



CSIRO

CSIRO Operational Plan

1998–1999



CSIRO OPERATIONAL PLAN

1998–99

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is an independent statutory authority constituted and operating under the provisions of the *Science and Industry Research Act 1949.*

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Available from:

CSIRO Strategic Planning and Evaluation
PO Box 225
Dickson ACT 2602

Tel: (02) 6276 6684
Fax: (02) 6276 6335
E-mail: spe@exec.csiro.au

CSIRO Enquiries:

The CSIRO Information Network provides a free access point to CSIRO for scientific and technical enquiries. Tel: 1300 363 400

World Wide Web:
<http://www.csiro.au>

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Contents

Foreword	v
Organisational Chart	vi

Corporate Overview

Purpose, Vision, Values and Operating Principles	1
Operations and Reporting Matrix	2
Strategies	3
Resources by Division	4
Planned Investment in Sectors	5
Participation in Cooperative Research Centres	6
Outlook for 1998–99	8

Operational Units

1. Animal Health	9
2. Animal Production	10
3. Atmospheric Research	11
4. Australia Telescope National Facility	12
5. Building, Construction and Engineering	13
6. Energy Technology	14
7. Entomology	15
8. Exploration and Mining	16
9. Food Science Australia	17
10. Forestry and Forest Products	18
11. Human Nutrition	19
12. Land and Water	20
13. Manufacturing Science and Technology	21
14. Marine Research	22
15. Mathematical and Information Sciences	23
16. Minerals	25
17. Molecular Science	26
18. Petroleum Resources	27
19. Plant Industry	28
20. RV Franklin (A National Facility)	29
21. Telecommunications and Industrial Physics	30
22. Tropical Agriculture	31
23. Wildlife and Ecology	32
24. Wool Technology	33
25. CSIRO Executive	34
26. Corporate Units	35

Contact Details

Divisional Chiefs	41
Sector Coordinators	42

This year promises to be another eventful and challenging one.

Our science remains exciting and is contributing a great deal to Australia's development. The continuation of the Cooperative Research Program, albeit with some welcome subtle changes, and our own collaborations with like-minded research institutions are creating concentrations of world-class expertise to tackle the problems of the future.

Turning to internal matters, with our Enterprise Bargaining round behind us we now need to resolve the issues identified in the Agreement. In particular we need to find a better way to handle our staff appraisal and reward processes and how we set our work objectives.

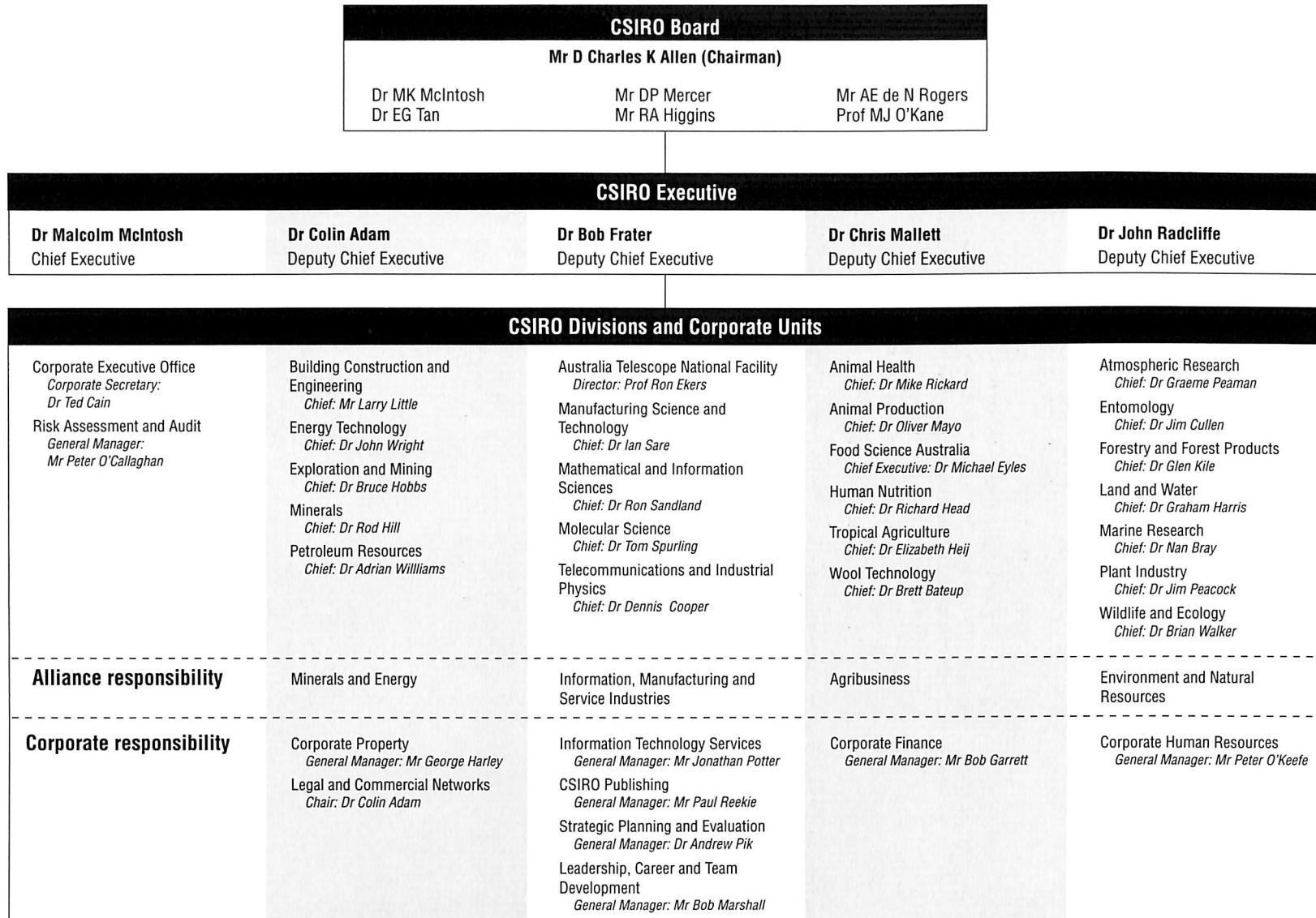
The Staff Opinion poll conducted earlier this year confirmed that we generally see ourselves as a high performing organisation, but raised some concerns about levels of trust beyond the immediate work group. The survey also revealed a very strong internal focus amongst many of our staff. Whilst pride in one's work and the intrinsic motivation that science provides are essential attributes for delivering quality outputs, and thus justify the internal focus, we must not forget that CSIRO's charter is to serve the Australian people—meeting customer needs, having a strong customer focus, is not an optional attribute for us.

This year marks the second year of our current funding triennium. The Divisional mergers are now in place and our sights firmly set on delivering the outputs we identified in our Strategic Research Plan. The outputs we intend to deliver this year are described in the Divisional entries to this Operational Plan as are the major objectives and activities for the Executive and each of the corporate support groups.

I urge all staff to read the Plan and to see how their work contributes to the goals we have set for ourselves and what we have set out to deliver.

Malcolm McIntosh
Chief Executive
June 1998
CSIRO Operational Plan 1998–99

Organisational Chart*



* As at 1 July 1998. Divisions and Corporate Units are shown below the Executive member responsible for oversight of their performance.

PURPOSE, VISION, VALUES AND OPERATING PRINCIPLES



Our Vision: To be a world class research organisation vital to Australia's future

Values Critical to our Success

Satisfied customers and supportive stakeholders through application of our research	CSIRO—Unity of purpose, diversity of means	Top people, top performance, integrity, trust and respect	First class science—because it helps Australia
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Operating Principles

<ul style="list-style-type: none">• We determine our research and commercialisation priorities by assessing the needs of, and potential benefit to, our customers, based on an understanding of their business and the world markets in which they operate.• We contribute our expertise to the development of science and technology policy and priorities in Australia.• We commit ourselves to excellence in technology transfer to ensure timely exploitation of research results.• We provide quality advice and service.• We deliver our research and services on time, within budget and in accordance with legal contractual and ethical obligations.	<ul style="list-style-type: none">• We determine priorities and implementation strategies at all levels of the corporation by a systematic process.• We apply the highest standards of management practice in all our operations. We pay particular attention to excellence in project management. We foster a culture of teamwork.• We evaluate all of our activities, working towards the world's best practice in quality and productivity.• We accept accountability for our decisions on the use of CSIRO's resources and take pride in our achievements for Australia.• We use lessons from our own and others' practices and experience to improve our performance continually.	<p>We work together to create an organisation that:</p> <ul style="list-style-type: none">• Seeks to recruit the best and the brightest, provides a stimulating environment to encourage individuals to develop their full potential and provides career opportunities which make CSIRO an attractive development base for future industry leaders.• Fosters adaptability and recognises exceptional performance with appropriate rewards.• Cares for the safety and well being of all employees with employment policies to support corporate goals.• Fosters creativity which underpins our performance and delivery.• Draws upon the breadth and depth of our skills to assemble excellent teams to tackle major challenges, and uses networks of special skills inside and outside CSIRO.• Respects the unique skills, professionalism and knowledge of all our employees, and recognises that we are responsible for creating and maintaining our reputation.	<ul style="list-style-type: none">• We maintain a world standard of scientific and engineering excellence in order to deliver agreed outcomes to our customers in industry, government and the community, on time and within budget.• The quality of our scientific research enhances Australia's international standing.• We work with Australia's education and training organisations to increase awareness of science and technology, and to enhance the supply of excellent graduates into the scientific and technical workforce.
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Corporate Overview

CSIRO OPERATIONS AND REPORTING MATRIX

Chief Executive—Dr Malcolm McIntosh



ALLIANCES		SECTORS																							
Agribusiness		Environment and Natural Resources		Information Technology, Infrastructure and Services		Manufacturing	Minerals and Energy																		
REPORTING DIVISIONS		Field Crops	Food Processing	Forestry, Wood & Paper Industries	Horticulture	Meat, Dairy & Aquaculture	Wool & Textiles	Biodiversity	Climate & Atmosphere	Land & Water	Marine	Information Technology & Telecommunications	Built Environment	Measurement Standards	Radio Astronomy	Services	Chemicals & Plastics	Integrated Manufactured Products	Pharmaceuticals & Human Health	Energy	Mineral Exploration & Mining	Mineral Processing & Metal Production	Petroleum		
DR CHRIS MALLETT																									
Animal Health		●			●	●												●							
Animal Production					●	●	●	●	●	●	●		●		●										
Food Science Australia		●	●	●	●	●												●	●						
Human Nutrition		●	●			●													●						
Tropical Agriculture		●				●	●	●	●	●	●	●													
Wool Technology						●																			
DR JOHN RADCLIFFE																									
Atmospheric Research																								●	
Entomology		●		●	●	●	●		●	●	●				●			●	●	●					
Forestry & Forest Products			●					●	●	●	●						●		●						
Land & Water		●		●	●	●	●	●	●	●	●		●		●		●			●	●	●	●	●	
Marine Research						●			●	●	●		●		●										●
Plant Industry		●	●	●	●	●	●	●	●	●	●							●	●						
Wildlife & Ecology		●		●		●	●	●	●	●	●		●		●		●			●	●				
DR BOB FRATER																									
Australia Telescope National Facility																	●								
Manufacturing Science & Technology			●										●		●			●	●	●	●	●	●	●	
Mathematical & Information Sciences		●	●	●	●	●	●	●	●	●	●		●	●	●		●	●	●	●	●	●	●	●	
Molecular Science																	●		●	●	●	●	●	●	
Telecommunications & Industrial Physics						●		●					●	●	●		●	●	●	●	●	●	●	●	
DR COLIN ADAM																	●								
Building Construction & Engineering																	●		●	●			●		
Energy Technology									●	●	●									●	●	●	●		
Exploration & Mining												●								●	●	●	●	●	
Minerals																				●	●	●	●	●	
Petroleum Resources																				●	●	●	●	●	

STRATEGIES

CSIRO conducts scientific research to assist Australian industry, further the interests of the Australian community and contribute to the achievement of Australian national objectives. Related primary functions are to encourage or facilitate the utilisation of research results, and to provide services and facilities in relation to science.

As the framework for planning and marketing its research, services and facilities, CSIRO has identified 22 Sectors representative of industries, natural resources and markets of national significance. The conduct and delivery of research is undertaken by CSIRO's Divisions in accordance with Sector Plans which are developed with the assistance of external Sector Advisory Committees. These Committees play an important role in helping CSIRO to identify those points at which CSIRO research can make the greatest contribution to the Sectors. Planning in this way emphasises our focus on identifying and serving the needs of the Australian community. Individual plans for each Sector form the basis of the CSIRO Strategic Research Plan for the current triennium: 1997–98 to 1999–2000.

CSIRO's Divisions are the focus of the Organisation's disciplinary skills base and the key business or operating units of CSIRO through which the Strategic Plan is put into effect. For this reason the CSIRO Operational Plan is presented on a Divisional basis.

CSIRO's strategies for the triennium are reflected in seven themes: Focus; Working with Customers; Teamwork and Collaboration; Balance; Excellence; Communication; and Fiscal Responsibility. Each of these is discussed in more detail in the CSIRO Strategic Research Plan 1997–98 to 1999–2000.

[1] Focus on real needs and realistic commitments

In planning for the triennium, a review of CSIRO's activities and opportunities highlighted CSIRO's impressive array of scientific achievements and diverse contributions to the nation, but raised the concern that resources in some areas may have been spread too thinly. Hence, a primary strategy for CSIRO is to focus increasingly on those research opportunities that are relevant to real economic, social or environmental needs, where CSIRO has an appropriate role and capability, and where there are firm signals of external support for CSIRO's involvement.

[2] Working with customers

To be truly successful in assisting industry and furthering community interests, CSIRO's efforts must not only focus on relevant research issues, they must also be grounded in a capacity to listen to, and work with, the stakeholders and customers for whom research is being conducted. To foster the efficient delivery and effective application of new knowledge and improved technologies, CSIRO will

continue to upgrade its commercial practices and will adopt flexible and responsive modes of working with customers.

[3] Encouraging teamwork and collaboration

CSIRO's core strength, which sets it apart from other research agencies, is the capacity to assemble and manage teams of highly skilled professionals from a very wide range of disciplines. The move to Sector-based operations and recent Divisional amalgamations opens the door to fresh opportunities for interdisciplinary collaboration. Where there are complementary roles and expertise, CSIRO will also seek to expand collaboration with other research performers and technology transfer services in both the public and private sectors.

[4] Achieving a balanced research portfolio

CSIRO requires a balanced portfolio of research based on short, medium and longer term needs. Research timescales oblige us to look beyond the lifetime of individual governments and the investment cycle of many businesses. To remain vital and relevant to emerging challenges, our interactions with customers and stakeholders must raise mutual awareness of what strategic research is needed to underpin future advances and of what is needed to address immediate concerns.

[5] The pursuit of excellence: quality people—quality processes—quality outcomes

CSIRO has a reputation for excellence in research and development. This commitment to excellence will be applied in every aspect of our endeavours including staff training and development, research management, administrative support, customer relations, marketing and commercialisation. The Sector Plans reinforce this strategy by explicitly addressing these aspects as well as specific research objectives.

[6] Enhancing communication

Effective internal communication is essential if the positive benefits of change within CSIRO are to be maximised. Line managers will be assisted to develop the necessary skills and held accountable accordingly. Effective external communication is also essential in building and maintaining CSIRO's profile and reputation amongst our stakeholders and customers—particularly potential future customers. The National Awareness Program will complement the continuing efforts of staff at all levels to promote awareness of the importance of science, and of CSIRO's contribution to the nation.

[7] Fiscal responsibility

A very high priority is being placed on securing the financial health of all Divisions, and on the maintenance of high standards of fiscal management and accountability.

Corporate Overview

RESOURCES BY DIVISION

The table below shows CSIRO's 1998–99 financial budget by Division, together with staff numbers at the commencement of the financial year. The relevant footnotes should also be read in conjunction with the resources summary which appears at the end of each Divisional entry.

1998–99 Financial Resources and Staff Numbers¹

Division/Unit	Direct Approp	Other Revenues	Total Revenue	Operating Result	Cash Balance ²	Capital Expenditure	Research Staff ³	Total Staff ⁴
	(\$'000)	(\$'000)	(\$'000)	(\$'000)	(\$'000)	(\$'000)	(EFT)	(EFT)
Animal Health ⁵	11,579	9,500	21,079	–341	577	700	118	241
Animal Production	14,934	5,381	20,316	3,222	265	550	143	196
Atmospheric Research	8,077	5,399	13,475	–56	932	658	90	130
Australia Telescope National Facility ⁶	12,483	3,756	16,239	–294	854	4,685	61	128
Building Construction and Engineering	19,182	9,800	28,982	318	1,000	2,200	169	241
Energy Technology	14,013	7,761	21,774	–50	–196	1,500	114	169
Entomology	15,831	14,743	30,574	–351	–625	1,188	228	291
Exploration and Mining	17,052	13,957	31,009	–1,238	124	2,202	156	252
Forestry and Forest Products	17,700	9,837	27,537	–824	3,046	1,500	188	261
Human Nutrition	6,281	2,958	9,239	–152	1,466	258	68	85
Land and Water	29,212	16,671	45,884	–543	4,569	3,020	287	452
Manufacturing Science and Technology	27,292	18,801	46,092	–1,127	1,835	4,500	242	322
Marine Research	21,562	10,889	32,451	–1,359	2,018	1,000	216	304
Mathematical and Information Sciences	25,396	9,400	34,796	–2,235	3,824	1,753	191	257
Minerals	20,756	13,819	34,575	–1,416	572	3,400	211	300
Molecular Science	26,913	11,126	38,038	301	274	2,200	257	334
Petroleum Resources	6,927	5,356	12,283	1,027	61	1,226	47	65
Plant Industry	30,749	19,348	50,097	–1,334	4,687	3,352	381	502
RV Franklin ⁶	4,544	180	4,724	–395	583	300	0	8
Telecommunications & Industrial Physics ⁷	37,549	15,400	52,949	–1,019	10,083	3,500	312	437
Tropical Agriculture	21,299	12,186	33,485	–1,553	4,225	2,880	215	305
Wildlife and Ecology	15,467	7,781	23,248	158	2,784	1,025	134	211
Wool Technology	12,067	13,652	25,719	107	7,434	3,250	157	271
CSIRO Executive	6,384	0	6,384	0	200	0	7	35
Corporate Units	30,531	8,444	38,975	–732	2,195	270	0	268
Centre for Mediterranean Agric. Research ⁸	678	22	700	–60	155	25	1	7
Capital Program	–1,165	1,724	559	–12,500	–10,654	35,241	0	0
Overallocation/Revenue Measure	8,183	900	9,083	15,200	–18,141	0	0	0
Operational Total	461,475	248,789	710,264	–7,245	24,147	82,382	3,993	6,072
Food Science & Technology ⁹	13,916	N/A	13,916	N/A	1,570	N/A	149	215
Total	475,390	248,789	724,180	–7,245	25,717	82,382	4,142	6,287

¹ Financial estimates for 1998–99 as at 16 July 1998. Staff numbers are as at 30 June 1998 and include indefinite and term CSIRO Officers only.

² Estimated 30 June 1999 cash balance.

³ Includes Research Scientist/Engineer, Research Projects and Research Management functional classifications.

⁴ Includes Research Staff plus Technical Services, Communications and Information, Administrative Services, General Services, Corporate Management and Senior Specialist functional classifications.

⁵ Includes the Australian Animal Health Laboratory—a National Facility managed by CSIRO on behalf of the government.

⁶ A National Facility managed by CSIRO on behalf of the government.

⁷ Includes the Australian National Measurement Laboratory—a National Facility managed by CSIRO on behalf of the government.

⁸ The Centre for Mediterranean Agricultural Research is supported by six CSIRO Divisions.

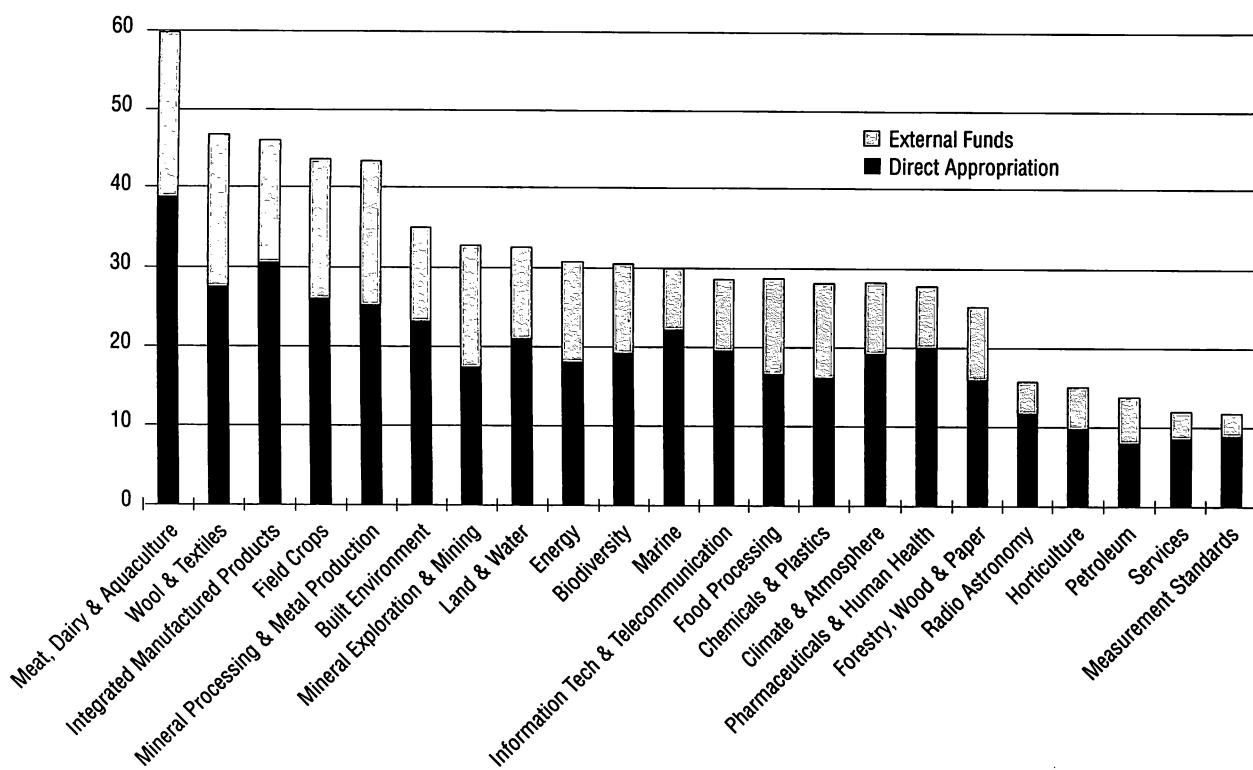
⁹ Through the Division of Food Science and Technology, CSIRO has entered a joint venture (Food Science Australia) with the Australian Food Industry Science Centre. CSIRO's direct contribution to the joint venture is \$13.92m. The joint venture has planned total revenues of \$34.10m, an operating result of \$0.03m and cash reserves of \$9.75m.

Source: CSIRO Corporate Finance and CSIRO Human Resources.

PLANNED INVESTMENT IN SECTORS

The chart below shows the relative size of CSIRO's planned investment in each of the 22 Sectors. The data are from Table 1 of the *CSIRO Strategic Research Plan 1997–98 to 1999–2000*, and expenditure by Corporate Units is additional to that shown in the chart. The estimates were based on revenue estimates at the beginning of the strategic planning period and are subject to change in

response to ongoing review of performance and developments in each of the Sectors. Each of the Divisional entries which follow this Corporate Overview also includes a planned investment profile—expressed as the percentage of total Divisional expenditure directed to particular Sectors. As with the Corporate profile, Divisional profiles are derived from estimates prepared for the Strategic Research Plan at the beginning of the triennium and are subject to revision.



Source: CSIRO Strategic Research Plan 1997–98 to 1999–2000.

Corporate Overview

PARTICIPATION IN COOPERATIVE RESEARCH CENTRES

Cooperative Research Centres (CRCs) bring together researchers and research groups from universities, State government agencies, business enterprises and Commonwealth research organisations such as the CSIRO. The Commonwealth Government provides up to fifty per cent of the cost of establishing and operating a Centre. The participating organisations contribute the balance of required resources in cash or kind.

Since the CRC Program was launched in May 1990, sixty-seven Centres have been established across six broad fields of research:

- Agriculture and Rural Based Manufacturing,
- Information and Communications Technology,
- Mining and Energy,
- Manufacturing Technology,
- Environment, and
- Medical Science and Technology.

CSIRO Divisions—as listed below—are core participants in fifty of the sixty-four CRCs continuing in 1998–99.

(Further information on the CRC Program can be found on the internet at: www.dist.gov.au/crc/).

Agriculture and Rural Based Manufacturing

CRC for Legumes in Mediterranean Agriculture

CSIRO Plant Industry
CSIRO Entomology
CSIRO Animal Production

CRC for Tropical Plant Pathology

CSIRO Tropical Agriculture

CRC for Sustainable Production Forestry

CSIRO Forestry and Forest Products
CSIRO Entomology

CRC for Hardwood Fibre and Paper Science

CSIRO Forestry and Forest Products

CRC for Viticulture

CSIRO Plant Industry

CRC for Premium Quality Wool

CSIRO Animal Production
CSIRO Wool Technology

CRC for the Cattle and Beef Industry (Meat Quality)

CSIRO Animal Production
CSIRO Animal Health
Food Science Australia
CSIRO Tropical Agriculture

CRC for Food Industry Innovation

Food Science Australia

CRC for Aquaculture

CSIRO Marine Research
CSIRO Animal Health

CRC for Sustainable Cotton Production

CSIRO Plant Industry
CSIRO Entomology

CRC for Quality Wheat Products and Processes

CSIRO Plant Industry

CRC for Sustainable Sugar Production

CSIRO Tropical Agriculture
CSIRO Land and Water

CRC for Sustainable Rice Production

CSIRO Plant Industry
CSIRO Land and Water

Information and Communications Technology

Australian Photonics CRC

CSIRO Telecommunications and Industrial Physics

CRC for Advanced Computational Systems

CSIRO Mathematical and Information Sciences

Research Data Network CRC

CSIRO Mathematical and Information Sciences

CRC for Satellite Systems Applications

CSIRO Telecommunications and Industrial Physics

CRC for Distributed Systems Technology

CSIRO Mathematical and Information Sciences

Mining and Energy

CRC for Mining Technology and Equipment

CSIRO Exploration and Mining
CSIRO Manufacturing Science and Technology
CSIRO Telecommunications and Industrial Physics

G K Williams CRC for Extractive Metallurgy

CSIRO Minerals

A J Parker CRC for Hydrometallurgy

CSIRO Minerals

Australian Petroleum CRC

CSIRO Petroleum Resources

CRC for Australian Mineral Exploration Technologies

CSIRO Exploration and Mining

Corporate Overview

Australian Geodynamics CRC

CSIRO Exploration and Mining

CRC for New Technologies for Power Generation from Low-rank Coal

CSIRO Minerals

CRC for Black Coal Utilisation

CSIRO Energy Technology

CRC for Landscape Evolution and Mineral Exploration

CSIRO Exploration and Mining

Manufacturing Technology

CRC for Materials Welding and Joining

CSIRO Manufacturing Science and Technology

CRC for Polymers

CSIRO Molecular Science

CRC for Molecular Engineering and Technology: Sensing and Diagnostic Technologies

CSIRO Telecommunications and Industrial Physics

CSIRO Molecular Science

Food Science Australia

CRC for Industrial Plant Biopolymers

Food Science Australia

CRC for Intelligent Manufacturing Systems and Technologies

CSIRO Manufacturing Science and Technology

CRC for Alloy and Solidification Technology

CSIRO Manufacturing Science and Technology

CRC for International Food Manufacture and Packaging Science

CSIRO Manufacturing Science and Technology

Food Science Australia

Environment

CRC for Catchment Hydrology

CSIRO Land and Water

CRC for Sustainable Development of Tropical Savannas

CSIRO Wildlife and Ecology

CSIRO Tropical Agriculture

CSIRO Land and Water

CRC for Weed Management Systems

CSIRO Plant Industry

CSIRO Entomology

CRC for Waste Management and Pollution Control

CSIRO Land and Water

CSIRO Molecular Science

CSIRO Energy Technology

CRC for Biological Control of Vertebrate Pest Populations

CSIRO Wildlife and Ecology

CSIRO Animal Production

CRC for the Antarctica and the Southern Ocean

CSIRO Marine Research

CRC for Freshwater Ecology

CSIRO Land and Water

CRC for Southern Hemisphere Meteorology

CSIRO Atmospheric Research

CRC for Tropical Rainforest Ecology and Management

CSIRO Wildlife and Ecology

CSIRO Plant Industry

CRC for Water Quality and Treatment

CSIRO Molecular Science

Medical Science and Technology

CRC for Tissue Growth and Repair

CSIRO Human Nutrition

CRC for Cellular Growth Factors

CSIRO Molecular Science

CRC for Eye Research and Technology

CSIRO Molecular Science

CRC for Cardiac Technology

CSIRO Molecular Science

CRC for Vaccine Technology

CSIRO Animal Health

CSIRO Animal Production

CSIRO Tropical Agriculture

CRC for Diagnostic Technologies

CSIRO Molecular Science

Corporate Overview

OUTLOOK FOR 1998-99

1998-99 is the middle year of the current funding triennium and the second year in which CSIRO's sectoral approach to research planning and delivery will be fully operational.

A number of events and developments are anticipated to have broad relevance to the Organisation during the year.

- Implementation of changes to corporate governance and reporting requirements due to passage of the Commonwealth Authorities and Companies Act.
- Implementation of Government decisions in response to the "Stocker Review" of Australia's science and technology arrangements.
- Implementation of Government policies relating to information technology, competitive neutrality and accrual budgeting (incorporating adoption of an "outputs and outcomes" basis for budgeting and reporting).
- Changes in government policies and programs in support of R&D.
- Response by the business sector to trends in economic conditions (including the impact of the Asian financial crisis).

Some activities and outcomes of especially broad corporate significance planned for 1998-99 include:

- Implementation of Sector marketing plans and strengthening of mechanisms of interaction with the 22 Sector Advisory Committees.

- Revision of the Corporate Commercial Practices Manual and continued upgrading of CSIRO's commercial skills.
- Full integration of CSIRO's Division of Food Science and Technology with AFISC as Food Science Australia (an unincorporated joint venture established 1 December 1997).
- Implementation of a new Enterprise Agreement.
- Achievement of initial milestones in the progress of the "Executive's Special Projects":
 - Towards Sustainable Energy
 - Low Emmission Transportation Technologies
 - Advanced mm-Wave Integrated Circuits for Radio Astronomy and Telecommunications
 - Sustainable Urban Water Systems
 - Novel Technologies for Feral Animal Control
 - Genomics and Gene Discovery
 - Bioinformatics Initiative
 - Bioactive Molecules Initiative.
- Substantial progress toward rationalisation and co-location of CSIRO, Queensland Government and University plant and animal research facilities in southern Queensland. Completion of stage two development of the Queensland Centre for Advanced Technologies.
- Implementation of plans to develop a centre of excellence in research for the petroleum and minerals industries in cooperation with the Government of Western Australia and local universities.

Chief: Dr Mike Rickard

FOCUS

CSIRO Animal Health is a national centre of excellence in disease diagnosis, research and policy advice in animal health. The Division has a high level of expertise in disease diagnosis and the development of diagnostic tests; virology; development of vaccines; veterinary skills; immunology; molecular biology; bacteriology and organic chemistry, particularly as it relates to natural toxins. It is this combination of special skills in the diseases of livestock that gives the Division its national stature in providing advice to the Commonwealth and States and in research on effective products for disease treatment and prevention. The Australian Animal Health Laboratory facility is recognised internationally as one of the best biocontainment facilities in the world for the safe handling and containment of micro-organisms and for contained experimentation in animals.

Outlook, Activities and Outcomes

As global free trade increases, the OIE (Office International des Epizooties) is developing new international standards for disease surveillance leading to an increased requirement for import and export disease testing and certification.

Key research activities and planned outcomes to the major Sectors served by the Division include:**Meat, Dairy and Aquaculture**

- Swift diagnosis and investigation of exotic diseases and efficient and rapid participation in the management of animal and fish disease outbreaks of national significance.
- Development of multivalent vaccines against major gastro-intestinal parasites of sheep and cattle.
- Definition of the kinetics of immune response in efferent lymph to 45W antigen.
- Evaluation of the efficacy of a recombinant vaccine against liver fluke.
- Development of more sensitive and specific methods for the detection of Johne's Disease in cattle.
- Recombinant *M.paratuberculosis* antigens tested in immune assays.
- Vaccines for infectious disease in intensive systems:
 - Live porcine pleuropneumonia and *P.haemolytica* vaccines transferred to commercial partner.
 - Killed *P.haemolytica* vaccine registered, manufactured and sold by an Australian company.

Wool and Textiles

- Minimise the risk of contamination of livestock and plant products by residues arising from therapeutics and natural toxicants.
- Corynetoxin ELISA applied to grain and fodder samples.
- Monoclonal antibodies to sheep lice trialed in a prototype assay.
- Development of more satisfactory tests for Capripox and Foot and Mouth Disease.

Food Processing

- Development of improved methodology for isolating and detecting virulence of emerging pathogens, including enterohaemorrhagic *E.coli* (EHEC).
- Development of tools for the measurement of plant associated toxins in food.

Major research support activities and outcomes planned for 1998-99:

- With the assistance of the AAHL Advisory Council and DPIE conduct a planning workshop to review industry, scientific and social changes that might influence the direction of the research portfolio in the next triennium.
- Complete a major review of support services to enable a shift of resources from services to science.
- Commission the new Animal Research Unit at Werribee.
- Restructure the business development and communications activities to allow a stronger focus on developing and retaining research collaborators and commercial partners.

Planned Investment Profile

Sector	%
Meat Dairy & Aquaculture	81.1
Wool & Textiles	14.8
Food Processing	2.7
Integrated Manufactured Products	1.4

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	11,579
External Revenue (\$'000)	9,500
Total Revenue (\$'000)	21,079
External to Total Ratio	45.1%
Operating Result (\$'000)	-341
End of Year Cash Balance (\$'000)	577
Research Staff (EFT)	118
Total Staff (EFT)	241

FOCUS

CSIRO Animal Production supports the international competitiveness and sustainability of Australia's livestock industries in the temperate climatic zones. The Division makes its major contribution to the Wool and Textiles Sector, with a large contribution to Meat, Dairy and Aquaculture, and small but growing contributions to the Marine and Climate and Atmosphere Sectors.

Outlook, Activities and Outcomes

The Division is seeking to reduce its dependence on the wool industry by initiating new work in the areas of Fresh Water Aquaculture, Non Chemical Disease Control, Functional Genomics and Livestock Production Systems Modelling. This will allow the Division to broaden its customer base and make a larger contribution to the success of Australia's livestock industries without significantly diminishing its capability to support the wool industry, the largest traditional customer.

The Division is continuing a series of workshops focussed on science excellence and disciplinary match to Sector needs, to identify and introduce the core enabling technologies for the future.

Key research activities and planned outcomes include:**Climate and Atmosphere**

- Development of a vaccine to reduce methane production from ruminants, aided by a major financial contribution from the Prime Minister's Greenhouse Initiative.

Meat, Dairy and Aquaculture

- A strengthened attack on the problem of efficient production of transgenic animals using the new cell-culture methodology; we will also complete the evaluation of our growth hormone transgenic sheep.
- Tests for immune competence in feed lot cattle ready for commercialisation.
- Rapid gene probe test for response of pigs to environmental stressors evaluated under commercial conditions.
- Commercial partnership established for development of protected anthelmintic technology in product for cattle.
- Active compound for regulation of egg laying activity in broiler breeder hens under commercial evaluation.
- Commercial linkage established for novel

antiprotozoal agent.

Wool and Textiles

- Launch of a breeding consultancy that will allow the most advanced methods, including DNA technologies (starting with DNA pedigreeing), to be introduced to the wool industry.
- Improvements in husbandry, in particular a replacement for the tradition mulesing operation to prevent breech strike.
- Markers for selection of parasite resistant sheep under pre-commercial evaluation in industry flocks.
- Environmental assessment of fungi for worm control on pasture completed as part of commercial development of delivery system.
- Basis for sensitive test for ivermectin resistance established.
- Computer simulation for population dynamics of the important nematode parasites of sheep integrated into a single model.

Planned Investment Profile

Sector	%
Wool & Textiles	56.5
Meat, Dairy & Aquaculture	41.4
Climate & Atmosphere	1.4
Marine	0.6

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	14,934
External Revenue (\$'000)	5,381
Total Revenue (\$'000)	20,316
External to Total Ratio	26.5%
Operating Result (\$'000)	3,222
End of Year Cash Balance (\$'000)	265
Research Staff (EFT)	143
Total Staff (EFT)	196

Chief: Dr Graeme Pearman

FOCUS

The Division of Atmospheric Research strives to solve significant problems concerning the physics, dynamics and chemistry of the atmosphere over the Australian region, and of the globe insofar as it affects the Australian region, and to provide the best possible scientific advice and solutions on problems and issues involving the atmospheric environment and the climatic system. Specifically, the Division addresses issues such as urban and regional air pollution, acid deposition, the enhanced greenhouse effect, ozone depletion, climatic variability and severe weather. Research tools include a range of computer-based climate and atmosphere models as well as remote sensing and other atmospheric monitoring instruments. Key stakeholders include Commonwealth and State Environment Departments, and energy and mineral resource companies.

Outlook, Activities and Outcomes

The Division will focus on four key areas: greenhouse gas emissions; underpinning government policy development and international negotiations; the role of aerosol on air quality and global climate; climate change and climate variability modelling and impacts assessments; and applications of air quality modelling.

Over 95 per cent of the Division's activities contribute to the CSIRO Climate and Atmosphere Sector and represent about half of the total Sector effort. The activities listed here are performed within the Climate and Atmosphere Sector. The Division contributes to Multi-Divisional Programs including the Climate Change Research Program, the Climate Variability and Impacts Program, and the Air Quality Program. The Division is a partner in the Cooperative Research Centre for Southern Hemisphere Meteorology.

The Division is a major user of the joint supercomputing facility, shared by CSIRO and the Bureau of Meteorology. The new facility will support the Division's climatic and air quality modelling.

The Division continues to develop and use sophisticated climate models to assess likely future regional changes to climate as well as testing model-based multi-seasonal predictions. Much of the Division's climate model development is conducted in collaboration with CSIRO Marine Research and with the Bureau of Meteorology.

By running multi-millennium climate simulations, the Division will assess the extent of natural variability of climate.

We are continuing to collaborate on regional impacts of climate change with various agencies, such as the Queensland Government and UNEP, and building tools for integrated climate impact assessment.

On an ongoing basis, the Division conducts research on the changing composition of our atmosphere using the Cape Grim Baseline Air Pollution Station in Tasmania. Jointly managed by the Bureau of Meteorology and CSIRO, the Cape Grim program is the foremost of its type for monitoring pollutant levels in southern hemispheric air.

The Division will publish an assessment of trend of changes to atmospheric concentrations of oxygen gas, information representing a major advance in understanding anthropogenic changes to the carbon cycle.

A number of major, ongoing field experiments will be conducted to provide Australia-wide validation of satellite-based measurements of atmospheric radiation and aerosol.

A series of aircraft-based atmospheric measurement programs, conducted collaboratively with Japanese agencies, will continue, examining biomass burning in northern Australia and Indonesia.

The Division has significant interactions with Commonwealth and State environment agencies on air quality characterisation, modelling and health risk assessment.

The Division will undertake national and overseas consultancy studies including completion of the Hong Kong Territory-wide Air Quality Modelling System project and expects to commence a project to characterise haze in Malaysia. Projects typically involve Australian and overseas partners and contribute to scientific advances in environmental management.

The Division is a partner in the Chief Executive's special project on hybrid car technology and will contribute to assessment of the impact of this technology on air quality and greenhouse gas emissions.

The Division receives significant external support from the National Greenhouse Research Program of Environment Australia. Environment Australia is the Division's foremost external funding agency, but there is increasing support from resource industries.

The Division will implement an enhanced human resources plan that emphasises employee development, performance, recognition, environment and personnel administration.

Planned Investment Profile

Sector	%
Climate & Atmosphere	99.0
Petroleum	1.0

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	8,077
External Revenue (\$'000)	5,399
Total Revenue (\$'000)	13,475
External to Total Ratio	40.1%
Operating Result (\$'000)	-56
End of Year Cash Balance (\$'000)	932
Research Staff (EFT)	90
Total Staff (EFT)	130

FOCUS

Australia is ranked among the top five countries in ground-based optical and radio astronomy, and the CSIRO's Australia Telescope National Facility (ATNF) is Australia's pre-eminent radio astronomy institution. It is the only facility in the world which can make high-resolution images of the southern sky at radio wavelengths. The ATNF's current major focus is on upgrading its observing facilities, both to maintain its operation as a prestigious world-class national research facility dedicated to the advancement of knowledge, and to provide a showpiece for Australian technology.

Outlook, Activities and Outcomes

The ATNF will begin a major upgrade of its observing facilities; this is supported by the Major National Research Facility (MNRF) and CSIRO Capital Investment funds.

Supported by the CSIRO Executive's Special Projects Fund, the MNRF and CSIRO Telecommunications & Industrial Physics (CTIP) will jointly begin a project on *Advanced Millimetre-Wave Integrated Circuits for Radio Astronomy and Telecommunications*.

The ATNF will continue to participate in planning future international research facilities. It will switch to a PSS project management system, and also maintain a rolling five-year budget.

Key activities planned for 1998–99 include:

- operating the Parkes, Narrabri and Mopra observatories, the Long Baseline Array (LBA) network, and the Marsfield facilities, as National Research Facilities;
- constructing a new north-spur-track and associated antenna stations for the Compact Array;
- modifying panels on one of the Compact Array antennas so that the full 22-m diameter reflecting surface can be used for future mm-wave operation;
- designing and then constructing the new 12-mm/3-mm receiving systems for the Compact Array;
- designing electronic devices to be used for the first foundry run in the joint ATNF/CTIP Special Executive Fund Project;
- supporting the MOU between the ATNF and the Onsala Space Observatory which will allow Australian astronomers access to 10% of Swedish time on the SEST Telescope;
- undertaking new research in astrophysics;
- participating in planning the one-square-kilometre telescope (1kT) and the millimetre array (MMA)/large southern array (LSA) project;
- being involved in national and international activities related to radio-spectrum management;
- promoting CSIRO and ATNF activities through information and educational resources.

Major results expected from the above activities include:

- providing access to ATNF's facilities that satisfies the Australian and overseas community of users;

- providing at least 70% of the available time for astronomy on the Narrabri Compact Array and Parkes radio telescope, keeping time lost during scheduled observing periods to below 5%;
- completing the civil works associated with the Compact Array upgrade, installing the first two new 12-mm receiver systems, and testing the Compact Array at 12-mm wavelength;
- completing the final design of InP MMIC devices, funded under CSIRO's SEP program;
- covering at least 60% of the southern sky, and 70% of the 'Zone of Avoidance' (the optically obscured region of the Milky Way) with the first multi-beam survey of atomic hydrogen gas in the local universe;
- successfully using the Parkes multi-beam system to detect new southern-specific millisecond pulsars;
- successfully supporting the Japanese VSOP Space-VLBI mission by allocating observing times of up to 5% at Narrabri and Parkes, and up to 25% on the 'Mopra' 22-m antenna;
- having ATNF radio astronomers awarded observing time on SEST;
- having ATNF staff participate in a major way in planning the 1kT, and in working-group meetings for the MMA/LSA project;
- having ATNF participate in OECD and ITU-related meetings on spectrum planning for radio astronomy, and in the formation of an Asia-Pacific group for regional planning discussions;
- actively participating in the commissioning of the new Astronomical Image Processing System (AIPS++);
- having at least 50 scientific papers published in refereed journals.

Planned Investment Profile

Sector	%
Radio Astronomy	100.0

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	12,483
External Revenue (\$'000)	3,756
Total Revenue (\$'000)	16,239
External to Total Ratio	23.1%
Operating Result (\$'000)	-294
End of Year Cash Balance (\$'000)	854
Research Staff (EFT)	61
Total Staff (EFT)	128

Chief: Mr Larry Little**FOCUS**

CSIRO Building, Construction and Engineering operates to support, advance and improve the operation of industries relating to the Built Environment and other related Sectors. Strategic research is focussed in life cycle performance; intelligent construction systems; information and communication in construction, alumina production and process design and optimisation. These key areas will provide substantial advantage to Australia in the next century. Our research capabilities include thermal and fluids engineering, design science/knowledge based systems, construction process reengineering and materials performance.

Outlook, Activities and Outcomes**Built Environment**

- The study of the interaction of whole buildings, building systems and components with environmental factors such as climate, pollutants, site and soil conditions will continue. Developing models of their behaviour requires a combination of thermodynamics, surface chemistry, and electrochemistry together with models of salt distribution, fluid flow and atmospheric physics. The results of this work include the design of more durable structures, estimation of the effects of pollution on infrastructure life and the development of new components.
- As part of research on low-energy processing technologies for the manufacture of pre-cast building products, strategic research in the microwave curing of cementitious composites will continue with the development of process control systems, mathematical modelling of the heat transfer, large scale bulk heating experiments and early microstructural studies.
- The Division will continue to develop a tool for the design of buildings, based on their constituent objects and processes as part of its participation in the International Alliance for Interoperability (IAI). The tool will allow identification of potential problems earlier in the design process, when the cost of rectifying problems is low.
- The Structural Laboratory at Highett will be renovated back to its full capacity enabling research and testing of large structures. This facility will be used to experimentally validate an integrated suite of structural models of low-rise buildings under severe environmental loads such as wind and earthquake.
- Guidelines for the design of natural and hybrid ventilation systems will be developed as part of an International Energy Agency Annex to improve energy efficiency of building heating, cooling and ventilation systems.
- The Department of Industry, Science and Technology (DIST) has recently embarked on a "Building for Growth" initiative which aims to assist the building and construction industry to maximise its contribution to the Australian economy. The Division prepared a formal submission to DIST, leading to an invitation to present and lead discussion at the DIST Industry Forum.
- Our communication strategy, which has successfully focussed on industry customers, will be expanded to

improve awareness of our achievements among the general public.

Mineral Processing & Metal Production

- Several new fluid flow and combustion technologies will be developed. These include innovative fluid mixing and combustion processes which will be applied initially to alumina production and then other process engineering applications. These new innovative processes promise improved quality with reduced energy consumption and environmental emissions.

Chemicals and Plastics

- The commercialisation of the patented SICOR process will continue with several industry applications being developed and significant contracts being prepared. The scientific principles backing SICOR will be extended to allow for even further industrial application.
- Plastics used in the building industry and pipeline applications may fail before the end of their design life at a significant cost to the community. The Division is developing models and researching early detection procedures that will establish the degradation rates and failure mechanisms of materials. This will enable the lifetimes of these materials to be extended and new materials based on high performance additives to be developed.

Planned Investment Profile

Sector	%
Built Environment	77.3
Mineral Processing & Metal Production	13.5
Chemicals & Plastics	7.6
Integrated Manufactured Products	1.6

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	19,182
External Revenue (\$'000)	9,800
Total Revenue (\$'000)	28,982
External to Total Ratio	33.8%
Operating Result (\$'000)	318
End of Year Cash Balance (\$'000)	1,000
Research Staff (EFT)	169
Total Staff (EFT)	241

FOCUS

CSIRO Energy Technology provides R&D contributing to the sustainability of Australia's energy industry—including its energy exports. The main areas of endeavour are coal preparation, advanced power generation, aspects of renewable energy and energy storage and the environmental impacts of the energy industry. The Division also contributes to CSIRO's broader environmental capability through its expertise in advanced analytical and biological chemistry applied to air and water quality.

Outlook, Activities and Outcomes

In 1997–98 the Division realigned its strategic direction to address the need for research which will contribute to the sustainability of Australia's energy industries. This realignment is a response to the restructuring and technological changes within the energy industry. This will lead to a progressive change in the fuel mix, the emergence of smaller, distributed power supply units, accelerated introduction of renewables and a greater focus on energy end-use efficiencies. This is taking place in a climate of increasing public concern about the impact of energy production on greenhouse emissions. Consistent with this realignment, the Division will:

- seek further support for relocation to a more suitable site which will demonstrate sustainable technologies and showcase CSIRO's energy research,
- undertake a major marketing and planning initiative to develop consensus among the many stakeholders on how best to focus limited R&D resources to achieve maximum stakeholder and community value,
- seek closer ties with government departments to provide input into technology aspects of policy development, particularly where these technologies impact on greenhouse emissions,
- develop projects in gas power generation and in gas technology for residential, commercial and industrial applications,
- explore further opportunities in renewables and electrical and thermal energy storage. The Division's capability will be increased by transferring the Melbourne-based battery group from CSIRO Minerals into the Division.

The Division will maintain strong links with the coal industry, working with industry associations and senior company executives to identify and gain financial support for research to address the longer-term requirements of the domestic and export industry including reduced greenhouse gas emissions.

Major activities and outcomes in 1998–99 will be:**Energy**

- commencement of a major solar/fossil hybrid sustainable energy project which received \$4.8 million over 3 years from the Executive's Special Project Fund; this will involve the acquisition of major new equipment including a solar dish and microturbines and the re-direction of staff skills,
- development of a commercial supercapacitor prototype for telecommunications at 9Wh/kg energy density, a demonstration at 12 Wh/kg based partly on materials

selection from electromechanical impedance spectroscopy, and a feasibility study of extension to 20–30 Wh/kg using hybrid carbon materials engineering on a nanometer,

- completion and commissioning of a coal gasification project (\$5.2 million over 3 years) at Pinjarra Hills, including relocation of staff and development of staff capabilities. The first half-year's operation will provide coal reactivity data on the use of Australian coals in advanced power generation technologies (CRC for Black Coal Utilisation project),
- commencement of a 5 tonne/day pilot plant for ultraclean coal in Newcastle, allied to completion of tests of coal-water mixture performance and environmental properties at Idemitsu Kosan, Japan.

Land and Water

- development of a large-scale ($\frac{1}{5}$ scale) plant for electro-dewatering of sewage sludge, with parallel optimisation studies via non-equilibrium (electro-osmotic) modelling and particle surface science (CRC for Waste Management and Pollution Control),
- development of models to describe the bioavailability of metals in contaminated sediments, and the incorporation of findings in the development of new ANZECC sediment quality guidelines.

Climate and Atmosphere

- redevelopment of indoor smog chamber for research into urban air quality and photochemical aerosol formation including the reactions and fate of chemical species in the atmosphere.

Planned Investment Profile

Sector	%
Energy	69.8
Climate & Atmosphere	10.3
Land & Water	8.3
Mineral Processing & Metal Production	6.0
Marine	4.1
Mineral Exploration & Mining	1.5

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	14,013
External Revenue (\$'000)	7,761
Total Revenue (\$'000)	21,774
External to Total Ratio	35.6%
Operating Result (\$'000)	-50
End of Year Cash Balance (\$'000)	-196
Research Staff (EFT)	114
Total Staff (EFT)	169

Chief: Dr Jim Cullen

FOCUS

CSIRO Entomology aims to generate economic, social and environmental benefits for all Australians through research into insects and their management by understanding the role of insects and other invertebrates in the natural, urban and rural environments, developing safe and sustainable methods of pest and weed management, and by using insects as models to understand fundamental biological processes. Our research is relevant to ten of CSIRO's Sectors with the bulk of our work targeted at three key areas: supporting Australian rural industries, developing innovative manufactured products, and managing environmental issues.

Outlook, Activities and Outcomes

High priorities in the rural sector are the management and ecology of pests, weeds and beneficial insects of field crops and pastures, focusing on strategies which reduce dependence on harmful synthetic insecticides, and the development of technologies for the storage, handling and transport of grains that deliver products free of residues and without loss through pest damage. In manufacturing, our priority focus is on engineered biopesticides as alternatives to chemical sprays using a range of insect pathogens (bacteria, fungi, nematodes and viruses) as environmentally safe and specific new pesticides. Environmental imperatives for Australia continue to shape our research portfolio; especially through the Australian National Insect Collection we are making major contributions to knowledge essential for the preservation and management of biodiversity.

Key activities and outcomes for 1998–99 include:

Field Crops

- Completion of field studies on a marked transgenic insect virus and a proposal to GMAC for permission to do field trials of an armed transgenic insect virus
- Initiation of studies on the population dynamics of *Helicoverpa* in St. George, Queensland

Chemicals and Plastics

- Evaluation of stable recombinant insect viruses for commercially viable levels of expression of insecticidal toxins
- Field testing of improved formulations of *Metarhizium* against sugar cane scarabs and plague locusts
- Completion of commercial trials and data packages for submission to the NRA for registration of carbonyl sulphide and ethyl formate as fumigants
- Characterisation of the attractive components from a range of products for addition to toxin-containing baits for termites

Biodiversity

- Evaluation of biological control of mimosa and the development of management strategies which integrate biological control with other options
- Completion and publication of monographs on genera of Australian Heliothinae, Australian ants, Australian Dermestidae, Australian butterflies and Australian Tettigoniidae III

- Completion of genetic analysis of over 500 specimens of the endangered Golden Sun Moth, *Synemon plana* and provide recommendations for its conservation management

Meat, Dairy and Aquaculture

- Establishment of a colony of Old World screw-worm flies in the new insect mass-rearing facility in Johor, Malaysia
- Measurement of the broad scale population build-up and impact of the first two *Onopordum* thistle agents released, the seed weevil *Larinus* and the stem-boring weevil, *Lixus*

Horticulture

- Undertaking cage field trials to assess the performance of parasitoids of silverleaf whitefly and development of a collaborative research project into whitefly transmitted geminiviruses

Pharmaceuticals and Human Health

- Installation of a functioning peptide characterisation capability for use in the Bioactive Molecules Initiative (an Executive's Special Project)

Research Support

- Implementation of key actions as described in the CSIRO Entomology Strategic Plan 1997–2003
- Participation in the development and planning of the infrastructure and facilities requirements for the Natural Sciences Precinct, Indooroopilly

Planned Investment Profile

Sector	%
Field Crops	24.6
Chemicals & Plastics	22.2
Biodiversity	20.4
Meat, Dairy & Aquaculture	11.7
Horticulture	8.2
Pharmaceuticals & Human Health	4.2
Forestry, Wood & Paper Industries	3.3
Land & Water	2.6
Built Environment	1.7
Climate & Atmosphere	1.1

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	15,831
External Revenue (\$'000)	14,743
Total Revenue (\$'000)	30,574
External to Total Ratio	48.2%
Operating Result (\$'000)	-351
End of Year Cash Balance (\$'000)	-625
Research Staff (EFT)	228
Total Staff (EFT)	291

FOCUS

CSIRO Exploration and Mining works with the exploration and mining industry to identify opportunities and deliver solutions through outstanding science and engineering. The Division's research spans the full spectrum of mining activities from primary exploration through to mine site rehabilitation and mine safety. Core science areas: processes governing mineralisation, rock alteration and landscape evolution; advanced instrumentation systems and interpretation of data for exploration, mining and environmental engineering; mechanics of geological excavation, extraction and materials handling processes, and control and optimisation of mining equipment and its interaction with the mining process.

Outlook, Activities and Outcomes

The Australian mining industry is experiencing unrelenting downward cost pressures as commodity prices trend downward in real terms. Exploration is increasingly international and the industry is seeking breakthroughs in ore deposit discoveries, extraction techniques and safety.

The Division's portfolio includes several long-term projects which contribute strongly to the Mineral Exploration and Mining, and Energy Sectors. Further links with other Sectors are being developed, particularly with Petroleum, Mineral Processing and Metal Production, Marine and Manufacturing.

Through its participation in four Cooperative Research Centres (CRC for Australian Mineral Exploration Technologies, CRC for Australian Geodynamics, CRC for Landscape Evolution and CRC for Mining Technology and Equipment), the Division has collaborative projects with public and private sector research groups. These relationships have generally been very successful, with significant commercial outcomes and contributions to fundamental science and education.

The Division is continuing its drive to support Australian companies operating offshore, with research initiatives in South Africa, Indonesia, Japan and particularly in the copper belt of South America where a letter of intent has been signed with CODELCO in Chile.

Major infrastructure developments associated with the Division will continue through Stage II of the Queensland Centre for Advanced Technologies and the National Centre for Petroleum and Mineral Resources Research in Western Australia.

Specific research activities and outcomes planned for 1998-99 include:

- Prediction of new unconventional target areas for world-class magmatic Ni-Cu deposits.
- Collaboration, with World Geoscience Corporation, in the CERBERUS project to develop the next generation of airborne geophysics exploration technologies.
- Secure funding for the ARIES-1 satellite system for mineral exploration and environmental monitoring.
- Completion of the first projects establishing regolith-landform procedures for mineral exploration in the Gawler Craton of South Australia.

- Establish a high performance computing facility in Western Australia with an emphasis on visualisation of geological data.
- Develop new methods of image and data processing for terrestrial photogrammetry and surface mapping.
- Investigate the development of techniques for seafloor exploration and mining in conjunction with commercial collaborators.
- In collaboration with Cutting Edge Technologies develop guidance systems for single—and twin—auger highwall miners.
- Develop prototype systems to allow autonomous tramping and dumping for underground vehicles such as load haul dump and haulage trucks.
- Develop a 3D visualisation monitoring system to increase productivity and safety levels in open cut and underground mines.
- Establish innovative methods for prediction, monitoring and control of dust generation and deposition from blasting operations.
- Develop an emergency underground communications system for monitoring location and status of personnel and equipment and providing optimal evacuation routes.

Planned Investment Profile

Sector	%
Mineral Exploration & Mining	77.2
Energy	21.4
Petroleum	1.0
Mineral Processing & Metal Production	0.3
Marine	0.1

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	17,052
External Revenue (\$'000)	13,957
Total Revenue (\$'000)	31,009
External to Total Ratio	45.0%
Operating Result (\$'000)	-1,238
End of Year Cash Balance (\$'000)	124
Research Staff (EFT)	156
Total Staff (EFT)	252

Chief Executive: Dr Michael Eyles**FOCUS**

Food Science Australia is an unincorporated joint venture between CSIRO and the Australian Food Industry Science Centre (Afisc). Food Science Australia's multidisciplinary skill base and knowledge of the latest developments in food processing technologies are unique in Australia. It works closely with a wide range of industries, including the dairy, meat, milling, baking, snack and fruit and vegetable processing industries, as well as with service providers to those industries, such as packaging, transport and storage companies. In association with CSIRO Divisions in the Food Processing Sector, Food Science Australia offers research and technical services which solve problems for the food industry at every stage of the processed food business system, from analysing consumer needs to product design, through production optimisation, transport and storage, to marketing and retail support. Although its main focus is on the food processing industries, Food Science Australia also contributes to other Sectors, particularly Meat, Dairy and Aquaculture, Field Crops and Horticulture.

Outlook, Activities and Outcomes

Food Science Australia commenced operation as a joint venture on 1 December 1997. The joint venture has been formed to provide the food industry with integrated research, technical, training and commercial product and process development services aimed at helping the industry stay competitive in a demanding global marketplace. Other priorities are strategic research to lay the scientific foundations for the industry's future profitability and to help ensure that food products are safe in an era of rising consumer concerns.

Since commencement, attention has been focused on presenting a new image to the food industry through a revised marketing strategy. In addition, an integrated management structure has been established and considerable work has been done to establish a new cultural foundation for the joint venture.

While the consolidation of the joint venture will be a major activity in 1998–99, Food Science Australia also intends to develop its business and strengthen its capabilities in other areas. In particular, the joint venture will:

- develop new long-term projects within the Australian Cheese Technology Program, with a range of objectives that include the development of high order process control technologies for bulk cheddar cheese plants using artificial intelligence concepts (*Food Processing*);
- commence two major projects aimed at optimizing transport of Australian food products into the Asian region. These results should enable the Australian industry to develop new markets, improve market returns through improved outturn quality and extend the marketing period by reducing quality loss during storage (*Horticulture & Food Processing*);
- complete the first full year of the 'Ingredients by Design' Program, an innovative collaborative research program involving Food Science Australia, The Centre for Food Technology and The Australian Ingredient Centre, which aims to serve the Australian dairy industry by creating and managing generic R&D in dairy ingredients and transferring the results to the dairy industry (*Food Processing*);
- develop opportunities arising from the successful completion of a group of four contracts covering the supply of Australian-made abattoir equipment, R&D and design skills to a Japanese company for the establishment of a model beef abattoir in Japan (*Meat, Dairy & Aquaculture*);
- revise its business strategies to ensure that its research programs continue to provide effective support to major meat industry customers following the dissolution of the Meat Research Corporation from 1 July 1998;
- continue to develop 'Food into Asia' research projects with Australian companies;
- offer a national program of industry seminars;
- enhance information services to provide improved advisory services for small to medium enterprises;
- continue the planning processes for new buildings at North Ryde (in conjunction with CSIRO Molecular Science) and extensions to the buildings at Werribee (to accommodate staff relocated from Hightett);
- implement new business systems following an objective assessment process facilitated by a consultant;
- Food Science Australia aims to increase external earnings from 41%, the level achieved by the former Division of Food Science and Technology in 1997–98, to 45% in 1998–99.

Planned Investment Profile

Sector	%
Food Processing	74.2
Meat, Dairy & Aquaculture	12.9
Chemicals & Plastics	4.9
Integrated Manufactured Products	4.4
Field Crops	1.9
Horticulture	1.6

Resource Summary 1998–99

Total Revenue (\$'000)	34,100
Operating Result (\$'000)	30
End of Year Cash Balance (\$'000)	9,750

FOCUS

CSIRO Forestry and Forest Products' mission is to increase economic and environmental benefit to Australia by improving the management and productivity of the nation's forests, and the quality and value of forest products. The Division delivers research outcomes for forest owners and growers, contractors, sawmillers, wood and paper product manufacturers, timber designers, specifiers and users, and for development assistance agencies, policy makers, forest regulatory agencies and the community. Its diverse skills base includes quantitative and molecular genetics, silviculture, forest ecology, plantation management, wood science and technology, soil science and stand nutrition, water management, materials and adhesive technologies, bioassay and biodeterioration, wood chemistry, fibre characterisation, pulpwood and fibre assessment, and recycling. The major proportion of activities relate to the Forestry, Wood and Paper Industries Sector.

Outlook, Activities and Outcomes

Amongst the primary objectives of Australia's National Forest Policy Statement are the sustainable management of all forests, the creation of new forests through the *Plantations 2020 Vision*—the target of trebling Australia's area of plantation and farm forestry over the next 25 years—and a value-adding industry development strategy through the *Wood and Paper Industry Strategy*. These policies and strategies are aimed at demonstrating sustainable forest management and achieving the greatest possible social, economic and environmental benefits from the forest industries for the Nation.

Australia is party to international conventions such as those covering *Sustainable Forest Management*, *Climate Change*, and *Biological Diversity*. Forestry and Forest Products contributes to implementation of these agreements through research within the Land and Water, Climate and Atmosphere, and Biodiversity Sectors, as well as the Forestry, Wood and Paper Industries Sector. In parallel developments, Australia's forest industries are moving from a domestic to a global focus with greater opportunities for export based on increased resource availability and value-adding.

Competitiveness in the Asia-Pacific markets is critical.

During 1998–99 the results from research for sustainable management will include:

- evaluation of sustainability indicators such as processes for determining site productivity;
- assessment of forest tree species for industrial plantations and also for rehabilitation of degraded environments;
- methods for minimising impacts of forest operations such as harvesting and transport;
- completion of draft national guidelines for effluent irrigated plantations;
- evaluation of impact of forestry on environmental values such as water quality and biodiversity;
- feasibility assessment of chemical/enzyme bleaching for economic pulp processing and reduced environmental impact;
- formulation of environmentally-friendly wood preservatives and adhesives;
- characterisation of the impacts of rising CO₂ levels and climate change on forests and their role in carbon sequestration;

- demonstration of energy and carbon production from wood residues.

Consistent product quality, performance and value-adding—essential to establishing and maintaining markets—will be facilitated through 1998–99 activities such as:

- the identification of genetic markers linked to such traits as wood density and fibre length for key plantation species;
- assessment of the effects of silviculture on wood properties;
- improved processing practices for utilisation of low quality wood to produce high value products;
- guidelines and models for high temperature (softwoods) and vacuum drying (hardwoods) technologies;
- evaluating various wood resources for paper-making and linking wood properties with product attributes;
- elucidation of measures to reduce fibre degradation during recycling.

Central to the research is *close and effective interaction* with a range of stakeholders including farmers, forest owners, industry, and policy makers. Development of a *marketing strategy* will contribute to improved realisation of opportunities and customer focus, and is a key management task to be completed during 1998–99.

Planned Investment Profile

Sector	%
Forestry, Wood & Paper Industries	74.2
Biodiversity	8.4
Built Environment	6.4
Land & Water	4.4
Chemicals & Plastics	4.0
Climate & Atmosphere	2.6

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	17,700
External Revenue (\$'000)	9,837
Total Revenue (\$'000)	27,537
External to Total Ratio	35.7%
Operating Result (\$'000)	–824
End of Year Cash Balance (\$'000)	3,046
Research Staff (EFT)	188
Total Staff (EFT)	261

Chief: Dr Richard Head

FOCUS

CSIRO Human Nutrition is one of the largest nutrition and training centres in Australia. The Division's goal is to improve human well-being and community health and reduce the incidence of diet related disease in Australia by nutritional and other means including influencing the production and consumption of appropriate foods. To achieve these goals the Division works closely with the food and food related industries in characterising the health potential of foods. The Division offers both clinical and laboratory based research facilities and multi-disciplinary research skills in nutrition, epidemiology, biotechnology, biochemistry, pharmacology and physiology. There is a growing number of national and international research collaborations and strong industry links across four sectors: Food Processing, Pharmaceuticals and Human Health, Field Crops and Meat, Dairy and Aquaculture.

Outlook, Activities and Outcomes

CSIRO Human Nutrition was established in 1975. Recent years have seen the consolidation of Divisional staff and facilities on one site on the University of Adelaide campus. Laboratory and clinic facilities have been progressively upgraded as part of a program which will continue in 1998–99, subject to confirmation of funding availability, with the planned refurbishment of the research support areas including reception and the library.

In addition to its Clinical Research Unit, the Division has three research programs: Consumer Science, Functional Foods and Nutrition-linked Cancers and Bowel Health. The consolidation of the Consumer Science Program in its new form, comprising staff from the Division and from the Food Science Australia joint venture, is a priority for 1998–99.

A further management priority for 1998–99 is the strengthening of the Division's collaborative research arrangements, through strategies which include staff exchanges. The Division has close associations with the three South Australian Universities, and collaborates with a growing number of food and nutrition research institutions in the UK, Indonesia and Malaysia.

Commercial development of the short-chain fatty acid delivery system *Starplus*, developed from several years of research in the area of gut health, is one of the Division's major contributions to the Pharmaceutical Sector. Licensing rights to an Australian pharmaceutical company will be finalised during 1998. CSIRO's substantial intellectual property investment in this project will be enhanced by the development of satellite patents.

Industry and community interest in protective substances in plant foods continues to influence the Division's research, relevant to the Food Processing, Pharmaceutical and Field Crops Sectors. Emerging areas of interest, which will be pursued in 1998–99, include the protective properties of tea polyphenols against UV-induced skin carcinogenesis and the link between folate status and micronucleus incidence.

A continuing research theme is the importance of antioxidants in reducing the risk of cardiovascular disease and cancer. There is potential for expanding the

commercialisation of the Division's research in this area, broadening the range of both commercial applications and commercial partners. Current discussions with industry are likely during 1998–99 to translate into research activities which will impact on the Food Processing and Pharmaceutical Sectors.

A cellular model has been developed which allows simulation of heart abnormalities in a single heart cell or group of cells. The Division will continue to test the protection afforded by various food substances in this system. A key focus for 1998–99 will involve the utilization of these technologies in the CSIRO Bioactives Initiative Project. This will provide insights into how these protective substances work, which in turn may influence future research directions with potential benefits across a number of Sectors.

The Division will continue active involvement with the CRC for Tissue Growth and Repair and with its commercial arm, GroPep. Twenty divisional staff from the Functional Foods and Nutrition-linked Cancers Programs are directly involved in this CRC research.

The provision of quality research support services at reasonable cost is an ongoing management issue. In 1998–99, the Division will explore possible enhanced efficiencies across South Australian Divisions in some areas. Current arrangements for the outsourcing of IT and communications services will also be reviewed.

Planned Investment Profile

Sector	%
Pharmaceutical & Human Health	43.3
Food Processing	38.8
Meat, Dairy & Aquaculture	10.7
Field Crops	7.2

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	6,281
External Revenue (\$'000)	2,958
Total Revenue (\$'000)	9,239
External to Total Ratio	32.0%
Operating Result (\$'000)	-152
End of Year Cash Balance (\$'000)	1,466
Research Staff (EFT)	68
Total Staff (EFT)	85

FOCUS

The mission of CSIRO Land and Water is to provide practical tools for the long-term sustainable management of land and water resources both in Australia and internationally. This is achieved through integrated research into water and landscape management. Specifically, the Division addresses issues such as redesign of urban water systems, management of contaminants, landscape sustainability, impact of climate variability and tropical land and water management. Whilst research efforts are focused on the Land and Water and Field Crops Sector the Division is involved in the environmental management aspects of 11 other Sectors.

Outlook, Activities and Outcomes

A major scientific review of activities in late 1997 identified these key research issues for the Division:

- Large scale land and water management,
- Quality and security of water supply,
- Re-designing agriculture, matching Australian plant production systems to land capability and climate variability,
- Decontamination of land and water, and
- Management of salinity.

Resource use and society. Models incorporating economic and social considerations are being developed to provide new approaches to achieving just and equitable outcomes for natural resource management. Development of the Division's research on socio-economic aspects of sustainable land and water management in 1998-99 will primarily focus on a new resource economics group based in Adelaide and the existing Australian Research Centre for Water in Society based in Perth. *Outcome:* Determination of stakeholder's perceptions of "equity" in the reallocation of groundwater for sustainable management.

Sustainable Urban Water Systems is a priority research initiative for 1998-99 to develop more environmentally sustainable and cost effective urban water systems that use and pollute less and recycle more water. This is a joint initiative with CSIRO Molecular Science, CSIRO Building Construction and Engineering and the water industry, with initial funding from the Executive's Special Project Fund.

Outcome: Innovative models of urban water systems, concerning the economics of water, wastewater and stormwater. *Sectors:* Built Environment; Land and Water

Sustainable land management in Northern Australian tropical environments is our second priority research initiative, based around our laboratories in Townsville, Atherton and Brisbane. Issues to be addressed include land clearance and expansion of both dryland and irrigated agriculture; resulting changes in water infrastructure, dams, and diversion of flows to irrigation; consequences to river and wetland health; sediment and contaminant release to sensitive coastal environments; and sugar cane yield decline. *Outcome:* Completion of a scoping study to identify appropriate focus catchments to study water quality and nutrient flows. *Sectors:* Land and Water; Field Crops; Marine; Horticulture; Biodiversity; Forestry, Wood and Paper Industries; Meat, Dairy and Aquaculture.

Establishment of a National Irrigation Science Network is the third major initiative for 1998-99. Irrigation uses 75% of diverted water, supports 25% of rural commodity production and has potential for significant expansion. A Network Director will be appointed during 1998-99. The Network will be centred at our Griffith laboratory but will address sustainable irrigation in the Tropics as well as in traditional areas (Murray-Darling Basin). *Outcome:* Following a stakeholder workshop in May 1998, a process of wide consultation will be undertaken to establish the network of stakeholders across State boundaries. *Sectors:* Field Crops; Land and Water; Horticulture.

A further major initiative is the multi-sectoral Executive's Special Project 'Sustainable Land Management for the Murray-Darling Basin'. *Sectors:* Land and Water; Biodiversity; Forestry, Wood and Paper Industries; Climate and Atmosphere.

In order to resource these key research areas a re-allocation of the Division's staff and financial resources to priority areas are currently underway.

The Division is a major stakeholder in six CRCs and is participating in re-bids for the CRC for Catchment Hydrology and CRC for Freshwater Ecology.

Planned Investment Profile

Sector	%
Land & Water	48.4
Field Crops	14.4
Biodiversity	5.6
Built Environment	6.3
Mineral Exploration & Mining	4.4
Climate & Atmosphere	3.5
Forestry, Wood & Paper Industries	3.6
Horticulture	3.3
Petroleum	2.8
Marine	2.9
Energy	1.8
Meat, Dairy & Aquaculture	1.9
Mineral Processing & Metal Production	0.9
Wool & Textiles	0.1

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	29,212
External Revenue (\$'000)	16,671
Total Revenue (\$'000)	45,884
External to Total Ratio	36.3%
Operating Result (\$'000)	-543
End of Year Cash Balance (\$'000)	4,569
Research Staff (EFT)	287
Total Staff (EFT)	452

Chief: Dr Ian Sare**FOCUS**

CSIRO Manufacturing Science and Technology supports Australian manufacturing industry through the development and exploitation of innovative materials, processes, products and services. Its science & technology foci range from materials development, processing and characterisation, electrochemical technologies, micromanufacturing, plasma and laser processing, joining and cutting technologies, and surface engineering through to pervasive technologies like automation and real time systems, photonics and intelligent manufacturing systems which are broadly important to many industry sectors. The Division aims for a balanced research portfolio delivering quality commercial outcomes to industry while maintaining a strong scientific base.

Outlook, Activities and Outcomes

A priority is to undertake major capital development at Clayton. Activities in Sydney will close in February 1999 and a decision concerning the future location of operations in Brisbane will be made by December 1998.

The Division has a significant involvement in five Cooperative Research Centres and will assess its future role and relationship in three which are approaching decisions on renewal: Alloy Solidification and Technology (CAST), Materials Welding and Joining, and Intelligent Manufacturing Systems and Technologies.

A planned asset replacement and infrastructure upgrade will be implemented across the Division over the next two years with an additional resource commitment of \$2.8 million.

Specific research activities and outcomes planned for 1998-99 include:

Integrated Manufactured Products (IMP)

- development of a platform of computer software tools using the asynchronous transmission mode of communication for concurrent engineering of manufacturing activities on a global scale;
- development of techniques for measuring the filling and solidification transients in high pressure diecasting for improved casting quality and control in production;
- further development of applications for the Division's high current gas tungsten arc welding technology, and optimisation of the system for specific applications in the welding of stainless steels and aluminium alloys;
- establishment of a collaborative project with Boeing Commercial Airplane Group to develop and prove repair welding procedures for aluminium alloy castings used in aerospace applications;
- development of new commercial applications of the X-ray phase contrast imaging technology which is being commercialised through a new start-up company X-Ray Technologies Pty Ltd;
- continuation of the development of prototype multispectral scanner systems but using alternative methods of data acquisition.

IMP and Services

- development of machine vision and high-speed data capture and processing systems across a range of manufacturing and inspection applications, particularly in road surface inspection and air transport monitoring;

Mineral Processing & Metal Production

- further development of a process for the continuous casting of magnesium following its successful demonstration in the laboratory and relocation of the casting hardware to the Australian Magnesium Corporation's demonstration plant in Gladstone;
- development of refractory lining solutions based on system thermo-mechanical modelling and materials design for improved operational efficiency of rotary kilns in the minerals industry;

Chemicals & Plastics

- continuation of the development of superior reactive milling methods for the production of ultrafine particles for formulation into UV-absorbing consumer products.

Planned Investment Profile

Sector	%
Integrated Manufactured Products	67.3
Energy	9.2
Chemicals & Plastics	8.3
Mineral Processing & Metal Production	6.5
Mineral Exploration & Mining	3.4
Services	2.0
Built Environment	1.9
Food Processing	0.9
Marine	0.6

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	27,292
External Revenue (\$'000)	18,801
Total Revenue (\$'000)	46,092
External to Total Ratio	40.8%
Operating Result (\$'000)	-1,127
End of Year Cash Balance (\$'000)	1,835
Research Staff (EFT)	242
Total Staff (EFT)	322

FOCUS

CSIRO Marine Research provides the scientific basis for ecologically sustainable development of Australia's marine resources, and for understanding and exploiting the ocean's role in determining the impact of climatic variability on Australia's resource productivity, both marine and terrestrial. A diverse skill base, and capabilities that include inshore and blue water research vessels, enable the creation of multi-disciplinary teams that deliver outcomes to the Marine, Climate and Atmosphere, Biodiversity, Petroleum, and Meat, Dairy and Aquaculture Sectors.

Outlook, Activities and Outcomes

1998–99 will have a strong domestic and international focus on the ocean. The Australian government will release a major policy for the sustainable use of the ocean and will establish national priorities for marine science and technology to support growth in the Marine Sector, and 1998 is the International Year of the Ocean.

CSIRO Marine has been involved in developing Australia's Oceans Policy and the Marine Science and Technology Plan and will need to address the priorities established under both the Policy and the Plan. In response, the Division will develop a 5 year Strategic Plan and integrate it into CSIRO's Sector planning activities for the next triennium. Educational and promotional activities will be held for the International Year of the Ocean.

In 1998–99 the Division will deliver outcomes predominantly to CSIRO's Marine Sector but many will have relevance to the strategic needs of the Biodiversity Sector, Meat, Dairy and Aquaculture Sector, Climate and Atmosphere Sector, and Petroleum Sector. Links will be strengthened to the Petroleum, Biodiversity, and Land and Water Sectors by identifying opportunities for collaboration.

Significant research activities and outcomes planned for 1998–99 include:

- A regional ecosystem model of the interactions between fishing and the marine and terrestrial ecosystems of Macquarie Island for use in fishery and conservation management decision making.
(Marine and Biodiversity)
- Habitat and biodiversity maps of a major section of the continental shelf of south eastern Australia and the reefs and shoal area of the Australia/Indonesian Timor Sea MOU74 Box. Development of a digital hydro-acoustic instrument that remotely senses seabed type and epifaunal communities for rapid mapping, monitoring and impact assessment.
(Marine and Biodiversity)
- Development and evaluation of techniques for reseeding tropical Australian prawn fisheries with application to the Western Australian Exmouth Gulf brown tiger prawn (*Penaeus esculentus*) fishery.
(Marine)
- Stock assessments and management strategy advice will provide the scientific base for Australian input to the International Commission for the

Conservation of Southern Bluefin Tuna.

(Marine)

- Screening for genes causing sterility and insertion trials using zebrafish and oysters will attempt to develop methods for controlling the fertility of feral populations of exotic species as the first stage of a major CSIRO initiative.
(Marine and Biodiversity)
- Completion of a 3-year study of the Huon Estuary and delivery of a comprehensive description of the cycling of nutrients particularly associated with fish-farming, as the scientific basis for ongoing environmental monitoring.
(Marine and Meat, Diary and Aquaculture)
- The application of genetic markers to selective breeding programs for prawns, oysters and abalone to develop healthy fast growing stock to assist the development of the aquaculture industry.
(Meat, Diary and Aquaculture)
- In liaison with the petroleum industry a strategic response will be developed to address the marine environmental issues related to off shore oil and gas exploration and extraction.
(Petroleum)
- An Australian Community Ocean Model 2.0 (ACOM 2) will be tested for its potential to predict interannual sea surface temperature anomalies and the processes that govern predictability. External funding will be sought to use it as the oceanic component for prediction of seasonal to interannual climate variations by the Bureau of Meteorology.
(Climate and Atmosphere)

Planned Investment Profile

Sector	%
Marine	67.2
Climate & Atmosphere	14.4
Meat, Dairy & Aquaculture	9.6
Biodiversity	5.3
Petroleum	3.5

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	21,562
External Revenue (\$'000)	10,889
Total Revenue (\$'000)	32,451
External to Total Ratio	33.6%
Operating Result (\$'000)	-1,359
End of Year Cash Balance (\$'000)	2,018
Research Staff (EFT)	216
Total Staff (EFT)	304

Staff in Mathematical and Information Sciences have particular expertise in areas such as computer science and engineering, applied mathematics, operations research, statistics and related disciplines. Our research and service delivery areas include datamining, simulation and scheduling, computational fluid dynamics, digital media systems, remote sensing, image analysis, expert systems, human-computer interaction, software engineering and environmental monitoring. The generic nature of the Division's knowledge base means its research can be applied to the solution of "real-world" problems across most industry sectors; for example, our technologies enable us to address a range of problems in the rapidly expanding area of electronic commerce. While our primary focus is the IT&T and Service Sectors, we have strong interactions with the manufacturing, mineral processing, mineral exploration and mining, agriculture, infrastructure, environment, marine and food processing sectors. The High Performance Computing and Communications Centre (HPCCC) and the CSIRO Office of Space Science and Applications (COSSA) and Earth Observation Centre (EOC) also come under the CMIS umbrella.

Outlook, Activities and Outcomes

Information Technology and Telecommunications

In the IT&T Sector, there is an increasing demand from government and industry for research services to support scoping, trialling and implementing electronic service delivery. Application areas for the Division's technologies are very broad and include such projects as Queensland On-Line Program, Commonwealth single access point for information; development of a test bed to prototype the "future state" electronic document and record creation system as part of defining the Victorian Electronic Records Strategy; improvement in the quality of delivered wool and in the price competitiveness of delivered wool through investigation of electronic bale identification systems and development and testing of global information exchange systems.

We expect to see investment in new equipment of Virtual Environments Laboratory (through ACSys CRC), restructuring of projects to better address electronic service delivery in government and industry and anticipated bids for 3 new or continuing CRCs (ACSys, DSTC, Services). Potential outcomes from these investments include; pilot forms of Spatial Information Infrastructures for Queensland, ACT and AUSLIG; formation of spinoff company or major industry alliance for Virtual Environments (through ACSys); commercialisation of Mobile Maps technology, arising from pilot system developed collaboratively with ACTEW; demonstration of networked information systems for public transport, including vehicle position sensing; initial demonstrations, within Bioinformatics Initiative (an Executive's Special Project), of services integration of Biodiversity information resources.

Services

The Division's activities in the Services Sector include the "Quality for SMEs" project in which collaborators will begin delivering courses to a wide range of SMEs using material developed by CMIS; completion of the project Data Mining In The Large Stage 2 for ACSys CRC and

completion of the next phase of a project for Polartechics to develop a prototype instrument for classifying skin lesions. R&D is also continuing on a personnel scheduling and rostering project (in collaboration with Time and People Australia, NSW Police and SA Ambulance Service).

Integrated Manufactured Products

We will develop numerical models of high pressure die-casting and design, implement and analyse relevant process improvement experiments. We will also develop mathematical models for rolling and extrusion systems, and apply sophisticated statistical process monitoring and control techniques to improve their reliability and capability.

Mineral Processing and Metal Production

In the MP&MP Sector, CMIS is developing a significant business relationship with Conveyor Dynamics Inc on the flow of granular material, particularly applied to mineral ore grinding mills.

Land and Water

Work in the Land & Water Sector has been recognized by the awarding of a National Heritage Trust grant of \$0.5M pa over 3 years for salinity hazard analysis in WA. The outcome will be maps showing risk of salinity, at catchment and property scale.

Marine

The Division will also make a significant contribution to the Marine Sector in 1998-99. Management of Australian fisheries is increasingly dependent on probabilistic assessments of risk. Risk analyses will be constructed for the most valuable Commonwealth fishery (the Northern prawn fishery) and the most valuable international fishery (Southern Blue Fin tuna), with expected outcomes being estimates of economic risk used in developing management options for the fisheries. Sustainable development of Australia's freshwater and coastal resources is dependent on effective environmental monitoring and

Chief: Dr Ron Sandland

assessment and the Division is developing new approaches to environmental assessment aimed at providing more effective and cost effective monitoring designs for key current studies (eg Brisbane River Morton Bay waste water management or North West Shelf environmental study).

CSIRO Office of Space Science and Applications, and the Earth Observation Centre

COSSA, through the COSSA Steering Committee, relevant CSIRO Divisions, and the Space Activities Board will ensure links are achieved between CSIRO and national and international space-related science and technology and policy agencies. In particular, CSIRO will be represented on international Working Groups and other science-based activities.

The COSSA Steering Committee and relevant CSIRO Divisions, in conjunction with EOC staff, play a role in ensuring delivery on key scientific outcomes and in the development of the EOC Science Plan, an element of which is the building of a renewable skills base through the support of young remote sensing scientists. Four major sets of experiments, using the Research Aircraft Facilities, are planned in collaboration with international scientific/space agencies. These have application in the Climate and Atmosphere, Exploration and Mining, Land and Water, and Forestry, Wood and Paper Industries Sectors.

High Performance Computing and Communications Centre

Following the successful establishment of the HPCCC in 1997–98, one of the major activities in 1998–99 will be the development of a plan for the consolidation of storage facilities for CSIRO and the Bureau at the HPCCC, to allow higher capacities and better access for large scale repositories of scientific data.

Divisional Operations

The Division will ensure that recommendations from a recent rigorous Divisional Project evaluation exercise are incorporated into operational activities. Focussing of business development activity to increase interactions with industry and external income and to increase research output will be key tasks, as will commencement of transition management for end of life for ACSys and DSTC CRC's. The advent of competitive neutrality places CSIRO at risk in some markets, particularly where it is in competition with the universities and within-government units (such as Bureau of Rural Research). A Human

Resources Strategic Plan that identifies the people related issues and strategies required to address the future business needs of CMIS will be prepared and implemented.

The Division expects to consolidate the benefits of the merged Division through on-going development of research support arrangements and activities including process improvement and staff development. A process for minimising Y2K exposure will be a key activity.

Plans are underway to co-locate the Division's two main Melbourne groups onto the Clayton site as the final step in the rationalisation of sites.

Planned Investment Profile

Sector	%
IT & Telecommunications	42.7
Services	16.8
Integrated Manufactured Products	11.7
Mineral Processing & Metal Production	4.8
Land & Water	3.8
Built Environment	2.6
Mineral Exploration & Mining	5.5
Marine	3.7
Food Processing	1.2
Petroleum	1.3
Field Crops	0.7
Meat, Dairy & Aquaculture	0.7
Biodiversity	0.8
Forestry, Wood & Paper Industries	0.6
Wool & Textiles	0.4
Horticulture	0.3
Climate & Atmosphere	2.1
Pharmaceuticals & Human Health	0.2
Radio Astronomy	0.3

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	25,396
External Revenue (\$'000)	9,400
Total Revenue (\$'000)	34,796
External to Total Ratio	27.0%
Operating Result (\$'000)	-2,235
End of Year Cash Balance (\$'000)	3,824
Research Staff (EFT)	191
Total Staff (EFT)	257

Chief: Dr Rod Hill

FOCUS

CSIRO Minerals' raison d'être is to provide the critical research, development and commercialisation support necessary for the Australian mineral processing and metal production industries to remain globally competitive. It achieves this through the innovative application of its staff's mineralogical, metallurgical, chemical, physical, engineering and mathematical skills and experience, and of its cutting-edge facilities for mineral characterisation, process modeling and diagnosis, and pilot plant construction and operation. These skills and equipment are applied from the micro (viz. atomic and molecular) to the macro (viz. plant) level to provide the required solutions to industry's complex problems.

Outlook, Activities and Outcomes

The minerals industry is in a state of rapid change, characterised by increasing globalisation, erosion of technical capability, and the need to process ever more complex and often lower grade ore bodies in the face of declining commodity prices. At the same time, there is increasing public scrutiny of the environmental impact of mining and minerals processing and of the life cycle of metal-containing products. This is leading to the need for the industry to accept cradle-to-grave responsibility for extracted and recycled metals.

Planning for the relocation of the North Ryde laboratories of the Division to QCAT-2 in mid 2000 will continue, resulting in the integration of the Iron Ore Processing activities on one site. Minerals staff and equipment at Waterford will expand into the Mineral Processing Laboratory of the Department of Minerals and Energy from July 1998, pending a decision of the WA Government regarding the transfer to CSIRO of these facilities. This will provide much-needed growth opportunities for the Division's operations in Perth, and will allow development of a wide range of new capabilities in mini-pilot-scale, continuous hydrometallurgical technologies.

The Novel Battery Technology (NBT) Program is expected to transfer to CSIRO Energy Technology from July 1998 to provide closer linkages with the Energy Sector. While about 95% of the activities in CSIRO Minerals will then be directed towards the Mineral Processing and Metal Production Sector, a small number of activities in coal combustion and flow measurements in oil/gas pipelines will continue to be directed towards the Energy and Petroleum Sectors. Linkages with industry will be enhanced through the establishment of Industry Technical Panels for Programs and the assignment of Key Account Managers for major clients. Centres of excellence will be established, or the planning will be well-advanced, in environmental systems, fluid dynamics and process modeling, fluidised bed technology, and pressure leaching. The Division will continue as the major partner in both the A J Parker CRC for Hydrometallurgy and the G K Williams CRC for Extractive Metallurgy, and it will reassess its role in the CRC for New Technologies for Power Generation.

Significant initiatives in 1998–99 include: decision tools for mineral processing for integrating social, political and technical issues into a whole-of-system methodology; new environmentally attractive bio-mineral processing

technologies; methods for in-situ processing of ores; flotation of fine-grained base-metal ores; new generation ore-sorting technologies; support for the direct iron-making industry; new or enhanced routes for the production of Al, Mg and Ti; interfacial reactions in smelting technologies; one-step copper smelting; electric arc furnace processing. These initiatives represent the focus for ongoing and new work with a number of major milestones expected in 1998–99 including:

- commencement of commercialisation process for one-step copper smelting and fine ore flotation
- demonstration of the feasibility of carbothermic routes for production of Al
- completion of preliminary evaluation for bio-processing of gold and copper
- completion of the commercialisation of on-line characterisation technologies
- development of initial industry linkages for the newly formed Environmental Systems Program.

To support this work, there will be continued development of enabling technologies such as computational fluid dynamics, nano-scale visualization and analysis, molecular simulation, integrated sensor technologies, and chemometrics.

There will be a focus on specific technologies that are 'weak spots' in mineral processing and metal production operations, such as hot-metal containment, material flows in cyclones and mills, crystallisation and redox kinetics, scaling, solid-liquid separation, flotation of fines, ore sorting, and in-process control.

Planned Investment Profile

Sector	%
Mineral Processing & Metal Production	90.1
Energy	9.2
Petroleum	0.6

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	20,756
External Revenue (\$'000)	13,819
Total Revenue (\$'000)	34,575
External to Total Ratio	40.0%
Operating Result (\$'000)	-1,416
End of Year Cash Balance (\$'000)	572
Research Staff (EFT)	211
Total Staff (EFT)	300

FOCUS

CSIRO Molecular Science is a centre of excellence for biological and chemical research. Our aim is to generate benefits for Australia by assisting the development of industries in the Chemicals and Plastics and the Pharmaceuticals and Human Health Sectors of the Australian economy. There are also smaller but significant contributions to the Integrated Manufactured Products, the Built Environment and the Petroleum Sectors.

Outlook, Activities and Outcomes

Molecular Science combines chemical and biological expertise to provide a broad research base for Australian industry, flexibility for strategic research and the ability to exploit emerging trends in science, through nine Programs: Specialty Chemicals and Environmental Technologies; Protein and Pharmaceutical Sciences; Applied Chemistry and Polymer Science; Biotherapeutics and Delivery; Molecular Discovery and Processing; Biomaterials and Bioengineering; Instrumental Methods; Research Support; and a Commercial Program.

Key research activities focus on innovation to provide sustainability for the Chemicals and Plastics Industry and on core therapeutic areas of diabetes, cancer, antivirals and biomaterials for the Pharmaceuticals and Human Health Industry. Establishing defendable intellectual property is our key strategy for commercialisation of R&D outcomes and working with commercial partners during the later stage of R&D projects. Involvement in CRCs represents a significant proportion of our research portfolio. Through participation in the Bioactive Molecules Initiative the Division will monitor developments in bioinformatics and genomics which are anticipated to profoundly influence the "biology-based" industries of pharmaceuticals and agribusiness. There will also be a strategic review of our work in biomaterials and bioengineering. Commercial strategies to provide 30% external funding of our operations will be implemented.

Management challenges include: streamlining all administrative processes; an urgent need to develop our infrastructure (accommodation and equipment); and managing our complex commercial arrangements with CRCs and the establishment of spin-off companies.

Major advances and commercial developments

Chemicals and Plastics: we will undertake market research for new technologies based on boron chemistry (also applicable to the Pharmaceuticals and Human Health Sector); royalties from the Continuous Microwave Reactor will flow to CSIRO this financial year; and a new herbicide is in field trials.

Pharmaceutical and Human Health: the influenza drug (Relenza™) is in a regulatory and commercial phase and could be available to the public and providing royalties to CSIRO by 1999; we will support the establishment of two start up companies to exploit biomaterials technologies developed in collaboration with CRC partners; we will support manufacturing scale-up of the extended wear contact lens; through our industry partner, we have significantly developed TRIS drug delivery technology and anti-cancer drug technology with first sales in the latter group expected in 1999; new Hep B treatments will be developed with an industry

partner; commercial development of Infectious Bursal Disease Virus vaccine is proceeding; we have determined the 3D structure of the first 3 domains of the IGF1 receptor, providing a significant opportunity for the rational design of better therapies for cancer and diabetes.

Built Environment: a trial of a pilot scale SIROFLOC® water treatment plant in Israel for agricultural application; royalties for the RACOD Meter™ are expected to flow this financial year; trial batches of MIEX® (Magnetic Ion Exchange) resins for water purification have been produced, Orica (formerly ICI Australia) will arrange for manufacture in Australia; AMT (Australian Meat Technology) have been granted a royalty bearing licence to market NutriVap 2000.

The Division will support two Chief Executive's Special Projects: the Urban Water Project to improve the design and delivery of urban water systems; and the Bioactive Molecules Initiative to provide an enhanced capacity to discover and exploit bioactive compounds.

Marketing initiatives will include: Sector-based science/industry fora to determine strategic research directions; customer satisfaction surveys to provide performance benchmarks; production of sector-focused brochures; and visits by Sector Coordinators to Sector Advisory Committee members and key industry leaders.

The Division's North Ryde laboratory will be replaced with a new chemical and biological research facility which will be shared with Food Science Australia. A site has been chosen, design options are being canvassed, and the building is expected to be completed by 2001.

Planned Investment Profile

Sector	%
Pharmaceutical & Human Health	59.8
Chemicals & Plastics	31.6
Built Environment	6.5
Integrated Manufactured Products	1.3
Petroleum	0.7

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	26,913
External Revenue (\$'000)	11,126
Total Revenue (\$'000)	38,038
External to Total Ratio	29.2%
Operating Result (\$'000)	301
End of Year Cash Balance (\$'000)	274
Research Staff (EFT)	257
Total Staff (EFT)	334

Chief: Dr Adrian Williams

FOCUS

CSIRO Petroleum Resources develops and applies knowledge in a range of science and engineering fields to reduce costs, increase new discovery rates and improve the percentage recovery of known resources in the oil and gas industry. We achieve these goals by application of world best practice and development of strategic relationships within the Australian Petroleum CRC and other national and international peer groups, and service and operating companies. The results of our research are applied within the petroleum, energy, mining and mineral processing sectors.

Outlook, Activities and Outcomes

The outlook for the Australian Petroleum industry is one of continuing growth. Investments in exploration, a precursor to development, are expected to grow by up to 51% in 1998 to \$1.6 billion. Plans for major growth of the Division, in recognition of the potential impact of research related to the industry, have been endorsed by the Executive and additional funds have been allocated.

The Division will commence appointment and re-location of staff to Perth, following completion of an agreement between CSIRO and the Western Australian Government to proceed with the development of a National Centre for petroleum and mining research. Staff in the short term will be accommodated in office and laboratory space available on the Bentley site.

Divisional strategies to explore the potential for growth of the Petroleum Sector have identified a research need to develop technology to determine conditions ahead of drilling. A major new initiative in seismic geophysics will commence in collaboration with Curtin University, GRI (Gas Research Institute, Chicago) and other industry participants.

Following wind-up of the ERDC program, the Division will actively explore alternative methods of support for research and development.

Commercialisation of an oil well drilling software package is planned on a world-wide basis using key software distributors known to the industry. The software is aimed at better utilising corporate knowledge to enable fast learning, risk analysis and well costing.

Strategic research has resulted in the development of technology that allows high-resolution interpretation of sparse data. This development will be incorporated as a module in commercially available 3D visualisation software, to assist with reservoir characterisation.

A full-scale field trial of CSIRO Petroleum shale stability technology is expected to commence in the South China Sea. The project will be conducted in collaboration with Petronas Research and Scientific Services Sdn Bhd, Malaysia.

Commercialisation and marketing of products resulting from shale stability research is planned. The Division is currently exploring the concept of setting up a shale stability consortium with GRI to package the products for the industry.

After agreement between an international drilling fluids company and CSIRO is reached, the partners will pursue the development of a high industry priority related

to the development of new drilling fluids. CSIRO input from Petroleum Resources, Molecular Science, Marine Research, and Land and Water is planned.

Major scientific activities and outcomes for the year include:

- commissioning of an NMR (nuclear magnetic resonance) facility in Perth to conduct measurements on reservoir samples to examine factors affecting producibility (*Petroleum*)
- commencement of a major project with the NCPGG (National Centre for Petroleum Geology and Geophysics) and AGSO, using fluid inclusion analyses to assess full field integrity (*Petroleum*)
- expansion of our effort in thermochronology by developing capabilities in Argon isotope and, with Exploration and Mining, Uranium-Thorium/Helium dating of sedimentary rocks to gain a better understanding of the thermal histories of hydrocarbon-bearing basins (*Petroleum*)
- transfer of advanced laser microprobe technology developed within the Division to Asia as an initial step in full commercialisation (*Petroleum*)
- development of a major hydrodynamic database, using data provided by AGSO and an industry consortium, to be used by the participants in exploring for or producing oil and gas in the Greater Northwest Shelf (*Petroleum*)

Planned Investment Profile

Sector	%
Petroleum	94.7
Energy	5.1
Mineral Exploration & Mining	0.2

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	6,927
External Revenue (\$'000)	5,356
Total Revenue (\$'000)	12,283
External to Total Ratio	43.6%
Operating Result (\$'000)	1,027
End of Year Cash Balance (\$'000)	61
Research Staff (EFT)	47
Total Staff (EFT)	65

FOCUS

CSIRO Plant Industry carries out research in the plant sciences to make Australia's agri-food and fibre and horticultural industries more profitable and sustainable. A major focus is on improving production efficiency and reliability while maintaining the natural resource base. We are placing increasing emphasis on product quality related objectives for the processing and manufacturing sectors and the development of novel plant products. Our research also contributes to conservation of biodiversity in the Australian flora and the implications of global climate change for natural and agricultural ecosystems.

Outlook, Activities and Outcomes

During 1998–99 we will have in place a significantly enhanced strategic research base in plant improvement and management technologies, global atmospheric change and conservation of biodiversity. Attention is being given to prospects for introducing molecular biology to our Merbein, Narrabri and Perth laboratories, and to the development of a tropical and subtropical horticulture program in Darwin and Brisbane.

Intellectual property development has become increasingly important for CSIRO Plant Industry, both to establish Australia's opportunities for market positioning and to establish advantage in bargaining for the use of overseas-owned proprietary technologies. We are seeking to broaden our strategic alliances with companies to secure freedom to operate with these technologies for benefit of Australian industry.

A number of genetically engineered agricultural and horticultural food crops originating from Plant Industry are expected to enter domestic and international markets over the next few years. We are researching management strategies to support the introduction of transgenic crops and contributing to public and industry education programs to introduce consumer acceptance of genetically engineered food products.

Through coordination of the Horticulture and Field Crops Sectors, participation in other Sectors, and direct dialogue with target clients we will actively develop marketing strategies and agreed priorities and actions.

Best practice in research support activities will be promoted and applied to facilitate the delivery of enhanced, efficient, effective and quality services.

Key research activities and outcomes planned for 1998–99 include:**Field Crops**

- Strengthening of our capacities in plant genomics to identify novel genes and determine their function—with support from the Executive's Special Projects Fund.
- Completion of extensive field testing to demonstrate the efficacy and agronomic performance of two-gene Bt lines of CSIRO cotton varieties sufficient to justify their progress to commercialisation.
- Identification, in collaboration with regional wheat breeding programs, of high yielding, water-use efficient varieties for yield and quality evaluation.
- Enhancement of a model which accurately describes the use of water by wheat in the Australian

environment, tying together production and sustainability aspects of wheat production.

- Initiation of trials with growers to investigate the role of a perennial pasture phase in crop sequences to modify groundwater recharge so that future crop production will be more sustainable and profitable.

Horticulture

- Expansion of tropical horticulture research in Darwin, the initial focus to be on agronomic and genetic improvement of mangoes and cashews
- Establishment of a major collaborative initiative on breeding and evaluation of table grapes, with funds from the table grape industry and the Horticulture Research and Development Corporation.

Food Processing

- Genetic engineering of seed storage protein genes in order to produce large amounts of novel proteins for assaying new functionality in flour processing.

Meat, Dairy and Aquaculture/Wool and Textiles

- Evaluation of the nutritive value of genetically modified high sulfur lupin seeds.

Biodiversity

- Release of an expanded Rain Forest Key with colour images and including both trees and shrubs.

Planned Investment Profile

Sector	%
Field Crops	36.9
Horticulture	21.8
Meat Dairy & Aquaculture	10.1
Wool & Textiles	9.8
Biodiversity	7.7
Food Processing	7.7
Forestry, Wood & Paper Industries	2.3
Climate & Atmosphere	1.9
Chemicals & Plastics	0.9
Integrated Manufactured Products	0.8

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	30,749
External Revenue (\$'000)	19,348
Total Revenue (\$'000)	50,097
External to Total Ratio	38.6%
Operating Result (\$'000)	-1,334
End of Year Cash Balance (\$'000)	4,687
Research Staff (EFT)	381
Total Staff (EFT)	502

FOCUS

The RV Franklin is a world class ocean-going research platform delivering outcomes in response to national priorities for marine research in the fields of physical, chemical and biological oceanography and marine geo-sciences. It is a National Facility operated by the CSIRO and is available to Australian marine researchers and agencies including CSIRO through a competitive tendering process. RV Franklin's strategic directions are managed by an independent Steering Committee. The National Facility has capabilities applicable to the outcomes required by CSIRO's Marine and Climate Sectors. Franklin's operations are fully supported by specialised electronic, data processing, chemical analysis and other scientific and technical services provided by the Division of Marine Research.

Outlook, Activities and Outcomes

During 1998 the government will release a long-term plan establishing national priorities for marine science, engineering and technology to support the government's Oceans Policy. In response, the current Strategic Plan for the National Facility will be reviewed to ensure it is responding appropriately to the national priorities in the Marine Science and Technology Plan.

In recognition of 1998 as the International Year of the Ocean, the contribution of the Franklin to understanding the ocean will be raised in the general community. Media events involving stakeholders and users of the marine research will occur in Adelaide, Melbourne, Hobart and Sydney to raise awareness of the benefits of conducting ocean research.

The effective and efficient deployment of scientific equipment used on large ocean-going vessels will be enhanced by the establishment of a National Marine Scientific Equipment Inventory.

During 1998–99 the National Facility will conduct ten cruises in support of the research outcomes of CSIRO, the Victorian Marine and Freshwater Resources Institute, seven Australian universities and collaborating scientists from the US, Canada, and Japan, thus strengthening Australia's national and international ocean research links.

Operations scheduled for 1998–99 will occur in temperate and tropical waters from the Southern Ocean, the Great Australian Bight, Bass Strait and the Tasman Sea

to the Coral Sea, Southern Pacific Ocean, the Bismark Sea, Torres Strait and the North West Shelf region.

The research focus for 1998–99 will improve the understanding of: the sub-tropical front and its seasonality; non-tropical carbonate shelves and slopes; reefal sedimentation on southern reefs; continental shelf processes; and marine stratigraphy and sedimentology.

Research will be conducted in fields as diverse as hydrothermal activity, sedimentology, ocean transport and dynamics, physical processes, climatology, fisheries management and related biological productivity.

The development and promotion of Franklin's equipment, capabilities and procedures will continue to ensure equity of access to Australian marine researchers and agencies to conduct high quality marine research.

Planned Investment Profile

Sector	%
Marine	100

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	4,544
External Revenue (\$'000)	180
Total Revenue (\$'000)	4,724
External to Total Ratio	3.8%
Operating Result (\$'000)	-395
End of Year Cash Balance (\$'000)	583
Research Staff (EFT)	0
Total Staff (EFT)	8

*Chief: Dr Dennis Cooper***FOCUS**

CSIRO Telecommunications & Industrial Physics provides innovative commercial solutions for industry in the telecommunications, security, medical, manufacturing, mining and energy areas and continues to invest in its long-term, flexible strategic research base in telecommunications, imaging, industrial sensing and measurement. CTIP is responsible for the National Measurement Laboratory, a National Facility, and NASA Operations in Australia.

Outlook, Activities and Outcomes

In the Information Technology and Telecommunications Sector CTIP focuses on maximising the benefit to Australia arising from the changes brought about by deregulation, technological change and rapid growth. Whilst supporting current customers in areas such as millimetre-wave systems for multi-point distribution services, emergency mine communication and defence systems, the Division is establishing linkages with multinationals and their Australian alliance partners, which target broadband networks and radio-based telecommunications. CTIP continues to develop the enabling technologies of antennas, microwave and millimetre-wave systems, integrated radio circuits and telecommunications networks and services.

Work in the Integrated Manufactured Products Sector focuses on instrument prototyping and process control. A priority will be to license gas flow metering and increased resources will be aimed at liquid applications of our basic ultrasonic flow measurement. Technical transfer of hard surface coatings for the tool industry is expected together with an emphasis on the science of multi-layered coatings, where the next major advances are expected. For electromagnetic instrumentation, technical transfer is planned for several instruments with applications in mine safety and machine guidance. Effort will be directed to developing additional applications for high efficiency electric motors.

In the Services Sector, CTIP is applying its expertise in image acquisition, interpretation, transmission and storage to assist industries in health services, retailing, on-line services, finance, banking, security and defence. SQIS face recognition technology will be used for user verification and identification (smart-cards, access control, law enforcement, missing persons). Fast image processing will enable still and video image transfer over the Internet and for telemedicine. Expertise in telecommunications and sensors will be integrated to enhance the home care of elderly and chronically ill patients. The development of an acoustic vision system to image underwater mines will continue.

The National Measurement Laboratory is developing a significant new area of standards research in chemical metrology to provide a reference base for traceability of chemical measurements. NML continues to provide policy support and technical development programs in countries of strategic or trading importance to Australia. NML is seeking to sign an international Mutual Recognition Agreement on measurement standards and calibration certificates which will require accreditation of calibration services to ISO Guide 25.

A Memorandum of Understanding between CSIRO and the Australian Government will be signed in the near future, defining the range of NML's responsibilities under the *Science and Industry Research Act 1949* and *National Measurement Act 1960*.

The Built Environment Sector includes the power and energy industry which is now undergoing significant changes due to privatisation. Design activities include work on improved condition monitoring for the electricity supply industry to reduce maintenance costs and extend asset life, development and application of superconducting materials and design and testing of underground power transmission cables.

CTIP is committed to 5 CRCs: the Centre for Satellite Systems, which is managed by the Division, as well as the Molecular Engineering and Technology, Mining Technology and Equipment, Southern Hemisphere Meteorology and Australian Photonics Centres.

CTIP has commenced an Executive's Special Project to develop leading-edge millimetre-wave, digital and photonic integrated circuits using Indium Phosphide, a new generation semiconductor material. The first wafers are due in March 1999, and will include ultra-low noise 100 GHz amplifiers and other circuits for use in the millimetre-wave upgrade of the Australian Telescope National Facility.

Planned Investment Profile

Sector	%
IT& Telecommunications	31.4
Measurement Standards	22.6
Integrated Manufactured Products	20.5
Services	11.4
Built Environment	4.7
Mineral Exploration & Mining	2.6
Climate & Atmosphere	2.0
Energy	1.8
Chemicals & Plastics	1.6
Wool & Textiles	0.9
Petroleum	0.5

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	37,549
External Revenue (\$'000)	15,400
Total Revenue (\$'000)	52,949
External to Total Ratio	29.1%
Operating Result (\$'000)	-1,019
End of Year Cash Balance (\$'000)*	10,083
Research Staff (EFT)	312
Total Staff (EFT)	437

* including trust funds of \$7.5M (mostly NASA).

Chief: Dr Elizabeth Heij

FOCUS

Tropical Agriculture provides options for northern Australian agriculture, and related natural resource systems. The region's principal agricultural industries—beef cattle, sugar, dryland cotton, and grains—have three common concerns. These are to increase the efficiency of production, to improve the quality and hence the international competitiveness of their products, and to ensure that the production systems are environmentally sustainable. The Division takes a systems approach in addressing the R&D needs of these and other industries and land users.

Outlook, Activities and Outcomes

The Division is completing a merger process that brought together the major part of CSIRO's research in animal- and plant-based tropical production systems. Following appointment of a new Chief on 1 July 1997, a major restructuring project was initiated. Recommendations of a Divisional "Change Team" have now been implemented. These recommendations encompass much of what follows.

An external scan of the Division's operating environment highlighted the need for a more coordinated approach to business development. In particular, it emphasised the need to reduce reliance on levy funding systems in favour of building more long-term alliances directly with industry leaders and innovators. In response, the Division will substantially alter the focus of positions at the program management level to generate a cross-Sectoral, cross-disciplinary Portfolio Development Group focussed on the interface between industry issues and effective formulation of research teams to address them.

An external scan of environmental issues confronting the Division's mandate area identified significant opportunities for further investment. They include opportunities to collaborate with others in providing the scientific basis for policy development in sustainable primary production and in responding to climate variability and climate change. Federal and State Governments, peak policy bodies for indigenous and other land users, and the relevant industries will therefore be targeted in our Portfolio Development activities.

A new Divisional Strategy Forum will comprise 19 senior Divisional staff, supplemented for particular issues by additional CSIRO and external advisors. It will focus on longer-term strategic issues, with operational issues being handled by appropriate task groups. The Division's research is now managed in 10 Research Groups to simplify the reporting structure and allow all research leaders at this level to participate in a Strategy Forum of manageable size. The intensity of disciplinary activities and cross-disciplinary dialogue is to be raised via enhancement of seminar and workshop activities. Research support activities (ie, Finance, HR, Information Services, Infrastructure and Services, and Marketing Services) will change in status and emphasis to function as consultancy groups interacting directly with their clients.

During the year, the Division will review the focus of its science. A "science map" of the Division and summary

of science opportunity areas has been passed to the Strategy Forum for further development. In response to profound change in the red meat industries and their R&D funding structures, the Division's livestock research will be the subject of an early external review.

The Division is participating in the Executive's Special Projects in Genomics, Bioinformatics and Bioactive Molecules. In the Genomics area, a major contribution will be made in two Sectors—MDA (beef cattle and prawns) and Field Crops (sugar). Genomics has been identified as a major development area for the Division's molecular genetics effort.

The Division will be participating in several CRC renewal bids, including major involvements through the CRC for the Cattle and Beef Industry: Meat Quality, and the CRC for Tropical Plant Pathology.

The Division expects to achieve planned outcomes during 1998–99 in a wide variety of endeavours. These include commercialising culinary soybeans for Japan, bringing gene marker technologies to various industries in commercial technology packages, expanding APSIM applications into the agribusiness sector, and developing integrated natural resource management activities in NW Australia.

Major co-location and rebuilding decisions are also expected for the St Lucia and Indooroopilly/Long-Pocket sites. Narayan Field Station is in the process of closure, and field station facilities at Lansdown (Townsville), Samford (Brisbane) and Belmont (Rockhampton) are under review.

Planned Investment Profile

Sector	%
Meat, Dairy & Aquaculture	55.0
Field Crops	28.2
Land & Water	7.7
Wool & Textiles	2.9
Biodiversity	2.7
Climate & Atmosphere	2.3
Marine	1.2

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	21,299
External Revenue (\$'000)	12,186
Total Revenue (\$'000)	33,485
External to Total Ratio	36.4%
Operating Result (\$'000)	-1,553
End of Year Cash Balance (\$'000)	4,225
Research Staff (EFT)	215
Total Staff (EFT)	305

FOCUS

The Division's focus is terrestrial ecology and wildlife research in conservation and production landscapes. With a broad range of ecological and biological disciplines it tackles national, regional and local scale resource management issues which require a strategic research foundation. Recognising that decisions about conservation of biodiversity are tightly linked with other decisions about land use, its research is particularly focussed on producing decision support techniques which assist policy makers and land managers to integrate the often competing values of production and conservation.

Outlook, Activities and Outcomes

The past year was one of transition and transformation in the Division, with a major program restructure, some redundancies and completion of a major building program at Gungahlin. Externally, the potential impact of the new National Heritage Trust (NHT) program and the economic downturn in Asia on our revenue budget was uncertain. Opportunities for NHT funding are now developing and we expect to start seeing new research and a more resilient funding base flowing from the strategic adjustments in our revised program structure.

New strategic and operational plans for all Divisional projects will be implemented. These plans integrate, for the first time, research, human resource, finance, and communication and business development plans. A new integrated Communication and Business Development Plan for the Division also will be developed, in tandem with development of marketing plans for the Biodiversity, Land and Water, and other Sectors.

A fund-raising foundation to support the development and maintenance of the Australian National Wildlife Collection will be launched, and plans developed to expand the use of the Collection and hence its value to Australia.

Following a bequest, the *Sonia Farley/CSIRO Wildlife and Ecology Post-Doctoral Program* will be established to support several new post-doctoral appointments in the Division every second year.

The Vertebrate Pest building will be upgraded to the PC2 standard necessary for the research done jointly with the Vertebrate Biocontrol Cooperative Research Centre. A new building at the Floreat Park site will be opened in August to house Divisional staff transferred from the Helena Valley site and to better integrate conservation research with agricultural research in WA.

Some specific research outputs will include:

- Completion of the development of two models that test future scenarios for Australia's physical resources—one based on stocks and flows and the other on energy—will provide the capability to test the physical feasibility of different national development scenarios and evaluate the effect of innovation within different sectors of the physical economy (*Biodiversity/Land and Water*)
- Multi-site assessments of the impact of global change on wheat cropping areas and on the rangelands (*Biodiversity/Climate and Atmosphere*)

- Guidelines for the rehabilitation of degraded woodlands, following completion of a three year research project supported by the LWRRDC (*Biodiversity*)
- Predictions of the pre-settlement distribution of forest types in the Wet Tropics (*Biodiversity*)
- A framework for evaluating the benefits and impacts of nature-based tourism in Tropical North Queensland (*Biodiversity*)
- Two new projects supported by the Executive's Special Projects Fund will gather momentum. For *Novel Technologies for Preventing the Establishment of Feral Populations of Exotic Animals* we plan, by June 1999, to have identified primary candidate genes for the mouse and have established mouse stem cell cultures. For the project, *Sustainable Land Management for the Murray-Darling*, we will continue conceptual development and establishment of active collaboration with other CSIRO Divisions and external collaborators. The emerging area of complex adaptive systems research will be explored to see how we might improve our research and understanding of Australian ecosystems and their interactions with socio-economic systems.

Planned Investment Profile

<i>Sector</i>	<i>%</i>
Biodiversity	54.2
Land & Water	13.2
Wool & Textiles	9.0
Meat, Dairy & Aquaculture	8.4
Field Crops	7.2
Climate & Atmosphere	2.8
Marine	1.8
Mineral Exploration & Mining	1.4
Forestry, Wood & Paper Industries	1.3
Energy	0.5
Services	0.3

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	15,467
External Revenue (\$'000)	7,781
Total Revenue (\$'000)	23,248
External to Total Ratio	33.5%
Operating Result (\$'000)	158
End of Year Cash Balance (\$'000)	2,784
Research Staff (EFT)	134
Total Staff (EFT)	211

Chief: Dr Brett Bateup

FOCUS

CSIRO Wool Technology services the Wool and Textiles Sector and provides social and economic benefits to industry and the community through research in and the development of advanced technologies for the wool, textiles, and leather industries. Research areas range from the specification of raw wool, to finished wool fabric, to production of hides, skins and leather with minimal impact to the environment. The emphasis is on ensuring sustainable production at all levels. The Division has a wide range of multidisciplinary skills capable of servicing wool, textiles and leather at national and international levels. We are recognised as the world's leading wool research laboratory supporting Australia's third largest earner of export revenue.

Outlook, Activities and Outcomes

The Australian wool industry has suffered a downturn in demand due to the Asian crisis and synthetic fibre prices are low due to over supply. Cotton production in Australia has almost doubled due to the favourable season this year. ABARE predict a slow improvement in demand for wool, that is, late 1998–99.

The Australian tanning industry is experiencing difficult trading conditions due to tight margins for wet-blue production for bovine hides and the Asian economic downturn. There continues to be a slow increase in the amount of finished leather produced in Australia.

Under a strategic alliance CSIRO and the International Wool Secretariat (IWS) have agreed to pursue joint management of the R&D portfolio and joint operational planning.

The Division will develop a business enterprise approach through consultancy in scouring, topmaking and effluent and environmental management to continue to facilitate technology transfer to the wool processing industry worldwide.

Wool processors, machinery manufacturers and textile additive manufacturers are increasingly preferring to outsource their R&D and the Division's recent successes in these areas is leading to collaboratively funded research projects with industry partners.

The involvement of tanning companies directly in the research portfolio will continue with emphasis on expanding the research portfolio to later stage leather processing.

Targeted fundamental research jointly funded by IWS and representing about 11% of expenditure, will focus on aspects of wool fibre structure and properties which underlie our major R&D projects.

A new collaborative project with CSIRO Telecommunications and Industrial Physics will evaluate the potential of atmospheric pressure gaseous discharges for modification of the wool fibre surface.

The Division's work on fibre formation, properties and processing within the CRC for Premium Quality Wool will largely be completed during 1998–99. The nature and extent of the Division's role in the proposed new Wool CRC will be determined.

The Division has developed cost effective measurement procedures which will enable wools which are essentially

pesticide free to be identified for markets which are highly environmentally sensitive.

A new, environmentally-friendly process for shrinkproofing wool will be commercialised. The project will protect a market for shrinkproofed wool tops worth \$400 million annually, together with an added value of \$80 million per annum.

Draft test methods will be presented to the International Wool Textile Organisation (IWTO), for the Division's technologies for the measurement of fibre curvature and greasy wool 'Style' to enhance the introduction of objective measurement into wool commerce.

A major project with an industry partner on sensor development will result in the commercial introduction of a device to detect, on-line, contaminants in coloured yarn.

Technology developed in collaboration with the Wool Research Organisation of New Zealand and IWS, which considerably reduces the cost of manufacturing woven wool fabrics, will be released in May of 1998.

A revolutionary new process for producing reduced micron fibre will be commercialised.

The development of an advanced mathematical model to predict spinning performance and yarn properties has reached a stage where it can be used to benchmark spinning mills against best commercial practice.

Outcomes from a collaborative project with four tanning companies will proceed to industrial trialing. These include faster processes and a new leather thickness measuring system.

Planned Investment Profile

Sector	%
Wool & Textiles	100

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	12,067
External Revenue (\$'000)	13,652
Total Revenue (\$'000)	25,719
External to Total Ratio	53.1%
Operating Result (\$'000)	107
End of Year Cash Balance (\$'000)	7,434
Research Staff (EFT)	157
Total Staff (EFT)	271

FOCUS

The Chief Executive and four Deputy Chief Executives, collectively CSIRO's Executive Committee, provide high level strategic leadership, business development, performance review and management of the Organisation. The Chief Executive is accountable to the Minister and the CSIRO Board for the total performance of the Organisation. The Deputy Chief Executives are accountable to the Chief Executive for the performance of groups of Sectors, Chiefs and their Divisions. They are also responsible for the oversight of areas of corporate support, for major sites and their development, for fostering cross-Divisional collaboration and for promoting CSIRO through internal and external interactions.

Outlook, Activities and Outcomes

Building on the decisions recorded in the Strategic Research Plan for the current triennium, the Executive will promote continued development of a balanced portfolio of research and development which utilises CSIRO's core strength in strategic research to address key national requirements and deliver outputs which focus on customer and stakeholder needs within all Sectors.

Priority goals for the Executive in 1998–99 will be to:

- consolidate the gains in financial strength and research synergy from recent Divisional mergers,
- further strengthen mechanisms of interaction between the Executive Committee, the Board and Sector Advisory Committees,
- reinforce the principles of the Sector processes and ensure that the benefits accrue through both enhanced science and effective management,
- monitor and support progress of the "Executive's Special Projects" announced in December 1997 with funding of \$22.4m over three years. The projects are expected to attract additional contributions of \$15m from Divisional and other sources,
- enhance national science facilities and performance through pursuit of joint venture and similar arrangements,
- reach decisions on Sector priorities and investments for the funding triennium 2000 to 2003.

With respect to corporate development, the Executive will:

- consider and respond to issues raised by the results of the recent staff opinion poll,
- substantially progress development of options to replace CSIRO's current performance appraisal and remuneration systems,

- conduct a broad examination of CSIRO policies with a view to removing redundant policies, streamlining administration and promoting positive performance,
- foster development of improved processes for key-account management,
- develop a more focussed approach to the development and demonstration phases of commercialisation.

The Executive will also focus on strengthening high level strategic relationships with senior representatives of key customer, collaborator and stakeholder groups in order to:

- ensure that CSIRO has access to the best advice and can make effective contributions to government and industry decision making, particularly through the Sector Advisory Committees,
- identify, assess and implement appropriate strategic responses to significant national and international issues and changes as they occur,
- secure more favourable terms for funding of CSIRO research by the R&D corporations and government agencies.

Where consistent with CSIRO's strategic directions, further opportunities for development of more effective collaboration between CSIRO and other research agencies will be pursued.

Resource Summary 1998–99

Direct Appropriation Revenue (\$'000)	6,384
External Revenue (\$'000)	0
Total Revenue (\$'000)	6,384
External to Total Ratio	0%
Operating Result (\$'000)	0
End of Year Cash Balance (\$'000)	200
Research Staff (EFT)	7
Total Staff (EFT)	35

The challenge for CSIRO's Corporate Units is to operate in the most efficient manner possible to promote organisational cohesion and facilitate the research and development activities undertaken by CSIRO's Divisions. In the following entry, a statement of the focus of each corporate unit is followed by a selection of specific activities and outcomes planned for 1998-99.

Corporate Executive Office

The Corporate Executive Office provides integrated support to the Board, Chief Executive, Deputy Chief Executives and Divisions to assist them in the efficient conduct of their business in the areas of policy development, interaction with Ministers and government departments/agencies, international matters, the public awareness and promotion of science, school education activities and the provision of an enquiry service for the public and industry. The Office provides briefing or action advice on meetings, correspondence and events involving the Chairman, Board members and Chief Executive, and is responsible for the coordination and management of Board and Executive meetings.

Government Business provides a central contact point, coordination, analysis and quality control for CSIRO's corporate interactions with the Minister for CSIRO, other Ministers as appropriate, Government departments and other parts of the Australian R&D system. Specific activities and outcomes include:

- Coordination and management of CSIRO's negotiations on Government policy issues such as the current Triennium Resource Agreement and associated Performance Indicators, the CSIRO submission for funding in the next Triennium for the May 1999 Budget (including strong reporting on adoption of research results and impact of advice), Competitive Neutrality, and developments with the Cooperative Research Centres Program.
- Liaison with Government Departments and agencies and other parts of the research system to provide input on issues relevant to CSIRO and achieve collaboration when appropriate.
- Preparation and coordination for the next Workshop with Government (likely late 1998).
- Provision of quarterly summaries of a wide range of policy issues and inquiries to alert senior staff to opportunities for input relevant to their areas.
- Preparation or coordination of corporate submissions and other input to external inquiries which arise during 1998-99.
- Coordination and provision of Ministerial briefings and correspondence; briefing of Ministerial staff in portfolios with a major interest in R&D; briefings for other Parliamentarians on CSIRO; coordination of briefings for Senate Estimates hearings and follow up questions;

coordination and preparation of CSIRO responses and contributions to Questions on Notice and Question Time Briefs; coordination of Parliamentarians' visits to CSIRO sites; advice to Chief Executive and Deputy Chief Executives on matters raised in Parliament affecting CSIRO; advice to senior CSIRO staff on protocols and processes associated with Parliament.

- Responsibility for obtaining and securing Cabinet documents and acquiring coordination comments. Maintenance of database of Ministerials, particularly Ministerial approvals required under the *Science and Industry Research Act 1949*.
- Provision of briefings for the Chief Executive, particularly for participation on high level councils and committees (PMSEIC, CCST, CRC Committee) and for meetings with portfolio Ministers.
- Awareness of national and international developments in S&T policy and provision of advice to senior staff when relevant to CSIRO.

International Scientific Liaison supports CSIRO's corporate and statutory responsibilities in relation to international matters, with emphasis on international scientific liaison. Specific activities and outcomes include:

- Provision of advice and support for the development of corporate policy on international matters. Preparation of submissions and representation of CSIRO for Government inquiries on international matters. Administration and review of CSIRO's international S&T agreements and facilitation of activities under them. Strengthening of CSIRO's liaison with Departments and agencies on international matters. Monitoring of developments in international fora such as APEC, to enable CSIRO input.
- Fostering of CSIRO's contributions to international scientific and technical cooperation. Briefing of the Chief Executive and Deputy Chief Executives for high level meetings and seminars. Briefings for Divisions and Sectors on how the unit can assist in identifying and facilitating international opportunities and on sources of support. Assistance with Divisional presentation overseas of corporate and Divisional information. Representation of CSIRO and coordination of CSIRO's interface with visiting delegations. Representation of CSIRO on the Australian Steering Committee on Collaboration for S&T Australia/Indonesia and representation of Australia on the Commonwealth Science Council.

- Provision of a corporate focus for development of activities with selected countries, particularly Indonesia, China, Italy and other countries and institutions for which CSIRO provides corporate funding. Support for strategy and collaborative activities for the CSIRO Indonesia Committee. Awareness of country developments, dissemination of information to Divisions and provision of opportunities for staff of Divisions/Sectors to share information and experience in international activities. Maximisation of the benefits of aid-related activities, including through provision of training placements.
- Maintenance and enhancement of the CSIRO international activities database for various corporate applications such as identifying potential new linkages of advantage to CSIRO, presenting a published overview which can be used externally to contact CSIRO, and exploration of its relationship with the Project Support System.

National Awareness Program seeks to achieve increased national awareness of CSIRO's research activities, particularly via the media; improved industry awareness of the benefits of research; and enhanced political awareness of the importance of science and the contribution of CSIRO. Specific activities and outcomes include:

- Enhancement of media coverage of CSIRO scientific achievements, particularly via the "Australia Advances" and "Sci-Files" television and radio series.
- Consolidation of high quality National Science Briefings in Federal Parliament and extension to State Parliaments.
- Further development and consolidation of a program for industry and national media using a network of professional science writers delivering major articles to influential publications.
- Preparation and delivery of the CSIRO Annual Report according to Parliamentary legislation and new regulations in the Commonwealth Authorities and Companies Act.

CSIRO Education Programs aims to alert school students, their families and teachers of science to the contribution of CSIRO and other scientific research to our community, encourage students to participate in scientific activities, especially those related to the applications of science, and encourage students to take up careers in science. Objectives for 1998-99 include:

- 160,000 students/teachers attending CSIROSEC sessions, 18,000 members of CSIRO's Double Helix Science Club, an audited circulation of 21,000 for *The Helix*, 350 students in CSIRO Student Research Scheme, 4,000 students achieving CREST Awards, 1,000 student entries in the BHP Science Awards and 200 schools participating in the GLOBE program.
- External funding obtained for a number of the programs and seed funds finalised for a new junior science magazine, *Scientific*.

CSIRO Enquiries is a national enquiry service with capacity to handle in excess of 40,000 enquiries annually. It offers specialised information about CSIRO research and referrals to other information agencies to the general public, industry, students and teachers, government and researchers. Enquiries are received via a national telephone number, e-mail, the WWW and by mail. Specific activities and outcomes include:

- The compilation of an information resource database to be used by the group's information officers to assist in enquiry handling. Information on the database will include reference to all Divisional information sheets, brochures and promotional publications, media releases and press clippings and external agencies.
- An extension of the Industry Liaison Program to include an industry-enquiry feedback procedure. Industry enquiries referred to Divisions are tracked to ensure the referral was appropriate and to determine whether the enquiry led to any commercial outcome.
- Increasing use of the CSIRO Enquiries national telephone number by CSIRO units and Divisions in their promotional activities; examples include the CSIRO corporate brochure, the CSIRO Achievements publication and radio Sci-Files organised by the National Awareness unit.

Corporate Finance

Corporate Finance provides advice and services to support financial planning and financial management within CSIRO. It also specifies and implements financial systems to meet line management and statutory reporting requirements. Specific activities and outcomes include:

- Support for the Chief Executive and Board in the development of strategy for securing funding from Government for the next triennium.
- Improvement of financial planning and management in CSIRO by working with Divisions to improve budgeting, accounting and management practices, especially in the areas of costing, pricing and project accounting.
- Preparation of the Organisation's financial data for Federal Budget documentation. In partnership with the Government Business unit, development of the related triennium funding agreement.
- Development of financial performance reports for Executive Committee and the Board. Production of CSIRO's statutory financial reports, including facilitation of Audit Committee review and Board approval.
- Development and promulgation of financial policies and procedures relevant to CSIRO's business and statutory requirements.
- Support and development of UNIBIS and financial reporting systems.

- In partnership with Corporate Information Technology Services, development, implementation and subsequent support of PSS and associated management reports to meet the needs of project managers in Divisions and the Organisation's sector planning and reporting process.
- Management of the transfer of CSIRO's insurance policies from current commercial insurers to COMCOVER.
- Implementation of contracts and procedures following the tender process for CSIRO's travel services.

Corporate Human Resources

Corporate Human Resources provides strategic leadership through the provision of advice and the development of processes and policies that will maximise the contribution of staff to the achievement of CSIRO goals. Specific activities and outcomes include:

- Development, in collaboration with Divisions of an effective CSIRO-wide HR Network.
- Further improvements to the performance management process in CSIRO.
- Further improvements to employee consultation arrangements.
- Provision of high quality HR and non-commercial legal advice to the Executive and Divisions.
- Implementation of the agreed occupational safety, health and environment strategy.
- Implementation of a remuneration system plus a recognition and rewards program that focuses on performance and rewards corporate behaviours.
- Development of improved workforce planning processes and tools.
- Formulation of a strategic legal compliance program and development of specific control systems including environmental, privacy and conflict-of-interest.

Corporate Property

Corporate Property provides a property management service to ensure adequate and cost effective accommodation and facilities, and maximises the inherent value of CSIRO sites. Specific activities and outcomes include:

- Implementation of the Board approved Property Management Plan 1997–2000 to include strategies such as rationalisation and consolidation of specific sites; the development of joint State/CSIRO initiatives; recognition of emerging Sectoral priorities; and evaluating industry and other research establishments capital investment benchmarks.
- Revision and management of the Capital Investment Plan; the CSIRO's Internal Leasing Scheme for accommodation and other such initiatives.
- Ongoing management of the North Ryde (Riverside) redevelopment initiative.

- Completion of rezoning processes for the Glenthorne and Ryde sites.
- PPWC approvals for the CSIRO/States initiatives QCAT Stage II, Pinjarra Hills; Bentley, Western Australia projects and implementation of the design development and tendering processes.
- Successful completion of negotiations for funding the Energy Division's relocation to Newcastle.
- Participation on the Organisation's Environmental Committee, to develop and implement a CSIRO Environmental Policy and Management System together with developing a strategy to remediate all contaminated sites.
- Finalise development/consolidation plans for Clayton and St Lucia sites.

Information Technology Services

Information Technology Services provides and maintains CSIRO's corporate network infrastructure for transmission of voice, data and image Australia wide; supports the Unix operational environment for corporate applications; maintains and develops corporate applications systems including the pay, human resources, finance, contracts and project support systems; provides library and information management services; and develops corporate strategic plans for information technology, networks, telecommunications and information management.

A current challenge is to ensure that CSIRO's information technology needs continue to be met with appropriately skilled staff in the context of the outsourcing model proposed by the Office of Government Information Technology. Specific activities and outcomes planned for 1998–99 include:

- Continuation of the corporate infrastructure equipment rolling upgrade to enhance responsiveness to users.
- Planning of architecture for a single IT systems log-on across the Organisation utilising the Microsoft NT domain model.
- Deploy Microsoft Exchange based messaging services to the major sites across the Organisation.
- Plan for and deliver new electronic library and information services across CSIRO.
- Implement improved records management practices across CSIRO, including electronic and scientific records.
- Continue with the upgrade of all data communications network equipment across the Organisation to implement the encryption of all traffic to corporate systems and enhance IT security.
- Continuation of the PABX replacement program, and further integration of voice and data networks utilising AARNet, Regional Network Organisations and the Virtual Private Network.

- Continued development of the CSIRO Project Support System including implementation of a contract management component by October 1998.
- Redevelopment of CSIRO corporate and sector WWW by December 1998. Define a structure and language to improve navigation and retrieval of information across CSIRO Divisional pages.
- Development of user requirements for a possible replacement or redevelopment of the human resources applications.
- Completion of Year 2000 changes in the human resource application by December 1998.
- Provision of expert technical and systems advice and, where required, development and implementation of cost effective solutions in consultation with relevant system owners, Divisional staff and the Executive.
- Coordination of the Year 2000 project in Divisions and corporate groups to ensure preparedness for the millennium change. A high level review of major exposures in the organisation is in progress and remedial activity continues on central software applications.
- Achieve economies of scale, expertise and approach through cooperative activities with similar external organisations (eg CAUL, CAUDIT, science agencies cluster).

Risk Assessment and Audit

Risk Assessment and Audit conducts a comprehensive audit program approved by the Chief Executive and endorsed by the Audit Committee. The program focuses on safeguarding of assets, compliance with internal policy and external regulations, integrity of information, and effectiveness and efficiency of operations. The Unit also assesses risks (other than those associated with the success of research) and evaluates controls in high and significant risk areas.

Operations are performed in accordance with the approved three year strategic plan commencing 1997–98. Specific activities and outcomes include:

- Updating risk assessments to ensure management focus of issues that are critical to the continuing success of the Organisation and where potential for improvement is the greatest.
- Facilitation of information technology risk assessments at Divisions.
- Ensuring the adequacy of the control infrastructure by conducting audits designed to test compliance with internal policies and procedures and external regulations.
- Providing assurance on the integrity of management information systems.
- Continued education in risk management techniques and cost effective control procedures through training workshops.

- Developing cost effective control strategies to reduce the level of risk exposure for high and significant risks.
- Continued development of self assessment tools and techniques to assist management in the identification, evaluation and treatment of risks.

Strategic Planning and Evaluation

Strategic Planning and Evaluation promotes and facilitates a strategic approach to planning and evaluation at all levels of CSIRO; provides or locates planning and evaluation services for CSIRO managers; coordinates the Sector planning process; and coordinates the preparation of corporate planning and evaluation documents. A particular challenge is to maintain the momentum of the new Sector planning process to achieve the revitalisation of CSIRO as a single entity serving the diverse sectors of the Australian economy. Specific activities and outcomes include:

- Monitoring of developments in implementation of Sector processes and facilitation of Organisational learning and capture of best practice.
- Preparation of planning and performance information for federal budget documentation and the CSIRO Annual Report.
- Preparation and provision of data on CSIRO's research effort in response to internal and external needs.
- Streamline performance and accountability measures for Executive Committee's strategic management of CSIRO.
- Coordinate and help implement revisions to the triennial planning and resource allocation process for the next funding triennium.
- Work with Divisions to integrate evaluation metrics in planning processes.
- Consultancies on analysis of citations to CSIRO publications in patent applications and on environmental indicators.

Training and Development

The Training and Development unit provides corporate policies and advice on leadership, career and team development and provides learning opportunities for staff at significant, career transition points. A link has been established with Deakin University and the Association of Professional Engineers, Scientists and Managers, Australia (APESMA) to provide accreditation of internal courses and status towards the University's Graduate Certificate, Diploma and Masters courses on technology management. Specific activities and outcomes include:

- The Leadership Development Program to develop senior staff and to support succession planning.
- The Team Development Program to encourage learning about team effectiveness, particularly in relation to multi functional and multi disciplinary teams.

- Research Management Courses for staff moving into program or functional management roles.
- Project Leadership Courses for staff moving into research project leadership roles.
- Leadership in R&D courses (in collaboration with the Business/Higher Education Round Table) for leaders of multi organisational teams in universities, the private sector, public sector research agencies and Cooperative Research Centres.
- The Leadership Consortium: a group of organisations who collaborate to develop and promote leadership within their own business.
- Consultancy services to Divisions on leadership, team development, change management and strategic planning.
- Research on the effectiveness of R&D teams and leaders.
- A new program being developed to provide appropriate skills and knowledge for staff moving into line management positions for the first time.

Legal Network

Through a complement of qualified legal practitioners at the Executive and Business Unit levels of the Organisation and quality external legal providers, the Legal Network ensures the provision of accurate, timely and practical legal input to CSIRO's management. Increased external interest on CSIRO's management and compliance systems is expected following the passage of the Commonwealth Authorities and Companies Act on 1 January 1998. Specific activities and outcomes include:

- Development of strong strategic corporate governance and compliance programs in relation to matters including the environment, competition, conflicts of interests and privacy.
- Continued strong emphasis on provision of quality and practical commercial advice to support CSIRO's commercialisation efforts.
- Strengthening of the network of CSIRO lawyers.
- Preparation and maintenance of CSIRO's preferred form of agreement and support in negotiating standard form contracts with major clients including research and development corporations.
- Provision of legal advice and related services to Chiefs, Business Managers and other research managers on legal aspects affecting their business units particularly in relation to commercialisation.
- Provision of legal advice to the Board, the Executive and General Managers on their roles and responsibilities including compliance with legislation and general law.
- Management of litigation on behalf of CSIRO.
- Facilitating access to legal information and materials through further development of the CSIRO Legal website.

- Establishment of electronic corporate registers to support corporate governance systems.
- Decentralisation of legal services and improvement of outsourcing arrangements through monitoring of CSIRO Legal Panel relationships.

Commercial Committee and Network

The CSIRO Commercial Committee and Network have responsibility to ensure that CSIRO's interaction with industry leads to an appropriate capture of the benefits from investment in research, occurs in an appropriate fashion, and enables the Organisation to respond to changes in the external environment.

The CSIRO Commercial Committee develops policy in this area, monitors implementation of the policies, and facilitates interaction between professionals in the legal, intellectual property and commercial areas across the Organisation. The Committee is responsible to the Executive Committee which acts as a point of accountability for a number of functions in the commercial, legal and intellectual property areas.

The Commercial Network was established by the Commercial Committee and covers all staff with a professional role in the commercial activity of the Organisation. The Network is involved in dialogue with the Commercial Committee and is the principal conduit for staff in raising the professional standards in the commercial activity of the Organisation. Specific activities and outcomes include:

- Revision of the CSIRO Commercial Practice Manual to reflect changes in the Organisation and in the commercial environment in which the Organisation operates. This is an annual activity.
- Consolidation and extension of the Organisation's Contracts Data Base.
- Establishment of an organisation-wide Marketing Data Base.
- Commissioning of a revised set of standard form contractual documents for use in research contracts, technology licences and collaboration with other parties.
- Extension of an Organisation wide system of account management which facilitates interaction between the Organisation and its major and key customers.
- Improvements to the management of Intellectual Property within the Organisation, particularly through the implementation of a new data base and communication system.
- Reviewing the business and commercial skills within the Organisation.
- Education of staff in the commercial area through induction and training programs, workshops and conferences.

CSIRO Publishing

CSIRO Publishing operates within CSIRO on a commercial basis publishing quality science for both Australian and overseas markets in three main product streams: primary research journals; academic and reference; and education and general. It also supplies publishing and communication services to CSIRO on a fee-for-service basis. Planned specific activities and outcomes include:

- Publication and distribution of 96 issues of 14 primary research journals to customers world-wide. Increase the base of on-line full-text subscribers established in 1998 while maintaining print subscriptions to minimise unit production costs.
- Publication of more than 30 new academic reference titles in both print and CD-ROM format with international appeal and sales potential.
- Broadening of *Ecos*, CSIRO's science and environment magazine, to cover all environment-related research, and increased subscriptions through improved customer focus and more targeted marketing.

- Publication of a broader range of science-based products, in print and CD-ROM for the school and home education markets, with an emphasis on developing co-publishing arrangements with other academic-based publishers.
- Development of a new publishing stream, Landlinks Press, together with building a substantial mailing list of people interested in practical information for the rural sector.

Resource Summary 1998-99

Direct Appropriation Revenue (\$'000)	30,531
External Revenue (\$'000)	8,444
Total Revenue (\$'000)	38,975
External to Total Ratio	21.8%
Operating Result (\$'000)	-732
End of Year Cash Balance (\$'000)	2,195
Research Staff (EFT)	0
Total Staff (EFT)	268

DIVISIONAL CHIEFS:

CSIRO Animal Health

Chief: Dr Mike Rickard

Private Bag 24, Geelong VIC 3220
Ph: (03) 5227 5050 Fax: (03) 5227 5250
Email: mike.rickard@aahl.dah.csiro.au

CSIRO Animal Production

Chief: Dr Oliver Mayo

Locked Bag 1, Delivery Centre Blacktown NSW 2148
Ph: (02) 9840 2833 Fax: (02) 9840 2940
Email: o.mayo@prospect.anprod.csiro.au

CSIRO Atmospheric Research

Chief: Dr Graeme Pearman

Private Bag 1, Aspendale VIC 3195
Ph: (03) 9239 4650 Fax: (03) 9239 4460
Email: graeme.pearman@dar.csiro.au

Australia Telescope National Facility

Director: Professor Ron Ekers

PO Box 76, Epping NSW 2121
Ph: (02) 9372 4300 Fax: (02) 9372 4310
Email: rekers@atnf.csiro.au

CSIRO Building, Construction and Engineering

Chief: Mr Larry Little

PO Box 56, Highett VIC 3190
Ph: (03) 9252 6114 Fax: (03) 9252 6241
Email: larry.little@mel.dbce.csiro.au

CSIRO Energy Technology

Chief: Dr John Wright

PO Box 136, North Ryde NSW 2113
Ph: (02) 9490 8610 Fax: (02) 9887 3590
Email: john.wright@syd.dcet.csiro.au

CSIRO Entomology

Chief: Dr Jim Cullen

GPO Box 1700, Canberra ACT 2601
Ph: (02) 6246 4025 Fax: (02) 6246 4028
Email: jim.cullen@ento.csiro.au

CSIRO Exploration and Mining

Chief: Dr Bruce Hobbs

Private Bag, PO Wembley WA 6014
Ph: (08) 9333 6361 Fax: (08) 9383 9324
Email: b.hobbs@dem.csiro.au

Food Science Australia

Chief Executive: Dr Michael Eyles

PO Box 52, North Ryde NSW 2113
Ph: (02) 9490 8341 Fax: (02) 9490 8455
Email: Michael.Eyles@foodscience.afisc.csiro.au

CSIRO Forestry and Forest Products

Chief: Dr Glen Kile

PO Box E4008, Kingston ACT 2604
Ph: (02) 6281 8314 Fax: (02) 6281 8277
Email: glen.kile@ffp.csiro.au

CSIRO Human Nutrition

Chief: Dr Richard Head

PO Box 10041, Gouger Street Adelaide SA 5000
Ph: (08) 8303 8865 Fax: (08) 8303 8899
Email: richard.head@dhn.csiro.au

CSIRO Land and Water

Chief: Dr Graham Harris

GPO Box 1666, Canberra ACT 2601
Ph: (02) 6246 5621 Fax: (02) 6246 5595
Email: graham.harris@clw.csiro.au

CSIRO Manufacturing Science and Technology

Chief: Dr Ian Sare

Private Bag 33, Clayton South MDC VIC 3169
Ph: (03) 9545 2787 Fax: (03) 9545 2829
Email: ian.sare@mst.csiro.au

CSIRO Marine Research/RV Franklin

Chief: Dr Nan Bray

GPO Box 1538, Hobart TAS 7001
Ph: (03) 6232 5212 Fax: (03) 6232 5125
Email: Nan.Bray@marine.csiro.au

CSIRO Mathematical and Information Sciences

Chief: Dr Ron Sandland

Locked Bag 17, North Ryde NSW 2113
Ph: (02) 9325 3203 Fax: (02) 9325 3226
Email: ron.sandland@cmis.csiro.au

CSIRO Minerals

Chief: Dr Rod Hill

Box 312, Clayton South VIC 3169
Ph: (03) 9545 8600 Fax: (03) 9562 8919
Email: Rod.Hill@minerals.csiro.au

CSIRO Molecular Science

Chief: Dr Tom Spurling

Private Bag 10, Clayton South MDC VIC 3169
Ph: (03) 9545 2470 Fax: (03) 9545 2447
Email: tom.spurling@molsci.csiro.au

CSIRO Petroleum Resources

Chief: Dr Adrian Williams

PO Box 3000, Glen Waverley VIC 3150
Ph: (03) 9259 6889 Fax: (03) 9259 6995
Email: a.williams@dpr.csiro.au

CSIRO Plant Industry

Chief: Dr Jim Peacock

GPO Box 1600, Canberra ACT 2601
Ph: (02) 6246 5250 Fax: (02) 6246 5530
Email: jim.peacock@pi.csiro.au

CSIRO Telecommunications and Industrial Physics

Chief: Dr Dennis Cooper

PO Box 76, Epping NSW 2121
Ph: (02) 9372 4200 Fax: (02) 9372 4210
Email: dennis.cooper@tip.csiro.au

CSIRO Tropical Agriculture

Chief: Dr Elizabeth Heij

306 Carmody Road, St Lucia QLD 4067
Ph: (07) 3214 2217 Fax: (07) 3371 6263
Email: Elizabeth.Heij@tag.csiro.au

CSIRO Wildlife and Ecology

Chief: Dr Brian Walker

PO Box 84, Lyneham ACT 2602
Ph: (02) 6242 1742 Fax: (02) 6241 3343
Email: Brian.Walker@dwe.csiro.au

CSIRO Wool Technology

Chief: Dr Brett Bateup

PO Box 21, Belmont VIC 3216
Ph: (03) 5246 4777 Fax: (03) 5246 4057
Email: brett.bateup@dwt.csiro.au

Contact Details

SECTOR COORDINATORS:

Field Crops—Dr Jim Peacock

CSIRO Plant Industry
GPO Box 1600, Canberra ACT 2601
Ph: (02) 6246 5250 Fax: (02) 6246 5530
Email: jim.peacock@pi.csiro.au

Food Processing—Dr Richard Head

CSIRO Human Nutrition
PO Box 10041, Gouger Street
Adelaide SA 5000
Ph: (08) 8303 8865 Fax: (08) 8303 8899
Email: richard.head@dhn.csiro.au

Forestry, Wood and Paper Industries—Dr Glen Kile

CSIRO Forestry and Forest Products
PO Box E4008, Kingston ACT 2604
Ph: (02) 6281 8314 Fax: (02) 6281 8277
Email: glen.kile@ffp.csiro.au

Horticulture—Dr Nigel Scott

CSIRO Plant Industry
PO Box 350, Glen Osmond SA 5064
Ph: (08) 8303 8626 Fax: (08) 8303 8635
Email: nigel.scott@pi.csiro.au

Meat, Dairy and Aquaculture—Mr Shaun Coffey

CSIRO Tropical Agriculture
PO Box 5545, Rockhampton Mail Centre QLD 4702
Ph: (07) 4923 8182 Fax: (07) 4923 8222
Email: Shaun.Coffey@tag.csiro.au

Wool and Textiles—Dr Ken Whiteley

CSIRO Wool and Textiles
Lot 13, Riverside Corporate Park, Delhi Road
North Ryde NSW 2113
Ph: (02) 9490 8129 Fax: (02) 9490 8215
Email: Ken.Whiteley@exec.csiro.au

Biodiversity—Dr Brian Walker

CSIRO Wildlife and Ecology
PO Box 84, Lyneham ACT 2602
Ph: (02) 6242 1742 Fax: (02) 6241 3343
Email: Brian.Walker@dwe.csiro.au

Climate and Atmosphere—Dr Graeme Pearman

CSIRO Atmospheric Research
Private Bag 1, Aspendale VIC 3195
Ph: (03) 9239 4650 Fax: (03) 9239 4460
Email: graeme.pearman@dar.csiro.au

Land and Water—Dr Roger Swift

CSIRO Land and Water
Private Bag 2, Glen Osmond SA 5064
Ph: (08) 8303 8405 Fax: (08) 8303 8555
Email: roger.swift@adl.soils.csiro.au

Marine—Dr Nan Bray

CSIRO Marine Research
GPO Box 1538, Hobart TAS 7001
Ph: (03) 6232 5212 Fax: (03) 6232 5125
Email: Nan.Bray@marine.csiro.au

Information Technology and Telecommunications— Dr Dennis Cooper

CSIRO Telecommunications and Industrial Physics
PO Box 76, Epping NSW 2121
Ph: (02) 9372 4200 Fax: (02) 9372 4210
Email: dennis.cooper@tip.csiro.au

Built Environment—Mr Larry Little

CSIRO Building, Construction and Engineering
PO Box 56, Highett VIC 3190
Ph: (03) 9252 6114 Fax: (03) 9252 6241
Email: larry.little@mel.dbce.csiro.au

Measurement Standards—Dr Barry Inglis

CSIRO Telecommunications and Industrial Physics
PO Box 218, Lindfield NSW 2070
Ph: (02) 9413 7460 Fax: (02) 9413 7383
Email: barry.inglis@tip.csiro.au

Radio Astronomy—Prof Ron Ekers

Australia Telescope National Facility
PO Box 76, Epping NSW 2121
Ph: (02) 9372 4300 Fax: 9372 4310
Email: rekers@atnf.csiro.au

Services—Dr Ron Sandland

CSIRO Mathematics and Information Sciences
Locked Bag 17, North Ryde NSW 2113
Ph: (02) 9325 3203 Fax: (02) 9325 3226
Email: ron.sandland@cmis.csiro.au

Chemicals and Plastics—Dr Albert Mau

CSIRO Molecular Sciences
Private Bag 10, Clayton South MDC VIC 3169
Ph: (03) 9545 2591 Fax: (03) 9545 2447
Email: albert.mau@molsci.csiro.au

Integrated Manufactured Products—Dr Ian Sare

CSIRO Manufacturing Science and Technology
Private Bag 33, Clayton South MDC VIC 3169
Ph: (03) 9545 2787 Fax: (03) 9545 2829
Email: ian.sare@mst.csiro.au

Pharmaceutical & Human Health—Dr Tom Spurling

CSIRO Molecular Science
Private Bag 10, Clayton South MDC VIC 3169
Ph: (03) 9545 2470 Fax: (03) 9545 2447
Email: tom.spurling@molsci.csiro.au

Energy—Dr John Wright

CSIRO Energy Technology
PO Box 136, North Ryde NSW 2113
Ph: (02) 9490 8610 Fax: (02) 9887 3590
Email: john.wright@syd.dcte.csiro.au

Mineral Exploration and Mining—Dr John Read

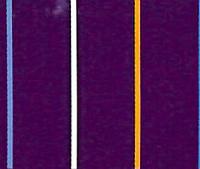
CSIRO Exploration and Mining
PO Box 883, Kenmore QLD 4069
Ph: (07) 3212 4460 Fax: (07) 3212 4578
Email: j.read@dem.csiro.au

Mineral Processing and Metal Production—Dr Rod Hill

CSIRO Minerals
Box 312, Clayton South VIC 3169
Ph: (03) 9545 8600 Fax: (03) 9562 8919
Email: Rod.Hill@minerals.csiro.au

Petroleum—Dr Adrian Williams

CSIRO Petroleum Resources
PO Box 3000, Glen Waverley VIC 3150
Ph: (03) 9259 6889 Fax: (03) 9259 6995
Email: a.williams@dpr.csiro.au



Our Purpose

We serve the Australian community through outcomes which provide:

benefit to Australia's industry and economy

environmental benefit to Australia

social benefit to Australians

support to Australia's national and international objectives

through excellence in science and technology, and in the provision of advice and services.

