
1. Project objectives, background and methodology

Purpose of the project

This study aims to assemble an inventory of significant global scientific programs in which Australian scientists and scientific institutions might reasonably be expected to be involved. This will allow Australia's current participation to be evaluated against the wider set of opportunities for international engagement. The report evaluates mechanisms that enhance Australian scientific involvement in global programs, including the mechanism of subscriptions to international scientific organisations. The intended outcomes are to ensure more targeted investment in areas of national priority and increased leverage of international scientific resources for the benefit of Australia.

The specific aims of the project are to:

- Assemble an inventory of significant global scientific organisations and collaborative opportunities in which Australian scientists and scientific institutions might reasonably be expected to be involved.
- Describe the aims and objectives of those research programs, the sponsoring bodies and involved governments and countries, and the progress and outputs to date.
- Map the extent to which Australia is currently engaged in these programs and the benefits that flow from that engagement.
- Assess the nature and extent of any gap between current participation in global scientific programs and potential opportunities, with a particular emphasis on the National Research Priorities.
- Evaluate mechanisms to enhance Australian scientific involvement in global scientific programs, including the mechanism of subscriptions to international scientific organisations.

Background

Australia, through subscriptions administered by the Australian Academy of Science, is a member of the **International Council for Science (ICSU)** that aims to 'strengthen international science for the benefit of society'. Australia is one of the 73 National Scientific Members that adhere to ICSU through their principal scientific academy, in order to effectively represent the broad range of national scientific activities. ICSU is the umbrella organisation for 27 International Scientific Unions, 21 International Scientific Associates, and 20 ICSU Interdisciplinary Bodies and Joint Initiatives. Australia is a formal member of 59 of these 68 ICSU activities, with the Australian Academy of Science directly responsible for managing formal subscriptions to 30 of them (Australian scientific societies and government agencies manage the subscriptions to the others – see Chapter 2). The Academy administers funds on behalf of the Commonwealth government to engage with these

international scientific organisations with minimum bureaucracy and administrative cost for maximum effect.

Other academies overseas subscribe to different sets of international science programs to the Australian Academy of Science. For instance, the US National Academy of Sciences adheres to the International Union of Soil Sciences but not to the International Union for Toxicology, in contrast to the Australian Academy which adheres to the latter Union but not to the former. The reasons behind why we are members of some, but not others, are largely historical and in need of a systematic review.

In addition to ICSU-related activities, the Australian Academy of Science is a member of the InterAcademy Panel (IAP) and the InterAcademy Council (IAC). The InterAcademy Panel is a global network of 91 science academies designed to help its members develop tools to participate in science policy discussions. In 2002, the world's science academies created the InterAcademy Council to mobilise the best scientists worldwide to provide high quality advice to international bodies such as the United Nations and the World Bank.

Australia also has formal links to other global science activities that are not administered by the Australian Academy of Science. These include global scientific activities run by UN bodies (described in Chapter 2), to which Australia is formally linked via membership administered directly by the Commonwealth government; and other, independent global scientific activities (described in Chapter 2), which attract formal membership from any interested groups (eg, government agencies or relevant scientific institutions or groups).

This project builds upon a previous study by the Australian Academy of Science in 1999 on 'International Networks and the Competitiveness of Australia's Science and Technology'¹. That study focused on individual international participation by Australian scientists ('bottom-up') rather than the 'top-down' approach taken here, where significant global programs are identified and Australia's existing and potential engagement in them is assessed. The current project also builds on a consultancy project of the Australian Academy of Science to the Australian Greenhouse Office in 2003, which assessed Australia's international participation in the area of climate change science².

Scope

The activities covered in the study are limited to:

- 'Global' science activities and bodies only, not bilateral or regional activities between individual scientists or research groups.
- 'Significant' activities only, referring to the principal disciplinary umbrella-type organisations, rather than the smaller subdiscipline-based organisations. Although much significant scientific activity does take place at the lower levels, it is necessary to put some boundaries on the study. There are many global science activities, perhaps thousands – too numerous to cover in a single report. Although we have attempted to include as many activities as possible, this report focuses on activities from the 'top down'.
- Natural science activities only, not arts or humanities or social sciences, or activities that are considered as political or regulatory.

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- Formal linkages only (ie, linkages involving membership subscriptions or other formal agreements), not informal links (although these will be discussed where they are apparent).

Methodology and governance

The study was overseen by a Steering Group consisting of eminent scientists and Fellows of the Australian Academy of Science.

Steering Group:

- *Chair*: Professor Kurt Lambeck, FAA, Professor of Geophysics, Research School of Earth Sciences, Australian National University;
- Professor Philip Kuchel, FAA, Professor of Biochemistry, University of Sydney;
- Professor Bruce McKellar, FAA, Foreign Secretary, Australian Academy of Science; Professor of Theoretical Physics, University of Melbourne;
- Professor Sue Serjeantson, Executive Secretary, Australian Academy of Science;
- Dr Judy West, Director, Centre for Plant Biodiversity Research, Australian National Herbarium, CSIRO Plant Industry.

Professor Lambeck and Professor Serjeantson were also responsible for project liaison with overseas academies and with ICSU and other global scientific organisations.

The study also drew upon the resources of the Australian Academy of Science's National Committees, which are a focal point for Australia's interaction with many of the global scientific activities.

Web searches were used to obtain detailed information on global scientific activities, including their aims and objectives, sponsoring bodies, involved governments and countries, major programs or projects and the progress and outputs to date, membership subscription mechanisms, and Australia's involvement.

The ISI Web of Knowledge database (<http://isi6.newisiknowledge.com/portal.cgi>) was used to carry out a bibliometric analysis in an attempt to quantify the effects of global engagement on Australia's scientific publications output.

2. Inventory of significant global science activities

Overview

This project deals only with **significant global** scientific activities. By 'significant', we refer to the principal disciplinary umbrella-type organisations, rather than the smaller subdiscipline-based organisations. Although much significant scientific activity does take place at the lower levels, this approach is necessary to put some boundaries on the study. There are hundreds, perhaps thousands,

of international scientific organisations – too many to cover in a report such as this, so this report attempts to take a ‘top down’ approach to global scientific activities. By ‘Global’, we refer to organisations that are truly global in their focus, rather than regional groupings or bilateral international collaboration between scientists or scientific groups. Although bilateral arrangements represent a significant portion of international science, these are dealt with in other studies^{1,3} and this project focuses on activities that have formal global participation and membership requirements.

Global science activities can be generally grouped under four broad categories, as shown schematically in Figure 1. These categories are:

- Global scientific activities under ICSU
 - ICSU International Scientific Unions (see Appendix 1);
 - ICSU International Scientific Associates (see Appendix 2);
 - ICSU Interdisciplinary Bodies and Joint Initiatives (see Appendix 3);
 - International scientific associations and services under ICSU bodies (see Appendix 4).
- Global scientific activities under UN organisations
 - UNESCO scientific activities (see Appendix 5);
 - World Meteorological Organization (WMO) (see Appendix 6);
 - United Nations Environment Programme (UNEP);
 - World Health Organization (WHO);
 - Food and Agriculture Organization of the United Nations (FAO).
- Scientific academy groupings
- Independent global scientific activities (see Appendix 7).

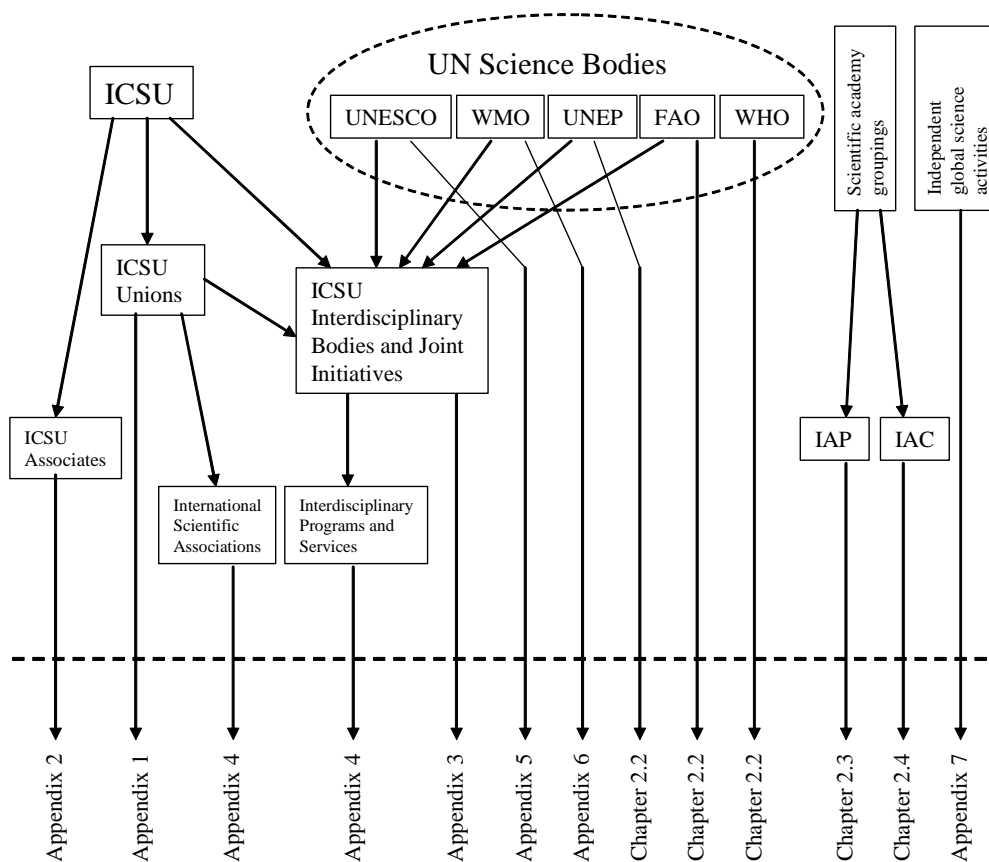
Most of these global scientific activities have formal membership requirements. In general, the activities under ICSU bodies require membership from a country’s academy of science or from the country’s relevant professional scientific society, while activities under UN bodies require membership from government agencies. The independent global scientific activities accept membership from any interested groups.

Brief descriptions of the four broad categories and Australia’s formal membership status in them are given below. More detailed descriptions of the specific activities and of Australia’s involvement are provided in Appendices 1–7.

A list of global scientific activities grouped by disciplines is provided in Appendix 8.

Formal membership in these global scientific activities confers certain benefits, which are discussed in Chapter 4. However, it should be noted that it is still possible for individual scientists to participate in the various projects without their country being a formal member.

Figure 1 – The structure of global scientific programs



Global scientific activities under ICSU

www.icsu.org/index.php

The International Council for Science (ICSU) is a non-governmental organisation representing a global membership that includes both national scientific bodies (101 members) and international scientific Unions (27 members). Through this extensive international network, ICSU provides a forum for discussion of issues relevant to policy for international science and the importance of international science for policy issues and undertakes the following core activities:

- planning and coordinating interdisciplinary research to address major issues of relevance in both science and society;
- actively advocating for freedom in the conduct of science, promoting equitable access to scientific data and information, and facilitating science education and capacity building;
- acting as a focus for the exchange of ideas, the communication of scientific information and the development of scientific standards;
- supporting in excess of 600 scientific conferences, congresses and symposia per year all around the world, as well as the production of a wide range of newsletters, handbooks, learned journals and proceedings.

The Australian Academy of Science pays annual membership subscriptions to ICSU. Further information about ICSU is given in Box 1.

Box 1 – ICSU develops its strategy for the twenty-first century

Report from Dr Graeme Pearman, FAA, Deputy Chair of the ICSU Committee for Scientific Planning and Review (CSPR), December 2004.

The International Council of Science (ICSU) is undertaking major change in an effort to align its activities to the 21st century needs of the international science community. The ICSU Committee for Scientific Planning and Review (CSPR) is charged with underpinning these changes by developing a new Strategic Plan for consideration by the General Assembly (the representation of academies, including the Australian Academy of Science, and the Scientific Unions) when it next meets in October 2005.

There is little doubt that ICSU was in need of some new directions reflecting the changing needs of its members and the changing circumstances of science in general. The CSPR over the past several years has undertaken a number of projects that have been designed to collect views on the most appropriate role for ICSU in this new century. These projects have included:

- contracting the University of Sussex to prepare a meta-database of various foresight studies from around the world on emerging issues in science and society;
- commissioning several assessments on priority areas identified by the foresight study and input from the Scientific Unions and targeted expert input as to how ICSU can contribute to the areas. The areas include capacity building in science, scientific data and information, environment and its relationship to sustainable development;
- establishing several working groups to provide input with respect to other emerging issues such as sustainability science and society, basic research, energy futures, etc;
- receiving input from national academies and the Scientific Unions, and ICSU's bodies concerning different views on science needs.

On 29 November – 1 December, the CSPR met in Paris to draft the new Strategic Plan which will be forwarded to ICSU members for comment in the first weeks of January 2005. The Plan contains background information about the changing context of international science, and a little about the past role of achievements of ICSU. But it concentrates on the future vision and role of ICSU including:

- addressing major issues of importance for science and society, including the environment, the International Polar Year (2007-2008), natural and human-induced hazards, human health and new horizons such as in genetics or biotechnology and others;
- facilitating interactions amongst scientists by reaching out to scientists in all countries, the establishment of regional offices of ICSU in four developing regions of the world, and facilitating planning and the identification and seeding of new initiatives;
- promotion of the participation in science and the concept of the universality of science including such things as the availability of data and information;
- science and policy, the role of good science in policy development and the interface with societies.

Aside from the development of the Strategic Plan the CSPR considered other issues such as the future of its Grants Program, the Reviews of the International Human Dimensions Program, and the Millennium Assessment (of biodiversity). Following on from ICSU's very successful representation of Science at the World Summit on Sustainable Development (WSSD, Johannesburg, September 2002), published as part of the ICSU series on Science for Sustainable Development, discussion has centred on the on-going role of ICSU in this forum and the preparation for the next meeting of the WSSD in 2007.

The CSPR meeting was, as usual demanding, yet rewarding: demanding, because the ICSU Executive Board and the CSPR itself have set significant targets for the development of ICSU in all aspects of its work. Rewarding in the sense that huge advances have already been made with exciting consequences and with great anticipation for the next few years.

ICSU International Scientific Unions

Under ICSU are the 27 discipline-based Scientific Union Members, defined by ICSU as ‘an international non-governmental organization devoted to the promotion of activities in a particular area of science and shall have been in existence for at least 6 years.’

Descriptions of the ICSU International Scientific Unions are provided in Appendix 1. Several of these discipline-based Unions have membership from subdiscipline-based international scientific associations, which are listed in Appendix 4.

As well as paying membership subscriptions to ICSU directly, the Australian Academy of Science also pays membership subscriptions to 21 of the 27 ICSU Unions:

- International Astronomical Union (IAU);
- International Geographical Union (IGU);
- International Mathematical Union (IMU);
- International Union of Biochemistry and Molecular Biology (IUBMB);
- International Union of Biological Sciences (IUBS);
- International Union of Crystallography (IUCr);
- International Union of Geodesy and Geophysics (IUGG);
- International Union of Geological Sciences (IUGS);
- International Union of History and Philosophy of Science (IUHPS);
- International Union of Immunological Societies (IUIS)
Subscription shared 50/50 with the Australasian Society for Immunology;
- International Union of Microbiological Societies (IUMS);
- International Union of Nutritional Sciences (IUNS);
- International Union for Pure and Applied Biophysics (IUPAB);
- International Union of Pure and Applied Chemistry (IUPAC);
- International Union of Pure and Applied Physics (IUPAP);
- International Union of Pharmacology (IUPHAR);
- International Union of Physiological Sciences (IUPS);
- International Union of Psychological Science (IUPsyS);
- International Union of Theoretical and Applied Mechanics (IUTAM);
- International Union of Toxicology (IUTOX);
- International Union of Radio Science (URSI).

Other Australian organisations pay membership subscriptions to the other six ICSU Unions, as listed below:

- International Brain Research Organisation (IBRO)
Australian Neuroscience Society;

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- International Society for Photogrammetry and Remote Sensing (ISPRS)
Remote Sensing and Photogrammetry Association of Australasia;
 - International Union of Anthropological and Ethnological Sciences (IUAES);
 - International Union of Food Science and Technology (IUFoST)
Australian Institute of Food Science;
 - International Union for Physical and Engineering Sciences in Medicine (IUPESM)
Membership is via the two constituent organisations: the International Federation for Medical and Biological Engineering (IFMBE) and the International Organization for Medical Physics (IOMP). The Australian Federation for Medical and Biological Engineering pays dues to IFMBE. The Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM) pays dues to IOMP;
 - International Union of Soil Sciences (IUSS)
Australian Society of Soil Science.

There are no ICSU Unions that Australia is not formally involved with in some way.

More details of Australia's involvement in each ICSU Union are provided in Appendix 1.

ICSU International Scientific Associates

ICSU also has a number of ICSU Associates under it. An International Scientific Associate is defined by ICSU as

an international non-governmental organization in the natural sciences or an organization in a field cognate to those of ICSU, such as the humanistic, medical, social and technical sciences whose association with ICSU is likely to be of mutual benefit or to advance the cause of science, and whose scientific activities do not fall primarily within the scope of a single Scientific Union Member.

A Regional Scientific Associate is defined by ICSU as

a non-governmental Scientific Academy, Science Council, or other scientific institution, to which scientists or scientific bodies from more than one nation adhere, whose association with ICSU is likely to be of mutual benefit and will facilitate the attainment of ICSU's objectives, and whose scientific activities do not fall primarily within the scope of a single Scientific Union Member.

ICSU Associates are generally composed of smaller groups of scientists than the ICSU Unions. Descriptions of the ICSU International Scientific Associates are provided in Appendix 2.

The Australian Academy of Science pays subscriptions to three ICSU Scientific Associates:

- Federation of Asian Scientific Academies and Societies (FASAS);
- International Foundation for Science (IFS);
- International Union for Quaternary Research (INQUA).

Other Australian organisations pay membership subscriptions to the following 14 ICSU Scientific Associates, as listed below:

- Federation Internationale des Geometres (International Federation of Surveyors) (FIG)
Institution of Surveyors, Australia;
- International Association of Hydraulic Engineering and Research (IAHR)
Five Australian organisations are corporate members: SunWater Technical Services, Hargrave-Andrew Library Monash, University of Queensland Central Library, Snowy Mountains Engineering Corporation and the University of Adelaide Acquisitions Department. Individual Australian scientists are also members;
- International Cartographic Association (ICA)
Mapping Sciences Institute, Australia;
- International Council for Laboratory Animal Science (ICLAS)
Australian and New Zealand Society for Laboratory Animal Science (ANZSLAS);
- International Council for Scientific and Technical Information (ICSTI)
CSIRO;
- International Federation of Information Processing (IFIP)
Australian Computer Society;
- Federation of Library Associations and Institutions (IFLA)
Australian Library and Information Association;
- International Federation of Societies for Microscopy (IFSM)
Australian Microscopy and Microanalysis Society Inc.;
- International Radiation Protection Association (IRPA)
Australasian Radiation Protection Society;
- International Society of Endocrinology (ISE)
Endocrine Society of Australia;
- International Union of Forest Research Organizations (IUFRO)
24 Australian organisations are members, including government agencies (such as the Bureau of Rural Sciences), CSIRO Divisions, universities and Cooperative Research Centres;
- International Union for Vacuum Science Techniques and Applications (IUVSTA)
Vacuum Society of Australia;
- International Water Association (IWA)
Australian Water Association;
- Pacific Science Association (PSA)
National Academies Forum.

Australia is NOT a formal member of:

- Academia de Ciencias de América Latina (ACAL);
- International Cell Research Organization (ICRO) – membership consists of elected individuals only;

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- International Institute for Applied System Analysis (IIASA);
 - Third World Academy of Sciences (TWAS) – membership consists of elected individuals only. Scientists from developed countries can only be associate members.

More details of Australia’s involvement in each ICSU Associate are provided in Appendix 2.

ICSU Interdisciplinary Bodies and Joint Initiatives

ICSU participates in international science initiatives in two ways: by establishing its own **Interdisciplinary Bodies** or by lending its support to **Joint Initiatives** that have multiple sponsors and partners.

Initially established by ICSU General Assemblies, Interdisciplinary Bodies focus on specific areas of international research that are of interest to all or many ICSU Members. Their roles vary depending on the area of science and on the related needs of the international science community, but usually combine operational and policy or advisory functions. They are designed to become self-sufficient and independent in terms of day-to-day operations and financing. Most Interdisciplinary Bodies have their own secretariat.

Joint Initiatives, co-sponsored by ICSU and other international organisations (eg, from the UN system), are an important means of bringing together a range of partners to address a particular issue or area. One of the key features of these collaborative programs is the ability to consider the issue from the broadest possible perspective while minimising overlap and duplication of effort.

Descriptions of the ICSU International Interdisciplinary Bodies and Joint Initiatives are provided in Appendix 3.

The Australian Academy of Science pays direct subscriptions to six ICSU International Interdisciplinary Bodies and Joint Initiatives:

- Committee on Space and Research (COSPAR);
- International Geosphere-Biosphere Programme (IGBP);
- Scientific Committee on Antarctic Research (SCAR) – also has membership subscriptions from the Australian Antarctic Division;
- Scientific Committee on Oceanic Research (SCOR);
- Scientific Committee on Solar Terrestrial Physics (SCOSTEP);
- World Climate Research Programme (WCRP).

Australia is also a formal member of:

- International Network for the Availability of Scientific Publications (INASP) – via financial contributions from the Australian Centre for International Agricultural Research (ACIAR).

Australia can also be considered a formal member of another eight ICSU International Interdisciplinary Bodies and Joint Initiatives, listed below. These organisations do not require

membership subscriptions from individual nations – formal involvement with these bodies is via membership to their sponsoring bodies:

- Astronomical and Geophysical Data Analysis Services (FAGS)
via membership subscriptions to sponsoring organisations (IAU, IUGG and URSI);
- Global Climate Observing System (GCOS)
via membership of sponsoring bodies IOC, WMO and ICSU;
- Global Ocean Observing System (GOOS)
via membership of sponsoring bodies IOC, WMO and ICSU;
- Global Terrestrial Observing System (GTOS)
via membership of sponsoring organisations FAO, UNESCO and WMO;
- Integrated Global Observing Strategy (IGOS)
via membership to several sponsoring organisations;
- Committee on Allocation of Radio Frequency (IUCAF)
via membership subscriptions to sponsoring organisations IAU, URSI and COSPAR;
- Scientific Committee on the Lithosphere (SCL)
via membership subscriptions to sponsoring organisations ICSU, IUGG and IUGS;
- Panel on World Data Centres (WDC)
Australia hosts the WDC for Solar-Terrestrial Science in Sydney, through IPS Radio and Space Services.

Australia has only indirect membership and involvement with the following five ICSU International Interdisciplinary Bodies and Joint Initiatives. Direct formal membership to these organisations is achieved via subscriptions from individual nations. Australia does not pay subscriptions directly to these organisations, but is indirectly involved via membership to bodies that sponsor these organisations, or through the participation of individual Australian scientists.

- Committee on Data for Science and Technology (CODATA)
via Australian Academy of Science subscriptions to the various ICSU unions that sponsor CODATA. Australian scientists play a significant role in CODATA as representatives of other scientific unions. The Academy paid direct membership subscriptions to CODATA up until 1999/2000, but no longer pays subscriptions;
- An Integrated Programme of Biodiversity (DIVERSITAS)
via Australian Academy of Science subscriptions to DIVERSITAS sponsoring organisations (ICSU, IUBS and IUMS);
- International Human Dimensions Programme on Global Environmental Change (IHDP)
via membership to sponsoring organisations ICSU and ISSC;
- Millennium Ecosystem Assessment (MA)
via UN agencies and programs;
- Scientific Committee on Problems of the Environment (SCOPE)
via membership to various sponsoring organisations. Although direct Australian Academy of Science subscriptions stopped in 2002, Australia is still listed as a formal member on the SCOPE website.

More details of Australia's involvement in each ICSU Interdisciplinary Body and Joint Initiative are provided in Appendix 3.

International scientific associations and services under ICSU bodies

The ICSU Unions, Interdisciplinary Bodies and Joint Initiatives also have some significant programs or associations under them. Several of the discipline-based ICSU Unions have membership from subdiscipline-based international scientific associations. Likewise, the Interdisciplinary Bodies and Joint Initiatives often have significant programs or services under them. These are listed in Appendix 4.

Most of the international associations consist of individual scientists as members. However, the Australian Academy of Science pays direct subscriptions to:

- International Association of Geochemistry and Cosmochemistry (IAGC)
IAGC is affiliated with IUGS, to which the Academy also pays subscriptions.
- International Commission for Optics (ICO)
ICO is an affiliated commission of IUPAP, to which the Academy also pays subscriptions.
The Australian Optical Society is also a member.

Global scientific activities under UN organisations

UNESCO scientific activities

(www.unesco.org)

From the UNESCO website:

The United Nations Educational, Scientific and Cultural Organization (UNESCO) is a specialized United Nations agency working to promote international co-operation among its 190 Member States and six Associate Members in the fields of education, science, culture and communication. The mission of UNESCO's science program is to be a promoter and broker of science throughout the world, and its goals are:

- Advancement and sharing of scientific knowledge;
- Application of scientific knowledge to sustainable development and technology;
- Contribution of science and technology to peace;
- Understanding the role of ethics in science and technology;
- Promotion of equity of access to S&T knowledge and benefits;
- Enhancement of productive linkages between scientists and decision makers.

UNESCO's scientific thematic areas are Fresh Water; People, Biodiversity and Ecology; Oceans; Earth Sciences; Basic & Engineering Sciences; Coastal Regions & Small Islands; and Science Policy.

The Commonwealth government is a member of UNESCO.

UNESCO funds the following major international scientific programs. All programs have involvement from Australian scientists.

- International Union Geological Correlation Programme (IGCP) – Joint Program of UNESCO and IUGS;
- International Hydrological Programme (IHP);
- Intergovernmental Oceanographic Commission (IOC);
- Man and the Biosphere (MAB);
- United Nations World Water Assessment Programme (WWAP).

More detailed descriptions of the UNESCO scientific programs, and Australia's involvement in them, are provided in Appendix 5.

World Meteorological Organization (WMO) activities

www.wmo.ch

WMO facilitates international cooperation in the establishment of networks for making meteorological, hydrological and other observations, and promotes the rapid exchange of meteorological information for public, private and commercial use. The scientific activities coordinated by WMO include weather predictions, climate change, air pollution, ozone depletion studies and tropical storm forecasting.

As of August 2003, there were 187 Members (including Australia), comprising 181 Member States and six Member Territories, all of which maintain their own National Meteorological and Hydrological Services. Australia has been a member of WMO since its establishment and participates strongly in its programs (eg, in the formal framework of the constituent bodies, especially the WMO Congress, the Executive Council, South-West Pacific Regional Association and all eight Technical Commissions). The nominated Permanent Representative for Australia with WMO is the Director of Meteorology.

WMO supports a number of climate and weather research programs at an International Level. The Australian Bureau of Meteorology and Australian scientists are involved in all of these programs. These include:

- Applications of Meteorology Programme (AMP);
- Atmospheric Research and Environment Programme (AREP);
- Global Climate Observing System (GCOS)
co-sponsored by WMO, IOC of UNESCO, UNEP and ICSU;
- Hydrology and Water Resources Programme (HWRP);
- Intergovernmental Panel on Climate Change (IPCC)
joint program of WMO and UNEP;
- WMO/IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM)
joint program of WMO and IOC of UNESCO;

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- Technical Cooperation Programme (TCO);
 - World Climate Programme (WCP);
 - World Climate Research Programme (WCRP)
joint program of WMO, ICSU and IOC of UNESCO;
 - WMO Space Program;
 - World Weather Watch (WWW).

More detailed descriptions of the WMO Scientific programs, and Australia's involvement in them, are provided in Appendix 6.

Other UN organisations that have scientific activities

United Nations Environment Programme (UNEP)

(www.unep.org)

UNEP was established in 1972 and is the designated authority of the United Nations system in environmental issues at the global and regional level. Its mandate is 'to coordinate the development of environmental policy consensus by keeping the global environment under review and bringing emerging issues to the attention of governments and the international community for action.' UNEP collaborates with a wide range of partners throughout the UN system and beyond to provide information on the state of the planet's natural resources and their contribution to sustainable development. UNEP is implementing or participating in several global environmental assessments, including the Global International Waters Assessment, the Global Environment Monitoring System Freshwater Quality Programme and the Millennium Ecosystem Assessment. UNEP aims to:

- assess global, regional and national environmental conditions and trends;
- develop international and national environmental instruments;
- strengthen institutions for the wise management of the environment;
- facilitate the transfer of knowledge and technology for sustainable development;
- encourage new partnerships and mind-sets within civil society and the private sector.

There are 60 member nations on the UNEP governing council. Although Australia is not currently a member state of the governing council, Australia has a permanent Mission in Nairobi that is accredited to UNEP, and represents Australia at various meetings, including the Committee of Permanent Representatives. The Commonwealth government's Department of the Environment and Heritage describes Australia's involvement in UNEP on its website as follows:

Australia has been actively involved in UNEP activities since the inception of the program, including through the provision of funding. We have been particularly active at various times with UNEP on issues such as cleaner production, sustainable consumption, marine environment, chemicals and ozone. Australia has assisted UNEP with work in our region, including contributing funding for regional meetings on specific issues. We have also had major involvement at various times with some of the sector-specific work of UNEP. Officers of Australian government departments represent Australia's interests at various UNEP meetings, including the Governing Council and Global Ministerial Environment Forum and meetings and workshops related to specific issues.

World Health Organization (WHO)

www.who.int/en

The World Health Organization, the United Nation's specialised agency for health, was established on 7 April 1948. The objective of WHO is 'the attainment by all peoples of the highest possible level of health. Health is defined in WHO's Constitution as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.' WHO's activities include scientific research in health and medicine, and there are projects dealing with approximately 240 health topics.

WHO is governed by 192 Member States through the World Health Assembly. Australia is a member state. There are 49 WHO Collaborating Centres in Australia.

Food and Agriculture Organization of the United Nations (FAO)

www.fao.org

The mission of the FAO is

to raise levels of nutrition, improve agricultural productivity, better the lives of rural populations and contribute to the growth of the world economy. FAO helps developing countries and countries in transition modernize and improve agriculture, forestry and fisheries practices and ensure good nutrition for all. Since its founding in 1945, FAO has focused special attention on developing rural areas, home to 70 percent of the world's poor and hungry people.

FAO supports scientific activities related to climate change and improved weather forecasting, biotechnology, and sustainable agriculture. FAO is funded by its 188 member nations. Australia is a member nation, and is also a current member of the 49-nation governing council of FAO.

Scientific academy groupings

The following organisations are groupings of scientific academies. The purpose of these organisations is to represent the views of the world's scientific academies, independently of UN organisations and discipline-based ICSU Scientific Unions and associations. They are becoming an increasingly important influence in international science.

InterAcademy Panel (IAP)

www.interacademies.net

The IAP is

a global network of the world's science academies, launched in 1993. Its primary goal is to help member academies work together to advise citizens and public officials on the scientific aspects of critical global issues. IAP is particularly interested in assisting young and small academies achieve these goals and, through the communication links and networks created by IAP activities, all academies will be able to raise both their public profile among citizens and their influence among policy makers.

Since its inception, IAP has issued statements on population growth (1994); urban development (1996); sustainability (2000); human reproductive cloning (2003); science education (2003); health of

mothers and children (2003); scientific capacity building (2003); science and the media (2003); and access to scientific information (2003).

The IAP has membership from 91 scientific academies from around the world, including the Australian Academy of Science, which was a member of the IAP executive from 2001-2003.

InterAcademy Medical Panel (IAMP)

www.interacademies.net/iamp/iamphome.nsf

The IAMP is a voluntary association of the world's medical academies or the medical divisions of science academies. The IAMP

is committed to improving health around the world. This includes collaboration to strengthen the role of all academies to alleviate the burden of the poorest, to build scientific capacity for health, and to provide independent scientific advice on promoting health science and health care policy to national governments and global organizations.

The Australian Academy of Science is a member. There are 47 member nations.

InterAcademy Council (IAC)

www.interacademycouncil.net

In 2002, the world's science academies created the IAC to 'mobilize the best scientists worldwide to provide high quality advice to international bodies such as the United Nations, the World Bank, and other organisations.'

The report of the first IAC study on building worldwide capacities in science and technology was presented in February 2004 to a meeting at UN Headquarters presided over by UN Secretary-General, Kofi Annan. A second IAC study commissioned by Secretary-General, Kofi Annan, resulted in a report entitled 'Realizing the promise and potential of African agriculture', and was presented to Mr Annan at a special meeting at UN Headquarters in June 2004.

The Australian Academy of Science is a member of the IAC.

Independent global scientific activities

There are a number of significant global science activities that do not fit under ICSU or UN categories. The main organisations are listed below, and are described in more detail in Appendix 7.

Australia is a member of:

- Global Biodiversity Information Facility (GBIF)
via the CSIRO;
- Global Water Research Coalition (GWRC)
the CRC for Water Quality and Treatment and the Water Services Association of Australia are formal members;
- Human Frontier Science Program
via the National Health and Medical Research Council (NHMRC);

-
- International Federation for the Promotion of Mechanism and Machine Science (IFTToMM)
The Australian Academy of Science pays formal membership subscriptions;
 - International Union Against Cancer (UICC)
Several Australian national and state cancer organisations are members;
 - World Conservation Union (IUCN)
31 Australian organisations are members, including 22 NGOs, nine state government environment departments, and the Commonwealth government’s Department of the Environment and Heritage.

Australia is NOT a member of:

- Global Forum for Health Research;
- International Group of Funding Agencies for Global Change Research (IGFA);
- Integrated Ocean Drilling Program (IODP).

More detailed descriptions of these independent global scientific activities, and Australia’s involvement in them, are provided in Appendix 7.

3. Membership subscription levels and mechanisms

This chapter deals only with the membership subscriptions to ICSU-related bodies (ICSU Unions, ICSU Associates, ICSU International Interdisciplinary Bodies and Joint Initiatives), as the Australian Academy of Science is responsible for administering the membership subscriptions to many of these bodies. Membership to the UN-related global science bodies is administered directly by the Commonwealth government.

The Academy receives annual grants from the Department of Education, Science and Training (DEST) and the Department of the Environment and Heritage (DEH) for:

- membership subscriptions to international scientific organisations;
- travel support for Australian voting delegates to General Assemblies of ICSU Scientific Unions (note – no money is provided for *bidding for or hosting* General Assemblies in Australia);
- support for regular meetings of Australian scientific National Committees.

The Academy administers these funds on behalf of the government to engage with international scientific organisations with minimum bureaucracy and administrative cost for maximum effect.

In the financial year 2002-2003, the Academy received about \$500,000 from the two departments (\$66,600 from DEH, the remainder from DEST). Approximately two-thirds of this money goes towards annual membership subscriptions to the various international scientific organisations.

These subscriptions are rising year by year (as the international organisations periodically raise their subscription levels) and are subject to international currency fluctuations, while government funding has remained essentially static for several years.

As government funding has remained essentially static, the Academy has made continual adjustments to its expenditure in order to fulfil its international obligations with the available money. Currently, the amount spent by the Academy on support for the National Committees and Australian voting delegates to ICSU bodies is approximately one-tenth of the amount spent on membership subscriptions. Therefore, the pressure to cut costs inevitably falls onto the membership subscriptions to global scientific organisations, as cutting support for the National Committees and Australian delegates would effectively reduce the benefits from being a member. In the past, the Academy has been forced to cancel or negotiate a temporary reduction in subscription levels to some ICSU bodies in order to deal with the rising cost of subscriptions. There are also some new and potentially worthwhile international science activities that the Academy is unable to fund because of its budget limitations. A review of the subscription levels and mechanisms to global scientific organisations is therefore required to assess whether extra funding is warranted, or if some of the membership subscriptions can be shed without adverse affects to Australia's science efforts.

A table summarising the membership subscription mechanisms for the ICSU-related bodies, and Australia's subscription details is provided in Appendix 9. Although information was not available for every ICSU body, information on enough of the bodies was collected to allow some general observations. The table shows that:

- Membership subscription mechanisms vary. There is no standard mechanism. All of the organisations designate a number of categories of membership level and assign a country to a particular level based on some criteria. Some Unions and programs have specific criteria on which they base the subscription levels (eg, number of active scientists), but in most cases the category of adherence is agreed to between the international body and the particular country.
- A higher category of membership means higher annual membership subscription, but confers a greater number of voting rights and delegates at general assemblies, which in turn confers a greater level of influence in the operations of the international body.
- In most cases, Australia's membership category is comparable with nations with similar economies and populations (where this information is available) – the same or slightly lower than Canada, the same or slightly higher than the Netherlands and Sweden.
- Australia's contribution to the total membership subscriptions for each organisation is generally between 2 and 3 per cent (for the 20 organisations where this information is available). This is consistent with Australia's contribution to global science publications, which represent about 2.7 per cent of the total⁴.
- In some fields, such as astronomy and earth sciences, Australia produces 4-5 per cent of the world's publications but still only contributes around 2-3 per cent of the total membership subscriptions to the relevant global Scientific Unions and Programs.

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- These observations suggest that Australia’s membership contributions to ICSU-related global science organisations are broadly in line with (or small in comparison to) its presence in the pool of global science publications. It certainly does not appear that Australia’s membership subscriptions are too high in comparison with the rest of the world, suggesting that there is scope for Australia to extend its membership to participate in additional worthwhile global scientific programs that may arise in the future.

It is worth noting that the ‘outcomes’ from Australia’s investment in global science activities are more important than the ‘inputs’, and these are discussed in Chapter 4.

The above analysis suggests that the membership subscriptions to most of the international scientific organisations managed by the Australian Academy of Science are at an appropriate level for Australia. There does not seem to be justification for Australia to further reduce its membership subscriptions to these organisations. In order to continue to support these subscriptions, the Academy is therefore in a position where it either needs to:

- obtain more funding from government to support the Academy’s international activities;
- decide to stop paying membership subscriptions to some of the international organisations;
- ignore opportunities to formally engage with potentially worthwhile global scientific organisations that may emerge in the future; or
- cut funding to support National Committees and travel support for Australian voting delegates to General Assemblies of ICSU Scientific Unions (however, the National Committees serve as a focal point for Australia’s interaction with many of the international science organisations, so cutting back on support for National Committee activities would lead to reduced benefits from Australia’s membership to those international science organisations).

The Academy welcomes further discussion regarding funding for subscriptions to global scientific activities in the forthcoming five-year review into the Academy’s responsibilities.

4. Benefits that flow from engagement

It is widely acknowledged that Australian participation in global scientific activities is not only critical to achieving excellence, but also that global engagement provides a means of leveraging Australia’s comparatively small research and development effort through access to global resources. Global engagement delivers national benefit through:

- prior and immediate access to the 97 per cent of research that is done overseas;
- benchmarking and maintenance of the highest of standards in our own scientific research;
- influence in international science directions and policy for science;
- leverage of international research in the Australian region;

-
- Australian public awareness of internationally emerging science and technology issues relevant to Australia.

If Australia is to continue to increase the excellence of its science then effective global engagement is considered essential. This chapter attempts to describe some of the benefits that flow from Australia's engagement in global scientific activities.

General qualitative benefits

Some science can only be carried out at a global level

In many fields of science, cooperation and collaboration with scientists around the world is essential for cutting edge-science to be done, especially in climate change science, astronomy, and some aspects of earth sciences. For Australia to be at the cutting edge of these fields, it needs linkages with countries around the world to obtain and share global-scale measurements from satellite imagery, aircraft, ships and so on. Sharing of this expensive scientific infrastructure is often coordinated by the peak global scientific organisations.

Involvement in cutting edge science

Global scientific programs allow Australian scientists to do science that they couldn't otherwise do, by providing access to global databases and access to and integration with comparative studies elsewhere in the world.

Participation in global science programs provides an opportunity to work with world-leading scientists as they decide on the future directions for the field, and to have input into defining that direction. Australian scientists working on global science projects get inspiration from and exposure to the expertise of world-leading scientists. A list of Australian scientists involved in leadership roles in global scientific activities is given in Appendix 11. The fact that this list is quite extensive indicates that Australian scientists are having a large influence in global scientific activities compared with Australia's relatively modest formal financial contributions.

By being involved in global science activities, Australian scientists showcase Australian science to the world, effectively advertising Australia as a strong science nation and leading to further interest and collaboration from overseas scientists.

Australian science has the comparative advantage of being quick to respond to directions set by new discoveries and advances in science, but needs to be involved with the global science programs that are defining the frontiers in order to make the most of this advantage.

Leveraging off scientific funding provided by larger nations

For a relatively modest subscription, Australia gets a voice in the organisations that direct and administer projects and results obtained from huge funding provided by the US, the EU and Japan.

National Committees

Many of Australia's global science activities are underpinned by Australia's National Committees (see www.science.org.au/natcoms) that serve as a focal point for the various disciplines within Australia, stimulate collaborative research within Australia and overseas, and develop strategic disciplinary reviews and scoping studies. Without formal involvement in global science activities, there would be less motivation for these National Committees to exist, and these benefits would subsequently be diminished.

Access to direct funding

Many of the global science activities award funding to individual scientists from member countries, for activities such as travel funding for Australian scientists to attend scientific steering committee meetings and travel scholarships for young scientists. Often the amount of money awarded to Australian scientists by an international organisation exceeds the annual subscription that Australia pays to that organisation.

Providing a forum for Australian scientists to develop formal and informal personal links with overseas scientists

Many Australian scientists build up informal personal international linkages through ICSU Union activities (such as congresses and steering committee meetings). These lead to collaborative research programs and provide the corner-stone of the development of international programs. The benefits are that many useful informal international scientific linkages are developed via Australia's formal global scientific linkages.

Political influence

Some countries use their involvement in global science programs as a direct foreign policy tool, by hosting the secretariats, driving the agendas, and directing aid to developing countries via these organisations.

The benefits of being involved with global science activities are important not just for science, but for **science politics**. Australia needs to be involved to have access to the decision-making and agenda-setting activities. Scientific issues are increasingly influential in matters of national security (eg, bioterrorism, infectious diseases, military technologies), international economic policy (eg, trade in genetically modified foods and products, international telecommunications, microelectronics), international environmental policy (eg, global climate change, protection of biodiversity), capacity building in developing countries, and other areas. In this regard, Australia could benefit from better links between the science community (represented by the Australian Academy of Science) and the Commonwealth government's Department of Foreign Affairs.

Australia's involvement in SCAR (Scientific Committee on Antarctic Research) provides an example of how political influence is enhanced through participation in science programs. SCAR, by initiating, developing and coordinating international scientific research in Antarctica, provides scientific advice to the Antarctic Treaty consultative meetings. Australia's significant involvement in scientific activities directed by SCAR therefore strengthens its standing within the Antarctic treaty (see Box 4).

Australia's participation in the Federation of Asian Scientific Academies and Societies (FASAS) provides an example of enhancing Australia's regional standing through science. The Academy has recently increased its membership contributions to FASAS in recognition of the importance of science for capacity building in Australia's region. The Academy will also host the FASAS meeting in 2005, which will be used to strengthen scientific as well as diplomatic ties between the member nations.

Capacity building in developing countries

Many of the global science activities have specific programs aimed at building the scientific capacity of developing countries, leading to improved national security in our region and the rest of the world. Examples include work by the InterAcademy Panel (IAP) and the InterAcademy Council (IAC) on regional capacity building in Africa and the Caribbean, and work by FASAS on capacity building in the Asian region (see www.interacademies.net, www.interacademycouncil.net and www.akademisains.gov.my/FASAS for details).

Fostering international relations and peace

By collaborating together in scientific activities, individuals and nations build up a greater sense of mutual understanding and co-operation that strengthens ties and relations between nations.

Global Commercialisation of Research

In an increasingly globalised economic environment, Australian scientists need to be globally linked at the forefront of world science in order to be able to fully commercialise their research.

Ability to bid for and host major international science congresses

Formal membership in global scientific bodies allows Australia to bid to host the major international congresses of those bodies. For the ICSU Unions, these congresses are often the major international events in the related discipline, attracting thousands of participant scientists. Without formal membership, Australia would not be able to bid successfully for these congresses. In most cases, the Australian Academy of Science (via its discipline-based National Committees) is the only legal entity entitled to bid for ICSU-sponsored international congresses. The guidelines for international scientific meetings held in Australia at the invitation of the Academy are provided in Appendix 10 and are also available on the Academy's website at www.science.org.au/internat/guidelines.htm.

There are many benefits to Australia from hosting major scientific congresses, such as:

- Showcasing Australian science to the rest of the world.
- Profiling Australia's young scientists.
- Allowing Australian scientists to meet and establish links with international scientists – this is particularly important for young Australian scientists.
- Exposing Australian scientists to the latest scientific results that are often presented at these congresses.

- Raising the profile of Australian science to the general public in Australia, as these big events tend to attract significant exposure in the local media.
- Bringing the local scientific community together, as hosting large congresses often requires the entire discipline-based community to contribute (both financially and with their time). This builds up useful working relationships within the local scientific community.
- Advertising Australia as a good place to do science (ie, demonstrating that it is a safe place, pleasant climate, friendly people, good infrastructure etc.), thus establishing Australia as a destination for scientists for short-term visits. This not only increases Australia’s interaction with world leading scientists, but improves Australia’s chances of securing investment in large scale projects.
- Economic benefits to the Australian community in general, especially the tourism industry, from attracting a large number of international visitors. Scientific Union General Assemblies generally attract between 2000 and 6000 delegates. Based on the findings of a report by the Cooperative Research Centre for Sustainable Tourism, it is estimated that for 2003 each international delegate to business events (such as scientific conferences) spent an average of \$3526 per trip⁵. This represents a significant direct contribution to the Australian economy.
- Effectively managed international congresses have enabled the local scientific communities to make profits that have been used for the benefit of Australian science. For example, profit from hosting the 1976 International Geological Congress in Sydney was used to set up a trust fund that for 30 years has been providing annual support for holding scientific meetings and lectures in the earth sciences in Australia, and for travel scholarships for young Australian scientists to international geological congresses. Similar funds have been established after hosting IAU, IUNS, IUPAC and IUPS congresses in Australia.

A recent example of the benefits from hosting an international congress in Australia was highlighted by the hosting of the International Astronomical Union General Assembly in Sydney in 2003. This example is given as a case study in Box 2.

Box 2 – Case Study: Benefits from the hosting of the International Astronomical Union General Assembly in Sydney in 2003

The following is adapted from a report given by Dr Rachel Webster at a meeting of the Chairs of the Australian Academy of Science’s National Committees in April 2004.

In July 2003, the astronomical community of Australia hosted the triennial General Assembly (GA) of the International Astronomical Union in Sydney. The proposal to host the GA was submitted by the Australian Academy of Science’s National Committee for Astronomy. The GA was extremely successful with over 2000 astronomers attending. Positive outcomes from the congress included:

1. Scientific

A broad scientific program was presented, including presentations of the latest results in key areas of the field. Local scientists, especially young scientists, were thus exposed to key people, results, presentations and inspiration that they would not otherwise have had access to.

2. International exposure

Interaction throughout the congress events (formal and informal) allowed Australian scientists to meet with leading scientists from around the world, thus building up important linkages and establishing future collaboration possibilities. Many young Australian scientists had the opportunity to present their work at the congress, thus raising their international profile in a way that would otherwise be difficult.

3. **Overcoming the ‘tyranny of distance’**

The successful running of the congress established Australia as a positive destination for scientists for future short-term visits. Using our positive tourist image, Australia was promoted as an ideal place for return visits (scientific and/or recreation). The success of the congress also demonstrated that Australia is a safe place, with a pleasant climate, friendly people, good infrastructure etc. This has undoubtedly enhanced Australia’s bid to have the proposed multi-million dollar Square Kilometre Array project hosted here. If successful, this project will bring in millions of dollars of foreign investment, enhance Australia’s reputation as a world leader in astronomy, and provide local scientists with easy access to an important piece of research infrastructure.

4. **Local political influence**

The high profile of the international congress meant that the organisers were able to arrange for the congress to be opened by the Australian Prime Minister and the Science Minister. This provided the local astronomical community with a valuable opportunity to promote itself to politicians and government officials. The involvement of such high profile figures also attracted significant coverage of the event in the local media, particularly in NSW, which raised the profile of astronomy within the general Australian community in a way that science often finds difficult to achieve.

5. **Local glue**

Due to the large scale of the congress, the entire Australian astronomical community needed to contribute, both financially and with their time. This helped to strengthen and enhance existing linkages within Australian astronomy, which should have positive future benefits.

A list of major international scientific conferences that have been held or are scheduled to be held in Australia is provided in Appendix 10. The list shows that a considerable number of global scientific organisations have held major conferences in Australia, or are planning to do so, indicating that Australia is accessing positive benefits from its engagement with these organisations.

Increased international collaboration in Australian scientific publications

On average, scientific publications that have international collaboration are more highly cited and have higher impact than papers without international collaboration, demonstrating the value of international collaboration in raising the quality of the overall science output and in raising the visibility of Australia’s science effort. Thus, Australian scientists must continue to develop extensive links with international scientists. These links can be built up through informal interaction between individual scientists, or through formal links between the Australian science community and global scientific activities. A bibliometric analysis using the ISI Web of Knowledge online database (<http://isi6.newisiknowledge.com/portal.cgi>), shown in Table 4.1, indicates that for the disciplines in which Australia has significant formal engagement with global science activities (eg, space science, earth sciences), Australian publications have a higher level of international collaboration than the disciplines in which Australia has little formal engagement with global science activities (eg, clinical immunology and infectious disease, environment or ecology). The table also shows that the level of international collaboration in Australian publications has increased since 1997. While the analysis does have its limitations, the results suggest that formal linkages with global scientific activities do indeed result in higher levels of international collaboration (see Box 3 for a description of the methodology used).

Box 3 – Methodology for bibliometric analysis

The bibliometric analysis was done using the ISI Web of Knowledge 'Current Contents Connect' online search facility. This allowed searching for publications from journals and books that are grouped within a specific discipline category. For the analysis, disciplines were chosen from the available list provided by ISI that corresponded with the activities of global scientific bodies discussed in this report. The database was searched for publications from each discipline that had 'Australia' in the author address field. This produced the figures given in the column '# Australian publications'. Next, the database was searched for publications from each discipline or subject that had an author address containing 'Australia' AND an overseas country address. This produced the figures in the column '# Australian publications with international collaboration'. The search facility limited the number of terms that could be entered at any one time, so the 40 countries with the most number of publications (as reported on the ISI Essential Science Indicators website, isi6.newisiknowledge.com/portal.cgi) were entered. These 40 countries account for most of the world's scientific publications (>95 per cent).

Table 4.1 – Percentage of Australian publications with international collaboration, for selected disciplines

Using ISI Web of Science 'Current Contents' search, for 'all years' (Nov 2004 to Nov 1997)

Discipline	Related international bodies	# Australian publications	# Australian publications with international collaboration	% of Australian publications with international collaboration
Australian Average (latest 6 months to 16 November 2004 only)		13,314	5,584	41.9
Australian Average for the year 1997		20,806	7,538	30.4
Space science	IAU, URSI, COSPAR, SCOSTEP, FAGS	2,703	2,210	81.8
Chemistry & physics, pure and applied	IUPAC, IUPAP	2,207	1,431	64.8
Mathematics	IMU	2,337	1,430	61.2
Physics	IUPAP	4,414	2,582	58.5
Earth sciences	IGBP, IGU, INQUA, IUGG, IUGS, IUSS, SCAR, SCL, SCOR, WCRP	7,222	4,007	55.5
Molecular biology and genetics	IUBMB	2,716	1,504	55.4
Biology	IUBS	2,280	1,150	50.4
Biotechnology and applied microbiology	IUMS	576	306	53.1
Inorganic and nuclear chemistry	IUCr	1,175	570	48.5
Biochemistry and biophysics	IUBMB, IUPAB	3,837	1,774	46.2
Animal and plant Science	IUBS,	1,841	847	46.0
Physiology	IUPS	1,532	692	45.2
Immunology	IUIS	3,356	1,469	43.8
Microbiology	IUMS	3,720	1,630	43.8
Clinical immunology and infectious disease	IUIS, WHO	1,401	571	40.8
Neurology	IBRO	1,896	751	39.6
Chemistry	IUPAC	2,120	833	39.3
Environment/Ecology	DIVERSITAS, MA, SCOPE	6,377	2,472	38.8
Psychology	IUPsyS	4,944	1,646	33.3
Pharmacology/Toxicology	IUPHAR, IUTOX	3,237	1,068	33.0
Food Science/Nutrition	IUNS, IUFOST	1,545	462	29.9

These disciplines were chosen from the list of fields provided by ISI for analysis as they relate to the work of corresponding global science bodies. There were no directly relevant discipline fields available for searching in the ISI Web of Knowledge database relating to the activities of IGU, IUHPS, IUTAM, IUAES, IUPESM and IHDP.

Case studies

Some case studies highlighting the benefits to Australia from formal linkages to global science activities are given in Boxes 4 and 5.

Box 4 – Antarctic research/SCAR

www.scar.org

The Scientific Committee on Antarctic Research (SCAR) is an interdisciplinary scientific committee of ICSU, and is charged with the initiation, promotion and coordination of scientific research in Antarctica. SCAR is the primary body providing international, independent scientific advice to the Antarctic Treaty system and other organisations on issues of science and conservation affecting the management of Antarctica and the Southern Ocean.

The membership of SCAR comprises national scientific academies or research councils that are active in Antarctic research, together with the relevant Scientific Unions of ICSU. Australia is one of 27 full members of SCAR, via membership subscriptions from the Australian Academy of Science and the Australian Antarctic Division.

Australia has stewardship for 42 per cent of Antarctica, and has been a major player in SCAR since its inception, underpinned by the activities of the Commonwealth government's Antarctic Division and the Australian Academy of Science's National Committee for Antarctic Research.

Antarctica is a region of global scientific relevance, and Antarctic processes are global in extent and influence. It is the 'hub' of world oceans and a major driver of circulation in the oceans and atmosphere, making it a driver of long-term global climate change and short-term regional weather. It is a major sink for CO₂ and acts as an early warning signal for the globe (for processes such as ozone depletion, global warming and sea-level rise). Improved short and long-term weather and climate forecasting represents significant economic benefits to Australian agriculture, catchment management etc.

Antarctica has a unique ecology and biodiversity of plants and animals that have adapted to live under extreme conditions. Australian involvement in SCAR is contributing to the understanding, preservation and sustainable management of this biodiversity, including the potential economic harvesting of marine resources such as fish and krill that will require careful scientific management.

International collaboration via SCAR enhances the effectiveness of Australia's Antarctic science programs by providing:

- Access to data (eg, satellite observations, ocean buoy data and observations) that would be impossible or prohibitively expensive for Australia to acquire on its own.
- Access to the expertise and inspiration of leading international scientists.
- Logistic support from other nations involved in Antarctic science. Antarctica is a cold and inhospitable place that presents unique challenges to researchers, so it is important for nations to work together to overcome these challenges.
- Validation of Australian research by comparison and contrast with the work of other nations.
- Training of new scientists and the building of links with overseas scientists.
- Adding value to the Australian Antarctic Science Program by leveraging off activities funded by other nations.

Antarctica also has important political implications for Australia. The Antarctic Treaty has maintained Antarctica as a zone of peace and international cooperation since its signing in 1959. Australia's involvement in Antarctic science and SCAR has allowed Australia to shape the international Antarctic Treaty, which has enhanced its standing on the world stage and contributed to increased national security as a result of having a significant presence in its southern border region.

To ensure long-term sustainable use of and access to Antarctica, Australia must remain actively involved in SCAR to underpin its political influence with sound scientific advice.

Box 5 – International Geosphere-Biosphere Programme (IGBP)

www.igbp.kva.se/cgi-bin/php/frameset.php

IGBP's scientific objective is 'to describe and understand the interactive physical, chemical and biological processes that regulate the total Earth System, the unique environment that it provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human actions'. IGBP works towards its objective in close collaboration with its partners in the Earth System Science Partnership (ESSP) – a partnership for the integrated study of the earth system, the changes that are occurring to the system and the implications of these changes for global sustainability. The ESSP consists of IGBP, the International Human Dimensions Programme on Global Environmental Change (IHDP), the World Climate Research Programme (WCRP), and DIVERSITAS, an international program of biodiversity science.

Australia is a member of IGBP via membership subscriptions from the Australian Academy of Science. For a more detailed description of IGBP and Australia's involvement, see Appendix 3.

IGBP adds value to a large number of individual, national and regional research projects through integrating activities to achieve enhanced scientific understanding. The benefits from Australia being involved in IGBP include:

- Access to the research networks formed by IGBP to tackle focused scientific questions. Australian scientists have taken advantage of these ready made IGBP networks to build their own personal scientific linkages and programs.
- Involvement of Australian scientists in leadership roles in IGBP, such as on the Scientific Steering Committee. For a relatively small annual membership subscription (which is often directly offset by return funding from IGBP to Australian scientists for travel to IGBP Scientific Steering Committee meetings), Australia gets an influence in the types of projects the IGBP does, ensuring that the work of this global organisation is of relevance to Australia.
- The development and promotion of standardised methodologies. This allows Australian scientists to more easily cross-compare their research with overseas scientists, so Australian science can more readily use and contribute to international research. This includes faster access to standardised global datasets (as well as a say in the design of the datasets and access systems), and the ability to undertake model intercomparisons (leading to enhanced models by seeing what others are doing and fine tuning the models). An example is research looking at the impacts of elevated global CO₂ levels to Australian forestries and catchments – access to IGBP networks, datasets, methodologies and model comparisons allows Australian scientists to develop more effective models for Australian environments and conditions, representing potential direct economic benefits to Australia.
- The hosting of the Global Carbon Project (GCP) in Canberra gives Australia a strong influence in how the GCP proceeds. The GCP is one of the four core projects of the ESSP in which IGBP is involved. Australia is a key player and has a strong interest in carbon cycle research, especially the policy side where the GCP plays an important role in advising the IPCC (International Panel on Climate Change). Hosting the GCP makes Australia the centre of world carbon cycle research, as well as ensuring that the southern hemisphere and Australian climate types are taken into account.

5. Gaps in Australia's current formal links to global scientific programs

Summary

Australia is a formal member of 59 of the 68 ICSU activities, with the Australian Academy of Science directly responsible for managing formal subscriptions to 30 of them, while Australian scientific societies and government agencies subscribe to another 21. There are also eight ICSU bodies that do not have membership from individual nations, but are sponsored by other ICSU bodies that Australia is a member of, so Australia can be considered a member of these bodies via formal membership to those sponsoring bodies. Another two ICSU bodies consist of individual scientists as members (rather than membership from a national body), so these are not considered as gaps in Australia's formal linkages. This list shows that although there are a few gaps in Australia's engagement, Australia is still extensively involved with global scientific activities on at least some level.

The following is a list of global science programs and activities that Australia does not currently have formal links with:

ICSU Unions

There are no gaps in Australia's formal links to the ICSU Unions. This does not necessarily imply that the formal links are at an appropriate level, merely that formal links exist.

ICSU Associates

- Academia de Ciencias de América Latina (ACAL);
- International Institute for Applied System Analysis (IIASA).

ICSU Interdisciplinary Bodies and Joint Initiatives

- Committee on Data for Science and Technology (CODATA);
- Scientific Committee on Problems of the Environment (SCOPE);
- An Integrated Programme of Biodiversity (DIVERSITAS);
- International Human Dimensions Programme on Global Environmental Change (IHDP);
- Millennium Ecosystem Assessment (MA).

Global scientific activities under UN organisations

- Council for International Organizations of Medical Sciences (CIOMS).

Other global science programs

- Global Forum for Health Research;
- International Group of Funding Agencies for Global Change Research (IGFA);
- Integrated Ocean Drilling Program (IODP).

The following pages describe the gaps in Australia's participation in more detail, and identify which activities that Australia should seek to become formally involved in.

ICSU Unions

There are 27 ICSU Unions. The Australian Academy of Science subscribes to 21 of them. The remaining six are subscribed to by the relevant Australian scientific society. Therefore there are no gaps in Australia's formal links to the ICSU Unions. This does not necessarily mean that the formal links are appropriate, merely that formal links exist.

ICSU Associates

There are 21 ICSU Associates. The Australian Academy of Science subscribes to three of them, and the relevant Australian scientific societies subscribe to another 14. Another two consist of individual scientists as members (rather than membership from a national body), so these are not considered as gaps in Australia's formal linkages.

There are two ICSU Associates that Australia does not appear to be formally involved with in some way. They are:

- Academia de Ciencias de América Latina (ACAL) (www.acal-scientia.org)
Australia is not a Latin American country, so it is not appropriate for Australia to be involved;
- International Institute for Applied System Analysis (IIASA) (www.iiasa.ac.at)
There are 16 member countries, but Australia is not a member.

It is not recommended that Australia should seek to become formal members of these organisations at this stage.

ICSU Interdisciplinary Bodies and Joint Initiatives

There are 20 ICSU Interdisciplinary Bodies and Joint Initiatives. The Australian Academy of Science subscribes directly to six of them (COSPAR, IGBP, SCAR, SCOR, SCOSTEP and WCRP). Australia is also formally involved with another eight - FAGS, GCOS, GOOS, GTOS, IGOS, IUCAF, SCL and WDC. These bodies do not receive direct funding from individual nations – they are funded by ICSU and ICSU Unions, to which Australia pays membership subscriptions. So, although there is no direct formal Australian membership to these bodies, membership to their sponsoring ICSU bodies seems the

appropriate way to be linked. Australia is particularly active in GCOS, GOOS and WDC via contributing data or hosting nodes.

There are six ICSU Interdisciplinary Bodies and Joint Initiatives that Australia is not formally involved with. They are listed below. Note that the Academy paid formal membership subscriptions to CODATA and SCOPE in the past, so although these subscriptions were stopped in recent times, there is still much Australian involvement in these bodies.

Committee on Data for Science and Technology (CODATA)

(www.codata.org)

CODATA is an interdisciplinary Scientific Committee of ICSU that works to improve the quality, reliability, management and accessibility of data of importance to all fields of science and technology. CODATA is a resource that provides scientists and engineers with access to international data activities for increased awareness, direct cooperation and new knowledge. CODATA was established 33 years ago by ICSU to promote and encourage, on a worldwide basis, the compilation, evaluation and dissemination of reliable numerical data of importance to science and technology. CODATA is concerned with all types of data resulting from experimental measurements, observations and calculations in every field of science and technology, including the physical sciences, biology, geology, astronomy, engineering, environmental science, ecology and others. Particular emphasis is given to data management problems common to different disciplines and to data used outside the field in which they were generated. In summary, the purpose of CODATA is to help foster and advance science and technology through developing and sharing knowledge about data and the activities that work with data. Twenty-three countries are members, and 14 International Scientific Unions have assigned liaison delegates. For more details see Appendix 3.

The Academy paid direct membership subscriptions to CODATA up until 1999-2000, but no longer pays membership subscriptions. Membership subscriptions were cut due to budget limitations that forced the Academy to reduce its international subscriptions. The Academy consulted with the chair of the Australian National Committee for CODATA at the time, who indicated that there was little activity related to CODATA in Australia and that the relevant Australian scientific communities would not be adversely affected by cancelling the subscription. Australia is still informally linked via Academy subscriptions to the various ICSU Unions that sponsor CODATA, and Australian scientists also play a role in CODATA as representatives of other Scientific Unions. There is still significant involvement in CODATA from Australian scientists, including a newly reformed Australian working group for CODATA, indicating that activity in Australia is increasing.

If more funding were available, the Academy would consider formally rejoining CODATA.

Scientific Committee on Problems of the Environment (SCOPE)

(www.icsu-scope.org)

SCOPE is an interdisciplinary body of natural and social science expertise focused on global environmental issues, operating at the interface between scientific and decision-making instances. It is a worldwide network of scientists and scientific institutions developing syntheses and reviews of scientific knowledge on current or potential environmental issues. There are 40 member countries and 22 ISCU Unions and International Bodies. For more details see Appendix 3.

The Australian Academy of Science paid membership subscriptions up until 2001-2002, but stopped subscriptions in 2002-2003. The decision to stop subscriptions was made due to the perception that the fees were too high (SCOPE was one of the more expensive international subscriptions managed by the Academy). The subscriptions were high because in the past there was very active involvement from several Australian scientists and positive benefits were flowing back to the Australian science community through their involvement. However, when these individuals reduced their involvement Australia's influence in SCOPE diminished, and budget limitations were at that time putting pressure on the Academy to cut the total cost of subscriptions to global science bodies. The Academy informed the relevant National Committees that they were considering cancelling the SCOPE subscription and asked for feedback, and when there were no strong objections the decision was made to cancel the subscription. Since then there have been requests from the science community to renew Australia's subscription to SCOPE.

Australia and the Australian Academy of Science are still listed as members on the SCOPE website. Several Australian scientists are involved in various SCOPE projects. Australia is informally linked via Academy subscriptions to the various ICSU bodies that sponsor SCOPE.

Australian involvement in SCOPE will contribute to the National Research Priority of 'An Environmentally Sustainable Australia', particularly for the Priority Goals of 'Water – a critical resource', 'Overcoming soil loss, salinity and acidity' and 'Sustainable use of Australia's biodiversity'. It is also relevant to the National Research Priority of 'Safeguarding Australia', specifically the Priority Goal of 'Protecting Australia from invasive diseases and pests'.

If more funding were available, the Academy would consider formally rejoining SCOPE.

An Integrated Programme of Biodiversity (DIVERSITAS)

(www.diversitas-international.org)

DIVERSITAS is an international global environmental change research program, sponsored by ICSU, SCOPE, IUBS, IUMS and UNESCO. DIVERSITAS's missions are:

- to promote integrative biodiversity science, linking biological, ecological and social disciplines in an effort to produce socially relevant new knowledge;
- to provide the scientific basis for an understanding of biodiversity loss, and to draw out the implications for the policies for conservation and sustainable use of biodiversity.

For more details see Appendix 3.

DIVERSITAS relies mainly (90 per cent) on voluntary national contributions from ten nations for funding – USA, Germany, Switzerland, the Netherlands, Norway, Mexico, Sweden, Austria, United Kingdom and China-Taipei. IGFA, the International Group of Funding Agencies for global environmental change research, facilitates the dialogue between national funding agencies and DIVERSITAS. The remaining 10 per cent of funding is provided by the sponsors (ICSU, SCOPE, IUBS and IUMS). Research projects contributing to DIVERSITAS are funded by national and regional agencies, on a competitive basis.

Australia does not contribute any funding directly to DIVERSITAS, although it contributes indirectly via Academy membership subscriptions to ICSU, IUBS and IUMS. Scientists from the CSIRO and the

Australian Network for Plant Conservation are involved in the DIVERSITAS collaborative research network (in-kind support), and Australian scientists are active in various DIVERSITAS committees. There are some informal Australian activities and networks related to DIVERSITAS activities that could be developed into a formal National Committee.

A recent report by the Australian Academy of Science to the Australian Greenhouse Office in 2003, which assessed Australia's international participation in the area of climate change science, recommended the following:

The issue of climate change in relation to biodiversity in Australia is a growing policy concern. Australia should seek more direct participation in DIVERSITAS by strengthening the membership of the DIVERSITAS Australian National Committee. This may also provide important linkages and support for the proposed National Biodiversity and Climate Change Action Plan currently under development through the Department of the Environment and Heritage. It should be noted that Australia currently has in place several high-level committees that deal with global change, environment and sustainability issues. Suitable resourcing may provide the opportunity for such committees to be brought together periodically, thereby enhancing Australia's effectiveness at the international level.²

Australian involvement in DIVERSITAS will contribute to the National Research Priority of 'An Environmentally sustainable Australia', particularly for the Priority Goal of 'Sustainable use of Australia's biodiversity'.

It is recommended that Australia seek to become a formal member of DIVERSITAS.

International Human Dimensions Programme on Global Environmental Change (IHDP) (www.ihdp.org)

IHDP is an international, interdisciplinary, non-governmental science program dedicated to promoting and coordinating research. IHDP's mission is to generate scientific knowledge on coupled human-environment systems, achieve comprehensive understanding of global environmental change processes and their consequences for sustainable development, and make contributions to explore:

- the anthropogenic drives of global environmental change;
- the impact of such change on human welfare; and
- societal responses to mitigate and adapt to global environmental change.

Australia does not provide direct funding to IHDP, but contributes indirectly via membership to ICSU and ISSC. No Australians are currently on the IHDP Scientific Committee. However, Australian scientists are involved in IHDP core projects.

A recent report by the Australian Academy of Science to the Australian Greenhouse Office in 2003, which assessed Australia's international participation in the area of climate change science, recommended that:

The human aspect of climate change is an area of research attracting increasing attention and Australia would be well suited to seek greater involvement in this issue. It is recommended that Australia make a direct contribution to IHDP (as it now does for IGBP and WCRP).²

Australian involvement in IHDP will contribute to the National Research Priority of 'An Environmentally sustainable Australia', particularly for the Priority Goal of 'Responding to climate change and variability'.

It is recommended that Australia seek to become a formal member of IHDP.

Millennium Ecosystem Assessment (MA)

(www.millenniumassessment.org)

The Millennium Ecosystem Assessment is an international work program designed to meet the needs of decision makers and the public for scientific information concerning the consequences of ecosystem change for human well-being and options for responding to those changes. MA was launched by UN Secretary-General Kofi Annan in June 2001 to help to meet assessment needs of the Convention on Biological Diversity, Convention to Combat Desertification, the Ramsar Convention on Wetlands, and the Convention on Migratory Species, as well as needs of other users in the private sector and civil society. MA focuses on ecosystem services (the benefits people obtain from ecosystems), how changes in ecosystem services have affected human well-being, how ecosystem changes may affect people in future decades, and response options that might be adopted at local, national, or global scales to improve ecosystem management and thereby contribute to human well-being and poverty alleviation. MA will:

- identify priorities for action;
- provide tools for planning and management;
- provide foresight concerning the consequences of decisions affecting ecosystems;
- identify response options to achieve human development and sustainability goals;
- help build individual and institutional capacity to undertake integrated ecosystem assessments and to act on their findings.

The four-year MA budget is approximately US\$17 million, with more than \$7 million of additional support through in-kind contributions. Major financial support for the MA is being provided by the Global Environment Facility (GEF), United Nations Foundation, the David and Lucile Packard Foundation, World Bank, United Nations Environment Programme (UNEP), the government of Norway, and the Kingdom of Saudi Arabia.

Eighteen countries and regions are affiliated via their national academies of science, but Australia is not one of those affiliated countries, so is not a formal member nation. Australian scientists do provide in-kind support for MA activities, and have been involved in several peer reviews of MA programs, particularly in round 2.

Australian involvement in MA will contribute to the National Research Priority of 'An Environmentally sustainable Australia'.

It is recommended that Australia seek to become a formal member, via the Academy becoming an affiliated scientific organisation.

Global scientific activities under UN organisations

The Commonwealth government is a formal member of UNESCO, the World Meteorological Organisation (WMO), the United Nations Environment Programme (UNEP), the World Health Organisation (WHO), the Food and Agriculture Organization of the United Nations (FAO), the International Telecommunication Union (ITU), the International Atomic Energy Agency (IAEA), and Australian scientists are involved in these global science programs.

Australia is NOT a member of:

The Council for International Organizations of Medical Sciences (CIOMS)

(www.cioms.ch)

CIOMS is an international, non-governmental, non-profit organisation established jointly by WHO and UNESCO in 1949. The main objectives of CIOMS are:

- to facilitate and promote international activities in the field of biomedical sciences;
- to maintain collaborative relations with the United Nations and its specialised agencies;
- to serve the scientific interests of the international biomedical community in general.

To achieve its objectives, CIOMS has initiated and coordinates the following main long-term programs:

- Bioethics;
- Health Policy, Ethics and Human Values - An International Dialogue;
- Drug Development and Use;
- International Nomenclature of Diseases.

The membership of CIOMS includes 48 international member organisations, representing many of the biomedical disciplines, and 18 national members mainly representing national academies of sciences and medical research councils. Australia is not a member country.

It is not recommended that Australia seek to become formally involved in CIOMS at this stage.

Other global science programs

Australia has formal membership links to the Global Biodiversity Information Facility (GBIF), the Human Frontier Science Program (HFSP), the International Federation for the Promotion of Mechanism and Machine Science (IFTOMM) (Academy subscription), the International Union against Cancer (UICC), the Global Water Research Coalition (GWRC), and the World Conservation Union (IUCN). The Academy is a member of the InterAcademy Council (IAC), InterAcademy Panel (IAP) and InterAcademy Medical Panel (IAMP), but does not currently provide any formal funding and is not currently represented on the governing councils or executive.

Australia does NOT have formal membership links with the following organisations:

Global Forum for Health Research

(www.globalforumhealth.org/pages/index.asp)

The Global Forum for Health Research is an independent international foundation established in Geneva (Switzerland) in 1998 with the objective of helping correct the 10/90 gap in health research. The Global Forum is currently supported by donations from the Rockefeller Foundation, World Bank, World Health Organization and the governments of Canada, Denmark, the Netherlands, Norway, Sweden and Switzerland. In addition, individual networks supported by the Global Forum receive funding from the Bill and Melinda Gates Foundation, the Institute of Medicine of the US Academy of Sciences, the UK Department of International Development, and others. Australia is not a formal member.

International Group of Funding Agencies for Global Change Research (IGFA)

(www.igfagcr.org)

The goal of IGFA is to foster global change research. IGFA is a forum through which national agencies that fund research on global change identify issues of mutual interest and ways to address these through national and, when appropriate, through coordinated international actions. There are 23 member nations. Australia is not a member.

A recent report by the Australian Academy of Science to the Australian Greenhouse Office in 2003, which assessed Australia's international participation in the area of climate change science, recommended that:

It seems strategically profitable for Australia to seek membership and involvement in other international and regional groupings such as IGFA, so as to enhance Australia's influence in international planning and to increase its access to information and data sets.²

It is therefore recommended that Australia seek to become formally involved in IGFA.

Integrated Ocean Drilling Program (IODP)

(www.iodp.org)

IODP is an international research program that explores the history and structure of the earth as recorded in seafloor sediments and rocks. IODP builds upon the earlier successes of the Deep Sea Drilling Project (DSDP) and Ocean Drilling Program (ODP), which revolutionised our view of earth history and global processes through ocean basin exploration. IODP greatly expands the reach of these previous programs by using multiple drilling vessels, including riser, riserless, and mission-specific platforms, to achieve its scientific goals. The IODP is perhaps the largest international earth sciences program.

Australia is not currently a formal member of IODP. Membership is in the order of US\$5 million per annum, up from \$1.5 million for the ODP. Australia had a 1/3 membership in the ODP (shared with Canada and Taiwan), funded by a consortium of Geoscience Australia, CSIRO, ARC, and 14 Australian universities. The Australian consortium decided not to go with IODP in 2004 due to increased cost and a change in Geoscience Australia's priorities for funding.

Australian involvement in IODP will contribute to the National Research Priority of ‘An Environmentally sustainable Australia’, specifically for the Priority Goal of ‘Developing deep earth resources’.

It is recommended that Australia seek to become formally involved in IODP. Some justification for this is given in Box 6.

Box 6 – Justification for Australian membership of the International Ocean Drilling Program (IODP)

The Integrated Ocean Drilling Program (IODP) is the largest international program in the earth and ocean sciences and represents the next phase of scientific ocean exploration, following on from the Ocean Drilling Program (ODP). IODP takes ODP a stage further by using multiple platforms with range of capabilities allowing for drilling and sampling in new regions of the world’s oceans that have previously been inaccessible. As a result of the multiple platforms and increased range of activities, membership of IODP is more expensive than the ODP program. The cost for a full membership in IODP is US\$5.6 million, although Australia could also join as part of an Australasian consortium membership in IODP which would cost in the range of US\$2.5-3 million per annum.

The following is taken from a proposal for the initial round of the National Collaborative Research Infrastructure Strategy (NCRIS) put together by the Australian Marine Geoscience Council, ‘MARGO’ (see ems.anu.edu.au/margo/html/IODP.htm).

Australia is at a critical point in marine geoscience. Under national and international legislation Australia has stewardship of a vast marine territory stretching almost 14 million square kilometres, most of which is unexplored and unknown. It requires management and assessment of both living and non-living resources. Australia is also in the prime location in the understudied Southern Hemisphere, surrounded by three of the four major oceans. This is the ideal position to potentially be driving Southern Hemisphere research in climate change, understanding the deep ocean, earth dynamics and geological processes, new mineralogical and energy resources, the sub-seafloor biosphere, hazards such as tsunamis caused by earthquakes in the region, and changes in marine life resulting from climate change.

As a result of not being involved in the IODP, Australia’s marine geoscience community no longer has access to facilities and technology to undertake significant deep-earth research. Australia needs to participate in the science driven IODP to provide Australian scientists with access to infrastructure and state-of-the-art technology to support such research. Participation in the IODP will also enhance collaboration between Australians and the broader global geoscience community, in much the same way that Australian researchers played a major role during Australia’s involvement with the previous Ocean Drilling Program.

Valued outcomes from Australian participation in the IODP will include:

- Revitalisation of Australian marine geoscience research;
- Exciting opportunities for young Australian researchers to be part of international projects;
- Exchange of skills, concepts and access to new technology;
- Improved understanding of marine ecosystems, biodiversity and potential climate change impacts;
- Critical data to assist natural hazard forecasting;
- New information to motivate offshore mineral exploration;
- Stimulus to offshore oil and gas explorers;
- Emphatic demonstration of Australia’s active investigation of its marine jurisdiction.

For Australia to be a leading player in the international marine geoscience community, we need to be an active and financial member of this community. Participation in IODP, the largest international geoscience research activity, will bring Australia back to the forefront of international scientific partnership in multidisciplinary marine geoscience.

6. Mechanisms to enhance Australia's involvement in global science activities

Close the key gaps identified in Australia's participation in global scientific activities

Although Australia is well engaged in the major global scientific organisations, some strategically important gaps were identified in Chapter 5. It is recommended that Australia closes these gaps by becoming a formal member of the following organisations:

- An Integrated Programme of Biodiversity (DIVERSITAS);
- International Group of Funding Agencies for Global Change Research (IGFA);
- International Human Dimensions Programme on Global Environmental Change (IHDP);
- Integrated Ocean Drilling Program (IODP);
- Millennium Ecosystem Assessment (MA).

Australia should also consider rejoining:

- the Committee on Data for Science and Technology (CODATA);
- the Scientific Committee on Problems of the Environment (SCOPE).

However, it should be noted that adopting these recommendations will require additional funding or a redistribution of existing funds (which carries the risk of creating other gaps).

Increased government funding to maintain and enhance the Australian Academy of Science's linkages with global scientific activities

Currently, the Academy receives annual grants from the Department of Education, Science and Training and the Department of the Environment and Heritage to pay for subscriptions to global scientific organisations, for support for Australian voting delegates to General Assemblies of ICSU Scientific Unions and for meetings of Australian scientific National Committees. As discussed in Chapter 3, the Academy is under pressure from the rising costs of international subscriptions and is in a position where it either needs to:

- obtain more government funding to support the Academy's international activities;
- decide to stop paying membership subscriptions to some global scientific organisations;
- ignore opportunities to formally engage with potentially worthwhile global scientific organisations that may emerge in the future; or
- reduce funding to support National Committees and travel support for Australian voting delegates to General Assemblies of ICSU Scientific Unions (which would lead to a reduced benefit from being involved with global science organisations).

The Academy welcomes further discussion regarding funding for subscriptions to global scientific activities in the forthcoming five-year review into the Academy's responsibilities.

Conference support

Chapter 4 described the many positive benefits from hosting international scientific congresses in Australia. It is apparent that Australia's involvement in global scientific activities could be enhanced by attracting more of these congresses to Australia. There are two main ways in which Australia might improve its ability to attract major scientific congresses:

1. Pay a higher membership subscription level to ICSU Scientific Unions, which would give Australia more influence in the decision making bodies of the Unions, in particular more delegates and voting rights at the General Assemblies.
2. Provide greater support for National Committees or other organisations to bid to host international congresses in Australia, as happens in many other countries. There is currently a barrier for Australia's scientific National Committees or other organisations that might like to bid for these congresses, in that there is very little 'seed' funding available to support the preparation and maintenance of bids. In most cases, there are several years between the date of initial acceptance of a bid and the date at which income begins to come in from registrations and sponsorship. This can put a significant burden on a prospective host organisation and presents a barrier to these organisations from attempting to put together bids for large international science congresses.

Enhancing the use of Australia's involvement in global science activities as a foreign policy tool

Scientific issues are increasingly influential in matters of national security (eg, bioterrorism, infectious diseases, military technologies), international economic policy (eg, trade in genetically modified foods and products, international telecommunications, microelectronics), international environmental policy (eg, global climate change, protection of biodiversity), capacity building in developing countries, and other areas. International science relations should be seen as part of Australia's international and trade relations. In this regard, Australia could benefit from better links between the science community (represented by the Australian Academy of Science) and the Commonwealth government's Department of Foreign Affairs and Trade.

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