. At this stage they should be related to the general plan for India and to the state of science and technology; and the Reviewing Committee suggests that the principal executive officer and director of the Council should be able to call together such members of the Advisory Board, directors and advisory committees of the laboratories and others from medical or agricultural research or the universities as would be needed to assess the importance and priority of particular ideas, and to suggest suitable laboratories within or without the organization where the research could be initiated. He would thus be enabled to present to the Advisory Board of the Council a directive in relation to the programme which is submitted to the Board for review at least twice a year.

The developments which the Reviewing Committee considers desirable to complete the Council's cover of India's requirements are the Institute of Mining Research and the Central Mechanical Engineering Research Institute, both of which are to be established, the latter at Calcutta, mainly through private

benefaction, and in this connexion the Committee comments on the need to attract young engineers to undertake research. It has also been agreed to accommodate a Telecommunications Research Institute in the National Physical Laboratory, where the Defence Science Laboratory is also temporarily housed. It recommends that full opportunities should be given for astronomical research in India, so as to utilize the ability for mathematical analysis and physical investigation for which Indian scientific workers are particularly noted, and that the Council should at least foster astronomical research in the universities and other centres. The proposal to establish meteorological stations is welcomed and a centre for geophysical research is also recommended.

Provision for atomic energy is regarded as adequate, but some concentration of research effort on the utilization of solar energy, either direct or by chemical or biochemical means, is recommended, as well as further attention to the de-salination of water and concerted efforts to conserve, improve and recover the soils of India. Physiological research requires full attention, and genetics also needs adequate cover. The Committee concludes its report with a tribute to the work already accomplished in so short a time and to the ability of the Council's chief executive officer, Sir Shanti Bhatnagar.

DEEP-WATER MOVEMENTS IN THE OCEAN

MUCH less is known about water movements in the depths of the oceans than about surface currents. The oceanic circulations, however, involve movements of water at all levels, with vertical as well as horizontal components, so that the movements in the various layers are to some extent dependent on one another. Deep-water movements are therefore of interest to meteorologists as well as to marine physicists, biologists and geologists.

A Geophysical Discussion on this subject took place at a meeting of the Royal Astronomical Society on October 22. Dr. G. E. R. Deacon (National Institute of Oceanography), who was in the chair, referred to a quotation from Croll, towards the end of the past century, to the effect that the cause of ocean circulations was a question belonging to the domain of physics and mechanics, whereas few physicists or mathematicians of note had given much attention to it; this, he said, is no longer true. The contributions to the Discussion, continued Dr. Deacon, would show evidence of various ways in which problems of oceanic circulation are being tackled theoretically and by laboratory experiments as well as by observations in the oceans themselves.

In the first paper, Prof. K. F. Bowden (University of Liverpool) gave a brief account of the main features of the oceanic circulation below the surface layers, as deduced from the observed distributions of temperature, salinity, oxygen content and other properties. He referred to various estimates which have been made of the velocities of the deep-water movements, such as those based on the balance between horizontal flow and vertical or lateral mixing, and particularly to the charts of currents at 800 m. and 2,000 m. in the Atlantic Ocean deduced by Defant on the basis of the absolute dynamic topography. Most estimates agree in order of magnitude, giving the velocity of flow of the Antarctic