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THE NATIONAL RESEARCH COUNCIL OF CANADA

It has been said facetiously that in Canada the National Research Council does everything in science that no one else wants to do. This is misleading if it is taken to mean that the role of NRC in science is casual or minor. It simply recognizes the fact that a great deal of research is conducted by government departments in such clearly defined areas as agriculture, fisheries, mining and defence. The large remaining areas of science and technology fall within the scope of the National Research Council.

When in 1916, during the First World War, the Government of Canada established the National Research Council, the purpose was clear - to strengthen science as an aid to industrial development. From the beginning the NRC has pursued this objective in two ways: by encouraging and supporting basic science; and, as conditions permitted, by strengthening technology as an aid to secondary industries.

Responsibilities

The duties of the Council are outlined in the Research Council Act. Broadly stated, the Council has charge of "all matters affecting scientific and industrial research in Canada that may be assigned to it by the Privy Council Committee" (to which it reports). The NRC also has the duty of "advising the Government on questions of scientific and technical methods affecting the expansion of Canadian industries or the utilization of the natural resources of Canada".

The Act also designates a number of specific responsibilities: for discovering processes and methods that may promote the expansion of industries or the development of new ones; for maintaining and improving primary standards for Canada and certifying scientific and technical apparatus and instruments used in the government service and in industries; for investigating industrial products or materials at the request of any of the industries of Canada; and for conducting researches on the utilization of industrial wastes.

Organization

The Council itself - the governing body of NRC - is composed of 21 members selected for their scientific attainments, most of whom are scientific administrators in universities, in industry or in government laboratories. Three members are full-time salaried officers of the Council. These are the president and two vice-presidents (one scientific, the other administrative). The rest of the Council undergoes fairly rapid change; two or three members are retired each year and are replaced by new appointees who serve for a term of three years.

The Council as a whole is responsible for policy, major decisions and the maintenance of a high professional level within the organization. The salaried officers are responsible, in addition, for the work of the research and administrative divisions operated by the Council.

The NRC reports not to a departmental minister as such but to a member of the Cabinet who acts as chairman of the Privy Council Committee on Scientific and Industrial Research. This Committee is made up of seven ministers whose departments support research programmes and who, as a group, have general responsibility for scientific policy and activities of the Canadian Government. The NRC is thus a government agency, not a government department. It is largely self-regulating; for instance, it is free to hire, promote or discharge its own professional staff without recourse to the Civil Service Commission, which controls appointees to the Canadian public service in general.

National Research Laboratories

In the late 1920's, the National Research Council began to develop laboratories and research staff; but it did not acquire a building of its own until 1932. By the outbreak of the Second World War, however, the Council's facilities were able to provide the nucleus in Canada for an explosive growth in scientific work, which came during and after the war. Beginning with three research divisions, in chemistry, physics and biology, NRC has expanded to comprise nine research divisions in science and engineering at Ottawa and two regional laboratories at outside locations. The entire staff of NRC numbers some 2600, about 740 of whom have professional status. The yearly operating budget is now about $42 million.

The Division of Administration is larger than one might expect in a research organization. In addition to its normal administrative duties, it handles NRC's extensive "foundation programme" (grants in aid of research, scholarships, fellowships), its library, information services, and publications, and other scientific responsibilities both national and international.

The scope of scientific investigation carried out by NRC and the high degree of specialization within its divisions are indicated by the detailed list of sections contained in Appendix A.

Most of the NRC facilities are located at Ottawa. After the last war, however, regional laboratories were established at Saskatoon and Halifax in order to improve the industrial utilization of the resources of those areas. At the Prairie Regional Laboratory, the emphasis is on agricultural materials and the work is mainly biochemical; at the Atlantic Regional Laboratory, much of the work is on seaweed, fish wastes, peat and special biological problems affecting the pulping of wood. Work is also being done on chemical factors in steelmaking, especially as they relate to the coal and iron ores of the Atlantic provinces.

For reasons of necessity other smaller laboratories are located outside Ottawa; for example, a meteor laboratory is situated 20 miles south at Springhill, a radio observatory in Algonquin Park, building research units in the far North and upper-atmosphere research facilities at various points in the Arctic.

Atomic Energy of Canada Limited

During the wartime scientific boom of 1939-45, large research units developed within NRC, which have since become separate research organizations. For example, the work in atomic energy, which began with the Council in 1942, grew to the point where its size and commercial importance justified its establishment in 1952 under a distinct authority. This is Atomic Energy of Canada Limited, the Crown Corporation whose extensive research facilities are centred at Chalk River, Ontario.

Defence Research Board

Various laboratories in Canada that NRC had staffed for defence work achieved separate identity in 1947 under the newly-formed Defence Research Board of Canada. With a budget comparable to that of NRC, the Board conducts investigations in materials, armament, special weapons, telecommunications, aeronautics, Arctic problems and operational techniques. Its programme of upper-atmosphere research is carried on in co-operation with NRC and other research groups in government and universities. The Board also makes grants to universities for medical studies related to problems of defence.

Medical Research Council

Aid to basic medical research in universities also developed within NRC to a yearly volume in 1960 of over $2 million; and, in that year, the Medical Research Council of Canada was formed as an autonomous body to take over the medical grants and fellowships and otherwise to pursue its own objectives.

Basic Science in Universities

The creditable state of science in Canada today is the result of steady growth over the past 40 years. In 1916, virtually no scientific research was done in Canadian universities. Only the universities of Toronto and McGill were granting Ph.D. degrees in science, and, during the 11 years before the First World War, only three such doctorate degrees were granted.

Looking to the universities for competent scientists, NRC very early began a programme under which research grants were offered to professors and scholarships were offered to graduate students interested in research. This programme has kept pace with the capacity of the graduate schools in Canada and the demands of government and industry for researchers. Thus, by way of contrast, in 1961-62 more than 3600 students were enrolled for postgraduate degrees in science and engineering (excluding medicine, dentistry and psychology) in some 30 Canadian universities. About 2000 of these expected to obtain their master's or doctorate degrees in 1962. This growth of course reflects a general development in Canada and was not accomplished solely through the NRC programme. Nevertheless the NRC programme played a most significant role in facilitating the expansion and in developing a system of financial aid to basic research in universities without interfering with academic freedom.

In 1961-62, NRC administered nearly 1100 scholarships for students in postgraduate science and 1480 grants to professors. The grants not only furthered basic investigations but also provided the means for hundreds of additional students to continue their postgraduate training. The Council's programme of aid to basic science is to cost nearly $15 million in 1962, compared to $3.6 million in 1957. Included in the programme are grants to Canadian and international scientific organizations, aid to international congresses held in Canada, and publication of a number of scientific journals.

Scientific Societies and International Affiliations

The Council makes annual grants to such organizations as the Royal Society of Canada and the Canadian Standards Association; it gives financial support to scientific conferences and aids in international exchange of scientists, for example in such programmes as the NRC-Nuffield Foundation Visiting Lectures and the recently-inaugurated exchange between the Soviet Academy of Sciences and NRC. The Council also participates in a space research programme in collaboration with a number of departments of the Canadian Government and other groups at the universities; and it facilitates Canada's share in the international space programme of COSPAR.

It holds membership as the representing body for Canada in various international scientific organizations. In 1961, NRC's president, Dr. E.W.R. Steacie, was elected president of the International Council of Scientific Unions.

Research Journals

The Research Council also edits and publishes the Canadian Journals of Research, six periodicals that report basic research in biochemistry, physiology, botany, chemistry, microbiology, physics, and zoology. Forty per cent of the papers published originate in Canadian universities and, at present, about 15 per cent come from laboratories outside Canada. Distribution of the Journals is world wide.

Research in NRC Laboratories

In its own laboratories NRC conducts a considerable volume of basic research. Though these fundamental studies are more usual in physics, chemistry and biology, investigations of basic character are carried on in the divisions of applied science and engineering as a balance and complement to the applied work.

Library Services

The NRC Library of Ottawa is designated as the national library of science for Canada. It is recognized as the central clearing-house and information centre for science publications, and also as a distributing agency for scientific literature not otherwise available in Canada. It provides lending and photocopy services; it carries out literature searches and compiles bibliographies; its translation services cope with scientific reports in many languages, including Russian; and its index of English translations of foreign scientific publications currently runs to 90,000 entries.

Postdoctorate Fellowships

Since 1948 the NRC has been developing a programme of postdoctorate fellowships. These provide salaries and travel expenses to enable young scientists who have already attained their doctorates to work for a year or two at NRC or other government or university laboratories in Canada. There are now about 270 of these visiting scientists in Canada, mainly from Europe, Asia and the United States. During 1962-63, 790 applications were received for postdoctroate fellowships, of which 170 were successful.

Applied Work for Industry

Much of the work of the NRC is of immediate application; for example, investigations requested by industrial groups or carried out under contract for individual companies. The projects range from electronics to building construction, from acoustics to food preservation.

Facilities are maintained by NRC that are too expensive or too specialized for most Canadian industries to support on their own. Examples are: a hydraulics laboratory, where scale-model studies are done on harbours, breakwaters, riverbeds, canal locks, ships and propellers; aeronautical facilities such as wind tunnels, jet-engine test beds, low-temperature installations for icing research on aircraft and helicopters; fire-research apparatus for the destructive testing of floors, walls and building components. Increasing use of these facilities is made by scientists and engineers from industry working along with NRC staff.

The Council's researchers have achieved international recognition in areas of applied research, such as corrosion, physical standards, noise abatement, medical electronics, electronic aids to navigation, soils research related to construction, snow and ice research, photogrammetry.

Standards

The primary physical standards for Canada are maintained by NRC, which enters into international agreements concerning weights and measures. In addition to regular calibration of industrial standards, considerable research is done on the improvement of the primary standards. Recently NRC made a distinguished contribution towards the adoption of a new standard for the metre, which is now based on wave-lengths of orange light emitted by an isotope of krypton. Advanced developments are being made by NRC physicists in the measurement of time, electrical quantities, heat, light, color, and acceleration due to gravity.

Technical Information

In 1945, NRC established a Technical Information Service (TIS). The purpose of this office is to bring together problems of industry and the technological facilities of the Council. TIS receives a large volume of enquiries each year, mainly from companies in the secondary and processing industries. In 1961, for example, about 17,000 enquiries were dealt with on a wide variety of problems. Most of the TIS work is with small and medium-sized firms possessing little or no technical staff; but large firms also make frequent use of the service because of the vast amount of material in technical periodicals and other scientific information available through NRC library facilities and the Council's foreign liaison offices. The Information Service itself does not operate research or testing laboratories, but it has at its disposal the technical experience of the NRC laboratories and is well acquainted with the services of other government laboratories and private consultants. Besides its central staff at Ottawa, TIS maintains local representatives across Canada, who work in co-operation with the field staffs of the provincial research councils, now five in number.

The Technical Information Service issues reports on current developments in technology that have wide application in industry, and each year a number of information notes are prepared in order to bring the smaller type of firm up to date on new manufacturing facilities, productivity techniques and scientific innovations.

Research in Industry

In 1961 NRC appointed an advisory committee on industrial research the aim of which was to bring industrial management into closer contact with the work of NRC and to keep NRC informed of the problems of industry. The committee, composed largely of top management of leading Canadian companies, also considers ways of encouraging greater research activity within industry.

In 1962 NRC established a Committee on Industrial Research Assistance (CIRA) whose membership was composed of senior representatives from government agencies having a direct interest in industrial research. The new committee is to assist NRC in an experimental programme aimed at fostering long-term research in industry. In 1962 an initial fund of $1 million was provided by the Government to help finance projects undertaken by industrial firms. The cost of projects aided under the plan will be shared more or less equally between NRC and industry. Projects are to be of company choice and the results will remain the property of the respective firms. In allotting the available funds preference will go to longer-term projects that appear to have potential for major industrial advances.

Patents and Development

In 1947, NRC established Canadian Patents and Development (CP&D), the Crown Corporation that patents NRC developments and inventions and makes them available under license to industry. CP&D also performs this service for other government laboratories and for Canadian universities.

Associate Committees

Over the years the Council has formed groups of specialists as needed, to study the use of certain resources and to investigate other problems science might help to solve. Today, some 42 associate committees, as these groups are called, are co-ordinating research effort and technical knowledge in as many fields (see Appendix B). National in scope, the committees combine the interests of industrialists, government experts, and university scientists. They have precise objectives and are disbanded as soon as their tasks are accomplished. Typical areas of interest at present are: aerodynamics, automatic control, crystallography, engines research, forest fire protection, national building code, oceanography, radiation biology, space research.

Scientific Liaison

During the Second World War, NRC found it necessary to establish scientific liaison officers in London and Washington working through a Scientific Liaison Office in Ottawa to create an expeditious and secure channel for the exchange of information on classified research and to organize the exchange of visits by scientists.

After the war, with the advent of the Defence Research Board, the liaison officers were no longer concerned with classified research and were able to devote their attention to non-defence research. In the post-war years, as national and international activity greatly expanded in the field of science, it became desirable to accredit the scientific liaison officers as scientific attaches to enable them to work in those areas where science and foreign relations intermingled.

The present science attaches thus perform a dual function. On the one hand, as liaison officers they function as a direct link between the National Research Council and the scientific community of the country to which they are accredited. On the other hand, as attaches they function as an inter-governmental link to facilitate the development of national policy and action in the international field of science.

In addition to the scientific attaches in London and Washington, a similar post has been created in the Canadian Embassy in Paris. The Paris attache is also accredited to the Canadian delegations to NATO and OECD and assists these delegations in their scientific and technological activities.

APPENDIX A

Laboratory Divisions
National Research Council of Canada

SCIENCE

DIVISION OF APPLIED BIOLOGY

- Animal Physiology
- Biological Macromolecules
- Biometrics
- Biophysics
- Carbohydrate and Fat Chemistry
- Food Technology
- Fermentations and Enzymology
- Food Chemistry
- Microbiology
- Plant Physiology

ATLANTIC REGIONAL LABORATORY--Halifax, N.S.

- Biology
- Chemistry
- Reactions at High Temperatures
- Engineering and Development

PRAIRIE REGIONAL LABORATORY--Saskatoon, Sask.

- Physiology and Biochemistry of Fungi
- Physiology and Biochemistry of Bacteria
- Plant Biochemistry
- Chemistry of Natural Products
- Engineering and Process Development

DIVISION OF APPLIED CHEMISTRY

- Analytical Chemistry
- Applied Catalysis
- Chemical Engineering
- Colloid Chemistry
- Corrosion
- Metallurgical Chemistry
- Applied Physical Chemistry
- Physical Organic Chemistry
- High Polymer Chemistry
- Rubber
- Textiles

DIVISION OF PURE CHEMISTRY

- Organic Chemistry
- Organic Spectrochemistry
- Organic Synthesis
- Chemical Kinetics and Photochemistry
- Mass Spectrometry
- Molecular Spectroscopy
- General Physical Chemistry
- Surface Chemistry and Low Temperature Calorimetry
- Thermochemistry
- Activated Carbon, Inorganic Chemistry
- Chemistry of Fats and Oils
- Fibre Research

DIVISION OF APPLIED PHYSICS

- Acoustics
- Electricity and Mechanics
- Heat and Solid State Physics
- Instrumental Optics
- Interferometry
- Photogrammetric Research
- Radiation Optics
- Special Problems
- X-Rays and Nuclear Radiations

DIVISION OF PURE PHYSICS

- Cosmic Rays
- Low Temperature and Solid State Physics
- Spectroscopy
- Theoretical Physics
- X-ray Diffraction

DIVISION OF BUILDING RESEARCH

- Building Materials
- Building Services
- Building Structures
- Building Physics
- Fire Research
- Soil Mechanics
- Snow and Ice
- Northern Building
- Construction
- Housing
- Building Standards
- Prairie Regional Station
- Atlantic Regional Station
- B.C. Regional Station
- Specifications

ENGINEERING

DIVISION OF MECHANICAL ENGINEERING

- Mechanics
  - Analysis Section
  - Instruments and Control Systems
  - Engineering Laboratory
- Hydrodynamics
  - Hydraulics Laboratory
  - Ship Laboratory
- Thermodynamics
  - Gas Dynamics Laboratory

ENGINEERING (Cont'd.)

Engine Laboratory
Low Temperature Laboratory
Fuels and Lubricants Laboratory
Engineering Workshops

NATIONAL AERONAUTICAL ESTABLISHMENT

Aerodynamics
Structures
Flight Research

RADIO AND ELECTRICAL ENGINEERING DIVISION

Navigational Aids
Microwave Section
Electrical Engineering
Upper Atmosphere Research
Instrument Section
Defence Section I
Defence Section II
Engineering Design

APPENDIX B

Associate Committees
National Research Council of Canada

Associate Committee on Aeronautical Structures and Materials

Associate Committee on Aerodynamics

Associate Committee on Aircraft Noise

Associate Committee on Automatic Control

National Committee for the International Organization for Pure and Applied Biophysics

National Committee for the International Union of Pure and Applied Chemistry

Canadian National Committee of Biochemistry

Canadian Committee on Culture Collections of Microorganisms

Associate Committee on Crystallography

Associate Committee on Dental Research

Associate Committee on Electrical Insulation

Associate Committee on Experimental Psychology

Canadian Committee on Fats and Oils

Associate Committee on Food

Associate Committee on Forest Fire Protection

Associate Committee on Gearing Research

Associate Committee on Geodesy and Geophysics

Associate Committee on Heat Transfer

National Committee for the International Union for the History and Philosophy of Science

Associate Committee on High Polymer Research

Associate Committee on Control of Hospital Infections

National Committee for the International Commission on Illumination

Associate Committee on Meteorites

Associate Committee on a National Aviation Museum

Associate Committee on the National Building Code

Associate Committee on National Fire Codes

Associate Committee on the Natural Sciences Programme of UNESCO

National Committee for the International Union of Nutritional Sciences

Canadian Committee on Oceanography

Joint Committee on the Institute of Parasitology

National Committee for the International Union of Pure and Applied Physics

National Committee for the International Union of Physiological Sciences

Associate Committee on Propulsion

Prairie Regional Committee

Associate Committee on Radio Science

Associate Committee on Radiation Biology

Associate Committee on Railway Problems

National Committee on Scientific Information

Associate Committee on Soil and Snow Mechanics

Associate Committee on Space Research

Associate Committee on Waves and Littoral Drift

National Committee for the International Institute of Refrigeration

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