# **CSIRO** Annual Report

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1978/79

Commonwealth Scientific and Industrial Research Organization, Australia

# CSIRO Annual Report

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# COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION

Senator the Hon. J. J. Webster, Minister for Science and the Environment, Parliament House, CANBERRA, A.C.T. 2602.

The Executive of CSIRO has pleasure in submitting to you, for presentation to Parliament, its thirty-first annual report. The report is submitted in accordance with section 57 of the Science and Industry Research Act 1949.

J.P. Wild (Chairman) D.J. Asimus N.K. Boardman W.L. Hughes V.E. Jennings H.M. Morgan R.K.R. Morris W.J.McG. Tegart



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# Introduction

This annual report differs from its predecessors. Far more than in previous years it is aimed primarily at accounting to Parliament for the conduct of the Organization's affairs during the past year. It no longer contains illustrated articles on the research work of the Organization, but concentrates instead on matters of legislation, policy, organization and the allocation of resources. The Organization's new research Institutes will in future produce their own annual reports in which it will be possible to present research results more comprehensively than previously. These changes signify the response of the Organization to the Act of 1978, which amended the Science and Industry Research Act 1949; to the Government's decisions following the 1976/77 Independent Inquiry; and to comments by the Senate Standing Committee on Science and the Environment relating to annual reports.

The amending Act came into force on 14 December 1978 and began a new era for CSIRO. It marked the beginning of a series of changes in the structure and operating procedures of the Organization. The importance of these changes should be neither under-estimated nor exaggerated. They affect the ways in which decision-makers at all levels in the Organization communicate with one another and in which information is exchanged with the outside world; they encourage us to make greater efforts in directions such as future planning, policy formulation, resource mobility, performance evaluation, and accountability; but they retain the main feature essential to the success of CSIRO—an environment in which the creativity of the scientists and the supporting staff in the Divisions can flourish.

The first six months of the new era have seen a rapid sequence of new developments. They include the appointment of a newly structured Executive, the grouping of Divisions into five Institutes, the establishment of a Bureau of Scientific Services, the establishment of a Planning and Evaluation Advisory Unit and the setting up of new arrangements in which many of the managerial functions of the former Executive are now delegated to Institutes and Directors.

The primary aim of the re-organization is to increase the overall effectiveness of CSIRO in fulfilling its functions: to provide a better framework in which imaginative research can be conducted, to ensure that we are working on the right problems, and to improve the mechanisms by which our work is put to use for the benefit of industry and the community. It is my personal opinion that already the new structure is contributing to this by improving communication throughout the Organization.

The amending Act has brought new challenges to CSIRO. The Executive is now responsible for determining research strategies across a much broader spectrum of publicinterest objectives, including those previously subject to Ministerial discretion. Nowhere are the challenges clearer than in the new categories of research undertaken as national and international obligations. The prospects for achievement in these areas are great: an example is research into the seas and oceans around Australia, which now assumes greater significance in view of the new 200-mile legislation. But the combination of our widened responsibilities and relatively static resources means that difficult decisions lie ahead.

Our policies need to have an element of continuity and permanence, yet also the flexibility to respond to changing circumstances. For, as in the past, CSIRO has a particular responsibility to meet Australia's changing requirements. Thus since 1972, we have stepped up energy research by a factor of 7 and water research by a factor of 2. On the agricultural front we have responded quickly to the need to meet urgent problems, particularly those resulting from the sudden arrival of exotic pests and diseases. A recent example was the

arrival in 1977 of two extremely serious pests—the spotted alfalfa aphid and the blue-green aphid—which severely damaged the important lucerne crop. An intensive program in collaboration with State Departments of Agriculture has resulted in the breeding of new resistant varieties of lucerne. Two varieties developed by CSIRO—SIRIVER and SIROTASMAN—are resistant to both pests. Work is proceeding to make these varieties commercially available in the autumn of 1981. A predatory wasp to attack the field population of aphids throughout Australia was also introduced.

Rapidly changing circumstances are easily identified; gradual changes, less so. In sensing the need to respond to gradually changing circumstances, CSIRO looks not only to its own internal sources of evaluation, but also to a wide network of external sources: to Government and its many special committees, including ASTEC; to CSIRO's formal advisory machinery, the Advisory Council and State Committees; and to a great many industry contacts. A current example of particular concern to the Organization is the growing need to assist manufacturing industry. This need was identified within the Organization, by the Independent Inquiry, and by the Crawford 'Study Group on Structural Adjustment'. Manufacturing industry is a field in which we are already strongly involved, but our impact is less than in agriculture. While re-affirming the importance of maintaining a strong effort in agriculture, the Executive has recently established a Manufacturing Industry Committee, which is now vigorously exploring ways of enhancing our efforts in this area.

The Executive must also consider the demands of the future. To retain the capacity for responsive and flexible action to meet the next generation of national needs, the groundwork must be laid now. We therefore recognize the importance of supporting a range of stable programs aimed at providing basic knowledge and expertise over a broad front to meet the new needs as they become defined.

Whether circumstances are changing or steady, policies must be developed which permit a rational ordering of priorities for research related to national needs. A nation of small population like Australia must be highly selective in the research it undertakes. But great care and sensitivity are needed in the application of research priorities. Above all, a scientist with a good idea should always be allowed a degree of freedom to explore its potential, for a good idea can transform an apparently unproductive field of research into one of the highest promise. Individuals and their ideas are at the very heart of our business.

J. P. WILD Chairman

# 1. Legislative changes

CSIRO is constituted under the Science and Industry Research Act 1949. On 14 December 1978 the Science and Industry Research Amendment Act 1978 came into operation. A brief outline of the background to and substance of the changes brought in by this enactment follows.

#### Background

In 1976 the Government instituted an Independent External Inquiry into CSIRO. The Committee of Inquiry, comprising Professor A.J. Birch, Sir Cecil Looker and Mr Russell Madigan, presented its report on 25 August 1977. On 11 May 1978 the Prime Minister, Mr Malcolm Fraser, announced in the House of Representatives the Government's decisions on the recommendations made by the Inquiry. The Prime Minister's statement and a supporting statement made in the Senate by the Minister responsible for CSIRO, Senator J. J. Webster, are reproduced in the 1977/78 Annual Report of CSIRO. The Science and Industry Research Amendment Act 1978 implemented those elements of the Government's decisions which it was appropriate to reflect in legislation. The opportunity was also taken to modernize the Act and incorporate desirable amendments of a machinery nature.

#### Changes

#### (i) General

The Amendment Act repealed most provisions of the then current Act and substituted entirely new ones. Chief amongst the original provisions which remained were:

- . section 8, which constitutes CSIRO as a statutory corporation;
- . section 9A, which authorizes the acceptance of grants; and
- . section 10, which deals with coordination with other research bodies.

#### (ii) Functions

Section 9 sets out the revised functions of CSIRO. Significant features include:

- broadening of the scientific and technological research function to encompass research designed to further community interests and contribute to the achievement of national objectives and the performance of national and international responsibilities;
- explicit recognition of the function of encouraging and facilitating the application and use of research results;
- clarification of the dissemination function by inclusion of specific reference to the interpretation of scientific and technical matters; and
- limitation of the extra-mural granting function to research for specific purposes.

The functions are discussed in detail in the next chapter of this report.

# (iii) Powers

In accordance with modern drafting practice, powers conferred upon the Organization to allow it to perform its functions are now detailed separately. Powers to make inventions available, pay bonuses and charge fees for services are derived from the preceding Act. Paragraph 9AA (a) makes it clear that CSIRO has the power to contract research work out to other bodies, and paragraph 9AA (b) empowers CSIRO to join in the formation of a partnership or company for the commercial development of an invention. These powers were thought to have been implicit in the Act as it was, but were included in the amendments to put the matter beyond doubt. Paragraph 9AA (b) is the subject of a direction by the Minister under paragraph 13 (c) of the Act, and is reported on in detail in Chapter 7.

#### (iv) Institutes

Section 9AB provides that the scientific research of CSIRO is to be carried out in up

to six Institutes. The reorganization of CSIRO into five such Institutes is reported on in Chapter 8.

# (v) Directions

Section 9 of the Act before amendment provided that the powers and functions of the Organization should be the subject of the approval of the Minister. Following the Independent Inquiry, the Government decided that CSIRO's autonomy in setting research project objectives should be maintained, subject to Ministerial discretion. This discretion should, however, be exercised only as a last resort, and if used, reported upon in the annual report. The amending Act reflects this decision by omitting from sections 9 and 9AA any reference to the Organization's powers and functions being subject to the Minister's approval, and substituting explicit powers of direction. Paragraphs (a) and (b) of section 13 in the amended Act provide for directions of a policy nature in relation to scientific research, and directions of a more general nature in response to recommendations to the Minister by the Executive. No direction under either of these paragraphs has been given by the Minister. The Government also decided that the implementation of research results should continue to be a function of CSIRO subject to a general power of the Minister to provide the Executive with guidelines. This decision is reflected in paragraph (c) of section 13. As mentioned above, a direction has been given under this paragraph and is reported upon in Chapter 7.

# (vi) The Executive

Section 14 provides for the constitution of the new Executive of CSIRO. Under the previous Act the Executive comprised five full-time members and four part-time members. The new Act provides for three full-time members and a minimum of three and a maximum of five part-time members. As discussed more fully in Chapter 8, the Government elected to appoint five part-time members to the Executive.

# (vii) The Chairman

Section 24 of the Act provides that the Chairman shall be Chairman of the Organization. Previously, the Chairman was Chairman of the Executive only. The section also provides that the Chairman is to be executive officer of the Executive and responsible to the Executive for the day-today operation and efficiency of the Organization. This implements a decision of the Government, based on a recommendation from the Independent Inquiry, that the Chairman should be Chairman of the Organization as a whole and its Chief Executive. It also formalizes an arrangement which has existed as a convention within CSIRO for a considerable time.

# (viii) Staff

Under the Act before amendment the staff of the Organization comprised two categories: officers and employees. The new provisions substitute a single category. Distinctions relating to terms of appointment and qualifications for appointment have therefore become matters to be determined by the Executive. Section 8 continues to provide that 'the Organization shall consist of the members of the Executive, and of the officers.....' As a result of the amendment all staff are now full members of the Organization. The statutory relationship between the Executive and the Public Service Board in staff matters has been preserved, and brought into line with modern practice.

# (ix) Advisory Council

The amended Act reconstitutes the Advisory Council with new membership and enhanced functions. The new functions of the Council include the provision of advice to the Executive in relation to:

- . the Organization's objectives and priorities;
- industrial and economic matters relevant to CSIRO;

. Australian community goals.

The role of the Council is further enhanced by providing that the Executive in its annual report to Parliament must comment on advice furnished to it by the Advisory Council during the year.

The independence of the Council has been emphasized by stipulating that members of the CSIRO Executive are ineligible for appointment, and officers are ineligible for appointment as Chairman of the Council. Membership now specifically includes persons selected from other Commonwealth agencies considered to be appropriate by the Minister. Provision is made for remuneration of Council members, and for support staff and facilities. The amended Act provides for the Advisory Council to comprise a part-time Chairman, the Chairman of each State Committee, and up to 18 other members.

Membership of the Advisory Council is reported on in Chapter 6.

#### (x) State Committees

Under the Act as amended State Committees have been retained, with revised functions. State Committee Chairmen will continue to be members of the Advisory Council ex officio. The functions now include a liaison role within the State and advice is required to be channelled through the Advisory Council.

Membership now specifically includes persons selected from agencies of State Governments, and CSIRO is required to provide the support necessary for the Committees to carry out their functions.

The Act provides for the State Committees to comprise a Chairman and not more than 11 other members. The membership other than the Chairmen had not been finalized as at 30 June 1979.

#### (xi) Consultative Council

The amended Act provides for the establishment of a Consultative Council on which the Executive and staff associations are represented. Its functions are to consider and report to the Executive on matters affecting or of interest to staff. The establishment of the Council is reported on in Chapter 8.

#### (xii) Annual report

New reporting requirements have been placed on the Organization. Ministerial directions and comments by the Executive on advice it has received from the Advisory Council must now be reported. These have been mentioned earlier in this chapter.

The remaining significant new element is a requirement to state the policies of the Organization in relation to the carrying out of scientific research. This is done in the following chapters.

#### (xiii) Disclosure of information

The official secrecy provision of the previous Act has been repealed as it no longer serves any practical purpose. Cases of unauthorized disclosure of information which are serious or harmful are to be dealt with under the CSIRO Terms and Conditions of Service as a disciplinary matter, or under the Crimes Act 1914 as a criminal offence.

# 2. Policy framework

Statutory functions and Executive policies The functions of CSIRO are laid down in section 9 of the Science and Industry Research Act 1949. Briefly they are:

- . scientific research and application of the results;
- . overseas scientific liaison;
- . research training and funding;
- . research association support;
- . maintenance of measurement standards;
- . publication and dissemination of scientific information.

The formulation in the Act reflects the Government decision reported in the last annual report that the Organization should continue to have a broad charter so that it will retain the capacity to respond to new needs as they evolve. Within this framework the Executive is responsible for deciding policies of varying degrees of generality which define how the Organization shall operate.

The Executive supports this notion of a broad legislative framework within which it develops policies and re-defines them from time to time in the light of changing circumstances. By their nature, the policies forming the foundations of the Organization's approach to its task are unlikely to change rapidly. It is the primary task of this chapter to present the policy framework. Chapters 4 and 5 will deal with specific policies which have been developed during the reporting year and other policy matters of current interest.

#### **Reporting Executive policies**

The Science and Industry Research Amendment Act 1978 introduced a requirement that certain policies of the Organization be reported in the annual report. Paragraph 57 (2) (a) provides that: 'The report shall set out —

(a) a statement of the policies of the

Organization in relation to the carrying out of the scientific research of the Organization that were current at the beginning of the relevant year, together with a description of any developments in those policies that occurred during that year.'

The Executive has concluded that it would be neither practical nor meaningful to attempt a comprehensive coverage of all the Organization's policies relating to its scientific research in this report. It believes that the purpose of the new reporting requirement will best be met by an initial statement covering the basic policies of CSIRO and a series of more detailed statements covering other important policies in a cycle of about five annual reports, a time-scale suggested in the Report of the Independent Inquiry into CSIRO.

The expression 'policies' in the context of the new reporting requirement is interpreted by the Executive as relating closely to the Organization's responsibility to account to Parliament. Of prime concern, therefore, are matters relating to the translation into practice of the functions given to the Organization in its Act, and to the allocation of resources.

This approach accords with the basic principles set out in the first report on 'Statutory authorities of the Commonwealth' by the Senate Standing Committee on Finance and Government Operations. In Chapter 5 of that report the Committee stressed the need for authorities to account directly to Parliament for the performance of functions conferred on them by Parliament.

The policies of CSIRO must, however, be seen in the light of the Organization's position within the framework of government. CSIRO is predominantly a budget-dependent body and this has implications for its freedom to act independently. For example, the distribution of effort in support of a set of objectives at any given time will, to a degree, reflect judgments made by Governments over the years. Moreover, political perceptions of national priorities shift, and at any one time the distribution may not be ideal from the national standpoint simply because research resources are not instantly redeployable.

Responsibility for decisions affecting CSIRO is shared between the Government and the Executive, and each is accountable to Parliament for its part. In the final analysis, CSIRO submits to the Government estimates of resources needed to carry out its functions, and then allocates the resources actually provided subject to any constraints imposed by the Government.

There has been a recent shift towards allocating to CSIRO an Appropriation determined almost entirely by reference to budgetary considerations relating to the economy generally. The Executive must now re-order its priorities within a level of resources maintained approximately constant in real terms. The Organization is at the same time moving from a situation in which the distribution of effort was strongly influenced by the cumulative effect of decisions made annually by Governments to one in which the Executive is expected by the Government to assume primary responsibility. In exercising its responsibility to re-order priorities the Executive is, of course, also expected to consult appropriately. Re-ordering will necessarily be gradual, but the program of reviews and associated measures now proposed and being formulated by the Executive will provide progressively the information and statements of objectives and criteria upon which policy reports will be based in future years.

The Executive of CSIRO was reconstituted under the amending Act in December 1978, and the new Executive therefore finds itself required to report on policies in force under its predecessor. Many of these policies were unwritten and often simply embodied in traditions. While this has made the task of responding to the new reporting requirements harder, it should be recorded that the Independent Inquiry and the Government recognized the success of earlier Executives in meeting the needs of Australia over the years. Changes were, and still are, necessary, but they are seen as being better accomplished by continued evolution rather than by revolution.

### Origins and growth

Present day policies have developed over the years, and a brief outline of their evolution is presented here.

In 1926, when the Council for Scientific and Industrial Research (CSIR) was established, Australia did not have adequate research resources; one task of CSIR was to build them up progressively. The build-up of those resources within CSIR in preference to other institutions was supported by the Government.

The universities had as their primary role the education of students. Such research as they maintained was ancillary to this function and, in conformity with English university tradition, was essentially free and undirected. This role was incompatible with the need to direct research towards pressing economic problems. State Governments had some capacity to deal with local problems, but they did not see it as their role to fund research on national problems or to engage in major programs. Industry was in a very primitive state and had negligible research capacity.

Research within CSIR concentrated at first on plant and animal production, soils, fisheries, food preservation and transport, insect pests, and forest products. In 1938 the Government agreed to a significant expansion into work for secondary industry. During and after the war research grew further in industrial chemistry, aeronautics, engineering, physical standards, metallurgy, coal, textiles and building.

In 1949, following a controversy arising out of the competing needs of creativity in research and security in military work, it was agreed that aeronautics research should be undertaken elsewhere. The Council was reconstituted as CSIRO. Over the next 25 years the pattern of CSIRO's research developed steadily in response to growing national needs for scientific knowledge in an ever-increasing number of spheres. Work on the impact of pests on rural industries expanded to cover Australia's interest in understanding and protecting its native flora and fauna. Work on the nutritional needs of sheep and cattle was extended to humans. The natural environment, land, air, and water, was studied increasingly. The breadth of the present coverage may be seen from the publication CSIRO Research Programs 1979/80. A summary is provided in Chapter 3.

Since the early days of CSIR substantial changes have occurred in the Australian research scene. The research capacities of universities, State Governments and industry have all increased markedly. All have developed, however, according to the pattern of their particular needs, and in recognition of the proper role of the Commonwealth, represented by the research interests of CSIRO and other Commonwealth agencies, notably the Defence Science and Technology Organization and the Australian Atomic Energy Commission.

#### Main role

The Science and Industry Research Act provides a deliberately wide charter for CSIRO and places upon the Executive responsibility for formulating the policies necessary to translate the charter into action. The first key question is the assignment of weights to the functions listed in section 9, which reads as follows: 'The functions of the Organization are—

- (a) to carry out scientific research for any of the following purposes:
  - (i) assisting Australian industry;
  - (ii) furthering the interests of the Australian community;
  - (iii) contributing to the achievement of Australian national objectives or the

performance of the national and international responsibilities of the Commonwealth;

- (iv) any other purpose determined by the Minister;
- (b) to encourage or facilitate the application or utilization of the results of such research;
- (c) to act as a means of liaison between Australia and other countries in matters connected with scientific research;
- (d) to train, and to assist in the training of, research workers in the field of science and to cooperate with tertiary education institutions in relation to education in that field;
- (e) to establish and award fellowships and studentships for research, and to make grants in aid of research, for a purpose referred to in paragraph (a);
- (f) to recognize associations of persons engaged in industry for the purpose of carrying out industrial scientific research and to cooperate with, and make grants to, such associations;
- (g) to establish, develop and maintain standards of measurement of physical quantities and, in relation to those standards –
  - (i) to promote their use;
  - (ii) to promote, and participate in, the development of calibration with respect to them; and
  - (iii) to take any other action with respect to them that the Executive thinks fit;
- (h) to collect, interpret and disseminate information relating to scientific and technical matters; and
- (j) to publish scientific and technical reports, periodicals and papers.'

The policy considerations involved in the operations of a body as complex as CSIRO cannot be summed up into a simple statement. It is helpful, however, to think of them in terms of a main role.

A statement of a main role must be seen in context. CSIRO has undertaken scientific research and provided related services to Australia to meet a progressively widening range of national needs. But it is not the only body with functions in this area. The private sector, educational institutions, State bodies and other Commonwealth agencies have roles which, in varying degrees, complement or interact with that of CSIRO. It is within this framework that the following statement should be seen.

The main role of CSIRO is to plan and execute a comprehensive program of scientific research on behalf of the Commonwealth, with the exception of research in specific areas discussed later in this section.

The reasons for the development of this main role are to be found in the circumstances surrounding the origins and growth of the Organization outlined earlier. Quite apart from commitments to staff and physical facilities, and the present institutional structure of scientific research in Australia, the Executive believes that there are good reasons to support a continuation of this role for CSIRO. The reasons were set out in some detail in the Report of the Independent Inquiry into CSIRO and may be summarized as:

- . The setting of priorities for, and the management of, strategic research are best handled by a scientifically oriented body consulting with users and their representatives.
- . An independent statutory research body is best suited to serve the national interest in areas of responsibility shared between the Commonwealth and the States.

Further arguments in support listed by the Inquiry were:

. 'the ability to conduct multidisciplinary work afforded by the presence of a large, multi-faceted research organization;

- . the ability to utilize the capabilities of various scientific disciplines in changing patterns to contribute to a changing number of objectives;
- . the flexibility afforded by a single organization in redeploying resources to respond more readily to changing needs and opportunities, to initiate new projects and to use resources released by termination of less important work;
- . the administrative savings that can accompany the operations of a central research-performing agency;
- . the potential and actual efficiency of a science-based information service with access to a wide range of scientists;
- . the international prestige of CSIRO, which facilitates international and national interactions in all of the areas of scientific concern;
- . the morale of the scientists, which depends on accumulated prestige; and
- . the opportunities for cross-fertilization of ideas, associated with the ease of consultation and collaboration between scientists in a single organization, which have clearly contributed greatly to its past successes.'

As previously stated, CSIRO does not have sole responsibility for the planning and execution of scientific research on behalf of the Commonwealth. Other bodies have full responsibility for the planning and execution of the research needed to support the Commonwealth's role in certain areas. In another set of areas the responsibility for planning research is shared.

The first set, those excluded from CSIRO's sphere of responsibility, are characterized by either security or business considerations. The defence and nuclear fields are excluded because they involve security constraints inconsistent with the degree of openness necessary for CSIRO's mainstream activities. Similarly, where the Commonwealth engages in self-financing business undertakings, such as the supply of telecommunications services, it is appropriate for the enterprise to assume full financial and other responsibility for its own research and development needs. CSIRO does, however, cooperate with requests for assistance from institutions responsible for these areas.

The second set of areas, those involving shared responsibility, include research funding schemes and the Australian Institute of Marine Science. The latter body has wide responsibilities for both planning and executing research in a field in which CSIRO is also active. It is recognized that at present the Institute has prime carriage of inshore and estuarine studies on the tropical east coast of Australia. CSIRO designs its programs to complement those of the Institute, and ensures through consultation that there is no duplication. In relation to the funding schemes the Rural Industry Research Funds and the National Energy Research Development and Demonstration Council - CSIRO endeavours to maintain an appropriate balance between the discharge of its own responsibilities and cooperation with the aims of the Funds. It does this by submitting research proposals and carrying out approved projects on behalf of the Funds while supporting the core of its research activities in the relevant area out of funds appropriated directly to the Organization. Within this framework, the involvement of granting bodies is welcomed both for the extra support they provide for individual projects and the inputs they can make generally to the formulation of CSIRO's core research activities by identifying needs.

The area of human medicine presents special problems in delineating CSIRO's area of responsibility. The mechanisms and policies that have been established are discussed in Chapter 5. Briefly, however, CSIRO includes basic biological sciences and human nutrition within its purview, but excludes work involving clinical medicine.

The role of ASTEC, the Australian Science and Technology Council, is also relevant in this context. ASTEC has a responsibility to provide advice which will assist the Government in encouraging Australian science and technology to meet the nation's needs and objectives. CSIRO sees no conflict between this and its own role of planning research on behalf of the Commonwealth because ASTEC has no executive responsibilities. Advice from ASTEC does, of course, form a helpful input to the planning process, particularly in the identification of national needs and their relative priorities. ASTEC has observer status on the CSIRO Advisory Council and the roles of the two bodies in this area are seen as complementary.

With the exclusion of work in the first of the above set of areas, therefore, and subject to conventions and understandings with other institutions, CSIRO accepts within its main role a responsibility to provide comprehensively for strategic research on behalf of the Commonwealth.

#### **Primary function**

It follows that function (a) — the carrying out of scientific research for the purposes specified — is prime amongst the functions of CSIRO. All governing bodies of CSIR and CSIRO have taken this view with the support of successive Commonwealth Governments. The Independent Inquiry and the subsequent Government decisions reaffirmed the position. Policies relating to the ancillary functions listed in section 9 of the Act are discussed later in this chapter.

Policy matters to be dealt with in connection with the primary function are:

- . fields of science
- . kinds of research
- . research management.

### Fields of science

It is the policy of the Executive that the natural sciences, physical and biological, should continue to form the basis of the Organization's research activities. The span of responsibility which the Executive can reasonably discharge would be overextended if it endeavoured to cover areas such as the human behavioural sciences. It believes that the discharge of the Commonwealth's responsibilities in these areas should be entrusted to other bodies, for example, the Australian Institute of Aboriginal Studies, the Australian Institute of Criminology, the Law Reform Commission and the Bureau of Transport Economics.

This policy is directed to the fields of science involved in CSIRO's primary research activities. This does not mean that inputs from areas of knowledge outside the natural sciences should be excluded. On the contrary, such inputs are essential to the definition, conduct and evaluation of much of the Organization's work. Where necessary, the Organization will undertake limited investigations in the fields of social science to enable it to carry out its primary research function more effectively or to assist in the discharge of its responsibility to facilitate the implementation of its research results. Examples include examination of home purchasing decisions to assist in the definition of building research programs and studies directed to promoting innovation in rural industries.

#### Strategic research

The term used in this report to describe the research that forms the mainspring of CSIRO's activity is strategic research. The characteristics are, firstly, that it is undertaken for a purpose listed in function (a), and secondly, that it usually involves work at the boundaries of scientific knowledge. It includes fundamental work in areas of major importance to the Australian economy and our national and international obligations, and the application of advanced scientific knowledge and techniques to the solution of defined national problems.

The central importance of this work in the role of CSIRO derives largely from the free-enterprise nature of the Australian economy and the federal structure of our political system.

In its White Paper on Manufacturing Industry (May 1977), the Government restated its general position regarding the principles underlying our economic system:

'The market mechanism, operating through the decisions of consumers and of public and private enterprises, remains and should remain the principal determinant of the allocation of resources within the Australian economy.'

In planning and executing scientific research on behalf of the Commonwealth, CSIRO confines itself to activities appropriately performed by the public sector in the Australian environment. In the main, these activities can be described as providing identifiable and important benefits to the nation which would not be provided by the ordinary operations of our market economy.

The second of the two factors mentioned is Australia's federal political structure. The Australian Constitution makes very few matters the exclusive preserve of the Commonwealth. In most areas the picture is one of shared responsibility, and this is true also of scientific research. The division of responsibility between the Commonwealth and State Governments is therefore primarily a matter of political agreement and convention, and as such tends to be variable and blurred. In general, however, the Commonwealth assumes major responsibility for matters of national significance. From the standpoint of scientific research these include matters affecting a number of States or involving relationships with other countries, or potentially having a significant effect on the national economy, or involving national and international scientific obligations. In the context of rural research, the following agreement with State Directors of Agriculture was reached in 1927:

'The field for the investigation of agricultural problems is almost unlimited in scope. In this field there are many problems which are regional or national in range or scope, fundamental in character, and which require concentration of effort and highly specialized research for their solution. These problems are specially suited for research by the Commonwealth.'

While this resolution requires some modification in the light of the much improved resources of the State Governments to conduct agricultural research, it still broadly represents the distribution of effort which has retained acceptance over the years, and has served as a model for areas other than agriculture.

The Commonwealth's role in scientific research therefore properly tends to be concentrated towards work of broad application, and hence towards work at the more fundamental end of the research and development spectrum.

Taking the major category of work in support of economic growth, the Commonwealth does not take upon itself the task of performing research and development which could and should be undertaken by industry. Instead it has, through CSIRO, concentrated its efforts on infrastructure support for industry, such as physical standards, plant and animal biology, physical and chemical processes, and properties of materials. Research is aimed at benefiting wide sections of industry and as such tends not to be of a kind which could be undertaken profitably by individual companies.

Similar conclusions for other broad categories of work flow from consideration of the implications of Australia's federal system, for example, work on conservation of the natural environment, human health and fundamental science.

In short, the main part of the Commonwealth's, and hence CSIRO's, research effort should be in what the Independent Inquiry into CSIRO termed strategic missionoriented work. 'Mission-oriented', in this context, means research undertaken in pursuit of a stated national-interest objective, and 'strategic' means work tending towards the basic or fundamental end of the research and development spectrum.

These considerations do not give rise to crisp definitions of appropriate areas of responsibility for CSIRO, but they are essential to answering often-raised questions as to why CSIRO is not doing more for this or that particular industry or public cause. The answer very often is that, given the structure of our economy, the responsibility rests with industry itself. Similarly, the States have roles and it is not appropriate for the Commonwealth to undertake every project with a public-interest component.

#### Research management

Three aspects of research management of special importance are:

- proportion of intra-mural effort
- . employment of staff
- . definition and review of programs

#### Proportion of intra-mural effort

As mentioned earlier, CSIRO had its origins at a time when Australia's scientific research capabilities were in their infancy, and the Organization had to build up those resources itself by employing scientific staff and establishing its own laboratories. The policy of the Organization has always been that its work should be carried out whereever it can be done most efficiently. There is, therefore, no objection in principle to the contracting of work out to other institutions. In fact, the Organization positively encourages this through the administration of an internal fund directed specifically to that purpose. But in the main, application of the policy has resulted in most of those resources being deployed within CSIRO.

From time to time questions are raised regarding the appropriateness of this result, especially when comparisons are made between Australia and other countries. It is not possible, of course, to deal with the question without acknowledging the fact of CSIRO's existence and all that flows from that fact. Accepting this, however, a question still remains as to whether the Executive should pursue a course directed to a substantial shift in the distribution between intra-mural and extra-mural work. The Executive is presently considering this question, and it is hoped that the outcome will be available for the next annual report. To comply with the new reporting requirement, however, a brief outline of the policy current at the beginning of the year follows.

The belief of CSIRO has been that no valid reasons exist which necessitate a radical departure from the principle of maximizing value for money in the allocation of available funds. Research of the kind properly undertaken by CSIRO does not typically lend itself to arm's length contracts. Strategic research is characterized by unknowns, and control must be exercised by supervision rather than through the specification of performance related to predictable outcomes.

The Organization is also conscious of the need to avoid distorting the proper roles of firms and other institutions. The research capabilities of firms should be designed to match their own research requirements. Excess capacity can be utilized by Government contract work, but this should remain secondary. The Executive has not believed it appropriate to build up research resources in industry matched to CSIRO's needs and dependent upon CSIRO for continuing financial support. It has taken the view that individual firms should assume primary responsibility for their own research needs, and that appropriate industry-wide needs should be met by the formation of research associations. The Industrial Research and Development Incentive Scheme exists to subsidize firms in respect of their own research, and CSIRO makes grants to research associations. These are discussed in more detail later in this chapter.

Similarly, tertiary-education institutions

have the training of students as their main role, and research done in support of this role has traditionally — and quite properly been free from direction by outsiders. In the main, therefore, CSIRO practice has been to make funds available to universities in the form of grants rather than contracts. Such grants have been made where the interests of CSIRO and a university coincide, and up to now the opportunities presented have been limited.

CSIRO has not, therefore, seen a need to divert resources away from the generation of research results and towards the subsidization of R & D activities in firms and tertiary-education institutions. The Independent Inquiry and the Government supported the maintenance of CSIRO as a predominantly in-house research body, but did implicitly emphasize the need for CSIRO to ensure that it abides by its own policy of having work done where it can be done most efficiently. A specific area nominated for inquiry related to the Organization's engineering requirements, and these are being investigated in the context of the review mentioned at the beginning of this section.

#### The employment of staff

The continuing need for CSIRO to carry out research within its own laboratories rather than have it performed elsewhere has considerably influenced the development of staffing policies. The key ingredient in maintaining and promoting the creativity essential to good research is the development of an appropriate intellectual environment. Creativity must be fostered, and where appropriate, harnessed. It cannot be commanded into existence.

In developing staffing policies matched to the needs of research CSIRO has sought deliberately to protect and encourage the natural creativity of its research staff. The main characteristics of the policy are:

the professional responsibility of research leaders is respected and developed by devolving to them as much decisionmaking authority in respect of their programs as possible, consistent with CSIRO's other responsibilities;

- a career in scientific research is offered to the majority of staff with proven capacity;
- within the general career framework, a policy of term appointments is administered with the aim of promoting flexibility, a more youthful workforce and a flow of new ideas;
- advancement is largely based on merit and not dependent upon vacancies occurring in a hierarchical structure;
- merit is reviewed annually, the most important factors being the assessment of the officer's achievement by his peers through the mechanism of publication in the scientific literature, the opinion of the Chief or Officer-in-Charge and, increasingly, the value of the officer's contribution to industry and the community through the implementation of the results of research.

A merit promotion system is also applied to scientific and technical support staff. Administrative staff are subject to a positional system similar to that obtaining in the Australian Public Service.

#### Definition and review of programs

The initiative for defining CSIRO's research programs rests primarily with the research staff, partly for reasons discussed in the previous sections, but also because of the nature of the work. Strategic research by its nature cannot be planned in detail from above and passed to a workforce for execution. The knowledge necessary to plan the work effectively is very often possessed only by the scientist involved, and even then, planning may need to be very flexible given the uncertainties inherent in investigations involving new knowledge.

Broad areas of research, commensurate with the scope of work that would be undertaken by a whole Division or Unit of CSIRO, are defined by the Executive. Within these broad areas, programs are defined and refined as part of CSIRO's annual budgeting cycle. Three-year, and sometimes longer-term, research strategies are prepared for indicative planning purposes. The Executive expects programs to be formulated within the context of full consultation with all appropriate interests. Additionally, it influences programs itself in the light of its own contacts with industry and Government. The Executive also executes a program of Divisional and subject reviews. Committees of inquiry are established with suitable outside representation and with wide-ranging terms of reference. The Divisional reviews are now timed to occur a year or so before the end of the term of appointment of a Chief of a Division, and are designed to ensure that major re-orientations take place where necessary. Subject reviews fall across Divisional boundaries, and are usually directed to identifying research needs and appropriate programs for a sector of industry or a significant part of a sector.

The consultative and review procedures employed by CSIRO do not yet reflect the new roles of the Advisory Council and State Committees described in Chapter 1. Membership of the Advisory Council is reported on in Chapter 6, but the reconstituted body had not met by the close of the reporting year. It is expected that revised procedures will be reported upon in the next annual report.

Following the Independent Inquiry, the Executive also established a Planning and Evaluation Advisory Unit with broad terms of reference, including a responsibility for providing advice to the Executive on priorities for research.

Application of these principles has led to the distribution of CSIRO's research effort summarized in the next chapter, and set out in more detail in the publication *CSIRO Research Programs 1979/80.* 

### Ancillary functions

The main role and the primary function of CSIRO were set out earlier. This section deals with functions (b) to (j) in section 9 of the Act (see page 14). Each of these functions is ancillary to the primary function either by explicit provision in the Act or by interpretation. Functions (b) and (e) are ancillary by explicit provision: the function of implementing research results is limited to those arising from research carried out under function (a); and fellowships, studentships and grants-in-aid must be for a purpose covered by function (a). The remaining functions - overseas scientific liaison, research association support, maintenance of measurement standards. and publication and dissemination of scientific information – are ancillary either because they may be performed satisfactorily with relatively modest funding, or because they have assumed lower priority than research in competing for the funds available. Function (h)- the collection, interpretation and dissemination of information relating to scientific and technical matters - is ancillary in the sense that the information service maintained by CSIRO is tailored to the support of research under function (a), and services provided outside this are currently limited to those requiring comparatively modest resources. Policy summaries in respect of each of these functions follow:

# '(b) to encourage or facilitate the application or utilization of the results of such research'

While the main function of CSIRO is the generation of scientific and technical knowledge based on research, the Organization also has a responsibility to carry work forward to a point where it can reasonably leave further development to potential users. In doing this

it must balance two public-interest considerations. The first is that CSIRO should not do industry's job. To do this would inhibit industry from assuming its proper role, and, moreover, raise equity problems in the allocation of public funds. On the other hand, CSIRO must ensure that potential public benefits associated with its work are realized. The Executive monitors this balance through the review mechanisms described earlier in connection with its primary research function. The emphasis on publication inherent in these mechanisms tends automatically to limit encroachment upon industry's preserve. Special cases do, of course, exist where the national interest requires that normal boundaries are over-stepped in order to meet a pressing need.

Publication is central to the functioning of CSIRO. It constitutes a primary mechanism for facilitating the application of the results of research, and a research program is not considered complete until the results are published in an appropriate scientific journal for peer review. In addition, CSIRO takes positive steps to transmit research results to potential users who cannot be reached through the ordinary processes of dissemination through the scientific literature. Where appropriate, findings are interpreted in terms meaningful to end users and made available for publication in the mass media and specialist trade publications. A number of magazines, booklets, pamphlets and the like are produced directly by CSIRO. The content of these publications is confined in the main to matters connected with CSIRO research activities

Where research results lend themselves to protection under the patent laws, and publication in the normal way would fail to secure satisfactory implementation of the results, patent and licensing action is undertaken. Policies relating to such action are covered in more detail in Chapter 5.

Contracting of work to industry is also used on occasion to facilitate the implementation of research results. This usage is distinct from the letting of a contract to secure the most efficient way of getting work done. The objective is to interest a firm in an innovation and develop its expertise by offering a financial incentive. Such a procedure is normally seen only as a last resort. Executive policy is to favour collaborative arrangements because typically they involve a substantial input of resources by a firm, and hence a judgment in support of the project from a market perspective. Other mechanisms, notably the Industrial Research and Development Incentives Scheme. exist to stimulate interest within industry in research and development generally and to promote the acquisition of technical expertise. CSIRO does not see itself as having a responsibility to duplicate these mechanisms.

'(c) to act as a means of liaison between Australia and other countries in matters connected with scientific research'

Scientific research is an international activity.Advances in research depend heavily on the free flow of information between scientists collaborating in different parts of the world. It has been estimated that Australia contributes somewhere between 1 per cent and 2 per cent of the world's scientific effort. Access to the other 98 per cent or more is therefore vital to the most efficient use of Australian scientific resources. The exchange of ideas and knowledge between CSIRO scientists and the scientists of other countries is an integral part of the Organization's research activities. It is the policy of the Executive to encourage its research staff to develop the closest possible ties with the international scientific community consistent with the constraints imposed by the need for economy in the operations of the Organization.

A comprehensive and up-to-date collection of the world's scientific literature is maintained in those fields of science related to CSIRO's research activities. CSIRO scientists are encouraged to submit papers based on their work for publication in scientific journals of the highest standing around the world. Visits from overseas scientists are encouraged, and in appropriate cases, international conferences in Australia are sponsored. CSIRO scientists are provided with opportunities to visit laboratories, attend conferences and inspect industries overseas.

In performing this function the Executive complies with the procedures and recommendations administered by the Oversea Visits Committee. A ceiling of 120 visits was placed on CSIRO under these arrangements for the reporting year, and this quota was filled. The arrangements apply to visits where funds appropriated to CSIRO are used for fares, allowances or other non-salary expenses. In addition to these visits covered by the CSIRO quota, a substantial number of visits were made by CSIRO staff on duty but outside these arrangements. Approvals were also given to officers overseas on other business to return to duty for limited periods.

The Organization also maintains scientific liaison offices in London, Washington, Tokyo and Moscow. The London and Washington offices are involved in recruitment for CSIRO and support for its studentship holders. Together with the offices in Tokyo and Moscow, they gather information for the Organization's scientific information network serving CSIRO and the broader Australian scientific community and public. Each office has assumed an increasing number of tasks on behalf of other Government agencies, including the provision of advice and representation at scientific meetings. The scientific liaison offices also facilitate contact between individual scientists by helping to arrange meetings and travel for Australian scientists overseas.

Scientists coming from overseas to work in CSIRO laboratories provide an especially valuable form of liaison. About 50 scientists come each year to work for terms up to one year. A smaller number come on term appointments of up to three years' duration.

Many trainees from overseas countries are placed in CSIRO each year through aid arrangements such as the Colombo Plan. CSIRO is also involved in development assistance projects in the South-East Asian, Pacific and Middle East regions sponsored by the Australian Development Assistance Bureau of the Department of Foreign Affairs. CSIRO advisers and consultants are also seconded overseas, and within a typical year about 45 CSIRO staff engage in aid assignments.

'(d) to train, and to assist in the training of, research workers in the field of science and to cooperate with tertiary-education institutions in relation to education in that field'

Universities and other institutions now provide very effectively for the basic training of scientific research workers in Australia. CSIRO does not, therefore, devote significant resources to such training. Aside from the development of research skills where necessary amongst its own staff, CSIRO's main activities under this function are the training of research workers from overseas as part of Australia's assistance program, and limited involvement in lecturing and the supervision of tertiary students. About 20 per cent of CSIRO's research staff have teaching ties of this nature with universities. The Executive also provides advice upon request

to universities on such matters as course content and projections of future needs for research workers in various disciplines.

'(e) to establish and award fellowships and studentships for research, and to make grants in aid of research, for the purpose referred to in paragraph (a)'

CSIRO awards between 15 and 20 postdoctoral studentships each year to applicants exhibiting outstanding ability and wishing to pursue research in an area of special interest to CSIRO. Recipients are encouraged to pursue their studies in Australia and ultimately to seek employment in Australia. A total of up to about five awards are also made to CSIRO officers each year to allow them to complete masters or doctors degrees in areas of special interest to their Division.

Numbers of grants of up to about \$20,000 are also made to universities, colleges of advanced education and institutes of technology each year to promote research in areas related to CSIRO's programs. Grants totalling \$300,000 were made in the last year. A further \$65,000 was contributed to the Radio Research Board and \$15,000 to the Electrical Research Board to support research in tertiary institutions.

'(f) to recognize associations of persons engaged in industry for the purpose of carrying out industrial scientific research and to cooperate with, and make grants to, such associations'

Research associations are usually established with the primary aim of providing to a group of firms a capacity for scientific research and related services beyond that which it would be economic for the firms to create individually. They play an important role in both the formulation of industry research requirements and in arranging for work to be carried out. CSIRO provides scientific and technical support to the associations and, in turn, the associations assist CSIRO in fulfilling its responsibilities to carry out research to assist industry, and to encourage application of the results.

CSIRO maintains close contact with the five associations recognized under the Act both at a working level and by representation on their Boards of Management. The policy regarding the formation of these associations has been that the initiative should come from industry. This policy is presently under review.

CSIRO also assists research associations by making grants for the general support of their activities. The Independent Inquiry recommended that CSIRO's funding role should be transferred to another agency. This matter is also under review.

'(g) to establish, develop and maintain standards of measurement and physical quantities and, in relation to those standards –

- (i) to promote their use;
- (ii) to promote, and participate in, the development of calibration with respect to them; and
- (iii) to take any other action with respect to them that the Executive thinks fit'

The great bulk of the Organization's work in connection with standards of measurement is research carried out under function (a). There is, however, a significant role played by CSIRO in support of legal units of measurement in Australia. These units are based upon a set of physical standards maintained by CSIRO in accordance with its obligations under the Weights and Measures (National Standards) Act 1960. In performing this function, CSIRO responds to the requirements of the National Standards Commission, established under the Weights and Measures (National Standards) Act, and upon which CSIRO is represented. A calibration service for

reference standards used in industry is provided. For more general testing, industry is encouraged to set up its own facilities as far as possible.

CSIRO also promotes and encourages standardization and the establishment of standards through its extensive support for NATA and SAA— the National Association of Testing Authorities, and the Standards Association of Australia.

'(b) to collect, interpret and disseminate information relating to scientific and technical matters'

CSIRO adopts two main lines of approach to its responsibilities under this function.

Individual scientists in CSIRO are highly versed in the scientific disciplines required for their research and they are encouraged to apply this knowledge to the solution of problems raised in inquiries from industry and, in some areas, the general public. Answers to straightforward requests for information and minor consultations are frequently quite informal and often given over the telephone. The provision of assistance placing substantial demands on an officer's time is, however, usually formalized and charged for at commercial rates. In fulfilling this role the Organization pursues a policy of encouraging the growth of private-enterprise consultants. Wherever possible, the Organization works through private consultants or research associations by providing them with scientific and technical support so that they can provide the necessary service to end users. In areas where the demand for information is high, professional information services are established centrally or in research Divisions.

The Organization also maintains a comprehensive library system to support the research work forming its major role. Present policy is that where this system can be made available to a wider group of users without the commitment of substantial resources, access is provided. CSIRO has not undertaken the role of a national scientific library, but it cooperates with existing library services and makes its resources available where it is in the best position to meet national needs.

The Organization's policies relating to this function are presently under review in the light of the Government's decision that the activities should be strengthened.

# *(j) to publish scientific and technical reports, periodicals and papers'*

A major responsibility of CSIRO is the communication of the results of its own research to potential users in Australia. Publication for this purpose has already been described in relation to function (b) the implementation of research results. The Organization also engages in publishing activities beyond those necessary to fulfil its implementation function.

The main activity under this heading is the publication of the Australian Journals of Scientific Research. The Journals are produced by CSIRO in collaboration with the Australian Academy of Science. There are nine journals in this series, covering Agricultural Research, Biological Sciences, Botany, Chemistry, Marine and Freshwater Research, Physics, Plant Physiology, Soil Research and Zoology. The primary reason for undertaking these publishing activities is to provide a service to Australian science and about two-thirds of the papers in the Australian Journals of Scientific Research are by non-CSIRO scientists. Charges are set at a level designed to recoup production costs in accordance with the formula used by the Australian Government Publishing Service. The role and scope of the Journals are currently under review.

#### Conclusion

The main purpose of this chapter has been to present a broad overview of the policies of CSIRO, with emphasis both on the way that the Organization's statutory functions have been interpreted and put into practice and on policies underlying the allocation of resources appropriated to the Organization. This course has been pursued with the intention that succeeding annual reports will progressively complete the picture. The aim of the Executive in future reports will be to explain in greater detail the reasons behind the allocation of research resources, with main emphasis on developing trends.

To comply with the new reporting requirement placed upon the Organization by sub-section 57 (2) of the Act, the Executive believes that it should now also present a statement of the current allocation of resources to research program objectives. This appears in the next chapter. The new statutory obligation to report on policy developments during the reporting year is the subject of Chapters 4 and 5.

# 3. Distribution of research effort

Chapter 2 described the functions of CSIRO and the broad principles underlying the allocation of resources between and within those functions. This chapter describes the allocation of resources to the Organization's research activities.

This is done in two ways. Table 1 shows the distribution of effort in relation to the research purposes specified in paragraph 9(a) of the Science and Industry Research Act. Table 2 shows the distribution in relation to the five research Institutes of the Organization, and also in relation to their component Divisions and Units. Table 2 is intended to be read in conjunction with the objectives and fields of research of the Institutes, Divisions and Units set out later in this chapter.

A more detailed account of CSIRO's research objectives may be found in the publication *CSIRO Research Programs 1979/80.* Detailed expenditure figures for Divisions and Units are provided in Chapter 9 of this report.

Table 1 categorizes CSIRO research programs according to the primary purposes for which they were carried out, that is,

- . to assist industry;
- . to further community interests;
- . to contribute to the achievement of national objectives or the performance of the national or international responsibilities of the Commonwealth.

Research in support of Australian industry has been analysed using industry categories based on the Australian Standard Industrial Classification. Other research has been categorized in terms of knowledge of our environment, human health, and Australia's international responsibilities. The last category includes radioastronomy and work at the Centre for Animal Research and Development at Ciawi, near Bogor, Indonesia.

Each research program conducted by CSIRO during 1978/79 has been allocated

to one of these categories. The nature of strategic research means that this allocation requires careful interpretation because such research can benefit a number of different industries simultaneously and provide other community benefits as well. Apportionment in terms of likely outcomes spanning two or more categories has not been attempted. To illustrate, programs included in the figure for the energy industry (4.6 per cent) relate only to programs concerned with production or gener-

#### TABLE 1

Rural industries	
Crops and pastures	18.4
Livestock	12.6
Forestry	2.7
Fishing	3.0
	36.7%

#### Mineral, energy and water resources

Minerals	5.3
Energy	4.6
Water	1.7
	11.6%

Manufacturing industries

Food processing	4.8
Textile and clothing	4.8
Forest products	1.9
Metal products	2.3
Other manufacturing	3.7
Standards	5.8
	23.3%

**Community** services

Service industries	8.4	
Environment	12.5	
Human health	3.0	
International responsibilities	4.5	
		28.4%

# TABLE 2

Institute of A	Animal and Food Sciences		
Division o	f Animal Health	4.6	
"	Animal Production	5.4	
"	Food Research	4.9	
"	Human Nutrition	1.2	
Centre for	Animal Research and Developm	ent 1.8	
Molecular	and Cellular Biology Unit	0.9	
Wheat Res	search Unit	0.2	
			19.0%
Institute of E	Biological Resources		
Division o	f Entomology	5.3	
"	Fisheries and Oceanography	4.6	
"	Forest Research	3.1	
**	Horticultural Research	1.1	
"	Irrigation Research	1.0	
,,	Plant Industry	5.6	
,,	Tropical Crops and Pastures	4.2	
"	Wildlife Research	2.0	
			26.9%
Institute of E	arth Resources		
Division of	f Applied Geomechanics	1.5	
"	Land Resources Management	2.8	
"	Land Use Research	2.3	
Minerals R	Research Laboratories	8.4	
Division o	f Soils	3.0	
			18.0%
Institute of In	ndustrial Technology		
Division o	f Applied Organic Chemistry	1.9	
**	Building Research	3.7	
,,	Chemical Technology	1.9	
,,	Mechanical Engineering	1.5	
"	Protein Chemistry	2.0	
,,	Textile Industry	2.9	
**	Textile Physics	2.0	
			15.9%
Institute of P	hysical Sciences		
Division o	f Applied Physics	5.9	
"	Atmospheric Physics	1.6	
"	Chemical Physics	1.7	
,,	Cloud Physics	1.1	
"	Computing Research	2.0	
"	Environmental Mechanics	0.5	
,,	Materials Science	2.3	
"	Mathematics and Statistics	1.7	
"	Radiophysics	3.1	
Australian Numerical Meteorology			
Research	h Centre	0.3	
			20.2%
		Total	100%

ation of energy from existing and new energy sources, together with general aspects of energy conservation. Research on energy conservation that is related specifically to, say, the building industry is included under service industries. The total amount of energy research being carried out by the Organization cannot therefore be determined by looking only at the category labelled energy. Subject to the uncertainties mentioned above, the energy total is estimated at 7.5 per cent of CSIRO's total research expenditure.

The percentages in Table 1 have been calculated by summing 1978/79 research expenditures relating to the programs allocated to each of the categories, and expressing these sub-totals as percentages of total CSIRO expenditure. The figures cover all sources of funds under CSIRO control; they include industry and other contributory funds, but exclude funds expended by other Commonwealth departments on behalf of the Organization. The expenditure figures include all research support and overheads.

The second table in this chapter presents the distribution of research effort between the CSIRO Institutes and their component Divisions and Units. The figures have been calculated using figures for 1978/79 expenditure subject to the same inclusions and exclusions listed above.

### Fields of research

The broad objectives and fields of research of the various CSIRO Institutes and their component Divisions and Units are given below.

# INSTITUTE OF ANIMAL AND FOOD SCIENCES

# Composition:

Division of Animal Health Division of Animal Production Division of Food Research Division of Human Nutrition Centre for Animal Research and Development

# Molecular and Cellular Biology Unit Wheat Research Unit

The Institute conducts scientific and technological research aimed at improving the efficiency of livestock production and the quality and safety of human foods, and obtaining a better understanding of the relationships between human diet and health.

The Institute's research includes work on:

- . control of animal diseases;
- nutrition, reproduction, genetics and management of livestock;
- . methods of processing, handling and storing meat, fish, dairy foods, fruit, vegetables and grain;
- . identification of nutritive imbalances and deficiencies in the Australian population and investigation of their effect on human health;
- . application of molecular and cellular biology to problems in the livestock and pharmaceutical industries.

#### ANIMAL HEALTH

The Division's research on health aspects of animal production is directed mainly to problems of the grazing sheep and cattle industries, although some deals with problems of the poultry and pig industries. Most of the work aims at resolving aspects of bacterial, viral and parasitic diseases of sheep and cattle. More basic studies are concerned with assessing the potential of genetic selection for disease control, especially control of internal parasites of sheep and cattle. The Division is also involved in immunological studies aimed at improving vaccines and vaccination procedures.

#### ANIMAL PRODUCTION

The Division aims at assisting the animal industries by providing new and improved technologies offering significant gains in efficiency of livestock production. Its short- and long-term research is mainly in the fields of nutrition, reproduction, genetics and livestock management.

#### FOOD RESEARCH

The Division's research relates to maintenance of the quality of meat, fish, dairy, fruit and vegetable foods throughout the chain of events from production to consumption. Microbiological safety, nutritional value, flavour and appearance are among the aspects of quality involved. Processing and storage methods are examined with a view not only to improving final quality, but also to avoiding or utilizing wastes and reducing the energy and labour costs of processing and handling.

#### HUMAN NUTRITION

The Division studies nutritional processes with a view to identifying the existence and health consequences of nutritive imbalances and deficiencies in Australian diets. Its research includes experimental studies in inorganic nutrition and in metabolism and digestion, and epidemiological and behavioural studies with emphasis on the relations between nutrition, life-style and human health.

### CENTRE FOR ANIMAL

RESEARCH AND DEVELOPMENT The Centre is a joint Indonesian-Australian project conducted by CSIRO on behalf of the Australian Development Assistance Bureau (ADAB). The object is the establishment of a new animal research laboratory and associated buildings, conducive to problem-solving research of the highest standard, with the long-term view of staffing it fully with Indonesian scientists trained to carry out first-class research. The Centre's research aims at increasing the productivity of chickens, ducks, sheep, goats, cattle and buffaloes in Indonesia. It is concentrated on nutrition, reproduction and genetics.

MOLECULAR AND CELLULAR BIOLOGY The Unit's research is concerned with the molecular evolution of influenza virus, DNA breakage and repair and its application to the development of new antibiotic systems, and mechanisms of differentiation in animal cells and the properties of differentiation factors.

### WHEAT RESEARCH

The Unit's research aims at elucidating the chemical, biochemical and physical factors governing the quality, processing properties and marketability of wheat and wheaten products. Particular emphasis is placed on studies of wheat proteins, quantitative methods for estimating important quality factors and the chemical structure of wheat gluten. Where it is considered relevant, studies, usually in collaboration with other workers, are extended to other cereals, including barley, rice and oats.

# INSTITUTE OF BIOLOGICAL RESOURCES

# Composition:

Division of Entomology Division of Fisheries and Oceanography Division of Forest Research Division of Horticultural Research Division of Irrigation Research Division of Plant Industry Division of Tropical Crops and Pastures Division of Wildlife Research

The Institute conducts scientific and technological research aimed at improving the management and productivity of Australia's agricultural, forestry and fisheries resources and the management and conservation of Australian ecosystems.

The Institute's activities include research on:

- . application of the plant sciences to the management and utilization of crops, pastures, forests and native ecosystems;
- . introduction, selection and breeding of plant material as a basis for developing new and improved varieties of crop and pasture plants and forest trees;
- . control of insect pests of plants and animals, and of weeds and plant diseases, with particular emphasis on biological control;

- . biology of native and introduced birds and mammals in the context of pest control and conservation;
- . oceanography of Australia's coastal and oceanic waters;
- . biology of the major fisheries and its application to the development of improved methods of management.

### ENTOMOLOGY

The Division carries out wide-ranging biological and chemical research aimed at elucidating the roles that insects play in the balance of life. The knowledge gained is applied to the control of major insect pests and to the solution of other entomological problems. Other applications include the biological control of land and water weeds.

### FISHERIES AND OCEANOGRAPHY

The Division investigates the ecology of marine populations and applies the knowledge gained to the development of management strategies for harvestable resources such as lobsters, prawns and fish. Studies of the biological, chemical and physical oceanography of coastal and oceanic waters aim at providing an understanding of their dynamical behaviour, productivity, sensitivity to pollutants and general ecology.

# FOREST RESEARCH

The Division is concerned with the long-term use of Australian forests—both conifer plantations and the native eucalypt forests for wood production, water supply, wildlife conservation and recreation. Broad areas of research include harvesting, genetics and tree breeding, taxonomy, ecology, forest protection (from fire, disease and insect pests) and forest assessment.

#### HORTICULTURAL RESEARCH

The Division's research aims at increasing understanding of the complexities of vegetative growth, flowering and fruit development in a range of perennial horticultural crops. This work includes investigation of disorders caused by plant nematodes and viruses. Applied projects include: the breeding of wine and drying grape varieties, and avocados, better adapted to Australian conditions; the introduction and selection of new fruit crops such as pistachios, mangoes and guavas; and the domestication of some Australian native plants. The Division also studies the management of grapevines and fruit trees and the effects of salinity on plant growth.

### IRRIGATION RESEARCH

The general concern of this Division is to improve production of irrigated crops. Broad areas of research include water management for efficient irrigation, development of ecologically sound methods for waste-water utilization, alleviation of root-zone problems associated with rising saline groundwater, studies of irrigated crop nutrition with particular emphasis on nitrogen utilization, breeding of oilseed crops, and development of energy-saving methods for greenhouse cropping.

#### PLANT INDUSTRY

The Division is concerned with improving agricultural production through research in the plant sciences, including plant breeding and plant introduction, biochemistry and physiology, nutrition and microbiology, and with developing new and existing crops, pastures and agricultural practices to meet both current and future requirements in Australia. The Division is also a major centre for research on the Australian flora, its taxonomy, ecology and management.

TROPICAL CROPS AND PASTURES The Division conducts research on field crops and pastures in tropical Australia, broadly defined as the lands north of 30<sup>o</sup>S latitude but excluding the arid zone. In pasture research, the emphasis is on beef production. The central aim is development of new legume-based pastures, together with definition of the effects of environment and management on their growth and productivity. The Division's irrigated and dryland crop research is mainly concerned with developing grain-legume and fibre crops that are new to Australian agriculture, and improving the performance of grain sorghum and soybeans at lower latitudes.

### WILDLIFE RESEARCH

The primary concern of the Division is the biology of birds and mammals, both native and introduced, in relation to pest control and conservation. The general objects of the research are to study the status and basic biology of species and their interaction with their environments to provide information about fundamental principles in animal ecology, behaviour and physiology, and to show how this knowledge may be applied in the management of wildlife populations.

# **INSTITUTE OF EARTH RESOURCES**

Composition:

Division of Applied Geomechanics Division of Land Resources Management Division of Land Use Research Division of Mineral Chemistry Division of Mineral Engineering Division of Mineral Opy Division of Mineral Physics Division of Process Technology Division of Soils Fuel Geoscience Unit Physical Technology Unit

The Institute conducts scientific and technological research relating to the more effective definition, utilization and management of Australia's resources – atmospheric, land, water, mineral and energy.

The Institute's activities include research on:

- . evaluating, locating, defining and characterizing Australia's earth resources;
- . planning the recovery, development and effective use of Australia's earth

resources with minimum harm to the environment; the balanced management of Australia's earth resources for such uses as mining, agriculture, urban development and recreation.

#### APPLIED GEOMECHANICS

The aim of the Division's research is the development, from theoretical and practical studies, of methods for the identification and solution of selected mining and related problems.

LAND RESOURCES MANAGEMENT

The Division conducts research directed towards the better management of land and water resources. This includes investigations of environment and social implications of current and alternative management methods in pastoral, agricultural, forested and near-urban areas, and the development of methods for processing, appraising and communicating information to assist decision-makers.

#### LAND USE RESEARCH

The Division has the broad object of promoting better use of land and water resources in Australia. It provides the Commonwealth, State and local authorities responsible for national and regional land use decisions with improved methods of gathering, processing and utilizing information on resources. To this end, it is engaged in research concerned with resource surveys, resource evaluation for various possible uses, and resource allocation planning techniques. The research also includes investigations aimed at achieving a better understanding of relevant physical, biological and socio-economic processes.

# MINERAL CHEMISTRY

The Division's expertise is in physical and inorganic chemistry and extractive metallurgy. Its research aims at identifying and solving problems in the mineral industry and various other problemsrelated to energy, for example-that affect the community as a whole.

# MINERAL ENGINEERING

The Division conducts theoretical and practical studies aimed at developing methods for improving and controlling industrial processes. Particular emphasis is placed on processes used for the treatment and handling of ores and mineral products.

#### MINERALOGY

The Division uses its expertise in the geological sciences—particularly in geochemistry, mineralogy and petrology with the aim of solving problems encountered, or expected, in exploration for ore bodies and economic minerals.

# MINERAL PHYSICS

The Division's research is aimed at contributing to the efficient development of Australian earth resources through the solution of problems, particularly in the mineral industries, by the application of the fundamental principles of physics, engineering, mathematics and geology.

### PROCESS TECHNOLOGY

The Division uses its expertise in chemistry, physics and engineering to improve existing processes and develop new ones for the treatment of fossil fuels and minerals. It also seeks to elucidate and, where possible, ameliorate any adverse environmental consequences resulting from the production, treatment or use of these resources.

#### SOILS

The Division studies the physical, chemical, mineralogical and biological properties, and the geographical distribution, of Australian soils, and applies knowledge of the soils to solve problems in crop and pasture production. Its research also covers soil conservation and reclamation, and knowledge in this area is utilized as an aid in agricultural, urban and regional planning, and pollution control.

### FUEL GEOSCIENCE

The Unit's research in geology and materials science aims at improving methods of exploring for hydrocarbons and characterizing coal and oil shales. It also seeks to improve methods for extracting fossil fuels, assessing their suitability for various end uses and using them without deleterious environmental effects.

#### PHYSICAL TECHNOLOGY

The Unit's research is aimed at solving specific problems associated with the recovery and utilization of coals, the processing of minerals and the transport in inland waters of trace metals arising from mining activities.

# INSTITUTE OF INDUSTRIAL TECHNOLOGY

Composition:

Division of Applied Organic Chemistry Division of Building Research Division of Chemical Technology Division of Mechanical Engineering Division of Protein Chemistry Division of Textile Industry Division of Textile Physics

The Institute conducts scientific and technological research and development aimed at increasing the efficiency, competitiveness and scope of Australian secondary and tertiary industries in relation to both national and international markets.

The Institute's activities include research on:

- . water utilization and reclamation;
- . conservation of oil;
- . renewable sources of energy;
- novel processes and products for application in industry and agriculture;
- . utilization of forest resources;

- . building and design of urban communities;
- . safety and comfort both in domestic and industrial environments;
- . properties and usefulness of wool as a textile fibre.

APPLIED ORGANIC CHEMISTRY The Division's particular expertise is in organic chemistry, physical chemistry and surface and polymer science. Its activities are directed to developing alternative sources of energy, to studying the action of organic chemicals on biological systems in order to synthesize new pesticides and veterinary drugs, and to the design, synthesis and use of plastics materials with special structures for specific end uses in industry and commerce.

### **BUILDING RESEARCH**

Through research on materials, design, economic and energy constraints on building practice, social needs and other matters, the Division aims at improving the effectiveness and efficiency of the building and construction sector of the economy.

### CHEMICAL TECHNOLOGY

The Division applies chemical technology, particularly polymer technology, to developing ways to utilize wood, water and other resources, including various waste products, more effectively. Research areas include: the fractionation of plants to produce fibre, protein and other marketable products including liquid fuels; pulp- and papermanufacturing processes; the manufacture of building, packaging and other materials from cellulose and composites of cellulose and other substances; assessment of plant material for possible uses; technology for purifying and recycling water; and the use of biological systems for energy production.

# MECHANICAL ENGINEERING

The Division's engineering research is directed mainly towards the development and efficient harnessing of renewable energy resources, particularly solar energy; the efficient use of energy in transportation and in buildings; improvements to thermal and noise conditions in various living and working environments; and increased efficiency in the cultivation, harvesting and preservation of crops and the harvesting of trees.

# PROTEIN CHEMISTRY

Research in the Division is concerned with the structure, chemistry and biological activity of proteins. The knowledge gained and techniques developed are used to assist industries based on protein products such as wool, leather and seeds. The Division collaborates with other research laboratories, including Divisions of CSIRO, on problems of a biochemical or biophysical nature relating to animal and plant products.

# TEXTILE INDUSTRY

This Division's prime function is to improve the utilization of Australian wool in the world textile industry. The work includes studying the relation between the properties of fibres and their performance in textileprocessing, improving the operations involved in converting raw wool into a clean fibre ready for mill processing, developing improved techniques and equipment for the manufacture of yarns, fabrics and garments, devising procedures that reduce the environmental impact of textile-processing, and improving the performance of the final product. Some work is also being done on the testing and processing of Australian cotton.

# TEXTILE PHYSICS

This Division's research relates to all stages of the handling and utilization of wool, from the shearing shed to end use. In the raw wool area, major efforts are directed towards achieving economies in handling and marketing. Research on fabrics deals with physical properties and processes, such as flame retardance and coloration, that are important to the competitive position of wool.

### INSTITUTE OF PHYSICAL SCIENCES

Composition:

Division of Applied Physics Division of Atmospheric Physics Division of Chemical Physics Division of Cloud Physics Division of Computing Research Division of Environmental Mechanics Division of Materials Science Division of Mathematics and Statistics Division of Radiophysics Australian Numerical Meteorology Research Centre

The Institute conducts scientific and technological research in the physical, chemical and mathematical sciences aimed at meeting the needs of Australian industry and increasing understanding of the physical environment.

The Institute's activities include research on:

- . maintenance of the national standards of measurement;
- . development of scientific and industrial instrument techniques;
- . properties of industrial materials and development of improved materials and chemical and physical processes;
- . climate, weather and atmospheric pollution;
- . physics of soil, water, plant and atmospheric interactions;
- radiophysics and its application to astronomy, navigation and communications;
- . application of mathematics and statistics to problems in industry and science;
- . development of advanced computer operating systems and the provision of a central computing service.

### APPLIED PHYSICS

The Division undertakes research in applied physics related to problems in industry and

the community, and collaborates with industry in exploiting promising developments. An important part of its work is the maintenance of the Australian standards of measurement of physical quantities and the provision of means of relating measurements, made throughout Australia, to these. It takes part in international scientific activities in cooperation with national laboratories of other countries under the Metric Treaty, and with countries establishing their own standards. The Division also conducts research on the properties of materials and on the physics of the Sun and the Earth's atmosphere.

#### ATMOSPHERIC PHYSICS

The Division is primarily concerned with the physical and chemical atmospheric processes that underlie and control the weather and climate and are responsible for the distribution of airborne material, including gases—particularly those substances affecting our environment. Research is also conducted into aspects of the oceans that affect the atmosphere. Investigational methods used include field work, laboratory and numerical models and analyses of globally derived data.

#### CHEMICAL PHYSICS

The Division conducts research directed broadly towards the understanding of chemico-physical phenomena, and encompassing spectroscopy, diffraction studies and solid-state investigations. It seeks to exploit the results of this research in solving scientific and technological problems and promoting technological innovation, particularly in the area of scientific instruments and techniques.

#### CLOUD PHYSICS

The Division is concerned primarily with the atmospheric processes that govern cloud formation and the production of rain. Its research includes studies of the sub-microscopic particles upon which cloud droplets and ice crystals form. Man's activities often result in the production of large numbers of smoke and dust particles, and the Division is investigating whether these may affect weather and climate. The stimulation of rainfall by seeding clouds with small particles is another research activity.

#### COMPUTING RESEARCH

The Division provides advanced scientific and technical computing services for CSIRO Divisions, Government departments and some universities through the CSIRONET computing network. This links the central computer in Canberra with smaller computers in all State capitals and other cities in various parts of Australia. To improve the standard of service available, the Division conducts research concerned with the development and application of advanced computer-operating systems, picture processing and graphics, simulation languages and simulation techniques, and data-base management systems.

### ENVIRONMENTAL MECHANICS

The Division conducts physical investigations of energy exchange, heat and momentum transfer, and the movement of natural and introduced substances (for example, water, carbon dioxide, salts and fertilizers) in the environment, with special reference to plants, soils and the lower layers of the atmosphere. It applies results of these investigations to problems in agriculture, ecology, hydrology, meteorology and industrial processes. Investigations of mathematical aspects of ecology and geophysics are also carried out.

#### MATERIALS SCIENCE

The Division studies the properties, behaviour and utilization of industrially important materials based on metals, alloys, refractory oxides and ceramics. Its work covers the development of catalysts for the synthesis and processing of liquid and gaseous fuels, the development of materials of very high strength and resistance to severe environments, and the study and development of various industrial processes.

### MATHEMATICS AND STATISTICS

The Division develops mathematical models and statistical methods to solve problems arising in research in agriculture, biology, the environment, the physical sciences and industry. It provides advisory and consultative services on mathematical and statistical problems to other Divisions of CSIRO and outside bodies. The Division also conducts basic research in probability, statistics, applied mathematics and computational mathematics.

#### RADIOPHYSICS

The Division observes and interprets radio emissions from celestial objects and interstellar matter in order to contribute to knowledge of the physical processes occurrin occurring. This work is carried out in major research programs on cosmic and solar radio astronomy. As progress in these fields requires use of the most advanced observing instruments and techniques available, substantial research and development effort is devoted to technical innovation. A third research program draws on the Division's radio and electronic expertise to study problems of importance to industrial and government organizations.

# AUSTRALIAN NUMERICAL METEOROLOGY RESEARCH CENTRE

The Centre develops numerical models of the atmosphere and uses these to study the possible causes and nature of natural and man-induced climate changes and to improve the accuracy of Australian weather forecasts and extend the period for which they apply. The Centre is jointly sponsored by CSIRO and the Department of Science and the Environment.
### 4. Reviews

Regular reviews of CSIRO's research effort are conducted at Executive level. These include subject reviews, which are concerned with a subject area or discipline as a whole and which frequently span research activities in a number of different Divisions, and Divisional reviews, which involve an examination of the effectiveness and relevance of the research programs of an individual Division.

Reviews considered or initiated by the Executive during the year are discussed below. In addition, a subject review will commence shortly into ocean sciences. The Divisions of Radiophysics, Entomology, Wildlife, Forest Research and the Dairy Research Laboratory of the Division of Food Research will also be reviewed. A review of the Australian Numerical Meteorology Research Centre is being conducted jointly with the Department of Science and the Environment, and a mid-term review of the Centre for Animal Research and Development will be conducted in conjunction with the Government of Indonesia and the Australian Development Assistance Bureau.

### Manufacturing Industry Committee

In February 1979 the Executive established a Manufacturing Industry Committee to advise the Executive on:

- . the impact of the Organization's research programs and related activities on Australian manufacturing industry;
- . new initiatives by CSIRO to develop more effective research programs;
- other ways in which CSIRO can help manufacturing industry introduce technological innovations aimed at producing new products or improved processes.

The Committee comprises Dr W.J.McG. Tegart (Chairman), Member of Executive, Mr H.M. Morgan, Member of Executive, Mr S. Lattimore, Director, Bureau of Scientific Services, Professor Emeritus H.W. Worner, Director, Institute of Industrial Technology, Dr D.E. Weiss, Director, Planning and Evaluation Advisory Unit, Dr W.R. Blevin, Division of Applied Physics, Dr P.M. Robinson, Division of Materials Science, and Mr C. Garrow (Secretary), Manager, Central Information Service.

### Water research

The Senate Standing Committee on National Resources in their report entitled 'Australia's Water Resources—The Commonwealth's Role' recommended that:

'A new Water Resources Division be created within CSIRO together with a mechanism above Divisional level to coordinate water-related research within CSIRO and to provide advice at the policy level to other Commonwealth bodies concerned with national research needs and priorities.'

After careful consideration, the Executive has concluded that CSIRO can contribute more effectively in the field of water research if the work continues to be spread over a number of Divisions. The Organization's water research program covers a wide range of subjects, including hydrology, water quality, purification and re-use, effluent treatment, and water in biological and physical systems and in industrial processes. It is because of this diversity that the research programs of a number of Divisions.

However, the Executive is giving consideration to the development of improved arrangements for coordinating water research in the new Institute structure. A CSIRO Directory of Water Research is in preparation and it is expected that the Minister for Science and the Environment will make a statement on the Organization's activities in water research when the Directory is tabled in Parliament. Forest and forest-product problems The Executive has established an ad hoc committee to provide advice on the nature and relative importance of the problems of Australian forests and of the forestproducts industry. Both the wood and nonwood uses of forests are being considered in the context of their economic and social significance to the nation, with particular attention being given to problems likely to benefit from scientific research.

The committee comprises Emeritus Professor L.D. Pryor (Chairman), Department of Forestry, Australian National University, Dr T.M. Cunningham, Forestry Commission of Tasmania, Mr W.T. Knight, International Division, Australian Paper Manufacturers Ltd, Mr D.M. Cullity, Westralian Forest Industries Ltd, Mr C.A. Lembke, Australian Forest Industries Journal, and Dr N.K. Boardman, Member of the CSIRO Executive. Secretarial support is provided by Mr K.L. Avent and Mr J.F. Burdett of CSIRO.

The committee, which has received some 120 submissions, is holding discussions with industry, professional and community groups that cover a wide range of interests, and with research workers.

The committee expects to report to the Executive in the latter half of 1979. Its recommendations regarding problems facing Australia will be relevant to several Divisions involved in forest-related research.

### Research for the leather industry

Since 1965 research for the Australian hides, skin and leather industry has been carried out almost exclusively by the Leather Industry Research Association, based at the DIVISION OF PROTEIN CHEMISTRY. Virtually no research other than minor troubleshooting work is carried out by the industry itself. Total expenditure on research is currently about \$280,000, \$100,000 of which is provided by the tanning industry. This expenditure amounts to less than 0.1 per cent of the value of the raw commodity, which is considerably less than for any other major primary product.

The closing of a number of tanneries which contributed to the funding of the Association by voluntary levy, together with the difficulty of establishing an equitable method of funding a research effort embracing all the sectors that the research group services, culminated in the winding up of the Research Association on 30 June 1979. Prior to considering its future commitment to leather, hides and skin research, the Executive commissioned Dr K.A. Ferguson, at that time an Associate Member of the Executive, to review the research needs of this industry. During the course of the review Dr Ferguson consulted widely with industry representatives, government departments, primary industry organizations and scientists familiar with the relevant fields of work.

The review report concluded that the industries producing and utilizing hides and skins would remain an integral part of the Australian industrial scene and that a dedicated, effective research group was necessary to serve the industry and capitalize fully on its true potential. Dr Ferguson recommended to the Executive that, on winding up the Leather Industry Research Association, it should transfer the existing Leather Research Group to Appropriation Funds and further, when circumstances permitted, that the Group should be expanded from its present complement of 9 people to at least 12. The first part of the recommendation was adopted and will come into effect on 1 July 1979. The second part of the recommendation was adopted in principle, but will not be implemented until a later date. The committee conducting the review of the DIVISION OF PROTEIN CHEMISTRY (see Divisional Reviews below), when considering the leather research programs, came to essentially the same conclusions.

### **Division of Applied Physics**

A review of the NATIONAL MEASUREMENT LABORATORY was undertaken in 1978 by a committee comprising Dr J.R. Philip, CSIRO (Chairman), Professor Emeritus H.W. Worner, CSIRO, Professor J.H. Carver, Department of Physics, University of Adelaide (presently Research School of Physical Sciences, Australian National University), and Dr W.J.McG. Tegart, Broken Hill Pty Co. Ltd (now CSIRO).

The review committee carried out its task during the second half of 1978 and its report was considered by the Executive in December 1978. The Executive's decisions arising from these considerations are designed to bring the Organization's physical research and standards activities closer to the needs of industry, and to fill a wider role. This change in emphasis has been reflected in the decision to change the name of the Laboratory to the DIVISION OF APPLIED PHYSICS. although in keeping with its national significance, the new headquarters of the Division at Bradfield Park in Sydney will continue to be known as the NATIONAL MEASUREMENT LABORATORY.

The following objectives of the Division were defined:

- . to establish and maintain the Australian legal standards of measurement as required by the Weights and Measures (National Standards) Act, together with the standards for basic and other physical quantities of importance to Australia;
- . to promote, together with other national organizations such as the National Association of Testing Authorities and the Standards Association of Australia, the development of calibration and other arrangements to enable the community to base its measurements on these standards;
- . to undertake applied research of importance to industry and the community and to collaborate with industry in exploiting promising developments;
- . to undertake appropriate physical research;
- . to undertake other scientific and industrial research that the Executive sees as

appropriate for the Division;

- to give advice and assistance to industry and the community in areas where the Division has special competence and to provide courses of training where appropriate;
- to participate in international scientific and technological activities, especially those arising from Australia's obligations under the Metric Treaty;
- to support and cooperate with other nations establishing their own standards and measurement facilities.

The review committee's recommendations have been used by the Executive as a guide in seeking a new Chief for the Division to replace Mr F.J. Lehany, who will retire in August 1979.

### **Division of Chemical Physics**

A review of the DIVISION OF CHEMICAL PHYSICS was undertaken by a committee comprising Dr J.P. Wild, CSIRO (Chairman), Professor Emeritus H.W. Worner, CSIRO, Professor D.P. Craig, Research School of Chemistry, Australian National University, Professor L.W. Davies, Department of Electrical Engineering, University of New South Wales, and AWA Research Laboratory.

In July 1978 the Committee presented its report to the Executive, which accepted all the recommendations:

- external contacts by the Division be made over a broader spectrum of industry;
- the next Chief of the Division (to fill the existing vacancy) be appointed for an initial period of seven years, or such tenure as may be negotiated, and further that a 'caretaker' Chief should not be appointed in the interim;
  - as Section Leaders retire, an evaluation of the Section's programs be undertaken to determine whether there would be benefit in replacing them with new lines

of research, and further that programs should be continued only if a definite case for continuing were evident;

- . the Executive consider methods of allocating resources to encourage Divisions to contract-out activities which the Organization considers to be of a service or development nature;
- . the new Chief make a thorough analysis of the resources used for support activities;
- . most future research appointments be made on a short-term basis, unless otherwise indicated by the evaluation of individual programs, and further that each Section should aim in the long-term to include a number of young scientists, preferably on short-term appointments;
- . the Division continue, in general, in its present role, seeking such changes in direction as are in accord with evaluations of its programs and the needs of industry and the community.

These recommendations have formed the basis on which a new Chief for the Division has been sought.

### **Division of Protein Chemistry**

In July 1978 the Executive appointed a committee under the chairmanship of Dr K.A. Ferguson, formerly an Associate Member of the Executive and now Director of the INSTITUTE OF ANIMAL AND FOOD SCIENCES, to review the programs and the management structure of the DIVISION OF PROTEIN CHEMISTRY. The other members of the Committee were Dr S.F. Cox, General Manager, Alkali and Chemicals Group, ICI Australia Ltd, Professor F.J. Fenner, Centre for Resource and Environmental Studies, Australian National University, and Professor D.A. Lowther, Department of Chemistry, Monash University. The committee saw a continuing role for the Division in contributing to knowledge of the molecular structure and chemistry of

proteins, and endorsed its role as a centre of excellence in this field.

The committee recommended that a number of smaller programs should be phased out and the resources thus released diverted to what it saw as higher-priority areas, such as leather research and the plant protein program. It saw the Division as having a significant contributory role to play in a range of inter-Divisional collaborative programs and identified a number of activities jointly being carried out in several Divisions where there was scope for some rationalization of effort.

It suggested the establishment of small management committees for a number of inter-Divisional collaborative programs. The committee also urged closer collaboration with relevant industries in formulating program objectives. The Executive adopted the committee's recommendations essentially without amendment. The majority of the recommendations have already been or are in the process of being implemented.

# 5. Policy developments

During the year under review the Executive developed new or revised policy statements in several areas related to its research. In accordance with the provisions of paragraph (a) of sub-section 57(2) of the Science and Industry Research Act 1949, these policy statements are described below.

### Energy research

Throughout the post-war period, the Organization has built up research groups in a number of fields of energy research and now has well-established activities in sectors such as:

- . characterization of coals;
- . understanding the origin of fluid hydrocarbons in the sedimentary basins of Australia;
- . geotechnical aspects of certain Australian coal deposits;
- . production of coke from Australian coal;
- . conversion of coal to liquid derivatives;
- . direct harnessing of solar energy by means of flat plate collectors;
- . biosynthetic routes to harnessing solar energy.

While past activities and achievements do not necessarily make a case for continuing lines of research, the Executive recognizes that the Organization's present capabilities must influence its ordering of priorities for the future. This applies particularly in sectors where Divisions have an established reputation such that other organizations consider it appropriate for CSIRO to continue to be primarily responsible for research in those sectors. The Executive also recognizes the need to redeploy resources when work progresses to the stage where it can satisfactorily be left to groups in industry or in other organizations. A recent example of this is in the field of domestic hot water systems partly energized by solar heating.

CSIRO's research programs relating to energy have been the subject of intense examination since mid-1976. The Organization's annual reports for 1976/77 and 1977/78 described in considerable detail research work already under way, the establishment of review machinery, and progress with reviews.

Other agencies of the Commonwealth Government have also been active in developing policies relating to energy. This activity culminated in the presentation of the Government's energy policy by the Prime Minister on 27 June 1979. CSIRO contributed wherever possible to this activity, and the statement of CSIRO policy which follows was formulated in the light of conclusions reached in the course of this involvement.

National energy policy considerations Factors influencing the progressive formulation of a national energy policy which are pertinent to the development of CSIRO's energy research policy include the need to:

- . provide Australian consumers with adequate supplies of energy in the required form at a reasonable cost;
- minimize disruptions to society that might result from sudden changes in the availability and/or cost of the various forms of energy, particularly petroleum, on the world market;
- maintain supplies of critical fuels under situations of national emergency;
- recognize public concern for the welfare of future generations both as regards availability of energy and the impact of technology that may be employed to provide future needs.

In developing its policy towards energy research, the Executive has noted:

- . the specific responsibilities and roles of the several States of Australia;
- . the economic, social and political ramifications of Australia's position

as a supplier, or potential supplier, of energy to other countries;

- . the role of other government agencies, academic institutions and industry in pursuing national objectives in the energy field;
- . the existence of, and need to develop further, collaboration with appropriate research organizations in overseas countries.

In preparing this statement, the Executive has given due consideration to the national energy policy statements made in Parliament by the Deputy Prime Minister in November 1977 and by the Minister for National Development in April 1979 as well as to the Government's subsequent actions in furthering policy objectives. These actions include establishing the National Energy Advisory Committee on a permanent basis and establishing the National Energy Research, Development and Demonstration Council. These bodies provide the Minister for National Development with independent and expert advice on energy research and related matters. While the Prime Minister's detailed presentation of the Government's energy policy on 27 June 1979 was delivered after the Organization's statement had been prepared, the Executive considers that its statement of energy research policy is in general accord with the policy objectives presented by Mr Fraser.

### CSIRO energy research policy

The provision of adequate amounts of energy in its required forms at reasonable cost is an essential element in the continuing development and prosperity of our primary, secondary and tertiary industries and has profound implications for Australia's overall economic prosperity and 'way of life'.

The uncertainties of the future demand that a number of potential supply/use 'options be studied in parallel.

It is in the national interest for CSIRO to have an adequate long-term core program of energy research, and the Executive will continue to allocate resources to this end. In addition, support for selected projects will be sought from other sources of funds established for energy research, notably those allocated by the Minister for National Development on the advice of the National Energy Research, Development and Demonstration Council. The Executive will maintain a balance between externally funded short-term studies and the Organization's longer-term core activities in basic research funded by direct appropriation.

The complexities of energy research call for coordinated multidisciplinary programs. The long time needed to progress through the phases of research, development and demonstration requires a continuity of effort. CSIRO is qualified to carry out such research programs and able to contribute to the development and demonstration phases.

It is Executive policy that:

- . CSIRO energy research projects be directed towards solving problems or advancing scientific or technological knowledge in areas that are of direct significance to Australia;
- . collaborative programs with other workers both in Australia and overseas be undertaken as appropriate;
- . after due regard to patenting and licensing considerations, the results of the research be made available to interested parties with minimum delay;
- special expertise be enlisted whenever it is required in the development or demonstration phases of particular projects to supplement the Organization's research competence.

The Executive considers that the one critical short-term problem facing Australia in the energy field is the predicted limited availability of indigenous petroleum. In view of the vital dependence of Australia's transport system on liquid fuels, this problem is of overriding importance. In the longer term, limited availability of liquid fuels world-wide will exacerbate the Australian position. The Executive has determined that CSIRO should conduct research which, in the short term, has the potential for delaying or alleviating the predicted shortfall in Australia's petroleum supply and which, in the longer term, will reduce our dependence on natural petroleum through the development of viable systems and technologies based upon renewable as well as non-renewable resources. Where appropriate, the techniques of energy systems analysis will be applied in the Australian context.

Long-term variations in atmospheric levels of particulates and carbon dioxide and the dynamics of carbon dioxide cycles in the biosphere may have an impact on future energy strategies both nationally and globally. The Executive has determined that appropriate resources will be directed to these and other environmental problems associated with the production and consumption of fuels.

It is likely that future changes in the world energy supplies and attendant increases in the prices of energy products particularly petroleum—will accelerate the introduction of measures for conserving non-renewable energy sources. It is also possible that developed countries such as Australia may move towards a society that is less dependent on fossil fuels and has a lower level of energy consumption overall. Renewable sources are likely to make an important contribution to this process. CSIRO will continue to respond to changing research needs in the overall social, economic and political climate.

Notwithstanding the necessity to establish priorities and guidelines to direct the Organization's research programs, the Executive will continue to support and foster original ideas, innovation and the products of new research results, especially when these open up possibilities of new competitive forms of technology. Such circumstances must be permitted to transcend research priorities and policies.

### CSIRO priorities in energy research The Executive gives its highest priority to projects which:

- . display a potential for delaying or alleviating the predicted shortfall in Australia's petroleum supply;
- examine those environmental aspects of proposed and existing technologies which could impose ultimate constraints on their development or continued use;
- . aim at the development and demonstration of options which could reduce the nation's high dependence on petroleum;
- . involve areas of fundamental research on which future advances in energy technology might be based.

Applications of these guidelines has led to the Executive categorizing research into high, medium and low priority activities and specifying those activities which are inappropriate to CSIRO. These categories are detailed in the table that follows.

### High-priority areas

Research with the potential for delaying or alleviating the predicted shortfall in Australia's petroleum supply.

*Petroleum* – Petrographic and geochemical studies, in collaboration with BMR and industry as appropriate, on samples of geological relevance to the oil and gas prospectivity of Australian sedimentary basins. The results of these laboratory investigations should complement field studies carried out by BMR and exploration groups in industry.

Coal - Synthesis of liquid fuels from Australian low-sulphur coals. Solar - Industrial process heating in the temperature range 65-150°C, focusing attention on Australian industrial practices.

Studies of those environmental aspects of proposed and existing technologies which could impose ultimate constraints on their development or continued use.

Fossil fuel combustion – Atmospheric levels of particulates and carbon dioxide and dynamics of carbon dioxide cycles in the biosphere.

Uranium utilization - As may be agreed with the AAEC, other Commonwealth and State agencies or industry as appropriate, studies in selected fields, such as those related to the safe disposal of radioactive wastes from uranium mining, beneficiation and/or concentration plants.

General energy consumption – Effects of thermal pollution from power stations, industry and population centres on aquatic and marine ecology, and urban and industrial atmospheres.

Research aimed at the development and demonstration of options which could reduce the nation's high dependence on petroleum.

*Coal* – Characterization and chemistry of Australian coals to ensure optimum utilization in the domestic and export markets; improved recovery of coal during underground mining operations; fluidized bed combustion as a means of replacing oil.

*Liquid fuels from plant products* – Alcohol and like materials derived from plants appropriate to the Australian environment.

*Electrochemical and solid state* – Development of new, and improvement of existing, battery systems for electric vehicles operating under Australian conditions of driving patterns and climate.

Catalytic and biosynthetic fuel conversion – Development of systems and technologies appropriate to Australian conditions.

Fundamental research on which future advances in energy technology could be based, eg. electrochemistry, photochemistry, solid state chemistry and physics, energy storage.

In general, these areas of research support the high-priority areas on the previous page.
Petroleum - In collaboration with BMR and industry as appropriate, develop enhanced recovery methods from existing oil fields that are appropriate to the particular
Australian geological environment, eg the application of microbiological techniques.
Road transport - Improvement in fuel economy of road transport appropriate to
Australian conditions.
Pipeline transportation of fossil fuels
Improved design and construction of buildings aimed at reducing beating and cooling requirements
Medium-scale generation of electricity from solar and wind energy
Coal gasification, including in situ processing
Geotechnical aspects of underground storage of petroleum products

### Low-priority areas

Areas in which CSIRO monitors developments within Australia and overseas, and is prepared to support innovative approaches as appropriate.

Large-scale generation of electricity by wind and solar energy Fuel cells Solar bydrogen production Geothermal energy Wave energy Tidal energy Oil-spill technology

### Areas inappropriate to CSIRO

Nuclear power production Large-scale power generation and transmission Magnetobydrodynamic (MHD) power generation

### Medical research

One of the recent decisions of the Government, based on the recommendations of the Independent Inquiry into CSIRO, stated that research in human medicine should not be a direct objective of the Organization. Accepting that some research undertaken in the course of CSIRO's primary functions may have implications for human medicine, the Government also decided that steps should be taken to assess research results in biological and physical sciences for their possible significance and application in human medicine.

From its inception in 1926, as the Council for Scientific and Industrial Research, the Organization has been primarily involved in research in biological and physical sciences for the support of agriculture and the manufacturing and mining industries. However, research in a number of fields relevant to this objective, such as animal health, food quality and physical standards, has implications both for the prevention of ill-health and for the treatment of disease in humans. Also some basic biological research in CSIRO is as relevant to humans as to animals. Recognizing this relationship, the Advisory Council of CSIRO commissioned a study of medically related research in CSIRO in 1972. The study was undertaken by Professor F. Fenner, then Director, John Curtin School of Medical Research, Australian National University.

Professor Fenner found that there was considerable research in CSIRO laboratories relevant to human health and that from time to time informal arrangements were made by CSIRO scientists and colleagues in clinical or public health research for collaborative work. He recommended that effective use of CSIRO discoveries relevant to human health would be promoted by the establishment of a CSIRO liaison committee on medical research. Professor Fenner also observed a major gap in research in Australia relating to human nutrition. As CSIRO was concerned with food production and processing, Professor Fenner argued that it was logical for the Organization to become directly involved in human nutrition research. He proposed that CSIRO establish a DIVISION OF HUMAN NUTRITION.

Both recommendations were adopted by CSIRO. The CSIRO Medical Research Liaison Committee was established in November 1973 and the DIVISION OF HUMAN NUTRITION came into being in January 1975. The question of a statement of policy on CSIRO research in human medicine was also raised but, as these two actions implied no change from established procedures and received the support of the Minister for Science, such a statement was deemed unnecessary. Following the new Government decision the Executive has decided that a statement is now required.

#### The CSIRO Policy on Medical Research is:

- except in the field of human nutrition, the Organization will not initiate programs of biomedical research which have the prime objective of solving problems in human health;
- where it becomes evident that results of CSIRO research in the biological and physical sciences could have relevance to human health, they should be drawn to the attention of the CSIRO Medical Research Liaison Committee, which should consider the possible development of the discoveries, including collaboration between CSIRO and a recognized medical research organization.

The Policy provides for the continuation of research in the field of human nutrition within CSIRO. The work of the DIVISION OF HUMAN NUTRITION is based on CSIRO capabilities in biological and physical sciences. However, some of its research will have direct implications for human medicine where it relates to the promotion and maintenance of good health and well-being and the prevention of disease through sound nutrition.

The Policy also emphasizes the role of the Medical Research Liaison Committee

in ensuring that CSIRO research results are assessed in terms of their possible significance and application in human medicine. The terms of reference of the Committee are:

- where appropriate, to encourage the development by medical research workers of discoveries made by CSIRO scientists, both by improving communications and facilitating research;
- . to report to and advise the Executive of CSIRO on matters relevant to medical research;
- . to improve communications about medical research within CSIRO and between CSIRO and medical research workers in other institutions.

The membership of the Committee includes CSIRO scientists and medical scientists associated with university research, along with Commonwealth Government administrators associated with responsibilities for public health policy and medical research funding. The Committee provides a mechanism for coordination of research in the field of human nutrition and for early recognition of possible unnecessary duplication of research in CSIRO, Departments of Health, universities and private research institutions.

### Licensing

The statement below outlines the Executive's current policies, strategies and procedures relating to the use of CSIRO's proprietary rights, particularly patents and related industrial property. A statement on these lines has been endorsed by the Minister for Science and the Environment, Senator J.J. Webster, as constituting the guidelines under which CSIRO should operate when using industrial property rights to facilitate the implementation of CSIRO research results.

CSIRO reports quarterly to the Minister on its licensing arrangements, and in addition brings to his attention potentially sensitive arrangements on an individual basis.

Implementation of research results In accordance with the functions of CSIRO as defined in the Science and Industry Research Act 1949, it is Executive policy to take positive steps to encourage and facilitate the application and utilization of the results of its mission-oriented research wherever possible.

Where the results of this research do not suggest any specific industrial application or change in current practice, open publication in the scientific literature is the appropriate means of ensuring that the results receive external evaluation and contribute appropriately to the body of existing knowledge. Because CSIRO's work is usually concentrated at the more fundamental and longerterm end of the spectrum of mission-oriented research and development, publication in the scientific literature is the most common way of encouraging application and utilization of CSIRO research results.

Where the results of CSIRO work suggest specific industrial innovations or changes in current technological practice, additional or alternative steps are needed to ensure implementation and utilization. These include publication through trade journals, technical reports, brochures and leaflets aimed at specific audiences, training schemes, films, media releases, and the appropriate use of the Organization's proprietary rights to the results of its work. Proprietary rights include patents and related rights and they can play a useful role in encouraging utilization of those research results which have direct industrial application. They include rights to unpublished information, the use of CSIRO's name, trademarks, designs, computer programs and copyright. For brevity, patents and inventions will be referred to, but these should be read as including the other forms of industrial and intellectual property mentioned.

### Patent policy

It is Executive policy to employ the proprietary rights of CSIRO to provide an incentive for firms to attempt industrial innovation in Australia based upon the results of CSIRO work. It is also Executive policy to employ these rights in appropriate cases to supervise the early stages of an industrial innovation in Australia so that CSIRO research results are properly applied. Insofar as it is consistent with these policies, the Organization's proprietary rights are also used to earn revenue. Accordingly, steps are taken to secure patent and other rights, grant licences, and conclude agreements in order to implement this policy, notwithstanding that it may be necessary to delay general publication of the results of CSIRO work to achieve this purpose.

#### Encouraging innovation

Where there is good reason to believe that an invention will fail to be implemented, or will be implemented inadequately, unless some measure of protection is available, patent and licensing procedures are initiated with the object of creating sufficient incentive, through the grant of privileged access, to encourage implementation appropriate to the perceived Australian public interest.

Under this heading, inventions are offered to companies and firms operating and producing in Australia and preference is given to technically competent firms prepared to invest an appropriate level of resources in development work.

In selecting firms and determining the conditions and royalties upon which a CSIRO discovery, invention or improvement will be made available under paragraph 9AA(c) of the Act, the following matters are considered:

the technical competence of the proposed licensee, including the ability of the licensee to contribute to the technological development of Australian industry;

- the capabilities, resources and experience of the proposed licensee to undertake the research, development, practical implementation and marketing work necessary;
- . the ability of the proposed licensee to make a commercial success of the development, particularly by way of exports;
- . the resources which the proposed licensee is prepared to commit to the project;
- . the length of time during which the proposed licensee will have privileged access to rights;
- any undertakings the proposed licensee may be willing to give on customer service and maintenance;
- . the royalty offered.

The overriding consideration is to secure the greatest benefits in the Australian national interest. This is normally achieved through licensing firms which operate in Australia in preference to those which do not. Where an Australian firm is licensed, the term of exclusivity granted is at least the minimum needed to ensure that an acceptable level of resources is allocated to developing the invention. The term of exclusivity is kept to a minimum when there are prospects of wider adoption of an invention in Australia following its successful establishment in industry. Where overseas firms are licensed, rights are normally reserved so that Australian firms may be licensed at any later date and be given rights to export. Foreign firms may also be licensed where the implementation of the inventions overseas will increase the value of an Australian product (for example, wool or minerals) in international markets.

Normally, CSIRO does not commit rights to any firm or group of firms to the exclusion of other Australian firms without prior public advertisement. The advertisement sets out details of the invention available for licence, any conditions which CSIRO believes a licensee should satisfy, and invites responses. The responses are evaluated according to the above criteria and any special conditions mentioned in the advertisement, and all respondents are notified of the outcome.

### Supervision

Where it is likely that an invention will only be adopted satisfactorily in Australia if CSIRO maintains an active oversight of the operations of licensees, an Australian patent is sought and non-exclusive licences granted on equal terms to all technically competent Australian firms on application.

### Revenue

The preceding sections relate to CSIRO's statutory functions relevant to licensing. The Organization has a secondary obligation to generate revenue in so far as this can be done consistently with its primary role. In appropriate cases, therefore, revenue may be generated where CSIRO makes licences available under its statutory function of encouraging and facilitating the application and utilization of its research results.

In the case of licensing arrangements having as their main objective the encouragement of an investment of resources in the commercial development of a CSIRO invention, the royalty charged reflects the competitive advantage conferred on the licensee. This advantage is normally proportional to the time over which the licensee has privileged access. This time is kept as short as possible where it is likely that other firms operating and producing in Australia could successfully adopt the invention after it has been developed commercially by the first licensee. Within the constraints set by this policy, the royalty charged is set to attract the maximum revenue.

In the main, licensing arrangements having supervision as their sole objective carry only a nominal royalty. However, where it is possible to increase revenue substantially above this level without significantly affecting the widespread adoption of a CSIRO invention, a higher royalty is imposed.

On occasion, CSIRO generates research results which do not lend themselves either to immediate application or utilization in Australia, or to furtherance of an Australian public-interest policy objective. Where it appears that such results are likely to attract significant overseas interest, patent and licensing procedures are initiated. Royalties and other charges are set to maximize revenue.

## 6. Advisory Council

The reconstitution of the Advisory Council and its enhanced functions were discussed in Chapter 1. The amended Act requires advice furnished by the Council to be reported in the Organization's annual report. The first meeting of the reconstituted Council was scheduled for July 1979; consequently no formal advice was furnished by the Council during the year under review.

The membership of the Council is given below. The appointment of the Chairman, Mr V.G. Burley, dates from 1 February 1979, and the appointments of other members from 1 July 1979. The possibility of two further appointments to bring the Council to full strength is still being explored.

Arrangements have been made for observers from the Australian Science and Technology Council (ASTEC), the Department of Finance and CSIRO to attend meetings of the Advisory Council.

#### Chairman

- Mr V.G. Burley, CBE, BE, previously Resident Director of Cadbury-Schweppes Pty Ltd and Chairman of the Tasmanian State Committee
- Chairmen of State Committees
- Mr A. Boden, BSc, Company Director and Science Writer (*New South Wales*)
- Mr L.C. Brodie-Hall, CMG, AWASM, Director of mining companies (*Western Australia*)

Mr K.E. Gibson, BSc, previously Managing Director and Deputy Chairman A.C.F.

- and Shirleys Fertilizers Ltd (Queensland)
- Mr J.E. Harris, BEng, Managing Director, Adelaide and Wallaroo Fertilizers Ltd (South Australia)
- Mr J.E. Kolm, IngChemEng, Executive Director, ICI Australia Ltd (Victoria)
- Professor P. Scott, PhD, Pro-Vice-Chancellor and Professor of Geography, University of Tasmania (*Tasmania*)

### Other members

Professor L.M. Birt, DPhil, Vice-Chancellor University of Wollongong

- Sir Alan Cooley, CBE, BEngSc, Secretary, Department of Productivity
- Mr N.S. Currie, CBE, BA, Secretary, Department of Industry and Commerce

Dr J.L. Farrands, PhD, FTS, Secretary, Department of Science and the Environment

Professor F. Fenner, CMG, MBE, MD, FAA, FRS, Director, Centre for Resource and Environmental Studies

- Professor P.T. Fink, BE, FTS, Chief Defence Scientist, Department of Defence
- Mr J.H.S. Heussler, President, United Graziers' Association of Queensland
- Professor P. Karmel, AC, CBE, PhD, LLD, DLitt, Chairman, Tertiary Education Commission
- Mr J.C. Kerin, BA, MP
- Dr G.A. Letts, CBE, DVSc, Veterinary consultant and pastoralist
- Sir Ian McLennan, KCMG, KBE, DEng, Chairman of companies and previously Chairman of Broken Hill Pty Co. Ltd, Victoria
- Mr J.A. Michael, BE, Executive Director, Association of Professional Engineers of Australia
- Dr B.W. Scott, DBusAdm, Managing Director, W.D. Scott and Co. Pty Ltd
- Mr I.H. Smith, BCom, Deputy Secretary, Department of Primary Industry
- Senator A.M. Thomas
- Mr A.J. Woods, BEc, Secretary, Department of National Development

### Observers

- Professor Sir Geoffrey Badger, AO, DSc, FTS, FAA, Chairman, Australian Science and Technology Council
- Mr J.H. Garrett, OBE, BCom, Deputy Secretary, Department of Finance
- Dr J.P. Wild, CBE, ScD, FTS, FAA, FRS, Chairman, CSIRO

## 7. Statutory directions

### Determinations

The Minister is empowered under subparagraph (a)(iv) of section 9 of the Science and Industry Research Act 1949 to determine additional purposes for which CSIRO might carry out research. No determination has been made in pursuance of this power.

### Directions

The Minister is also empowered under section 13 of the Act to issue directions to the Executive. One direction was given by the Minister during the reporting year. This direction related to any exercise or proposed exercise by the Organization of its power to join in the formation of a partnership or company for the purpose of the commercial development of a discovery, invention or improvement the property of the Organization which involves :

- entering into a contract or other arrangement with any person, group of persons or body; and
- (b) under that contract or other arrangement, assuming (whether subject to a contingency or otherwise) any obligation involving or likely to involve the disbursement by the Organization of funds either in the nature of a contribution of working capital to an enterprise or towards meeting liabilities arising out of the conduct of such an enterprise.

The Minister directed the Executive as follows :

'Prior to the Organization entering into any such contract or other arrangement the Executive shall :

 provide full details of the proposal to the Secretary, Department of Finance, for comment;

- (ii) provide full details of the proposal to the Minister administering the Science and Industry Research Act 1949 at the material time together with any comments made on the proposal by the Secretary, Department of Finance; and
- (iii) provide the Minister with an adequate opportunity to determine whether or not a further direction affecting the proposal should be given.'

### 8. Organization and staff

CSIRO on 30 June 1979 had a total staff of 7296 people located in more than 100 laboratories and field stations throughout Australia. About one-third of the staff are scientists.

CSIRO is governed by an Executive comprising three full-time Members, including the Chairman, and five part-time Members. The Chairman is Chairman of the Organization and also Chief Executive. The Executive is responsible for the development of policies relating to the scientific and technical direction of the whole Organization and to internal management; relationships with Government, advisory bodies and other institutions; the definition of broad areas of CSIRO research; the securing and distribution of resources to each area; and monitoring of the effective performance of the Organization.

The Executive Committee comprises the Chairman, the full-time Members of the Executive, and the Directors of the Institutes and the Bureau of Scientific Services. The Director of the Planning and Evaluation Advisory Unit and the Secretary of CSIRO also attend. The role of the Committee is to consider Organization-wide management issues and to develop policies for consideration by the Executive in respect of major policy issues.

The scientific research of the Organization is undertaken in 37 research Divisions and six smaller research Units grouped into five research Institutes. Each Institute is headed by a Director, and each Division or Unit by a Chief or Officer-in-Charge respectively.

Institute Directors are the key people who advise and assist the Executive in defining the broad areas of research in which CSIRO should be working and in allocating resources to these areas. In consultation with their constituent Chiefs, they are also responsible for regularly reviewing research objectives, programs and priorities being pursued in their Institutes. Directors are also responsible for delegated management functions.

Chiefs or Officers-in-Charge retain their traditional role in CSIRO of providing the scientific leadership and managerial direction of their Division or Unit in the pursuit of Institute and Organizational goals.

A Bureau of Scientific Services, headed by a Director, is responsible for facilitating and promoting technology transfer and information flow, fostering cooperative technical assistance programs and providing advice and assistance to the Executive, Directors and Divisions in these areas.

The Executive is assisted in the development, implementation and administration of its policies by a Planning and Evaluation Advisory Unit, an Office of the Executive, and by a Secretariat, all headquartered in Canberra. Some administrative functions are undertaken at regional offices in Brisbane, Canberra, Melbourne, Perth and Sydney.

The chart overleaf shows the interaction between the various elements of the Organization.



### Executive changes

Following the proclamation of the Science and Industry Research Amendment Act 1978, with effect from 14 December 1978, the following appointments to the Executive were made:

Chairman:	Dr J.P. Wild
Full-time Members:	Dr N.K. Boardman
	Dr W.J.McG. Tegart
Part-time Members:	Mr D.J. Asimus
	Dr W.L. Hughes
	Mr V.E. Jennings
	Mr H.M. Morgan
	Mr R.K.R. Morris

The Chairman and full-time members of the Executive were appointed for terms of seven years. Part-time Members of the Executive were appointed for terms of three years.

Two full-time Members of the previous Executive, Dr J.P. Wild and Dr N.K. Boardman, were reappointed. Their terms of office expire on 24 September 1985.

The third full-time Member, Dr W.J.McG. Tegart, worked for the Organization from 1947 to 1955, during which time he gained the degrees of BSc and MSc from the University of Melbourne. He later gained the degree of PhD from the University of Sheffield. After considerable experience in the United Kingdom and the USA, Dr Tegart returned to Australia in 1968 and took up the appointment of Manager of BHP's Melbourne laboratories. In 1978 he was appointed Executive Assistant to the Chief General Manager of BHP, which position he held until his appointment to the CSIRO Executive.

Mr V.E. Jennings, Executive Director of Research, Jennings Industries Ltd, and a part-time Member of the previous Executive, was reappointed to the new Executive. His term of office expires on 25 March 1980.

The new part-time Members are: Mr D.J. Asimus, grazier and Deputy Chairman of the Australian Wool Corporation. Mr Asimus gained the degree of BEc from the University of Sydney in 1955, and in 1958 won a Nuffield Travelling Agricultural Scholarship to the United Kingdom. He has taken a leading role in the Australian Wool Corporation for a number of years and was appointed its Deputy Chairman in 1975.

Dr W.L. Hughes, Chairman and Managing Director of Walkers Ltd, Maryborough. Dr Hughes gained BE and BSc degrees from the University of Sydney in 1939, and in the same year became the Rhodes Scholar for New South Wales. Dr Hughes was appointed General Manager of the shipbuilding firm, Walkers Ltd, Maryborough, in 1954 and Managing Director in 1975.

Mr H.M. Morgan, Executive Director of Western Mining Corporation Ltd. He graduated LLB from the University of Melbourne in 1964 and BCom from the same university in 1966. After practising law, Mr Morgan became Executive Director of Western Mining Corporation Ltd in 1976 and was appointed a Director of ALCOA of Australia Limited in 1977.

Mr R.K.R. Morris, a partner in the firm of chartered accountants, Price Waterhouse and Co. Mr Morris graduated BCom from the University of Melbourne in 1956. He became a partner in his firm in 1969.

### **Retirements from Executive**

Mr V.D. Burgmann, CBE, retired as Chairman in 1978, having held office since March 1977. During his term, Mr Burgmann played a key role in developing the new shape of CSIRO, following the Independent Committee of Inquiry.

Mr Burgmann graduated BSc from Sydney University in 1936 and BE (Hons) from the same university in 1939. In the same year he joined CSIRO'S DIVISION OF RADIOPHYSICS, and with the outbreak of war became involved in the development of radar. He spent several years in London and then in Washington, investigating developments in this field. After the war, Mr Burgmann returned to the DIVISION OF RADIOPHYSICS and led a team which developed radio navigational aids for aircraft.

In 1949 he was appointed Officer-in-Charge of the new Physics and Engineering Unit of the Wool Textile Research Laboratories, and when this unit achieved Divisional status in 1959 he was appointed Chief of the DIVISION OF TEXTILE PHYSICS. Ten years later Mr Burgmann became an Associate Member of the Executive and a year later, a full-time Member.

Mr Burgmann was created a Commander of the Order of the British Empire in 1977.

Dr A.E. Pierce and Professor Emeritus H.W. Worner retired from the Executive following its reconstitution in December 1978.

Dr Pierce has been appointed Acting Director of the INSTITUTE OF PHYSICAL SCIENCES, prior to taking up appointment in London in November 1979 as Minister (Scientific). After a distinguished research career in Britain Dr Pierce became Chief of the CSIRO DIVISION OF ANIMAL HEALTH in 1966 and a Member of the Executive in 1973. In addition to bringing his wide agricultural and veterinary knowledge to bear on the activities of the Executive, Dr Pierce has been particularly involved with a number of Commonwealth and State bodies concerned with ensuring Australia's preparedness to cope with the accidental introduction to Australia of exotic diseases of livestock.

Following his retirement from the Executive, Professor Emeritus H.W. Worner was appointed Director of the INSTITUTE OF INDUSTRIAL TECHNOLOGY . Professor Worner joined the CSIR Lubricants and Bearings Section, later the DIVISION OF TRIBOPHYSICS, in 1940. In 1946 he transferred to the Physical Metallurgy Section, which was located in the Department of Metallurgy of the University of Melbourne. Between 1956 and 1964 Professor Worner served as both Officer-in-Charge of the CSIRO Physical Metallurgy Section and Professor of Metallurgy at the University of Melbourne. In 1964 he gave up his position in the Organization to concentrate on his university activities, but in 1976 he returned to CSIRO as a full-time Member of the Executive. Professor Worner's expertise in the fields of minerals and energy and his wide knowledge of industry enabled him to make a significant contribution to the Executive.

Professor Mollie E. Holman retired as a part-time Member of the Executive in October 1978 at the expiration of her threeyear term. Professor Holman, an authority on the transmission of nerve impulses to muscle, is Professor of Physiology at Monash University.

Sir Frederick Wiltshire, CBE, retired from the Executive in October 1978, after serving as a part-time Member since 1974. Sir Frederick, who was, until recently, Managing Director of the Wiltshire File Co. Pty Ltd, had a wide knowledge of Australian industry and was director of a number of local industrial companies and a member of various bodies such as the Science and Industry Forum of the Australian Academy of Science and the Australian Industry Development Association.

### Institutes and Directors

In accordance with the requirements of the Science and Industry Research Amendment Act 1978, the Executive grouped the research Divisions and Units into five Institutes, namely the INSTITUTES OF ANIMAL AND FOOD SCIENCES, BIOLOGICAL RESOURCES, EARTH RESOURCES, INDUSTRIAL TECHNOLOGY, and PHYSICAL SCIENCES.

The broad objectives of the Institutes and their fields of research have been described in Chapter 3.

In December 1978 the following Institute Directors were appointed:

. INSTITUTE OF ANIMAL AND FOOD SCIENCES: Dr K.A. Ferguson, formerly an Associate Member of the Executive;

- . INSTITUTE OF BIOLOGICAL RESOURCES: Mr M.V. Tracey, formerly Chief of the Division of Food Research;
- . INSTITUTE OF EARTH RESOURCES: Mr I.E. Newnham, Director of the Organization's former Minerals Research Laboratories;
- INSTITUTE OF INDUSTRIAL TECHNOLOGY: Professor Emeritus H.W. Worner, formerly a full-time Member of the Executive;
- . INSTITUTE OF PHYSICAL SCIENCES: Dr A.E. Pierce (Acting), formerly a full-time Member of the Executive.

Dr J.R. Philip, a former Associate Member of the Executive, will succeed Dr Pierce as Director of the INSTITUTE OF PHYSICAL SCIENCES in February next year. Dr Philip's appointment was announced in March 1979.

### Bureau of Scientific Services

The Executive has established a BUREAU OF SCIENTIFIC SERVICES to facilitate and promote the transfer and use of technology and scientific and technical information for the benefit of Australian science, industry and the community at large and to foster cooperative technical assistance projects.

The Bureau comprises the Central Information, Library and Editorial Section, the Centre for International Research Cooperation, the Commercial Group and the Science Communication Unit.

The Bureau's activities include:

- provision of scientific and technical information and publishing, library and data base services for CSIRO and the community;
- . communication of information about CSIRO and its research to a variety of audiences, both technical and nontechnical;
- encouragement of the adoption by industry of technical know-how and CSIRO inventions and technology through

the use of patents and licences, contracting out, grants, and the organization of technical conferences;

- planning, coordination and evaluation of CSIRO's involvement in technical assistance programs in developing countries;
- provision of advice to the Executive, Institutes and Divisions on matters of policy related to the Bureau's areas of activity.

Mr S. Lattimore, formerly Secretary (Research) of the Head Office Secretariat, was appointed Director of the Bureau in December 1978.

Planning and Evaluation Advisory Unit Following Government acceptance of a recommendation of the Independent Inquiry, the Executive established a PLANNING AND EVALUATION ADVISORY UNIT in February 1979. The purpose of the Unit is to assist the Executive in its development strategies and priority allocation of resources. The Unit is directly responsible to the Executive. The Unit's objectives are:

- . advising the Executive, Institute Directors and Chiefs on planning and evaluation methods;
- . assisting the Executive in improving the methods of priority setting and resource allocation;
- . providing guidance on the source of suitable skills which could be made available to the Executive, and elsewhere in the Organization, for particular tasks;
- . assisting in the assessment and assimilation of advice from the advisory mechanism;
- . forecasting trends and research opportunities;
- . assisting the Executive in the presentation of general policies and broad strategies in the annual report;

 analysing trends in research planning and the handling of inputs from advisory mechanisms in other countries, and advising the Executive on their successes and failures.

Dr D.E. Weiss, formerly Chief, DIVISION OF CHEMICAL TECHNOLOGY, was appointed Director of the Unit for an initial period of three years, commencing in March 1979.

Senior appointments and retirements Dr P.E. Kriedemann was appointed Chief of the DIVISION OF IRRIGATION RESEARCH for a period of six years from July 1978, succeeding Mr E.R. Hoare.

In September 1978 Mr H.C. Minnett was appointed Chief of the DIVISION OF RADIOPHYSICS for a period of three years. He succeeded Dr J.P. Wild.

Dr D.F. Kelsall was appointed Chief of the DIVISION OF APPLIED GEOMECHANICS in May 1979 in succession to Dr G.D. Aitchison. He will also continue his present appointment as Chief of the DIVISION OF MINERAL ENGINEERING. His appointment as Chief of both Divisions is effective until February 1983.

In May 1979 Dr F.A. Blakey was appointed Chief of the DIVISION OF BUILD-ING RESEARCH for a period of five years, succeeding Dr R.W.R. Muncey.

Dr H.G. Higgins was appointed Chief of the DIVISION OF CHEMICAL TECHNOLOGY for a period of three years. He succeeds Dr D.E. Weiss.

Dr J.H.B. Christian was appointed Acting Chief, DIVISION OF FOOD RESEARCH, in December 1978 in succession to Mr M.V. Tracey.

In December 1978 Dr T.D. Grace was appointed Counsellor (Scientific), Tokyo and Seoul, for a period of three years. He succeeds Dr C.A. Anderson.

Mr R.N. Morse, Director, Solar Energy Studies Unit, retired in August 1978. The Unit was subsequently incorporated as a section within the DIVISION OF MECHANIC-AL ENGINEERING.

### Divisional changes

The Executive has renamed the NATIONAL MEASUREMENT LABORATORY, comprising its Lindfield, Adelaide and Melbourne laboratories, the DIVISION OF APPLIED PHYSICS. However, the Division's headquarters at Lindfield are continuing to be known as the NATIONAL MEASUREMENT LABORATORY. Mr F.J. Lehany, AO, previously Director of the NATIONAL MEASUREMENT LABORATORY, is Chief of the new Division. Mr Lehany will be retiring on 3 August 1979. In June 1979 Dr W.R. Blevin was appointed Acting Chief of the Division.

A new Unit, the PHYSICAL TECHNOLOGY UNIT, was created in April 1979. The Unit comprises staff previously involved in the DIVISION OF TEXTILE PHYSICS' research programs oriented towards the minerals field. The Unit forms part of the INSTITUTE OF EARTH RESOURCES. Dr E.G. Bendit was appointed Officer-in-Charge.

### Staff policies and staff relations

The Organization has developed a range of policies and practices relating to staff and employment matters which reflect the distinctive requirements of a national research body. Certain of these policies are being reviewed in the context of the recent Independent Inquiry into CSIRO. Developments in this field and areas of current interest include:

### Consultative Council

As mentioned in Chapter 1, the Science and Industry Research Amendment Act 1978 provides for the establishment of a Consultative Council 'to consider, and to report to the Executive on, any matter affecting, or of general interest to, the officers of the Organization, including any such matter that is referred to the Council by the Executive.'

As foreshadowed in the Second Reading Speech on the Science and Industry Research Amendment Bill 1978, the constitution of the Council, and the manner in which it carries out its functions, are expected to be prescribed in the Science and Industry Research (Consultative Council) Regulations before the next scheduled meeting of the Council in October 1979.

Pending completion of the formal process for the constitution of the Consultative Council, a Council of 16 members, eight of whom are nominated by staff associations, has been formed on an interim basis. The remaining eight members consist of Dr N.K. Boardman of the Executive (Chairman) and seven officers of the Organization selected by the Executive.

Two interim meetings of the Council took place during 1978/79 and it is planned that the Council will meet twice a year in future. Items of interest to officers of the Organization discussed at these meetings included compensation in relation to transfers and secondments, staff ceilings, occupational safety and health, grievance procedures, and clerical and administrative promotion procedures.

These meetings decided to form committees to inquire into and report to the Council on the following matters –

- . the employment of women in CSiRO;
- . flexible working hours;
- . staff counselling;
- . technological change;
- . changes in the CSIRO Terms and Conditions of Service;
- . remote locality conditions.

Appointment of Directors and Chiefs The Executive's policy is that Chiefs of Division are appointed for a fixed term, with the possibility of reappointment for a further limited term. At the conclusion of appointment as Chief, the scientist will be offered retention in some other capacity, often entailing his return to active research. This approach gives considerably increased flexibility to the Executive in the broad management of the Organization. During the year the Executive also commissioned a detailed review of the related issues of attracting, selecting and appointing Chiefs. The review covers such questions as the best approach to publicizing the availability of Chief's positions, barriers to attracting outstanding senior scientists from overseas to Australia, ways of overcoming problems associated with the dis continuity in leadership of a Division, induction needs of Chiefs, and matters associated with the transition of former Chiefs to other roles at the end of their tenure. The review is also examining the approach to appointing Institute Directors.

### Appointment of research staff

A major review of the use of fixed-term appointments for research staff was carried out during the year. Such appointments offer a means of introducing new ideas, skills and experience into laboratories on a continuing basis, of maintaining a more balanced age structure among the Organization's staff and of providing flexibility for recruitment and redeployment.

The review included an analysis of the implications of increased use of term appointments in relation to both the calibre of scientist likely to be attracted to fixed-term positions, and the likely long-term effects on scientists' careers, CSIRO's research programs and the Organization's manpower resources.

As a result of the review, steps were taken to increase the proportion of research staff on term appointments at any one time from 5 per cent to 7.5 per cent. In addition, procedural changes were introduced in the management of research staff recruited for fixed terms.

# Manpower population analyses and manpower information

Marked changes have occurred in the patterns of recruitment and termination of staff, primarily as a result of the wider use of fixed-term appointments, a general decline in staff resignations, the low growth rate of the Organization and a trend towards earlier retirement. It is desirable that the interaction between these variables be defined, together with their net long-term effect on such basic descriptive features of the Organization's staff as mean age, age distribution and staff turnover. These are useful for planning and policy formulation. Consequently, computerbased manpower models have been produced for two major staff categories and the information is being analysed.

### Staff counselling

The Executive has a long-standing commitment to improving the nature and amount of feedback available to staff, particularly in relation to the performance of their duties. Such feedback is important in CSIRO, where there is a possibility that the relatively low levels of staff mobility could produce motivational problems and interpersonal difficulties.

As noted elsewhere in this chapter a Committee of the CSIRO Consultative Council is examining methods of staff counselling with the aim of formalizing and upgrading counselling services.

The Committee's terms of reference also encompass the topic of personal or welfare counselling. Here also, considerable progress has been made towards improving the guidance available to staff members.

*Classification and appointment criteria* Work has been in hand for some time to expand and enhance documentation of criteria for promotion or appointment. The availability of such material to staff is most important in the *in situ* promotion system applying to most CSIRO employees. Its availability to management is also essential if the Executive's policy of delegating operational responsibilities to Chiefs of Divisions and Directors of Institutes is to be implemented smoothly.

The setting down of classification and appointment criteria is a time-consuming task requiring detailed, systematic analysis of the performance levels of many staff members. The task has been completed in respect of two staff categories, with the resultant documentation now widely available throughout CSIRO.

Joint management/staff association working parties are presently engaged in documenting criteria for the major staff groups of Experimental Officers and Technical Assistants/Technical Officers.

### Staff development and training

CSIRO's staff development and staff training needs are unusual among public sector employers for several reasons. On the one hand, the nature of the Organization's work dictates that most staff have completed formal courses of training in various educational institutions. This tends to limit the training which the Organization needs to provide to programs aimed at developing supervisory or managerial skills on the part of supervisory staff and those likely to attain supervisory responsibilities in the future. Consequently, staff development activities are particularly directed towards familiarizing such staff with contemporary approaches to management issues and providing them with appropriate management skills. Particular emphasis is given to staff managing research programs and research services of various types. Use is made, as appropriate, of courses conducted by outside bodies.

At the same time, the way in which CSIRO tends to deploy its staff means that the traditional programs of training in the tertiary institutions sometimes do not provide the range of skills which CSIRO staff are often called upon to exercise. To an extent, therefore, the Organization's staff development programs are aimed at complementing courses of instruction available elsewhere.

CSIRO's personnel management practices have contributed greatly to the development of a climate favourable to scientific research, but at the same time have created staff development needs. In particular, the *in situ* merit promotion concept applying to the majority of staff categories by its nature tends to discourage mobility and to encourage a very high degree of specialization by staff. This in turn points to the need to provide training aimed at broadening and generalizing the skills which CSIRO officers possess. Many of the recent initiatives in staff training and staff development have been directed to this end.

The geographic spread of CSIRO has also led to particular training needs, stemming from both the relatively low accessibility of colleges and universities in remote localities and the relative isolation of many staff from those with like interests. The Organization's training activities have reflected these needs, particularly as they apply to technical, trades and administrative staff.

These considerations together have had a marked effect in shaping CSIRO's present staff development and training activities, especially the development and conduct of specific courses. The majority of courses in technical and trades fields, for example, are arranged by regional and State training committees in response to local needs. Many actually draw on CSIRO staff for much of all of the instruction, although selective use is made of external consultants.

Coordination and policy advice in all sectors of the Organization's staff development activities are provided by a specialized staff development unit in Head Office. The responsibilities of this unit also include the establishment and maintenance of contact with a range of training and related specialists outside CSIRO; monitoring the effectiveness of CSIRO's staff development program; and presentation to the Executive of an annual report on staff development and training. The unit also develops and conducts specific courses, with particular emphasis on management development. As well as a continuing program of courses in traditional management development subjects, significant courses conducted have encompassed research management (financial resources allocation), management effectiveness, selection interviewing and counselling, the use of microprocessors, technical photography, pedological techniques and purchasing techniques.

During the year the Organization expanded its level of training of apprentices. The appointment of 60 additional apprentices was possible under the Government's special training scheme for apprentices in Commonwealth establishments.

Mechanisms for coordinating and supervising the training of apprentices were also reviewed and upgraded. Two regional apprenticeship coordinators have been appointed, responsible for:

- . assisting Divisional staff in the selection, induction, training, rotation and counselling of apprentices;
- . advising Divisional staff on detailed trade training programs;
- providing policy advice on the Organization's overall approach to apprentice training;
- . producing an annual report on CSIRO's apprentice training.

### 9. Finance and buildings

In 1978/79 CSIRO's total expenditure of \$167.9 million, comprising expenditure from all sources of funds directly available to CSIRO, represented a 4.9 per cent increase over the 1977/78 level. However, this increased expenditure was significantly less than that required to compensate fully for the impact of inflation on the Organization's operating expenses.

The staffing levels of the Organization's existing programs decreased slightly as a result of a further reduction in its approved staff ceilings for existing Appropriationfunded activities, and a slight decrease in positions supported from other funds. However, the Government provided additional staff ceiling cover to accommodate the transfer of part of the Materials Research Laboratories, Adelaide, from the Department of Defence to CSIRO; the employment of an additional 60 apprentices by CSIRO as part of the Government's apprenticeship training scheme; support for high-priority research associated with the management of the Australian Fishing Zone; and the expansion of the Government's energy research, development, and demonstration program through grants administered by the Department of National Development.

Some staff were redeployed during the year to meet the increased requirements of the Australian National Animal Health Laboratory and the newly established Centre for International Research Cooperation, and for work on bluetongue and the breeding of aphid-resistant strains of lucerne. The Executive continued to encourage the redeployment of staff and resources into high-priority research within the areas of energy, biological control, land and water resources, and oceanic research. Resources were also deployed to help consolidate the research effort of a number of other nationally important research programs.

During 1978/79 the Organization received significant support for its energy research program through grants from the National Energy Research Development and Demonstration Council (NERDDC) funded from Appropriation to the Department of National Development and levies collected from the coal industry under the Coal Levy Research Act. Grants amounting to \$1.674 million from the Coal Research Trust Account, and \$1.598 million over a threeyear period from Appropriation funds, were approved by the Minister for National Development during 1978/79.

The table on the following page summarizes the sources of CSIRO's funds for 1978/79 and the categories of expenditure.

The expenditure of \$149.5 million from Appropriation and Revenue represents an increase of \$10.9 million or 7.9 per cent over the Organization's expenditure of \$138.6 million from these sources in 1977/78. However, a significant proportion of this increase relates to the need to meet the fullyear costs of supporting the wool research activities transferred from the Wool Research Trust Fund to Appropriation and the transfer of the Materials Research Laboratory of the Department of Defence to CSIRO during 1977. The 1977/78 expenditure by the Organization reflected only a part-year support of these activities from January 1978 in the case of wool research programs and from September 1977 in the case of the Materials Research Laboratories. It was therefore necessary in 1978/79 for the Organization to meet the added cost of a full-year's expenditure against these activities.

CSIRO's 1978/79 expenditure was also increased by \$348,000 to provide additional research to assist the Department of Primary Industry in relation to monitoring and managing the resources of the Australian Fishing Zone.

Source of funds	Salaries and general running expenses	Contributions to Research Associations and other contributions	Capital works and services and major items of equipment	Total
	(\$)	(\$)	(\$)	(\$)
Appropriation				
including revenue	144,836,611	1 409 558	3 256 628	149 502 797
Wool Research	1,000,011	1,107,000	5,250,020	147,502,777
Trust Fund	5,717,848	_	776 156	6 494 004
Meat Research	-,,		770,150	0,474,004
Trust Account	2,778,687	-	955	2 779 642
Wheat Research	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		,,,,	2,777,042
Trust Account	357,001	_	_	357 001
Dairying Research				557,001
Trust Account	337,527	-	_	337 527
Fishing Industry				557,527
Research Trust				
Account	155,028	_	-	155 028
Oilseeds Research				155,020
Trust Account	28,892	_	_	28 892
Dried Fruits Research				20,072
Trust Account	42,332	_	_	42 332
Poultry Industry				12,552
Trust Fund	_	_	9.500	9 500
Chicken Meat Research			,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Trust Account	18,200	-	10,687	28.887
Pig Industry Research			510 L. · · · · · · · · · · · · · · · · · ·	
Trust Account	22,854	_	7,637	30,491
NERDDC – Coal Researc	ch			
Trust Account	177,806	-	122,983	300,789
NERDDC –				
Appropriation Fund	33,722	-	_	33,722
Other contributors	6,374,807	-	1,400,079	7,774,886
Total	160,881,315	1,409,558	5,584,625	167,875,498

During 1978/79 CSIRO's commitments were reduced by \$2.7 million as a result of the changed funding arrangements for the payment of the Government's contribution to the Standards Association of Australia and the National Association of Testing Authorities. During 1978/79 the payment of grants for these bodies was made by the Department of Science and the Environment and CSIRO's Estimates were reduced accordingly. This action follows the Government's decision on the recommendation of the Independent Inquiry into CSIRO that CSIRO's budget should not be used as a channel for Government contributions to these bodies.

After taking into account the above adjustments, CSIRO's increases in expenditure during 1978/79 were accounted for largely by the need to meet inescapable increases in the salaries of its staff. Only a moderate increase of some 5 per cent was available to lessen the impact of inflation on its operating costs.

In addition to the money that CSIRO received directly from the Government, industry and other contributors, some \$19.9 million was spent by the Departments of Housing and Construction and Administrative Services on buildings and other works for CSIRO and on the acquisition of land. Some 89 per cent of CSIRO's income was provided directly by the Commonwealth Government and by revenue. Of the remaining 11 per cent, some threefifths was contributed from Research Funds concerned with primary industries. Most of these funds are derived from a statutory levy on produce, with a supporting contribution from the Commonwealth Government.

### **Buildings**

The Government's policy of financial restraint caused some slowing down of the Civil Works Program during 1978/79; however, all items included on the Civil Works Program proceeded to tender.

Many of CSIRO's buildings were constructed before 1960 and it has been necessary to provide an increasing amount of finance to repair and maintain the assets. During 1978/79 a repairs and maintenance program of \$3.7 million was implemented.

# Centre for Animal Research and Development

On 13 November 1978 President Suharto officially opened the Centre for Animal Research and Development at Ciawi, near Bogor, Indonesia.

The laboratory, generally known in Indonesia as P3T (Pusat Penelitian dan Pengembangan Ternak) is a joint Indonesian-Australian Colombo Plan project. The Australian component is financed by the Australian Development Assistance Bureau, and CSIRO is responsible for management. The objective is to develop a research institute capable of problem-solving research of the highest calibre, in order to assist Indonesia to improve the efficiency and output of its animal industries. Most of the research staff are at present Australian, but a vigorous training program is being conducted so that the research can be taken over by Indonesian scientists.

The buildings were constructed by the Department of Housing and Construction at a cost of some \$11 million. They include laboratories, an administration building, a library, a workshop, chicken and duck facilities, a feed mill, a sheep and goat section and a large ruminant complex. Although the scientists working at P3T will have the use of the latest scientific equipment to assist them in their task, the emphasis is on developing technologies and animal production systems applicable at the village level.

National Measurement Laboratory On 23 February 1979 His Excellency, the Governor-General, Sir Zelman Cowen, opened the new \$27 million National Measurement Laboratory in the Sydney suburb of Lindfield. The Laboratory is the headquarters of the DIVISION OF APPLIED PHYSICS. It replaces the former National Measurement Laboratory buildings at the University of Sydney. These were built 40 years ago and, apart from being too small to cope with the Division's expanding activities, failed to provide the freedom from vibration and electromagnetic interference essential to the high-precision nature of the Division's work.

The overall design of the new complex was the result of extensive collaboration between the Organization and the Department of Housing and Construction. The 30-hectare site was selected to minimize vibration and the main blocks were screened against radio frequency interference by steel mesh in the outer walls and metal films on the windows. The air-conditioning system provides very fine temperature control to suit the needs of individual laboratories. The complex includes laboratories, a lecture theatre, library and administration area.

### Central Australian Laboratory

The Prime Minister, Mr Malcolm Fraser, opened the Central Australian Laboratory of the DIVISION OF LAND RESOURCES MANAGEMENT in Alice Springs on 6 April 1979. The \$750,000 Laboratory provides a base for studies of Australia's vast rangelands and also accommodates the Australian resources satellite administered by the Department of Science and the Environment. The Laboratory was built by the Department of Housing and Construction.

### ANAHL

The Australian National Animal Health Laboratory (ANAHL) has been under construction since March 1978. During 1978/79 about \$10.5 million was spent on the project. The current authorized cost is \$83.1 million. Progress is on schedule and site works and below-ground construction of the basements and engineering service areas are well advanced. It is estimated that the Laboratory will be operational in 1985.

### Cattle Research Laboratory

In March 1979 a \$4.5 million contract was let for the construction of a new Beef Cattle Research Laboratory for the DIVISION OF ANIMAL PRODUCTION. The Laboratory will be built on a 32-hectare site some 5 kilometres north of Rockhampton and should be completed towards the end of 1980. Site works and ancillary facilities are estimated at an additional \$0.5 million.

For more than 20 years the Division has been conducting an extensive research program at the National Cattle Breeding Station, Belmont, near Rockhampton, to study the adaptation of cattle to the tropical environment. This work has been hampered, however, by the scattered and inadequate nature of back-up laboratory facilities in Rockhampton.

The new Laboratory will make possible an intensification of the present research program of the DIVISION OF ANIMAL PRODUCTION which is concerned with improving breeding and management strategies for beef production in Northern Australia. It will also provide accommodation for officers from the DIVISIONS OF ANIMAL HEALTH, ENTOMOLOGY, COMPUTING RESEARCH and TROPICAL CROPS AND PASTURES.

### Clayton complex

In May 1979 Parliament approved the recommendation of the Standing Committee on Parliamentary Public Works (PPWC) that the construction of a new laboratory for the DIVISION OF CHEMICAL TECHNOLOGY at an estimated cost of \$9.1 million should proceed. Construction should commence towards the end of the 1979/80 financial year and be completed over a period of two and a half years. The laboratory will be on a 15.4-hectare site at Clayton, South Melbourne, adjacent to Monash University. The site, which was acquired in 1961, already houses the DIVISIONS OF CHEMICAL PHYSICS and MINERAL ENGINEERING.

The existing accommodation of the DIVISION OF CHEMICAL TECHNOLOGY, originally constructed for research into wood science by the former DIVISION OF FOREST PRODUCTS, is now totally inadequate and unsuitable for highly sophisticated physical and organic research. The site is also mentally unsuited to the conduct of modern-day scientific research. The work of the Division centres on the application of chemical and polymer technology to the effective utilization and protection of Australia's renewable and recyclable resources.

It is also proposed to construct laboratories at Clayton for the DIVISIONS OF MATERIALS SCIENCE and APPLIED ORGANIC CHEMISTRY. During the course of the 1978/79 financial year, Cabinet approved reference to the PPWC of CSIRO's proposals for the construction of laboratories for these two Divisions. It is anticipated that the Committee will be examining these proposals during the course of the 1979/80 financial year.

The establishment of the Chemical Technology laboratory at Clayton and the proposed establishment of laboratories for the DIVISIONS OF MATERIALS SCIENCE and APPLIED ORGANIC CHEMISTRY is part of a long-term plan initiated by the Executive in the late 1950s to overcome the inadequate and unsuitable conditions in which much of the Organization's chemical and industrial research was then carried out.

### Crop Adaptation Laboratory

Cabinet has approved reference to the PPWC of the Organization's proposal to construct a crop adaptation laboratory for the DIVISION OF PLANT INDUSTRY at Black Mountain, Canberra. It is anticipated that the Committee will examine this proposal during the course of the 1979/80 financial year.

Projects costing \$40,000 or more which were completed during 1978/79 are listed below with their authorized cost.

ANIMAL HEALTH-Badgery's Creek, NSWprovision of fire-hydrant facilities-\$90,981

ANIMAL HEALTH-Sydney-renovation of animal annexe at Glebe-\$52,929

ANIMAL HEALTH-Badgery's Creek, NSWconstruction of incinerator-\$52,839

ANIMAL PRODUCTION-Perth-erection of animal house at Floreat Park-\$171,914

APPLIED GEOMECHANICS-Melbournemodification to laboratories and conference room at Syndal-\$106,003

APPLIED ORGANIC CHEMISTRY–Melbourne– upgrading of laboratories at Fishermen's Bend– \$203,447

CHEMICAL TECHNOLOGY-South Melbourneprovision of neutralizing tank and acid waste drainage system-\$44,195 CSIRO BLACK MOUNTAIN SITE-Canberradevelopment works including construction of roads and erection of glasshouses at Black Mountain-\$451,700

CSIRO BLACK MOUNTAIN SITE- Canberraconstruction of entrance roadway and site development-\$102,667

FOOD RESEARCH-Sydney-erection of workshop and store complex at North Ryde-\$219,856

FOOD RESEARCH–Melbourne–extension and upgrading of workshop modifications to microbiological laboratory at Highett– \$179,625

FOOD RESEARCH–Sydney–improvements to fire-fighting facilities at North Ryde– \$69,471

FOOD RESEARCH-Sydney-provision of fume cupboards at North Ryde-\$42,742

FOREST RESEARCH–Atherton, Qld–erection of herbarium–\$144,614

HORTICULTURAL RESEARCH– Merbein, Vic.– erection of workshop and toilet block– \$171,841

LAND RESOURCES MANAGEMENT- Perthenlargement of photographic laboratory at Floreat Park-\$46,625

MINERALS RESEARCH LABORATORIES– Melbourne–extension of light technical laboratories at Clayton–\$283,565

MINERALS RESEARCH LABORATORIES-Port Melbourne-upgrading of process bay-\$175,618

MINERALS RESEARCH LABORATORIES– Perth–erection of hydrothermal laboratory at Floreat Park–\$99,268

MINERALS RESEARCH LABORATORIES– Sydney–installation of fire-protection system at North Ryde–\$43,099 RADIOPHYSICS-Culgoora, NSW-extension of water supply-\$109,591

TEXTILE INDUSTRY- Geelong, Vic.extension of laboratory and library-\$511,145

WILDLIFE RESEARCH-Kapalga, NTdevelopment of field site (Stage 2)-\$166,725

WILDLIFE RESEARCH–Berrimah, NT– erection of herbarium and library–\$91,800

WILDLIFE RESEARCH–Berrimah, NT– structural strengthening of laboratory– \$50,023

Projects costing more than \$40,000 which were committed during 1978/79 are listed below with their program authorization.

ANIMAL HEALTH–Armidale, NSW– erection of immunological laboratory–\$217,280

ANIMAL PRODUCTION- Rockhampton, Qlderection of beef cattle laboratory-\$4,746,622

ANIMAL PRODUCTION-Badgery's Creek, NSW-upgrading of field station facilities including irrigation and cattle pens-\$129,987

ANIMAL PRODUCTION-Sydney-upgrading of electricity supply at Prospect-\$97,649

CSIRO BLACK MOUNTAIN SITE-Canberraerection of site services building at Black Mountain-\$244,536

ENTOMOLOGY – Canberra – erection of accommodation for Australian National Insect Collection at Black Mountain– \$899,446

ENTOMOLOGY–Sydney–conversion of existing rooms to provide quarantine facilities at Warrawee–\$108,137

ENTOMOLOGY–Canberra–replacement of service lift, building 101, Black Mountain– \$48,326

FOOD RESEARCH-Brisbane-erection of

experimental animal slaughter facility at Cannon Hill–\$312,647

HORTICULTURAL RESEARCH-Merbein, Vic.erection of glasshouse-\$117,727

HUMAN NUTRITION-Adelaide-erection of experimental animal house at Glenthorne-\$139,254

MECHANICAL ENGINEERING-Melbourneerection of research support building at Highett-\$602,157

MINERALS RESEARCH LABORATORIES– Sydney–erection of rock magnetism laboratory at North Ryde–\$585,796

MOLECULAR AND CELLULAR BIOLOGY UNIT-Sydney-erection of library, seminar and tea room annexe at North Ryde-\$212,900

PLANT INDUSTRY–Canberra–erection of glasshouse services building and potting shed (stage 1) at Black Mountain–\$160,000

PLANT INDUSTRY-Burren Junction, NSWerection of one house, a small ablutions block and upgrading of existing quarters-\$71,324

PROTEIN CHEMISTRY– Melbourne–upgrading of air-conditioning in west wing laboratory, Parkville–\$57,040

RADIOPHYSICS – Culgoora, NSW – extension of radio observatory building – \$394,709

SOILS-Townsville, Qld-erection of soil service building-\$83,081

SOILS–Adelaide–extension of plant and soil preparation building at Glen Osmond– \$62,000

TROPICAL CROPS AND PASTURES- Samford, Qld-erection of grass crossing house-\$454,345

TROPICAL CROPS AND PASTURES– Kununurra, WA–erection of three 3bedroom houses–\$158,323

TROPICAL CROPS AND PASTURES– Kununurra, WA–erection of two 3bedroom houses–\$105,880 TROPICAL CROPS AND PASTURES– Kununurra, WA–erection of two 2bedroom flats at Kimberley Research Station–\$97,970

TROPICAL CROPS AND PASTURES-Samford, Qld-erection of conditioned seed store-\$72,420

WILDLIFE RESEARCH- Canberra-erection of biology laboratory and research support building at Gungahlin-\$786,883

WILDLIFE RESEARCH-Helena Valley, WAerection of workshop and store-\$79,837

WILDLIFE RESEARCH-Kapalga, NTconstruction of access roads-\$65,905

### Annual Expenditure

The following summary gives details of expenditure by CSIRO Divisions and Units on other than capital items from 1 July 1978 to 30 June 1979.

Division or Unit	Appropriation Funds	Contributory Funds	Total
	(\$)	(\$)	(\$)
Head Office			
The main items of sumar diture under this heading are			
salaries and travelling expenses of the staff at Head			
Office and the Regional Administrative Offices.			
salaries and expenses of officers at the Liaison			
Offices in London, Washington, Tokyo and Moscow:			
and general office expenditure	10.035.506	343	10.035.849
			,,,,-
Research Programs			
Agricultural Research – Animal Industry			
Animal Health	5,814,820	705,385	6,520,205
Animal Production	5,581,483	2,112,289	7,693,772
Centre for Animal Research and Development, Indones	ia –	2,486,072	2,486,072
Agricultural Research – Plant Industry			
Plant Industry	7,630,123	316.871	7,946,994
Horticultural Research	1,518,074	56,109	1,574,183
Irrigation Research	1,307,215	49,820	1,357,035
Tropical Crops and Pastures	5,542,251	445,402	5,987,653
Agricultural Research – Entomology	5,940,251	1,620,587	7,560,838
Agricultural Research - Processing of Agricultural Proc	lucts		
Wheat Research	198,455	155,268	353,723
Textile Industry	1,719,448	2,362,846	4,082,294
Textile Physics	1,920,960	889,811	2,810,771
Protein Chemistry	2,784,430	90,698	2,875,128
Land Resources Studies			
Wildlife Research	2,610,712	206,809	2,817,521
Soils	4,112,726	83,092	4,195,818
Land Use Research	2,829,751	455,578	3,285,329
Land Resources Management	3,783,594	233,398	4,016,992
Forest Research	4,327,140	14,277	4,341,417
Fisheries and Oceanography	6,486,223	137,368	6,623,591
Food and Human Nutrition			
Molecular and Cellular Biology Unit	1,249,058	-	1,249,058
Human Nutrition	1,698,290	12,139	1,710,429
Food Research	5,739,285	1,231,794	6,971,079
Manufacturing Industry – General			
Chemical Technology	2,499,931	218,352	2,718.283
Building Research	5,042,249	129,316	5,171,565
Materials Science	3,145,985	58,983	3,204,968
Mechanical Engineering	1,992,050	194,145	2,186,195

Division or Unit	Appropriation Funds	Contributory Funds	Total
	(\$)	(\$)	(\$)
Manufacturing Industry – Chemical Support			
Applied Organic Chemistry (including			
Microanalytical Laboratory)	2,554,004	171,026	2,725,030
Manufacturing Industry – Physical Support			
Chemical Physics	2,476,387	2.200	2,478,587
Applied Physics*	8,413,295	_	8,413,295
Mining, Minerals and Energy			
Minerals Research Laboratory–Clayton	1,954,998	76,494	2,031,492
Minerals Research Laboratory–Port Melbourne	3,053,799	154,854	3,208,653
Minerals Research Laboratory-Floreat Park	1,169,590	48,404	1,217,994
Minerals Research Laboratory–North Ryde	4,853,851	427,847	5,281,698
Baas Becking Geobiological Group	15,000	101,682	116,682
Applied Geomechanics	1,761,216	376,723	2,137,939
Atmospheric Science			
Atmospheric Physics	2,181,147	35,985	2,217,132
Cloud Physics	1,515,580	-	1,515,580
Environmental Mechanics	641,811	6,758	648,569
Australian Numerical Meteorology Research Centre	422,861	10,484	433,345
Astronomy			
Radiophysics	4,203,067	218,243	4,421,310
Research Support			
Computing Research	2,900,384	1,400	2,901,784
Mathematics and Statistics	2,477,581	-	2,477,581
Contract Research	208,798		208,798
Extra-Mural Grants	302,066	_	302,066
Developmental Projects	385,629	_	385,629
Information Services			
Central Information, Library and Editorial Section	3,594,850	240	3,595,090
Central Communication Unit	807,441	85,543	892,984
Miscellaneous			
Centre for International Research Cooperation	163,645	22,662	186,307
Other Expenditure	3,269,601	37,407	3,307,008
Contributions			
Research Associations	871,050	-	871,050
Other Contributions	538,508	_	538,508
Total Expenditure	146,246,169	16,044,704	162,290,873

\*Formerly known as the National Measurement Laboratory

### Capital Expenditure under CSIRO Control

The table which follows shows capital expenditure from funds made available directly to CSIRO. It includes expenditure on capital and developmental works and on items of equipment costing more than \$25,000 each.

Division or Unit	Appropriation	Contributory Funds	Total
	Funds		
	(\$)	(\$)	(\$)
Head Office	97,726	_	97,726
Agricultural Research – Animal Industry			
Animal Health	131.776	27,824	159,600
Animal Production	106.202	252.124	358,326
Centre for Animal Research and Development, Indon	esia –	1,368,044	1,368,044
Agricultural Research – Plant Industry			
Plant Industry	177,373	-	177,373
Horticultural Research	45,321	2,898	48,219
Irrigation Research	50,979	_	50,979
Tropical Crops and Pastures	133,217	_	133,217
Agricultural Research – Entomology	42,105	955	43,060
Agricultural Research – Processing of Agricultural Pro-	oducts		
Textile Industry	181,409	439,113	620,522
Textile Physics	59,640	113,555	173,195
Protein Chemistry	5,053	-	5,053
Land Resources Studies			
Wildlife Research	11,082	_	11,082
Soils	164,511	-	164,511
Land Resources Management	137,483	500	137,983
Forest Research	51,150		51,150
Fisheries and Oceanography	93,245	_	93,245
Food and Human Nutrition			
Molecular and Cellular Biology Unit	61,774	-	61,774
Human Nutrition	49,040	-	49,040
Food Research	313,529	-	313,529
Manufacturing Industry – General			
Chemical Technology	49,512	_	49,512
Building Research	37,622	-	37,622
Materials Science	217,116	-	217,116
Mechanical Engineering	21,132	_	21,132
Manufacturing Industry — Chemical Support			
Applied Organic Chemistry	94,389	—	94,389
Manufacturing Industry — Physical Support			
Chemical Physics	10,348	_	10,348
Applied Physics*	50,599		50,599

Division or Unit	Appropriation Funds	Contributory Funds	Total
	(\$)	(\$)	(\$)
Mining, Minerals and Energy			
Minerals Research Laboratory-Clayton	46,289	-	46,289
Minerals Research Laboratory-Port Melbourne	20,003	_	20,003
Minerals Research Laboratory-Floreat Park	183,809	—	183,809
Minerals Research Laboratory-North Ryde	137,951	122,984	260,935
Applied Geomechanics	86,074	_	86,074
Atmospheric Science			
Atmospheric Physics	17 546	_	17 546
Cloud Physics	23,890	_	23,890
Astronomy			
Radiophysics	19,502	-	19,502
Research Support			
Computing Research	85,151	-	85,151
Mathematics and Statistics	7,940	-	7,940
Information Services			
Central Information, Library and Editorial Section	235,140	-	235,140
Total Expenditure	3,256,628	2,327,997	5,584,625

\*Formerly known as the National Measurement Laboratory

#### AUDITOR-GENERAL'S OFFICE

Canberra House, Marcus Clarke St., Canberra City, A.C.T. 2601 P.O. Box 707 – Telephone 49 1988 Telegrams 'Secaudit'

24 August 1979

The Honourable the Minister for Science and the Environment Parliament House CANBERRA A.C.T. 2600

### Commonwealth Scientific and Industrial Research Organization

Dear Sir,

In compliance with section 57(3) of the Science and Industry Research Act 1949, financial statements of the Commonwealth Scientific and Industrial Research Organization for the year ended 30 June 1979 have been submitted for my report. These comprise:

> Summary of Receipts and Payments Consolidated Statement of Payments Statement of Payments – General Research Account Statement of Payments – Specific Research Account

One set of the statements, in the form approved by the Minister for Finance, is attached.

I now report in accordance with section 57(3) of the Act that the statements are in agreement with the accounts and records and in my opinion –

- . the statements are based on proper accounts and records; and
- . the receipt, expenditure and investment of moneys and the acquisition and disposal of assets, by the Organization during the year have been in accordance with the Act.

Yours faithfully,

(SGD) D.R. STEELE CRAIK

(D.R. STEELE CRAIK) AUDITOR-GENERAL
	Funas neld 1 Juiy 1978 (\$)	Receipts	Total funds available	Payments	Funds held 30 June 1979
		(\$)	(\$)	(\$)	(\$)
General Research					
Account	479,293	150,574,846*	151,054,139	149,502,797	1,551,342
	(336,515)**	(138,719,845)	(139,056,360)	(138,577,067)	(479,293)
Specific Research					
Account	3,362,615	19,431,533	22,794,148	18,372,701	4,421,447
	(2,874,307)	(21,931,577)	(24,805,884)	(21,443,269)	(3,362,615)
Other Trust					
Moneyst	317,517	1,455,702	1,773,219	1,522,975	250,244
	(431,583)	(1,313,022)	(1,744,605)	(1,427,088)	(317,517)
Total	4,159,425	171,462,081	175,621,506	169,398,473	6,223,033‡
	(3,642,405)	(161,964,444)	(165,606,849)	(161,447,424)	(4,159,425)

## Summary of Receipts and Payments

\*Comprises

Appropriations-Consolidated Revenue Fund		
Operational	142,929,000	
Capital	3,100,000	
		146,029,000
Revenue and Other Receipts		
Sale of publications	295,762	
Receipts in respect of expenditure of former years	308,229	
Sale of produce, including livestock	459,369	
Royalties from patents	28,467	
Fees for tests and other services	251,666	
Computing service charges	2,765,732	
Miscellaneous receipts including interest on		
investments	436,621 ø	
		4,545,846
		150,574,846

\*\* Figures in brackets refer to 1977/78 financial year.

+ Moneys held temporarily on behalf of other organizations and individuals.

<sup>‡</sup> Includes investments totalling \$2,160,200.

ø Interest of \$240,705 was transferred from the Specific Research Account during the year. Of this sum \$213,772 was accumulated at 30 June 1978.

N.K. Boardman (Acting Chairman)

## Consolidated Statement of Payments

1977/78 (\$)		1978/79 (\$)
	Head Office (including Regional Administrative Offices)	
6,706,994	Salaries and allowances	7,098,752
333,929	Travelling and subsistence	387,905
455,798	Postage, telegrams and telephone	613,990
1,880,005	Incidental and other expenditure	1,935,202
9,376,726		10,035,849
	Research Programs	
	Agricultural Research	
15,618,984	Animal Industry	16,700,049
16,083,578	Plant Industry	16,865,865
7,051,940	Entomology	7,560,838
9,506,042	Processing of Agricultural Products	10,121,916
17,703,432	Land Resources Studies	18,657,077
5,564,500	Fisheries and Oceanography	6,623,591
9,052,182	Food and Human Nutrition	9,930,566
12 501 106	Manufacturing Industry	12 291 011
2 701 610	Chamical Support	2 7 25 0 20
10 461 943	Physical Support	10 891 882
13 222 814	Mining Minerals and Energy	13 004 458
4 1 27 41 3	Atmospheric Science	4 814 626
4,050,414	Astronomy	4 421 310
6.225.174	Research Support	6,275,858
4,165,720	Information Services	4,488,074
2,629,897	Miscellaneous	3,493,315
140,756,758		150,845,466
	Contributions	
976.072	Research Associations	871.050
3,125,797	Other Contributions	538,508
4,101,869		1,409,558
	Capital Works and Samiaas	
3,369,467	Building works plant and developmental expenditure	2 084 202
2,415,516	Major items of laboratory equipment	2,984,295
	major remit or laboratory equipment	2,000,332
5,784,983		5,584,625
	Other Trust Moneys	
	Remittance of revenue from investigations financed from	
362,659	Industry Trust Accounts	407,004
1,064,429	Other miscellaneous remittances	1,115,971
1,427,088		1,522,975
161,447,424 <sup>ø</sup>	Total Expenditure	169,398,473

 $\phi\,$  Dissection details of 1977/78 expenditure have been adjusted, where necessary, to allow comparison with 1978/79 figures.

N.K. Boardman (Acting Chairman) F.J. W

### Statement of Payments-General Research Account\*

1977/78 (\$)		1978/79 (\$)
(\$)	Head Office (including Regional Administrative Offices)	(4)
6,706,994	Salaries and allowances	7,098,752
333,929	Travelling and subsistence	387,562
455,798	Postage, telegrams and telephone	613,990
1,880,005	Incidental and other expenditure	1,935,202
9,376,726		10,035,506
	Research Programs	
	Agricultural Research	
9,692,157	Animal Industry	11,396,303
14,903,687	Plant Industry	15,997,663
5,395,860	Entomology	5,940,251
4,192,523	Processing of Agricultural Products	6,623,293
16.516.171	Land Resources Studies	17,663,923
5,458,296	Fisheries and Oceanography	6,486,223
7,890,173	Food and Human Nutrition	8,686,633
10.05/.054	General	12 680 215
2 538 746	Chemical Support	2 554 004
10 461 943	Physical Support	10 889 682
12 389 586	Mining Minerals and Energy	12 808 454
4 114 041	Atmospheric Science	4 761 399
3 827 597	Astronomy	4 203 067
6 225 174	Research Support	6 274 458
4 1 35 262	Information Services	4 402 291
2,549,532	Miscellaneous	3,433,246
122,347,702		134,801,105
076 072	Contributions	971.050
976,072	Action Associations	8/1,050
5,125,797	Other Contributions	538,508
4,101,869		1,409,558
	Capital Works and Services	
757,440	Building, works, plant and developmental expenditure	999.875
1,993,330	Major items of laboratory equipment	2,256,753
2,750,770		3,256,628
138,577,067	Total Expenditure	149,502,797

\*Previously styled Special Account; the title has been changed to General Research Account following amendments to the Science and Industry Research Act assented to in November 1978.

N.K. Boardman (Acting Chairman)

1977/78 (\$)		1978/79 (\$)
	Head Office (including Regional Administrative Offices)	
_	Travelling and subsistence	343
ø		343
	Research Programs	
	Agricultural Research	
5,926,827	Animal Industry	5,303,746
1,179,891	Plant Industry	868,202
1,656,080	Entomology	1,620,587
5,313,519	Processing of Agricultural Products	3,498,623
1,187,261	Land Resources Studies	993,154
106,204	Fisheries and Oceanography	137,368
1,162,009	Food and Human Nutrition	1,243,933
	Manufacturing Industry	
534,152	General	600,796
162,873	Chemical Support	171,026
_	Physical Support	2,200
833,228	Mining, Minerals and Energy	1,186,004
13,372	Atmospheric Science	53,227
222,817	Astronomy	218,243
-	Research Support	1,400
30,458 Ø	Information Services	85,783
80,365	Miscellaneous	60,069
18,409,056		16,044,361
	Capital Works and Services	
2,612,027	Buildings, works, plant and developmental expenditure	1,984,418
422,186	Major items of laboratory equipment	343,579
3,034,213		2,327,997
21,443,269	Total Expenditure	18,372,701

## Statement of Payments-Specific Research Account

 Ø Parkes Visitors' Centre expenditure previously included under Head Office is now recorded under Information Services.

N.K. Boardman (Acting Chairman)

# Appendix 1

The following is a list of Members of the Executive, Directors of Institutes, Chiefs of Divisions and Officers-in-Charge of Units, together with senior staff of Central Administration, Overseas Offices and Regional Administrative Offices.

#### EXECUTIVE

Chairman and Chief Executive I.P. Wild, CBE, ScD, FTS, FAA, FRS

Full-time members N.K. Boardman, ScD, FAA, FRS W.J. McG. Tegart, PhD, FTS

Part-time members D.J. Asimus, BEc W.L. Hughes, DPhil V.E. Jennings, OBE, BE H.M. Morgan, LLB, BCom R.K.R. Morris, BCom

#### INSTITUTE OF ANIMAL AND FOOD SCIENCES

Director Divisions Chiefs Animal Health Animal Production Food Research Human Nutrition Units Centre for Animal Research and

Development Molecular and Cellular Biology Wheat Research

K.A. Ferguson, PhD, FTS A.K. Lascelles, PhD T.W. Scott, PhD J.H.B. Christian, PhD, FTS (Acting) B.S. Hetzel, MD

#### Officers-in-Charge

R.H. Wharton, PhD, FAA G.W. Grigg, PhD E.E. Bond, MBE, ARMTC

#### INSTITUTE OF BIOLOGICAL RESOURCES

2	
Director	M.V. Tracey, AO, MA,
	FTS
Divisions	Chiefs
Entomology	D.F. Waterhouse, CMG,
	DSc, FAA, FRS
Fisheries and	
Oceanography	D.J. Rochford, BSc
Forest Research	M.F.C. Day, AO, PhD,
	FAA
Horticultural Research	J.V. Possingham, DSc
Irrigation Research	P.E. Kriedemann, PhD
Plant Industry	W.J. Peacock, PhD, FAA
Tropical Crops and	
Pastures	E.F. Henzell, DPhil
Wildlife Research	H.J. Frith, DSc, FTS,
	FAA

#### INSTITUTE OF EARTH RESOURCES

Director

Divisions Applied Geomechanics Land Resources Management Land Use Research Mineral Chemistry Mineral Engineering Mineralogy Mineral Physics Process Technology Soils Units Fuel Geoscience Physical Technology

**Textile Physics** 

MSc. FTS Chiefs D.F. Kelsall, PhD, FTS

I.E. Newnham, MBE,

R.A. Perry, MSc, FTS R.J. Millington, PhD, FTS D.F.A. Koch, PhD D.F. Kelsall, PhD A.J. Gaskin, MSc K.G. McCracken, DSc A.V. Bradshaw, BSc A.E. Martin, DAgSc

Officers-in-Charge G.H. Taylor, DSc E.G. Bendit, DSc

#### INSTITUTE OF INDUSTRIAL TECHNOLOGY

Director	Professor Emeritus H.W. Worner, DSc, FTS
Divisions	Chiefs
Applied Organic	
Chemistry	D.H. Solomon, DSc, FTS FAA
Building Research	F.A. Blakey, PhD
Chemical Technology	H.G. Higgins, DAppSc, FTS
Mechanical Engineering	B. Rawlings, PhD
Protein Chemistry	W.G. Crewther, DSc
Textile Industry	D.S. Taylor PhD

A.R. Haly, DSc

#### **INSTITUTE OF PHYSICAL SCIENCES**

Director	A.E. Pierce, DSc (Acting)
Divisions	Chiefs
Applied Physics	F.J. Lehany, AO, DSc
Atmospheric Physics	G.B. Tucker, PhD
Chemical Physics	A.McL. Mathieson, DSc,
	FAA (Acting)
Cloud Physics	J. Warner, BSc, BE
Computing Research	P.J. Claringbold, PhD
Environmental Mechanics	J.R. Philip, DSc, FAA,
	FRS
Materials Science	J.R. Anderson, ScD, FAA
Mathematics and	
Statistics	J.M. Gani, DSc, FAA
Radiophysics	H.C. Minnett, OBE, BSc, BE, FAA
Unit	Officer-in-Charge
Australian Numerical	
Meteorology Research	
Centre	D.J. Gauntlett, PhD

#### **OVERSEAS OFFICES**

Minister (Scientific)	
London	R.M. Moore, AO, DScAg
Counsellor (Scientific)	
Moscow	J.G. Downes, BSc
Counsellor (Scientific)	
Tokyo and Seoul	T.D. Grace, PhD
Counsellor (Scientific)	
Washington	J.H. Whittem, BVSc

#### **REGIONAL ADMINISTRATIVE OFFICES**

Brisbane	D.B. Thomas, BA
Canberra	G.A. Cave, BCom
Melbourne	W.C. Hosking, AASA,
	ACIS
Perth	J.P. Brophy, MBE
Sydney	T.C. Clark, AASA, ACIS

#### BUREAU OF SCIENTIFIC SERVICES

Director	S. Lattimore, BSc, ARCS
Units	Officers-in-Charge
Central Information,	
Library and Editorial	
Section	P.J. Judge, MA
Centre for International	
Research Cooperation	A.F. Gurnett-Smith,
	BAgSc
Commercial Group	P.A. Grant, FRMIT
Science Communication	
Unit	(Vacant)

#### PLANNING AND EVALUATION ADVISORY UNIT

Director	

D.E. Weiss, OBE, DSc, FTS, FAA

#### OFFICE OF THE EXECUTIVE

First Assistant Secretary (Office of the Executive) J. Coombe, OBE

#### **CENTRAL ADMINISTRATION**

Secretary	L.G. Wilson, AO, MSc
First Assistant Secretary	
(Administration)	H.C. Crozier, BA
First Assistant Secretary	
(Science Liaison)	P.F. Butler, MAgSc
Senior Assistant Secretary	
(Staff)	K.J. Thrift, BA

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