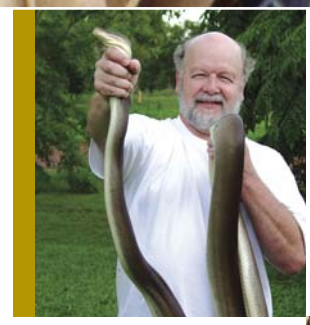
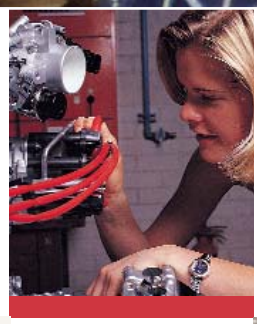
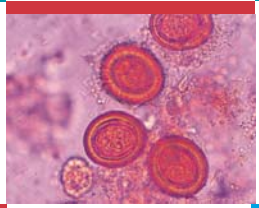
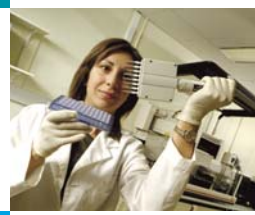
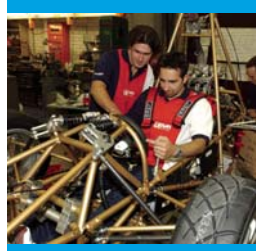
Research and research training management report 2005











The University of Sydney

Excellence in research

Contents

Executive Summary

The University of Sydney is one of Australia's leading, research-intensive universities, comprising 3 academic colleges, under which are 19 faculties and 45 departments. In 2004, the university had 47,296 students enrolled, of which 3441 were undertaking higher degrees by research.

The university strategically uses its research block grants to support its diverse and world-recognised research activities. Nearly 50% of the block grants are directly allocated to the 3 colleges to strengthen their research and research training efforts. In 2004, these allocations were driven by the metrics used by DEST to distribute the block grants. Sydney targets the remainder of these grants to ensure that the university's research is enabled by world-class infrastructure through: (i) major programs of capital works and upgrading of essential ICT infrastructure; (ii) provision of centralised research facilities; (iii) participation in major, collaborative initiatives under schemes such as Major National Research Facilities (MNRFs), Australian Research Council (ARC) Centres and Linkage Infrastructure, Equipment and Facilities (LIEF) grants, and National Health and Medical Research Council (NHMRC) Enabling Grants; and (iv) an institutional competitive grants program for major equipment and research and development projects.

The University of Sydney supports and manages its research and research training through the Research and Innovation Portfolio, which includes the Research Office, the Strategic Research Development Unit, the Business Liaison Office (BLO) and the Office of the Dean of Graduate Studies. Sydney ensures that the entire university community is kept well informed of research performance through supply of essential performance indicators, including benchmarked data, and it continues to improve its framework for excellence in research training. Through this careful planning and management in 2004, The University of Sydney's success in achieving its research and research training goals is evident in, for example:

(i) Continued pre-eminence in receipt of national competitive grants income—a total of $13 million in ARC funding for new projects (12.5 % of the national total) and nearly $8 million in NHMRC Project Grants income (15 % of the national total).
(ii) Quality and impact of research outputs—the prestigious ISI Essential Indicators shows that the university ranks in the top 1 % in more fields than any other university in Australia.
(iii) Significant, ongoing growth in higher degree research (HDR) student load and completions—2767 and 618, respectively.
(iv) Recognition of staff and students—nearly 130 staff members are elected Fellows of Australian Academic Academies, the university hosts ten of the fifty ARC Federation Fellows, and its staff and students received numerous national and international awards.

The diverse research strengths of The University of Sydney are making key contributions to all four of the National Research Priorities (NRPs), with particularly exceptional impacts in NRP2 (good health) and NRP3 (frontier technologies). For example, research under NRP2 brought $104.8 million research funds into the university, generated 2,236 publications and trained 1,178 HDR students (EFTSL) in 2004. Sydney's research efforts also remain strongly collaborative, on the regional, national and international level, and with diverse institutions, organisations and businesses. The university is lead institution for 2 ARC-NHMRC Research Networks and is a participant in 13 others. It is a core participant in the new International Centre of Excellence in Sports Science and Management, with $7.8 million of Federal Government funding, and completed a major $1.7 million research project funded by BAE Systems, with the world's first flight of multiple unmanned aircraft. Sydney's industry research collaborations have continued to grow to approximately 800 industry research agreements worth nearly $54 million in 2004.

A central aim of The University of Sydney is ensuring the highest quality of research training. In 2004, the university introduced the Higher Degree Annual Progress Report to aid in quality assurance of candidature progression. It also provided 1287 centrally-funded stipends for HDR students. The 30% growth in commencing HDR student enrolments since 2001 evinces the university's achievements in this area.

Sydney continues its focus on and success with management and commercialisation of intellectual property (IP) through the BLO, which was reviewed in 2004 and will be restructured during 2005 to further enhance its effectiveness. The university is spawning spin-off companies at an average of 5 per year and currently has equity in 29 spin-offs.

The University of Sydney is committed to excellence in research and research training, to seeing growth in the numbers and quality of all possible measures of research performance. It will continue to strive to be a leading university at national and international levels.

Part A

Introduction

The University of Sydney was Australia's first university and, today, remains one of the nation's premier, research-intensive universities. By many measures of performance, such as national competitive grants income, The University of Sydney is the leading national institution. Nonetheless, Sydney continuously strives to improve the quality of its performance and outcomes in all core activities, which include:

- Teaching and learning;
- Research and innovation;
- Internationalisation;
- Engagement with industry and the professions;
- Effective management; and
- Service to the community.

In 2004, The University of Sydney had a total enrolment of 47,296; of these 3441 were students undertaking higher degrees by research. The university has 45 departments or schools and 19 faculties, which are grouped into 3 academic colleges: the College of Humanities and Social Sciences (CHASS), the College of Health Sciences (CHS), and the College of Sciences and Technology (CST). The University of Sydney is one of the Group of Eight (Go8)—Australia's major, research-intensive universities—and is a member of international organisations including the Academic Consortium 21 (AC21) and the Association of Pacific Rim Universities (APRU).

A1 Use of Research Block Grants and Scholarships

A1.1 Ensuring that Research and Research Training are Adequately Supported by Infrastructure

The University of Sydney is committed to providing world-class research infrastructure for its academics and research students. The university recognises that large research infrastructure can only be acquired, and frequently is best utilised, through major internal and external collaborations. Thus, Sydney continues to invest in and develop major infrastructure resources strategically through provision of targeted internal funding and through accessing external, collaborative funding sources. These include:

Internal Mechanisms

Provision of new and expanded research facilities. The University of Sydney has ongoing and significant capital development works to expand, renew and create entirely new facilities for research and research training. For example, in 2004, The University of Sydney made significant investments to provide facilities for postgraduate research students, including new facilities for PhD students in the major Arts/Psychology project. Ongoing enhancements in this area are being made as part of the *Campus 2010+ Building for the Future* program, and the School of Information Technologies Building is presently under construction. New accommodation for the research work of the university's four 2003 Federation Fellows was planned and implemented during 2004; the new "Advanced Catalysis for Sustainability" laboratories were opened in November. Stage I of the Brain and Mind Research Institute, a new, major research facility in Camperdown, was opened in September by the NSW Governor Professor Marie Bashir. Over the next five years, other major developments under the *Campus 2010+* program will include a new building for the School of Law, a redesign of the Madsen building for the School of Geosciences, new centralised accommodation for a wide range of important student administrative services—including those for HDR students—and the new Science and Technology Library, and new public domain areas.

Provision of University-funded central facilities. The University of Sydney provides funding for core facilities, such as the Electron Microscope Unit (EMU) and the University Library. Each of these provides centralised research infrastructure to the entire university research community, and each seeks to expand its ability to serve the local and national research communities. For example, as headquarters of the Nanostructural Analysis Network Organisation (NANO) Major National Research Facility (MNRF), the EMU was able to install a Local Electrode Atom Probe (LEAP®), unique to the Southern Hemisphere, from Imago Scientific Instruments in June 2004. The University Library undertook several activities in 2004 specifically aimed at improving researchers' access to key archival materials, including participating in the Australian Partnership for Sustainable Repositories project and becoming a foundation member of the Sustainable Object Repositories for Research and Teaching project.

Provision of improved information and communications technologies for underpinning research. Network access was greatly enhanced by the introduction of fibre-optic links to the Cumberland, Mallett Street and Burren Street campuses during 2004, as well as extensions to the wireless network at the Camperdown and Darlington campuses. This development increased the wireless coverage of the Camperdown and Darlington campuses to approximately 40 %.

Internal equipment and infrastructure grants. In 2004, the university provided $4 million in funds for research equipment and infrastructure via the Major Equipment Scheme ($3 million) and Postgraduate Research Support Scheme ($1 million). A further $0.8 million was allocated for improving research infrastructure for research training through the new Research Postgraduate Infrastructure Scheme (RPIS), which created, for example, a new research students' common room at the Northern Clinical School, Royal North Shore Hospital.

External Mechanisms

The University of Sydney uses block research funds to participate in and support major collaborative research initiatives of national and international significance. For example, The University of Sydney is a participant in:

Major National Research Facilities (MNRFs). Sydney is involved in three MNRFs, including the NANO-MNRF, the Australian Proteome Analysis Facility (APAF), and the Australian Astronomy MNRF.

Major Research Centres. The university hosts two ARC Centres of Excellence, the Centre for Autonomous Systems and the Centre for Ultrahigh-bandwidth Devices for Optical Systems (CUDOS), and is involved in the Centre for Quantum Computer Technology and National ICT Australia (NICTA). Sydney also hosts the ARC Key Centre for Polymer Colloids and is home to the ARC Special Research Centre for Research on Ecological Impacts of Coastal Cities.

Cooperative Research Centres (CRCs). The university is a key participant in 23 Cooperative Research Centres. In 2004, five new CRCs, worth more than $157.4 million over seven years, were established in which the university is a core or supporting participant.

ARC Linkage Infrastructure, Equipment and Facilities (LIEF) grants. In the 2004 round of offers, The University of Sydney was awarded grants worth a total of $4.3 million under the LIEF scheme, and was a collaborator in further grants totalling $5.2 million. This enabled the university to establish local facilities such as an advanced electron spectroscopy system and provide its researchers with access to external infrastructure such as international telescopes through the Gemini Partnership.

NHMRC Enabling Grants. This new NHMRC funding scheme was introduced in 2004 to provide support for specific facilities and activities that will underpin Australia's health and medical research. The University of Sydney was awarded the largest grant nationally—$2 million over five years—to establish the Breast Cancer Biospecimen Resource, which will store biopsy samples from the majority of newly diagnosed breast cancers in NSW and track clinical data.

Research infrastructure from bequests and donations. In 2004, significant donations were received for large equipment grants for the Brain and Mind Research Institute and the Melanoma Foundation.

A1.2 Use of Research Block Grants

Structurally, the university comprises three colleges—CHS, CHASS and CST. A large proportion of the research block grants is dispersed to the colleges, to meet the strategic research and research training needs of the faculties, schools and departments in each college. In 2004, two-thirds of the RIBG was distributed to the three colleges; the remaining third was retained by the Deputy Vice-Chancellor (Research and Innovation) to provide centralised support for areas of strength and for strategic priorities. Approximately $35 million of the IGS and RTS grants were directed to the colleges on the basis of research performance, as outlined below in A1.3. The remainder of the IGS and RTS grants were placed into the central operating fund to support research and research training through mechanisms such as:

- The internal grant schemes, a $10.4 million investment in 2004.
- Significant capital development, including the commencement of the *Campus 2010+* program. 2004 saw nearly $49 million spent on 23 major capital projects, including a laboratory refurbishment for Agriculture, the major Arts/Psychology refurbishment, construction of the clinical schools at the Dubbo and Orange campuses, new PC1 laboratories for gene technology, an aquarium at the One Tree Island Research Station, and new laboratories for Federation Fellows in the Faculty of Science.

- Contributions towards the external funding mechanisms available to support research and research infrastructure—such as ARC Special and Key Research Centres and Centres of Excellence, CRCs and MNRFs. In 2004, the university provided in excess of $5 million in internal funding for these initiatives.

A1.3 Internal Allocation Mechanisms for RIBG, IGS and RTS

In 2004, The University of Sydney allocated approximately $35 million of the IGS and RTS grants to the three colleges, based on their respective research performance as assessed by absolute and benchmarked measures. The absolute measure is a composite of the data used by DEST for distribution of the RTS and IGS in the first place; i.e., 47% research income, 33% research completions—weighted 2:1 for PhD to Masters—10% student load and 10% research publications—weighted 5:1 for books to all other publications. The benchmarked measure quantifies the research performance of each faculty relative to that of their counterparts in the other Go8 universities (excluding The University of Sydney and The Australian National University). The relative performance levels are calculated by comparing the absolute research indicators, on a per academic staff member basis for the Go6 universities. In 2004, the absolute and benchmarked measures each were used to distribute half of the total funding.

In 2004, two thirds of RIBG was distributed to the three colleges according to the dollar value of national competitive grants received by each college that year. Each college then has total discretion in how it distributes these funds within the college, faculties and departments/schools, to allow them to best meet their own strategic needs and priorities and to maximise the research and research training benefits. The remaining third is retained by the Deputy Vice-Chancellor (Research and Innovation) to provide support for areas of strength and for strategic priorities.

A1.4 Identifying and Rewarding Quality of Research and Research Training through Allocation of Research Block Grants

The University of Sydney considers that the metrics of research performance and quality used by the Department of Education, Science and Training (DEST) permit funding allocations that identify and reward the quality of research and research training. As outlined below, The University of Sydney is continuing to assess and refine the allocation mechanisms to most appropriately and efficiently drive excellence in research and research training.

A1.5 Review of the Internal Allocation Mechanism for Research Block Funding

During 2004, the university reviewed the research performance measures by which the $35 million of the IGS and RTS grants were allocated to the three colleges. From this review, it was decided to allocate this income in 2005 by a revised weighting of the two measures of research excellence outlined above: 70% of the income allocated on the basis of the absolute performance data and 30% allocated on the basis of the Go6 benchmarked performance. This change was made because there is a lag of up to three years in the benchmark data, which, therefore, cannot accurately assess recent changes in comparative performance. At present, The University of Sydney is reviewing the benchmarked performance indicator, looking for more current metrics, and metrics for allocating the 30% component that will better drive its pursuit of research excellence.

A2 Managing Research Performance

A2.1 Research Structures and Resources

The management of research performance across The University of Sydney is consolidated under the responsibility of the Deputy Vice-Chancellor (Research and Innovation). A variety of structures and resources exist under this portfolio to support the university's quest for research excellence. As evidence of the value of these research support mechanisms, the Australian Universities Quality Agency, AUQA, gave the following commendation in their 2004 audit report: "AUQA commends The University of Sydney for the calibre of support provided to research staff by the Research Office and the Directors of Research Development and Strategic Development, for example in seeking and crafting research grant applications." (Australian Universities Quality Agency, *Report of an Audit of The University of Sydney*, 2004.) Specifically, these resources are:

Research Office

The Research Office manages the administration of the university's competitive research grants and scholarship funding, as well as internal research incentive schemes. It provides support to the university's human and animal ethics committees and manages the collection and dissemination of research performance data. The Research Office is proactive in providing information and training relating to research grant processes. For example, an *ARC Focus Day* was held in November 2004 with members of ARC Expert Advisory Committees from a range of disciplines invited to the Camperdown campus to provide advice and insight into the key success factors in obtaining ARC funding.

Strategic Research Development Unit

The Strategic Research Development Unit is unique to The University of Sydney in the Australian higher education sector. The unit provides strategic advice and support to individuals and groups of researchers applying for grant funding, and is the single focus for major research initiatives requiring complex coordination of resources. For example, in the ARC Discovery Project grants for funding to commence in 2004, the success rate of applicants who worked closely with the Director, Research Development in submitting their applications was higher (34 %) and the average grant size larger ($239,965) than for those that did not seek assistance (16 % and $117,738). The university recently created the position of Director, Strategic Development to support applicants seeking health and medical research funding. Now advice and support for applicants for NHMRC funding are available in a structured way through provision of one-on-one assistance in strategic considerations for funding proposals, a compendium of assessors' comments, and a roadshow of talks and assistance at Sydney's medical research centres. A mock interview program is also available to all applicants (group and individual) to improve interviewing skills. The Director, Strategic Development has aided in major research projects on behalf of the university, such as the Australian Synchrotron project in Victoria.

Business Liaison Office

The Business Liaison Office supports researchers involved in industry and other external collaborations as well as managing commercialisation. It prepares business planning documentation, advises on governance and management structures, and negotiates complex legal and intellectual property issues. It also manages research funding from industry, intellectual property protection and licensing, and the creation of new ventures to commercialise research outcomes.

Office of the Dean of Graduate Studies

The Office of the Dean of Graduate Studies was established in 2003 to coordinate and manage postgraduate research and coursework activities within the university. The Dean's responsibility is to ensure that best practice in all aspects of graduate research and coursework training is known and adopted throughout the university.

Centralised Support Mechanisms

The university provides central funding for participation in large-scale, collaborative research ventures including ARC Centres of Excellence and Research Networks, MNRFs and CRCs. More than $5 million in internal funding was provided for these initiatives in 2004, along with in-kind support in the form of staff time, space or accommodation, and general laboratory and office infrastructure. Sydney also provides significant, annual, central support to research and research training through a suite of internal grants, which is the university's major internal vehicle for supporting and strengthening research. These grants aim to improve the competitiveness of specific projects in subsequent applications for external grants. The seven principal grant schemes will contribute in excess of $150 million to research over the 10-year period to 2010. In 2004, grants worth in excess of $10 million were distributed through the:

1. Research and Development Scheme ($2.3 million),
2. Major Equipment Scheme ($2.2 million, matched by schools and faculties and colleges),
3. Postdoctoral Fellowship Scheme ($2.6 million),
4. New Staff Support Scheme ($0.8 million),
5. Near-Miss Scheme ($0.8 million),
6. Bridging Fellowship Scheme ($0.5 million, matched by faculties and colleges), and
7. Postgraduate Research Support Scheme ($1 million).

Infrastructure Management

The University of Sydney created an Infrastructure Advisory Committee (IAC) to supersede the Capital Development Advisory Committee. The role of the IAC is to provide strategic direction and advice to those submitting proposals for capital funding, with a whole-of-university vision, considering each application as a business case and issues such as return on investment and strategic fit to university's goals. This pertains to all major infrastructure, including that used for research and research training.

A2.2 Research and Research Training Management

Planning Processes

Research

The university community is well informed about research performance at all levels of the organisation. Schools, faculties and colleges can track performance across a range of indicators. Annually, deans and college pro-vice-chancellors get current and historical data on research income, publications, HDR enrolments and HDR completions, which assist in their planning of research and research training. Throughout 2004, the university has been developing its *Strategic Directions (2005-2010)*, which will impact on the university's drive for excellence at all levels, including research and research training. An extensive planning and consultation exercise, the Senior Executive, the Vice-Chancellor's Advisory Committee (VCAC) and a retreat of 120 senior managers of the university have contributed to this initiative. VCAC, the Budget Advisory Committee and the University Research Committee are updated regularly on major research initiatives and research performance.

To aid in research planning and management, Sydney is implementing several electronic-research-management initiatives. Providing an effective management, planning and communication tool for all staff, the Activities Diary was launched in 2004 as an online calendar of key administrative deadlines and dates across the major business units of the university; categories include, among others, research, seminars, workshops and conferences. As part of a three-year program of work to upgrade and integrate all major electronic information management systems, a new system for research management and administration will be implemented in the near future. Also, the University Library, in coordination with the Research Office, intends to implement the MIT software *DSpace*—a comprehensive digital repository system—to allow efficient storage, management and redistribution of all the university's digital research outputs.

Research Training

The 2004 AUQA Audit review report commended the university for improvements to the management of research training as a result of establishing the Dean of Graduate Studies' Office. During 2004, the office further consolidated elements of the postgraduate planning framework, including:

- Implementation of the Postgraduate Research Higher Degree Training Supervision policy, which details supervisory requirements, and the maintenance of the Supervisor Register, allowing improved planning for HDR supervision needs.
- Implementation of the Higher Degree Candidature Annual Progress Report, the mandatory review of postgraduate research candidates' progress and probationary candidature. The review process allows structured planning of candidature and the benefit of early identification of potential problems.

Allocating Resources

Research

The University of Sydney continues to invest heavily to strengthen its position in the forefront of national and international research. In addition to funds made available at college, faculty and school levels and the operating grant allocated according to research performance through the funding formula, Sydney has committed more than $150 million to directly support research and research training from 2001 to 2010. These internal funding mechanisms are flexible and are targeted at the next generation of researchers in all disciplines.

In allocating resources, the university aims to maintain and improve the capacity for high quality research and increase opportunities for training research students and new researchers. It acts to enhance areas of existing strength, particularly by encouraging the establishment of research teams and centres within the university. Sydney also seeks to enable individuals and research groups to attract support for research, at international standards of excellence, from external sources. Research performance and potential drive resource allocation for research, primarily to existing and emerging areas of research strength, which align well with the National Research Priorities.

Research Training

Excellence in research requires renewal and updating of infrastructure to support HDR students in their research training. In 2004, the Research Postgraduate Infrastructure Scheme (RPIS) commenced, providing internal funding to faculties to support research students through the provision and replacement of research infrastructure within the university. The RPIS is not designed to create new facilities, but is strictly for the improvement of existing infrastructure for the training of research students, and is targeted at those areas of the university where the need for postgraduate support is most acute. The scheme encourages the possibility of cross-college initiatives that benefit the widest range of students.

In 2004, the university again offered a mid-year round of University of Sydney Postgraduate Awards (UPAs) for commencing postgraduate research students in semester 2. Up to 40 University scholarships were made available. The university continued funding the Postgraduate Research Support Scheme (total $1 million), in which funds are allocated to schools and departments on the basis of the previous year's HDR enrolment figures. Eligible research students under this scheme are awarded up to $2000 on a competitive basis to support conference travel and other research costs, such as access to off-site equipment.

Monitoring Research Performance

Research

The Deputy Vice-Chancellor (Research and Innovation) is responsible for the management of research performance. This includes administrative support through the Research Office, and contract and collaborative research and the management and development of intellectual property through the Business Liaison Office. It also involves the administration of ethics compliance through the Ethics Administration section of the Research Office and administrative support for postgraduate research scholarships.

In 2004, the Deputy Vice-Chancellor (Research and Innovation) established the Research Strategy Advisory Group—comprising leading academics, researchers and research managers from across the university, along with representatives from the Research Office and Business Liaison Office—to provide support in developing university-wide, research strategies and creating research initiatives.

Each college has a research committee reflecting the disciplinary groupings within the college. These committees, supported by the Research Office, help to evaluate requests for R&D support. The Research Committee of the Academic Board assists with the development of university-wide, research policies and advises the Deputy Vice-Chancellor (Research and Innovation). Chairs of the college research committees are also members of the research committee, providing a conduit for information through the Academic Board and colleges.

Research Training

The university aims for best practice in all aspects of postgraduate research training. During 2004, the focus on research training issues meant aspects of that best practice were adopted throughout the university. These include the policies and procedures for supervision and candidature annual progress reports. Performance data is used to provide regular advice to colleges and faculties on research student management, including:

- Total and commencing research student load and completions data, benchmarked to other Go8 universities.
- The results of the Student Research Experience Questionnaire (SREQ, inaugurated in 2002). With the 2004 data, the university now has three years of data on postgraduate research students' perceptions of the quality of supervision, the research climate and infrastructure provided to them, and the generic skills they have acquired. Overall satisfaction with the research training experience in 2004 was 91 % (broad agreement), with small but steady increases since 2002 in all areas.

Performance in research training is monitored by the Graduate Studies Committee, within the Academic Board, which has a representative from each faculty and is responsible for research and postgraduate coursework programs. The newly constituted Research Policy Sub-Committee oversees the formulation of HDR policy.

Benchmarking

The University of Sydney directly benchmarks research and research training performance against members of the Go8. Data from the Go8 are collected and analysed to provide quantitative indices of research and research training performance at faculty levels. For example, in 2003, the Faculties of Medicine and Science, respectively, received 62 % and 18 % more research income and had 51 % and 18 % more HDR student completions than the Go7 average (i.e., the Go8 less The University of Sydney). This analysis has a formative function in providing senior management with direct comparators for assessing relative performances, identifying areas of strength and areas where improvement is possible.

A range of other qualitative and quantitative metrics provides evidence of the university's high research standing. These include:

Involvement in International Organisations. The University of Sydney has taken a major leadership in international organisations including the Academic Consortium 21 (AC21) and the Association of Pacific Rim Universities (APRU). These are valuable consortiums to share best practice in research, research training and commercialisation. AC21 was established in 2002 with the aim of creating an international network to further global co-operation on higher education issues and to contribute to world and regional society by promoting collaborative research. The University of Sydney is Australia's only member of this prestigious group, and the Vice-Chancellor was elected president of AC21, for a two year term, in July 2004.

Indicators of Peer-Esteem. Five academics were elected as Fellows of Australian Academies in 2004, bringing the total number of University of Sydney academics who are fellows of one or more of the four academies to nearly 130. In 2004, the university also hosted two new Federation Fellowships, bringing the total number to 10.

Staff and Student Awards and Prizes. The university's staff and students received numerous awards and prizes in 2004. A selection of these is detailed below in A2.4.

International Rankings. In 2004, the research of the Australian Graduate School of Management (AGSM) was ranked 26th in an international survey of business schools.

Media Coverage of Research. According to data recorded by the Media Office, the university's academics made more than 4000 appearances in the print and electronic media during the year, most of which focussed on the university's extensive research activities.

Supporting research performance

As mentioned above in A2.1, the university has a number of internal research funding schemes aimed at fostering research and supporting research development. These competitive schemes provide financial support for senior and early career researchers to promote research and provide a basis for improved competitiveness in attracting external research support.

The Vice-Chancellor's Awards for Excellence in Research Higher Degree Supervision, each of which is valued at $5000, promote, recognise and reward sustained excellence in postgraduate supervision. The winners for 2004 were Dr Penelope Russell from the School of Philosophical and Historical Inquiry and Professor John Christodoulou from the Children's Hospital at Westmead and the Westmead Clinical School. 2004 marked the inauguration of college-based awards for excellence in higher degree supervision, each valued at $2,500. The university has decided to double the value of all Vice-Chancellor's and college awards for higher degree supervision from 2005.

Conflict of interest policies

The university holds its researchers and students responsible for scholarly and scientific rigour and integrity in obtaining, recording and analysing data and in presenting, reporting and publishing results as set out in the *Code of Conduct for Responsible Research Practice and Guidelines for Dealing with Allegations of Research Misconduct* (http://www.usyd.edu.au/ab/policies/Rsch_Code_Conduct.pdf).

Commencing postgraduate research students attend university postgraduate induction programs each semester (inaugurated in 2003), where they are welcomed and addressed by senior members of staff on issues vital to their acclimatisation and progress at Sydney. These include students' rights and responsibilities under the code of conduct.

A2.3 Identifying Research Performance

Research performance is identified by means of key research outputs: number and value of research grants from all sources, number of research publications and successful supervision of postgraduate research students as measured by student load and completions.

The university presently is investigating the use of other possible measures to more comprehensively identify research performance, including other metrics related to research quality—including citations of publications and elements of peer-esteem such as prizes, awards, fellowships, election to academies and learned societies—knowledge diffusion, industry engagement and commercialisation.

A2.4 Achieving Research and Research Training Objectives

The *University of Sydney Strategic Plan 1999-2004* encompasses research and research training through its goal of pursuing "Excellence in Research." This goal states that The University of Sydney will:

- Encourage research of national and international standing in both existing and emerging areas.
- Identify and enhance areas of excellence in basic, strategic and applied research, and establish centres that promote interdisciplinary research.
- Facilitate strategic and applied research carried out in collaboration with industry, government and community organisations.
- Increase the use by industry and other external organisations of our technology, research and expertise to create social and economic benefits, while generating income to support research and education.
- Develop collaborative links with key off-shore institutions to facilitate strategic and applied research.
- Attract, encourage and reward staff with a demonstrated commitment to excellence in research.
- Create opportunities for all staff to maximize their research output, including opportunities for intellectual renewal through the provision of special studies programs and special duties overseas.
- Attract more students with research potential.
- Provide more support for research training and recognition for outstanding research students, and assist the transition of students into research-based programs through opportunities provided with undergraduate programs.
- Foster and reward skills and achievements in postgraduate supervision among university staff.
- Support the conduct of outstanding research by both students and staff by fostering an academic and physical environment that incorporates access to information technology and necessary library resources.

Achieving the University's Goals and Objectives

The University of Sydney's success in meeting its strategic research goals can be seen from its achievements in winning national competitive research grants and attracting other research income, its publication and citation records, its patent record in technology transfer, and its reputation in research training. Block research grant funding from the Commonwealth Government and national and international staff and student recognition also testify to this success. The university's outstanding performance in these areas in 2004 is outlined below.

Grants Supporting Research

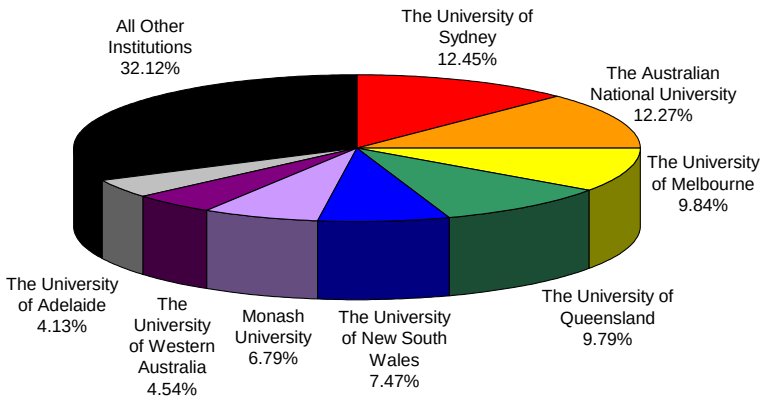
The budgeted research income for the year included $27 million from the Institutional Grants Scheme, $57 million from the Research Training Scheme, $14.5 million from the Research Infrastructure Block Grants Scheme and more than $170 million from Research and Earmarked Grants. The last category recorded a rise of more than 20 %. In 2004, the university's income from the RTS grant was equal to 10.5 % of the total allocated by this scheme nationally across all institutions, and in excess of $3 million more than any other university.

Australian Research Council (ARC) Recognition

In 2004, for the fifth year in succession, the university received more funding in new grants from the ARC than any other university in all fields of science, engineering, social science and the humanities—a total of $13 million in ARC project funding for new projects (12.5 % of the national total).

In the round of ARC grants commencing in 2004, the university was awarded 100

National Share of New ARC Grants 2004 (%)



new Discovery Project grants valued at $9.5 million for the first year, and more than $30 million over the life of the projects to 2008. The average size of these grants was $374,000 over their lifespan. This was in addition to $15.3 million awarded in 2004 for continuing Discovery Projects. As part of these new grants, the university was awarded 24 new ARC Research Fellowships—the largest number ever awarded to the university in a single round—including four, prestigious, five-year Australian Professorial Fellowships and seven, five-year Queen Elizabeth II/Australian Research Fellowships.

In the mid-2004 round of ARC Linkage Projects, the university was awarded $7.3 million by the ARC, while industry partner contributions for the 21 new projects totalled $2.4 million in cash and $7.1 million in kind. The university secured 10.5 % of the national share of Linkage Projects funding in 2004.The new projects included funding for four postdoctoral fellowships and 25 postgraduate scholarships.

ARC Federation Fellowships

In 2004, the university celebrated the announcement of two new Federation Fellowships—the richest publicly funded research fellowships offered in Australia—bringing the number of Federation Fellows hosted by Sydney to 10. The new fellows were:

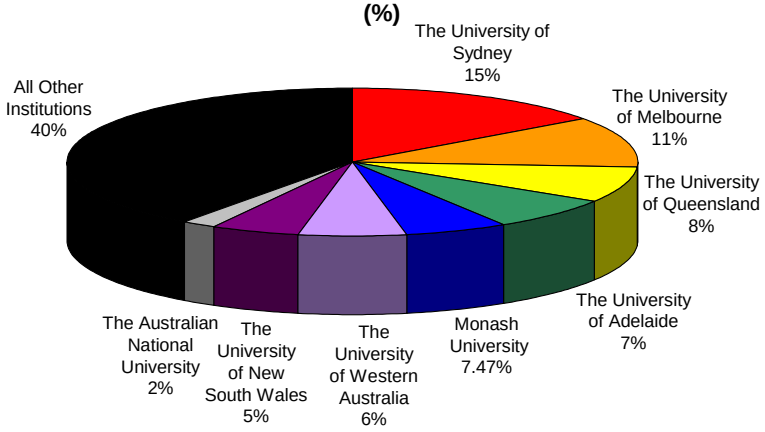
- Dr Jill Trewhella (School of Molecular and Microbial Biosciences), who is investigating the molecular mechanisms of biochemical regulation.
- Professor Stephen Simpson (School of Biological Sciences), whose work includes uniquely integrative behavioural approaches to analysing swarming in locusts.

ARC Research Networks

In 2004, The University of Sydney was the lead institution in an ARC-NHMRC Research Network on Ageing Well and an ARC Research Network for Molecular and Materials Structure. In addition, The University of Sydney is a collaborating institution in 13 of the other new national Research Networks.

National Health and Medical Research Council (NHMRC) Recognition

National Share of New NHMRC Project Grants 2004 (%)



The university was again the lead institution in attracting project funding from the NHMRC.

In 2004, the university was awarded 15 % of the total funding allocated to new projects by the NHMRC. The university received $7.95 million for 55 new projects, valued at a total of $24.9 million over their lifespan to 2008. Since 2000, The University of Sydney has recorded a continuous increase in performance in this category.

Researchers from The University of Sydney were awarded four prestigious NHMRC Research Fellowships in 2004. These comprised a Principal Research Fellowship (Professor Mark Onslow, Faculty of Health Sciences) and three Senior Research Fellowships. The NHMRC also announced 17 University of Sydney researchers as recipients of Training, Industry and Practitioner Fellowships, and two researchers from the Centenary Institute for Cancer Medicine and Cell Biology as winners of RD Wright Biomedical Career Development Awards. As outlined earlier, the university also received the largest grant nationally in Enabling Grants, a new NHMRC funding scheme introduced in 2004.

Publication Record

The University of Sydney has one of the highest levels of research publications nationally and has increased its research publications output by over 70 % since 1996. The prestigious ISI Essential Indicators shows that The University of Sydney is playing a significant role in generating and then exporting Australia's research excellence abroad. The survey, based on citation indexes across 22 fields since 1994, shows that the university ranks in the top 1 % in more fields than any other university in Australia.

One of Sydney's key researchers, materials scientist Professor David McKenzie was awarded a 2004 Thomson ISI Citation Laureate, for having his writings cited 1,077 times, the highest number in his field in Australia. Professor McKenzie is one of only five Australian researchers (across all fields) to be awarded two consecutive ISI Citation Prizes. Professor Rick Shine was included in the ISI list of the world's most highly cited authors, which comprise the top 0.5% of all publishing researchers.

Research Completions

Since 1996, PhD completions have increased by 48 %, from 307 to 455 in 2004, with total HDR completions also rising from 420 in 1996 to 618 in 2004. The University of Sydney has one of the highest numbers of PhD completions of all Australian universities, which attests to its ability to attract and retain high quality research students. Furthermore, the high standard of many of its research masters students sees them upgrade their degrees to complete with a PhD.

Research Supervision

The Academic Board reported on strengths, weaknesses and areas of improvement after faculty reviews (2001-2004), and found major improvements in the quality of supervision for postgraduate research students. A combination of factors contributed to this achievement, including the implementation of CST's 10-point research training plan, encouragement for supervisors to undertake the Postgraduate Supervision Development Program, and the efforts of the Dean of Graduate Studies' Office in establishing the annual progress review policy, initiatives to continuously improve the quality of supervision, and the twice-yearly, university postgraduate induction program.

Staff and Student Recognition

Currently, nearly 130 staff members of the university are elected Fellows of Australian Academic Academies. Ten of the fifty ARC Federation Fellows are held by staff of The University of Sydney. In 2004, a number of staff and research students received prestigious prizes and awards including (listed alphabetically):

- Peter Abolfathi (PhD student, Biomedical Engineering, supervised by Dr Timothy Scott), the British Council Eureka Prize for Inspiring Science.
- Dr David Adams (NHMRC CJ Martin Fellow, School of Biological and Biomedical Sciences), a 2004 NSW Young Tall Poppy Award.
- Professor Masud Behnia (Dean of Graduate Studies), the 2004 Fluid Science Foundation Award.
- Professor Marcela Bilek, (Federation Fellow, Physics), the Pawsey Medal, the Australian Academy of Science.
- Professor Frank Billson (Clinical Ophthalmology and Eye Health), a Claude Worth Lifetime Distinction Medal.
- Dr Tracy Bryan (Head of the Cell Biology Unit, Children's Medical Research Institute), a 2004 NSW Young Tall Poppy Award.
- Janet Deane (PhD student, Molecular and Microbial Biosciences) the 2004 Young Brilliance Award, Cure Cancer Australia.
- Richard Doumani (a former tutor at the Conservatorium of Music), the Fulbright's Visual and Performing Arts Award.
- Dr Ed Duyker (Lecturer, Department of French Studies), the General History Prize, 2004 NSW Premier's History Awards.
- Professor Ben Eggleton (Federation Fellow, Centre for Ultra-high bandwidth Devices for Optical Systems), the 2004 Malcolm McIntosh Prize for Physical Scientist of the Year.
- Dr Elizabeth Ellis (Physiotherapy), the Anthonie Johannes Zietse Research Award, the National Heart Foundation.
- Dr David Gell (Research Fellow, Molecular and Microbial Biosciences), the Applied Biosystems Edman Award, the Australian Society for Biochemistry and Molecular Biology.
- Shane Hearn (School of Public Health), an Aboriginal Health Career Development Fellowship.
- Imre Hunyor (student, Sydney's Graduate Medical Program), the 2005 NSW Rhodes Scholarship.
- Dr Cameron Kepert (Senior Lecturer, Chemistry), the 2004 Le Fevre Prize, the Australian Academy of Science.
- Emeritus Professor Charles Kerr (Public Health), Order of Australia.
- Professor Thomas Maschmeyer (Federation Fellow, Chemistry), a 2004 NSW Young Tall Poppy Award.

- Dr Kirsten McKenzie (Lecturer, Department of History), the Crawford Medal, the Australian Academy of the Humanities.
- Mr Robert McLean (Dean, Australian Graduate School of Management), a 'Benevolent Australian' award, the Benevolent Society.
- Jock McOrist (student, Masters of Science), the Fulbright Science and Engineering Award.
- Professor Paul Mitchell (Ophthalmology), the 2004 Global Glaucoma Award.
- Associate Professor Dietmar Muller (Geosciences), the S.W. Carey Medal, the Geological Society of Australia.
- Dr Maryanne Large and collaborators (Optical Fibre Technology Centre), Australian Computer Society Eureka Prize for ICT Innovation.
- Natalie Rainger (student, Medicine), an Order of Australia Association Foundation bursary.
- Associate Professor Christopher Semsarian (Head of Molecular Cardiology, Centenary Institute of Cancer Medicine and Cell Biology), a 2004 NSW Young Tall Poppy Award.
- Lydia Taylor (Geosciences), the Australasian Hydrographic Society Education Award.
- Associate Lecturer Helen Watt (Education and Social Work), an American Educational Research Association award for the best PhD thesis.
- Associate Professor Lea Williams (Director, Sydney University's Brain Dynamics Centre), a Pfizer Australian Research Fellowship of $1 million over five years.
- Professor Lin Ye (Aerospace, Mechanical and Mechatronic Engineering), the Friedrich Wilhelm Bessel Research Award, the Alexander von Humboldt Foundation.

A2.5 Current and Emerging Areas of Research Strength

Sydney's research strengths contribute to each of the four National Research Priorities (NRPs). Each strength is underpinned by major research themes that, in many cases, cross traditional disciplinary boundaries. Some themes place the university's researchers at the cutting-edge of their disciplines, and others cover newly emerging fields, but the themes in all areas are a measure of national research strength. The University of Sydney's identified areas of research strength, by NRP, are:

NRP1: An environmentally sustainable Australia

- Environment, Ecology and Sustainability

NRP2: Promoting and maintaining good health

- Disease, Medical Research, and Medical Biotechnologies
- Neurosciences
- Health, Disability and Ageing
- Public Health and Health Services Research
- Philosophy and Society

NRP3: Frontier technologies for building and transforming Australian industries

- Fundamental and Enabling Sciences
- Advanced Materials
- Cellular and Molecular Biology and Biotechnology
- Information and Communication Technologies
- Work, Economics and Finance

NRP4: Safeguarding Australia

- Nation, Citizenship and Culture
- History, Prehistory and Archaeology
- Veterinary Science

Our current areas of research strength are based on research income, research completions, research enrolments and research publications. These areas of research strength are further underpinned by identified major research centres and facilities—CRCs, ARC Centres of Excellence, Special Research Centres, Key Centres and Research Networks, and MNRFs—as well as staff with recognised international standing such as Federation Fellows and fellows of learned academic academies and societies.

For example, an area of research strength is in the Frontier Technology of Advanced Materials, which is underpinned by major research themes of materials characterisation, materials design and manufacture, nanomaterials and nanoscience, plastics and polymers, biocompatible materials, and ceramics. Advanced Materials incorporates five Federation Fellows, Professors Bilek, Eggleton, Mai, Maschmeyer and Stampfl,

and the NANO-MNRF. It also takes into account: two ARC Centres of Excellence, the Centre for Ultrahigh-bandwidth Devices for Optical Systems (CUDOS) and the Centre for Quantum Computing; the ARC Key Centre for Polymer Colloids; the Australian Key Centre for Microscopy and Microanalysis, no longer funded by the ARC but still an active research centre; and three current CRCs, the Australian Photonics CRC, CRC for Polymers, and CRC for Advanced Composite Structures.

Another example is the College of Health Sciences' multi-disciplinary research program in Ageing and Health. Major achievements in this area of research strength include the ARC-NHMRC Research Network in Ageing Well (Professor Kendig), the Concord Health and Ageing Men's Project (Professors Cumming and Handelsman), the Blue Mountains Eye Study (Professor Mitchell), the Brain and Mind Research Institute (Professors Bennett, Pollard and Hickie), hip fracture and falls prevention (Professors Fiatarone Singh, Cameron, and Quine and Dr Clemson), laboratory and clinical-based research on dementia and liver function at the Centre for Education and Research on Ageing (Professors Le Couteur and Krill), and developmental disability over the life course (Professor Llewellyn). The research program fosters collaboration between disciplines, for example, in bio-psycho-social approaches to longitudinal research on healthy ageing; and multi-professional research to provide an evidence base for improving treatment, services, and policies. This research is pro-actively related to applications by governments, peak bodies, service providers and research funders across Australia, as well as to international collaboration with key US and European studies of health and retirement.

A3 Research and Research Training Objectives

A3.1 Research and Research Training Objectives

In 2004, The University of Sydney initiated preparations for its new strategic plan for the years 2005-2010. This new plan, *The University of Sydney Strategic Directions 2005-2010*, states unequivocally that the university's reputation is directly linked to the quality of its achievements in research and research training. By 2010, the implementation of these strategic directions will enhance the university's research competitiveness through an increased focus on interdisciplinary capability, international research linkages and collaboration, and proactive engagement with industry.

The objectives for research and innovation from the new strategic plan are outlined below in the areas of research, research training and commercialisation.

Future Directions for Research

The Deputy Vice-Chancellor (Research and Innovation) has established that the priorities in research will be to:

- Conduct cutting-edge research in a culture that inspires discovery and innovation,
- Create a vibrant research environment that attracts and retains the best researchers and values and rewards their contributions, and
- Promote high-impact collaboration with other leading universities in Australia and worldwide.

In support of achieving these goals, the plan outlines a number of performance criteria. Specifically, the university will:

- Seek to enhance its research intensity by increasing:
  a) The proportion of research active staff,
  b) The percentage of research active staff conducting internationally competitive research, and
  c) The number of staff supported on externally-funded research fellowships, including the number of Federation Fellows (and equivalent).
- Seek to grow its large research income.
- Increase the number of publications in leading international journals each year and the overall total number of publications each year.
- Increase national and international research collaborations, monitored through joint grant applications, joint publications and joint supervision of research students.

Future Directions for Research Training

The Office of the Dean of Graduate Studies has responsibility for ensuring best practice in all aspects of postgraduate research training is known and adopted throughout the university. In the new strategic plan, and under the guidance of the Dean of Graduate Studies, the university is renewing its commitment to further improve the quality of research training and the quality of the postgraduate student experience.

To meet this commitment, the university will:

- Increase the HDR load per research active academic member of staff.
- Increase the number of HDR students successfully completing.
- Increase the number of HDR students completing within time.
- Achieve increasingly positive outcomes in the Student Research Experience Questionnaire (SREQ).

Generic Attributes of HDR Students

The University of Sydney is committed to the development of key generic attributes and skills in its higher degree students, particularly its research students. These include the development of research skills, technical skills (academic writing, statistical analysis, laboratory work, etc.), expansion of knowledge, the ability to work independently, and support in English language proficiency for non-English speaking background postgraduate research students. A number of faculties have introduced, or are in the process of introducing, compulsory research methodology courses for their postgraduate research students. The establishment of these courses has been identified as a priority area by the Academic Board; it has commended those faculties, such as Law, already involved in this initiative.

Specifically, The University of Sydney ensures the following attributes are developed in its graduates:

1. An interested and enquiring mind capable of critical judgment and rigorous, creative and independent thinking.
2. Finely honed technical and research skills appropriate to the particular area in which they have completed their work.
3. The capacity to apply theoretical principles to practical problems and issues; to be problem-solvers.
4. An appreciation of the ethical issues involved in the conduct of research generally, and more specifically in their particular field.
5. The ability to present their results skilfully in oral, written and visual forms.
6. A high level of literacy in IT programs and procedures relevant to their area of research.
7. Entrepreneurial skills and the ability to address cross-disciplinary problems and issues.

Commercialisation

In 2004, the university commenced a detailed review of its commercialisation office, the Business Liaison Office, to improve its output and performance. This review will meet the priority of stimulating knowledge transfer and commercialisation. During 2005, Sydney will seek to implement the changes recommended in the review to enable the university to meet the following performance criteria as part of the strategic plan:

- Increase the number of invention disclosures.
- Increase the number of patent applications.
- Increase the number and value of licenses, research contracts and research consultancies.

A3.2 Emerging Areas of Need or Opportunity in Research and Research Training

The University of Sydney has identified a number of major areas of opportunity in research and research training. These are outlined by each of the three colleges, corresponding to the research clusters of Part B.

College of Humanities and Social Sciences (CHASS)

CHASS has identified and pursued several opportunities in research and research training during 2004. In a research environment that can sometimes undervalue work in the Humanities, Arts and Social Sciences, the primary opportunity is contributing to mechanisms that raise the visibility and increase the contribution of these disciplines within the university, nationally and globally. To that end, the college was closely associated with the formation of a national body—the Council for the Humanities, Arts and Social Sciences—that was established in June 2004 to forge a collective voice for Australian researchers in these fields. The college is also involved in ongoing efforts to establish a fifth National Research Priority for Australia, to provide an expanded place for Humanities and Social Science research undertaken in the national interest.

Another emerging opportunity is the role of the Research Institute for Humanities and Social Sciences (RIHSS)—the primary research support and development arm of CHASS—in facilitating and enabling the college to achieve its research and research training goals. In 2004, the college undertook a strategic

review of RIHSS; this is leading to a diversification and expansion of the institute's programs of support across the college, a strengthening of its policy role within the university and further recognition of the institute's key role in building up research infrastructure across the college. As part of this effort, the college continued its strategic support for postgraduate research students, initiating a major program to increase the number of college-funded, postgraduate research scholarships and designing a postgraduate research centre for research students within the college.

CHASS also continues to respond to the increasing role of information and communication technologies in research. In 2004, it expanded the innovative application of emerging information technologies to research in the Humanities and Social Sciences, which included the university's leadership in several e-humanities projects.

College of Health Sciences (CHS)

CHS has identified two major areas of opportunity for strategic development of its research activities. Firstly, the college consists of five faculties that share a common goal of education and research on health; together the faculties provide the most comprehensive coverage of health-care disciplines in the country. This presents a unique opportunity for collaborative educational and research programs across different healthcare disciplines. In 2004, the college began to develop cross-disciplinary research programs, to coordinate and enhance research in areas of existing strength, within the National Research Priorities. The Programs are built around a core of internationally recognised researchers, with the capacity to enhance research across all faculties. The first two such Programs are "Ageing and Health" and "A Healthy Start to Life," and their development is being supported by seed funding for administrative purposes and by the provision of postgraduate scholarships for candidates undertaking cross-disciplinary research in these areas.

Secondly, the college has identified that the university needs to strengthen its capital infrastructure for modern biomedical/biotechnological research, and that its traditional department/faculty/college administrative structure could discourage researchers from seeking research partners outside this structure, thereby acting as a disincentive to free interaction across disciplines. In 2004, CHS and CST developed a joint initiative to create a biomedical, biotechnological, bioengineering precinct (Bio^3) that crosses conventional discipline boundaries to bring scientists in engineering and material sciences, biophysics, informatics and computer sciences together with those in traditional health disciplines. The rationale was that major advances in healthcare in the next one to two decades are likely to come from research at the interface between these disciplines. The plans involve a major capital development, leading to a research hotel for collaborative research, not aligned to or administered by a single discipline or faculty.

College of Sciences and Technology (CST)

CST has identified a number of areas of opportunity for its research. One major area is bioinformatics and computational bioscience, which is supported by research efforts in veterinary science, mathematics and statistics, information technologies and biological sciences. For this area to emerge as a future strength for the university, a major goal for 2005 will be to increase the research interactions with the Faculty of Medicine. Another area of significant opportunity is sustainability, which incorporates diverse research across the Faculties of Science, Engineering, Agriculture, Food and Natural Resources, Law and Medicine. These research strengths are substantive, but dispersed. The Faculty of Architecture has taken on the task of drawing together these different areas to provide the necessary focus to this emerging area, to produce a cohesive, coordinated and multidisciplinary research strength.

Major opportunities are evident in the science of aquaculture, given the unrelenting demand for fish protein globally. Disease is one of the main challenges associated with aquaculture, and the Faculty of Veterinary Science is already carrying out related research for the Pest Animal CRC. The college intends to mount undergraduate and graduate programs and to increase research training in this field, in anticipation of unmet demand for scientists over the next decade. The college has strengths in plant science and plant breeding, with the Plant Breeding Institute and the numerous plant scientists in Biological Sciences. These two groups have established a new major in plant sciences in the undergraduate science degree, which will lead to an increased number of PhD students in fundamental research areas such as plant pathology, plant physiology and cell biology. The plant and animal scientists are collaborating in shared molecular platforms, and in exploring the interaction between crop and animal science in safe food production.

A4 Ensuring a Quality Research Training Experience

A4.1 Ensuring a Quality Research Training Experience

Structures and Resources to Support Research Training

Research training of the highest national and international quality is one of the university's most important responsibilities. The 2004 policy *Postgraduate Research Higher Degree Training Supervision at The University of Sydney* maintains this proactive approach to ensure that HDR students work in the best intellectual and academic environment that can be provided, and receive excellent supervision during their candidature (http://www.usyd.edu.au/ab/policies/PG_Rsch_Hghr_Dgree_Train_Sprvsn.pdf).

In June 2004, the Academic Board approved the introduction of the Higher Degree Candidature Annual Progress Report, the mandatory review of HDR candidates' progress, from probationary candidature through to submission and examination.

The University has identified research infrastructure and the research environment as priority areas for improving resources to support research training. The 2004 SREQ results showed a welcome increase in HDR students' satisfaction levels in these areas.

In 2004, the university provided centrally-funded stipends to 1287 HDR students. New scholarships awarded included 148 Australian Postgraduate Awards (APAs), 109 University of Sydney Postgraduate Awards (UPAs), 21 Australian Postgraduate Awards (Industry, APAIs) and 31 International Postgraduate Awards (IPAs). The university also provided 24 bequest-linked stipends to commencing postgraduate research students and allocated 55 scholarships awarded by external bodies. This latter category included 26 NHMRC scholarships, 6 full and 17 top-up CRC scholarships, and 2 full and 4 top-up scholarships from various rural research and development corporations. In addition, the university received 4 full and 5 top-up scholarships from National ICT Australia (NICTA).

Following wide consultation, the university developed an International Action Framework, which will be the basis for the university's international strategic plan. Among the four major areas on which the framework focuses is diversifying recruitment activities to increase numbers and attract the best and brightest students, especially in the postgraduate research area.

Recent Achievements with respect to Research Training

The APRU Doctoral Students Conference was held at The University of Sydney in August 2004, attracting 180 PhD students from more than 30 universities in the Pacific Rim region. This prestigious event showcased the fine achievements and excellent progress of The University of Sydney's final-stage PhD candidates and highlighted the university's international standing as a leader in research training. The conference provided a unique platform for presenting and discussing the leading-edge research being undertaken within the region in all disciplines, giving an important networking opportunity for students.

The university introduced a policy for postgraduate HDR supervisors. The policy ensures that supervisors are appropriately trained for supervising HDR candidates. Supervisors are now required to be registered on the "Registry of Supervisors," which is managed by the Dean of Graduate Studies.

A4.2 Strategies to Enhance Areas of Research Strength in Relation to Research Training

Research training at The University of Sydney is showing strong growth. Between 2001 and 2004, the number of HDR students (EFTSU) increased by 10 %, and the annual number of commencing students (EFTSU) increased by in excess of 30 %. (These figures are tabulated below in A4.3) Much of this growth has been in the university's areas of existing and emerging strength.

The University of Sydney has a number of mechanisms in place that are responsible for this growth and will continue to enhance the existing areas of research strength and cultivate new areas of research strength. These strategies include:

Encouraging cross-disciplinary research training. The strong interactions between the Faculties of Science and Medicine are a good example of this approach.

Provision of research training opportunities in research centres such as ARC Centres of Excellence. For example, the Centre for Autonomous Systems is creating a unique environment for world-class research training as it expands it critical mass. In 2004, the CAS enrolled 28 new PhD students—bringing the total to 74 students across the centre—and completed 11 PhD students. In addition to being engaged in such a vibrant research environment, these students also are fully involved in all aspects of the centre's activities, including industry projects, teaching and outreach.

Holding college-wide conferences and workshops. For example, the fourth CHS Research Conference, "From Cell to Society 4," attracted around 800 participants and more than 370 research papers. The two-day conference focused on improving postgraduate researchers' experience and on building collaborations across the college. During 2004, CST also held college-wide conferences on Information and Communications Technology, Photonics and Optics, and Food Science and Safety.

Recruitment of leading, research active academics to new positions in areas of research strength or emerging areas of strength. The University of Sydney continues to increase its numbers of research active staff, particularly by targeted recruitment to areas of existing or emerging research strength, whether this is through creation of new positions internally or by increased success in attracting ARC Professorial Fellowships and Federation Fellowships. This, in turn, increases the numbers of active supervisors for research students, creates more attractive intellectual and research environments for students, and increases the numbers of scholarship opportunities for quality research students.

A4.3 Allocation of Research Training Places

The university's research training places are allocated on the basis of research and research training performance to each of the colleges, representing the three research clusters in Part B.

(EFTSL)	2001		2002		2003		2004	
Research Cluster	All HDR Students	Commencing HDR Students	All HDR Students	Commencing HDR Students	All HDR Students	Commencing HDR Students	All HDR Students	Commencing HDR Students
CST	843	199	840	234	931	275	1006	311
CHS	832	182	840	216	843	202	869	203
CHASS	843	180	853	207	883	231	892	228

Commencing load is directed to areas of institutional strength and takes into account the availability of adequate infrastructure and supervisory capability in the faculties. In 2004, there were no significant shifts in commencing load (see table above). Research scholarships (APAs, UPAs and IPRSs) are allocated primarily on the basis of completion rates, ensuring that places are directed to those areas of the University that have strong records in research student management through to completion.

A5 Collaboration and National Priorities

A5.1 Significant Contributions to the National Research Priorities

Much of the research undertaken within the university, particularly in the areas of research strength, falls within the National Research Priorities (NRPs).

NRP1: An Environmentally Sustainable Australia

The university contributes to the first NRP via its identified research strength of *Environment, Ecology and Sustainability*. This also incorporates Environmental Remediation, Marine & Coastal Ecology, Ocean Science, Sustainable Agriculture, Sustainable Industry and Maintenance of Biodiversity. In 2004, this research strength brought $12.7 million research funds into the university, generated 251 publications and supported 139 HDR students (EFTSL). Crossing the boundaries between NRP1 and NRP3, ARC Federation Fellow Prof. Thomas Maschmeyer is doing world-leading research on production of industrial chemicals in a more sustainable manner through development of new, nanostructured, functional materials. There are numerous research centres in the university that contribute to NRP1 including the Centre for Rural Sustainability, the Centre for Salinity Assessment and Management, The University of Sydney Institute for Marine Science, the newly established Wildlife Health and Conservation Centre, and the ARC Special Research Centre for Research on Ecological Impacts of Coastal Cities. Sydney also is involved in three relevant CRCs: the CRC for Sustainable Cotton Production, the CRC for Sustainable Rice Production and the CRC for Sustainable Resource Processing.

Selected Examples of Research in NRP1

The research activities in NRP1 vary from basic science to industrially-relevant, applied research. For example, fundamental research by Professor Richard Shine and colleagues on the developmental effects of prey size on baby tiger snakes has shed light on the processes by which adaptive evolution occurs. In other basic research, Dr Andrew Holmes and co-workers conducted one of the first studies to integrate mathematical descriptions of ecological patterns with large-scale, microbial diversity data sets. This work offers potential for a more unified view of biodiversity of micro- and macroorganisms and presents a way to more accurately estimate terrestrial biodiversity.

A special Faculty of Veterinary Science project, supported by the Rural Industries Research and Development Corporation (RIRDC), has produced the first estimates of genetic and phenotypic parameters of salt-water crocodiles from production and pedigree records maintained by Janamba Crocodile Farm in the Northern Territory. From this research, Dr Sally Isberg and co-workers have successfully developed a multitrait genetic improvement program (CROCPLAN) that is now ready for implementation by the industry. Addressing the priority goal of *overcoming soil loss, salinity and acidity*, Professor Alex McBratney and Dr Budiman Minasny commenced a 2004 ARC Linkage Project grant on development of soil-inference systems for bridging the gap in environmental modelling. The research of Dr Inakwu Odeh, as part of a contribution to the Australian Cotton CRC, has resulted in a database of more than 90,000 quantitative and qualitative indicators of soil quality, including soil salinity and physical and chemical properties. The NSW Minister for Primary Industries launched this database in 2004.

NRP2: Promoting and Maintaining Good Health

The university contributes significantly to NRP2 through research strengths that include *Health, Disability and Ageing*, *Public Health and Health Services Research* and *Philosophy and Society*, incorporating research themes such as Cancer Research; Neurological Diseases, Psychiatric Disorders and Neuroscience; Infectious Diseases, Microbiology and Immunology; Cardio-Respiratory Diseases; Psychosocial Aspects of Health; Public Health Policy and Practice; Indigenous Health, Rural and Regional Health and International Health; Ageing; and Social Work and Social Policy. In 2004, the research strengths under this NRP brought $104.8 million research funds into the university, generated 2,236 publications and supported 1,178 HDR students (EFTSL). There are more than 20 research centres in the university that contribute to NRP2, and in excess of 30 associated research units and medical research institutes. Major externally-funded centres include NHRMC Centres of Clinical Research Excellence in liver disease and renal medicine, the CRC for Asthma and the CRC for Cochlear Implant, Speech and Hearing Research. The ARC-NHMRC Research Network on Ageing Well, convened by Professor Hal Kendig, was established in 2004 with an award of $2.5 million over five years. The network will link outstanding researchers from many disciplines across 16 Australian universities, nurture developing researchers, relate social and health research, strengthen international collaboration, and involve and inform endpoint users. The Brain and Mind Research Institute, a multi-disciplinary hub for neuroscience research into debilitating forms of neurological and psychiatric illness, was officially opened in 2004 by the NSW Governor, Professor Marie Bashir. In November, NSW Premier Bob Carr opened the Medical Foundation Building, which is a flagship facility for post-genomic research.

Selected Examples of Research in NRP2

Targeting the priority goals of *a healthy start to life* and *preventative healthcare*, a team led by Professor David Celermajer demonstrated that the arteries of obese children function abnormally, but that diet and exercise can reverse these abnormalities. Professor Louise Baur co-edited the major report to the World Health Organization (WHO) on childhood obesity. Awarded an ARC Discovery Project in late 2004 worth more than $300,000, the Department of Gender Studies in the Faculty of Arts will commence a cultural analysis of youth obesity in 2005. Also pertaining to *a healthy start to life*, Dr Kathryn Rose and national collaborators are conducting the Sydney Myopia Study, a large-scale survey of eye health in Australian school children. Though still underway, the results to-date are informing the current debate over the benefits of vision screening programs in NSW and strongly suggest that a fundamental revision of the current understanding of the development of young children's eyes is needed. Further benefiting *preventative healthcare*, Professor Nick Jacques demonstrated that Streptococcus mutans plays a critical role in the initiation of dental caries through the production of organic acids during metabolism of dietary sugars. Selective control of this organism through incorporation of inhibitors in oral hygiene products will provide major public health benefits.

In work that has implications for the priority goal of *ageing well, ageing productively*, a research team at the Kolling Institute of Medical Research has discovered that the protein IGFBP-3 can cause breast cancer

cells to grow more rapidly. This could have a major impact on the non-surgical treatment of breast cancer in Australia. Addressing the priority goals of *a healthy start to life* and *strengthening Australia's social and economic fabric*, a research team from the Faculty of Health Sciences has established that new mothers with disabilities suffer serious health inequalities that, in turn, lead to poor developmental outcomes for their children. The team, in collaboration with the Victorian Parenting Centre, is building health and human services capacity across the nation with $2.3 million funding from the Federal Government, under the "Stronger Families and Communities" strategy, to provide evidence-based practice for these families.

NRP3: Frontier Technologies for Building and Transforming Australian Industries

The university contributes to this NRP through research strengths that include *Fundamental and Enabling Sciences*, *Advanced Materials*, *Information and Communication Technologies* and *Work, Economics and Finance*, which incorporate research themes such as Materials Characterisation, Materials Design and Manufacture, Nanomaterials and Nanoscience, Plastics and Polymers, Biomaterials, Communications Technology, Photonic Devices, Robotics, High Performance Computing and Networking, Biotechnology, Proteomics, Genomics, Bioinformatics, Organisational Management and Industrial Relations, Government and Public Policy, Securities and Financial Markets, and Globalisation. In 2004, the research strengths under this NRP brought $40.3 million research funds into the university, generated 1,551 publications and supported 638 HDR students (EFTSL). Among the evidence of critical mass in this NRP are seven ARC Federation Fellows across the Schools of Aerospace, Mechanical and Mechatronic Engineering, Chemistry and Physics; two MNRFs (NANO and APAF); three ARC Centres of Excellence—the Centre for Autonomous Systems, the Centre for Ultrahigh-bandwidth Devices for Optical Systems (CUDOS) and the Centre for Quantum Computing—and NICTA; the ARC Key Centre for Polymer Colloids; various other centres including the Centre for Advanced Materials Technology and the Optical Fibre Technology Centre; and the Australian Photonics CRC, the CRC for Polymers, the CRC for Advanced Composite Structures, the CRC for Smart Internet Technology, and the Technology Enabled Capital Markets CRC. The ARC Research Network for Molecular and Materials Structure, convened by Dr Cameron Kepert, was established in 2004 with $1.5 million over five years. Encompassing physics, computer science, applied mathematics, chemistry and biochemistry, and catalysing interaction across these disciplines, the network will build powerful e-science resources for the structural sciences, and will impact all five priority goals under this NRP.

Selected Examples of Research in NRP3

Under the priority goal of *frontier technologies*, Drs Tisse and Tonkes from the Centre for Autonomous Systems are developing biomimetic sensing for aerial micro-robots. Drawing on principles of the vision systems of flying insects, the team already have overcome issues associated with hemispherical eye miniaturisation, and are well on their way to producing unique perception systems that will allow the robots to independently assess their motion and avoid collisions during flight. Also within this priority goal, Biomedical Engineering PhD student Peter Abolfathi (supervised by Dr Timothy Scott) won the Eureka Prize for Inspiring Science for his design of a revolutionary glove embedded with artificial muscles that can give movement back to people with paralysed hands.

A new 2004 Linkage Project grant will provide more than $1 million over three years for Professor Max Crossley and collaborators to develop a molecular flash memory for long-term, extremely high-capacity, unpowered data storage. The collaborative project with Intel Australia will demonstrate data density more than four orders of magnitude greater than any commercially available technology and unattainable by conventional electronics. Crossing *advanced materials* and *frontier technologies*, an interdisciplinary team of researchers from the Optical Fibre Technology Centre (OFTC) received the Eureka Prize for ICT Innovation for developing microstructured polymer optical fibres (mPOFs). Over short distances, mPOFs already have shown enormous bandwidths (2.4 Gbits/s over 100 m) without design optimisation, yet cost far less to mass-produce than conventional technologies. These new fibres have applications in short distance, high speed data transmission in office and home environments, and have shown outstanding potential in cutting-edge technologies such as fibre amplifiers, lasers and sensors.

NRP4: Safeguarding Australia

The university contributes to the final NRP through identified research strengths such as *Nation, Citizenship and Culture, Philosophy and Society*, *History, Prehistory and Archaeology* and *Veterinary Science*, which encompass research themes such as National Identity, The Regional Context, Languages, Anthropology, Near Eastern Archaeology, and Invasive Pests and Diseases. In 2004, these research strengths brought $7.0 million research funds into the university, generated 408 publications and supported 523 HDR students (EFTSL). Research centres within the university that contribute to NRP4 include the Sydney

Centre for International and Global Law, the Centre for Peace and Conflict Studies (CPACS), the Research Institute for Asia and the Pacific (RIAP), the Australian Mekong Resource Centre, and the Australian Biosecurity CRC and the CRC for Biological Control of Pest Animals.

Selected Examples of Research in NRP4

Crossing the priority goals of *understanding our region and our world* and *protecting Australia from terrorism and crime*, The University of Sydney's Centre for Peace and Conflict Studies (CPACS), in partnership with the Bankstown-based Lebanese Community Council, is undertaking research into the effects of racism on Lebanese youth in Australia. The two-year research project seeks to promote the self-esteem of Lebanese suburban youth and contribute towards breaking the cycles leading to 'deviant' behaviour. The Research Institute for Asia and the Pacific (RIAP) is the leading international projects and multidisciplinary agency of The University of Sydney, and plays an important role in research pertaining to the priority goal of *understanding our region and our world*. Current priority areas for research include private and public sector governance, youth transitional issues, Islam in Southeast Asia, cross cultural communication, migration and ethnic diversity, and development cooperation issues.

The Faculty of Veterinary Science hosts the Education and Training Program of the Australian Biosecurity CRC. This CRC will develop new technology platforms for surveillance of diseases that threaten human and animal health in Australia, thereby making contributions to *protecting Australia from invasive diseases and pests*. In addition, the faculty hosts the OIE International Reference Laboratory for the Epizootic Haematopoietic Necrosis Virus of finfish, and plays an active role in safeguarding the rapidly developing Australian aquaculture industry. Other research in the faculty is developing new tests and vaccines for mycobacterial diseases, which threaten livestock health, and other serious infectious agents.

A5.2 Significant Recent Research Collaborations

Much of the research conducted by The University of Sydney is collaborative, and includes collaborations at all levels: internal, rural, national, regional and international. Viewed from the perspective of collaborating organisations, these collaborations also cover the spectrum of partners, from universities and publicly funded research agencies to charitable organisations to government departments to industry and business.

An insight into the scale and diversity of these collaborations is evident from even a brief overview. The University of Sydney is leading two new Research Networks, as part of a scheme from the ARC and NHMRC directed towards developing more inter-disciplinary approaches to research. In addition, Sydney is collaborating in 13 networks led by other universities. The University has also continued to develop long-term relationships and collaborations with industry through the CRC Program, through the ARC's Linkage Project grants, through collaborative and contract research, through consultancies and through commercialisation of intellectual property. In 2004, five new CRCs, worth more than $157.4 million over seven years, were established in which the university is a core or supporting participant.

A selection of major research collaborations from 2004 include:

Internal Collaborations

Within the Faculty of Medicine, the clinical schools were awarded a total of 33 new grants, led by the Western Clinical School with 11. This result demonstrates the success of the continuing strong collaboration between the university and its teaching hospitals. Researchers from health and medical research institutes affiliated with the Faculty of Medicine were successful, including the Westmead Millennium Institute, Centenary Institute of Cancer Medicine and Cell Biology, ANZAC Research Institute and the Kolling Institute for Medical Research. Furthermore, 17 of the new grants involve multi-institution collaboration between The University of Sydney and other universities, hospitals and research institutes.

Rural Collaborations

Three of the faculties within CST have continued in their strong research links with rural organisations in 2004, through partnerships with Meat and Livestock Australia, Rural Industries Research and Development Corporation, Australian Centre for International Agricultural Research, The Australian Egg Corporation, Australian Wool Innovation, and Grains Research and Development Corporation. In a new collaboration, the Marsh Lawson Mushroom Research Unit was opened in December 2004. This unit, which is sponsored by the Australian Mushroom Growers Association, will foster the relationship between the university and the Australian mushroom industry.

National Collaborations

The School of Exercise and Sport Science was a partner with the University of Technology, Sydney and the Sydney Olympic Park Authority in winning a tender from the Department of Education, Science and Training to establish the $7.8 million International Centre of Excellence in Sport Science and Management (ICESSM), to be based at Sydney Olympic Park, Homebush. ICESSM is being set up specifically "to facilitate the international exchange of students and sports management and science professionals." ICESSM will be the focal point in Australia for education, research and knowledge services in Sport Science and Management. The centre will develop new products and services, manage information, gather and broker intelligence as well as draw on each partner's existing education, research and administrative capabilities.

Another significant new collaboration for 2004 was formalised with CSIRO, when it became an additional node of the NANO-MNRF. As a result, all divisions of CSIRO have open access to NANO's state-of-the-art research facilities—including nanoSIMS, Cryo-TEM, dual-beam FIB, advanced electron microscopy and state-of-the-art atom probe tomography—and research expertise.

Asia-Pacific Collaborations

Established in 1987, the Research Institute for Asia and the Pacific (RIAP) is an applied research agency, undertaking research with a specific application in view, such as building institutional and human resource capacities and promoting network linkages between Australia and Asia Pacific region. Partner institutions of RIAP include: the Chinese Academy of Social Sciences, the Centre for Corporate Governance and Empowerment in Indonesia, the Institute for Economic and Social Research in Indonesia, the Centre for Asia Studies at the University of Hong Kong, the Korean Institute for Economic Policy, the University of Malaya in Malaysia, the Asian Institute of Management in The Philippines, the National University of Singapore, Chulalongkorn University in Thailand, the Central Institute for Economic Management in Vietnam and the National Economics University in Vietnam. In 2004, RIAP published its seventh research report, which was on delivery of Japanese development aid in the Asian region. RIAP also secured a United Nations Children's Fund (UNICEF) research grant to assess the child criminal justice system in Cambodia.

The University of Sydney's George Institute for International Health formalised its collaborative research links with Peking University with the opening of a new Centre for Evidence-based Medicine in Beijing. The centre will undertake a range of research projects that will tackle major health problems facing the world's most populous country. In another significant, new research collaboration, a multidisciplinary team from Sydney are developing an information monitoring system for World Heritage site management, using Angkor Wat in Cambodia as a test case. This ARC Linkage Project has been awarded $955,000 over five years. The industry partners include UNESCO Phnom Penh, the NSW Department of Environment and Heritage, Horizon Geoscience Consulting Pty Ltd and a Cambodian government authority.

International Collaborations

In 2004, the university signed 2 new, university-wide Memoranda of Understanding, and renewed 6, with institutions in countries including the USA, Indonesia, China, the UK and Greece. Another 11 Memoranda of Understanding were signed or renewed at the college or faculty levels. Numerous other international cotutelle and student exchange agreements were signed for the first time or renewed across different parts of the university. These agreements provide enhanced opportunities for academics, researchers and students to become involved in new research collaborations, undertake research internationally, and create shared research training opportunities.

In support of such international collaborations, Sydney allocated $245,000 in 2004 from the International Development Fund (IDF) to support initiatives from faculties aimed at enhancing the university's international standing and strengthening collaborative relationships. Grants included projects to examine recent developments in Iranian archaeology and comparative histories of public health detention in the 20th century in India and England; health initiatives in India and Vietnam; and a marine science collaboration with Tongji University in China.

The Australian Centre for Field Robotics (ACFR) completed a major $1.7 million research project funded by BAE Systems in Australia and the UK, which resulted in the world's first flight of multiple, unmanned aircraft. This has led to new contracts with BAE Systems UK, the UK Ministry of Defence, the US Air Force, and the US Office of Naval Research. Engineers from the ACFR are also now working on applications of this technology with the Australian Defence Forces.

In the area of medical research collaborations, The University of Sydney holds 12 grants from the US National Institutes of Health valued at over US$2 million in 2004. Sydney is the lead institution on eight of these projects, which involve international collaborations with several universities in North America and Europe. Professor William Tarnow-Mordi, Western Clinical School, is leading a team funded US$600,000 over 6 years by the UK Medical Research Council to undertake an international neonatal immunotherapy study. Professor David Henderson Smart, Central Clinical School, is leading a multi-disciplinary team funded AU$1.3 million over 5 years by the NHMRC and the UK Wellcome Trust to build evidence based research and practice in South East Asia regarding pregnancy and childbirth care outcomes.

A6 Intellectual Property, Commercialisation and Contractual Arrangements

A6.1 Current Intellectual Property and Commercialisation Policies

In accordance with the National Principles of Intellectual Property Management for Publicly Funded Research, the university has procedures in place to identify, assess and protect IP. The *Intellectual Property Rule 2002* and guide to the rule, respectively, are available at http://www.usyd.edu.au/senate/policies/Intellectual_Property_Rule.pdf and http://www.usyd.edu.au/senate/policies/Intellectual_Property_Rule_Guide.pdf.

The Business Liaison Office (BLO) is the technology transfer and commercialisation office of the university and also manages contract research and consulting with industry. It is staffed by commercialisation experts and has an Intellectual Property and Licensing Unit, a New Ventures Unit and a Contracts Unit. Under the *Intellectual Property Rule 2002*, staff and students who believe they have generated IP must report to the BLO as soon as possible, through the head of department or unit.

The university builds links with industry through collaborative and contract research, the licensing of IP and the formation of spin-off companies. Whether the innovation is a new wheat variety or a remotely operated underwater drill, which are two recent examples, the BLO works to ensure maximum benefits for researchers, the university and the economy. As the importance of commercialisation has increased, the BLO has built up extensive expertise in commerce, IP and the law, and have framed a range of standard agreements to ease contractual arrangements with other organisations.

A priority for 2005 and beyond for the BLO is continuing to identify, develop and support the most promising commercial opportunities arising from The University of Sydney's research. To do so, the BLO has protocols to capture and assess early stage ideas and inventions so that their commercial potential can be assessed rapidly. It reviews all disclosures to ensure that all IP is captured and students and staff are fully aware of their responsibilities. Another priority is continuing to optimise the benefits to the university from the Innovation Statement relevant to technology transfer and commercialisation. The BLO has a program for systematically locating investors or potential end-users for all technology developed by researchers. Major opportunities include licensing technology and establishing spin-off companies. A further priority is expanding the commercial enterprise of the university. The BLO has an on-going program to establish new spin-off companies. The university is spawning spin-off companies at an average of 5 per year and currently has equity in 29 spin-offs. The final major priority is educating and informing the university research community of best practices in protecting and commercialising IP.

A6.2 Changes in Intellectual Property and Commercialisation Policies

In April 2004, the Senate of The University of Sydney approved new Commercial Activities Guidelines for ensuring diligent adherence to best practice in commercial activities including risk management. These guidelines have yet to be formally approved by the NSW State Government. The policy can be accessed by staff internally at: http://intranet.usyd.edu.au/staff/index.html#policies.

A6.3 Incentives Offered to Encourage Research Commercialisation

The University of Sydney ensures that all academic staff involved in the generation of IP and its subsequent commercialisation benefit through a royalty share scheme. This approach has not changed since the 2003 RRTMR.

A6.4 Collaboration with Other Institutions to Share Commercialisation Expertise and Facilities

The BLO shares information with its counterparts in other Australian and overseas universities through participation in industry associations such as Knowledge Commercialisation Australasia (KCA). The University of Sydney has joined the InnovationXchange, a scheme set up with Commonwealth Government backing to bring together Australian industry, education and the research sector for the first time. The new national exchange links Australian universities and major research institutions to professional and industry associations representing more than 40,000 companies. The venture has the backing of the Federal Government's Innovation Access Program, as well as the support of the NSW, Victorian and Queensland State Governments.

A6.5 Commercialisation Policy

The BLO helps realise potential for developing new products by protecting the IP and then proactively developing the ideas and concepts to the stage where they are attractive to external investors. For spin-off companies, the BLO draws on external consultants in an entrepreneur-in-residence program to provide management skills and a dedicated entrepreneur to develop and grow each spin-off. Almost all of the university's spin-off companies have managed to attract support from government programs to offset the initial costs of establishing the company and attracting external investors.

The commercialisation policy is embedded into the *Intellectual Property Rule* described above.
A staff manual outlining current university policy on IP and industry collaboration is available on line at www.usyd.edu.au/blo. The manual describes IP identification and commercialisation procedures in detail.

A6.6 Future Arrangements for Commercialisation of Research and Management of Intellectual Property

In 2004, a review of the BLO's activities was undertaken to identify ways to strengthen its commercialisation role. This will result in the establishment of Commercialisation Managers in the various faculties and discipline areas with a client focussed approach to interaction with academic staff. These developments will build upon on an already successful effort that saw further growth in the university's industry interaction and commercialisation activities in 2004. Industry agreements in which The University of Sydney is involved have continued to increase in number and size, from 240 (worth $12 million) in 1996 to approximately 800 (worth in the order of $54 million) in 2004. The continued development of the university's commercialisation processes is crucial to research success.

A6.7 Managing Intellectual Property

The university's policies and procedures are consistent with the *National Principles of Intellectual Property Management for Publicly Funded Research* in the following ways:

- The *Intellectual Property Rule* deals with the ownership, protection and exploitation of IP and is approved by its governing body;
- The BLO has procedures and a team dedicated to the identification and protection of research with commercial potential;
- The *Intellectual Property Rule* provides guidance on the protection of IP and regular training sessions are held with research staff on these topics;
- The *Intellectual Property Rule* provides a clear policy on ownership of research created within the institution by staff or students, and standard agreements used for such purposes;
- The BLO has procedures and a team dedicated to assessing existing IP and the freedom to operate;
- The university's *Commercial Activity Guidelines* sets out clear policies and procedures for the management of such activities, and the BLO is resourced to support its implementation;
- The *Intellectual Property Rule* provides the basis for sharing the benefits of IP commercialisation with appropriate stakeholders;
- The BLO maintains detailed records of IP commercialisation activities that are used for internal and external reporting; and
- The university's *Conflict of Interest Policy* deals with potential conflicts arising from the commercialisation of IP.

Part B

Table B1 Higher Degree Research (HDR) Students (by EFTSL) in 2004

	All HDR Students (EFTSL)[1]	HDR Students Commencing in 2004[2]
All research – by research cluster[3]		
Science & Technology	1,006	311
Health & Medical Research	869	202
Arts, Humanities & Social Sciences	892	228
Total – All Research	**2,767**	**741**
Areas of Research Strength[4]		
Environment, Ecology & Sustainability	139	39
Fundamental & Enabling Sciences	144	39
Advanced Materials	84	29
Cellular & Molecular Biology & Biotechnology	113	23
Information & Communication Technologies	173	78
Disease, Medical Research & Medical Biotechnologies	407	94
Health, Disability & Ageing	118	28
Public Health & Health Services Research	300	71
Neuroscience	93	23
Nation, Citizenship & Culture	349	109
Work, Economics & Finance	124	36
History, Prehistory & Archaeology	106	15
Philosophy & Society	260	49
Veterinary Science	68	18
Total – Areas of Research Strength	**2,478**	**651**

NOTES ON DATA PROVIDED IN TABLE B1

[1] Includes all categories of HDR students enrolled in HDR courses according to definitions in DEST Higher Education Student Collection documentation.
[2] Commencing students are counted in accordance with DEST Higher Education Student Collection documentation.
[3] Any cross-disciplinary research that spans these broad groupings is attributed to the most appropriate research cluster, as is also the case in Tables B2 to B4.
[4] Areas of research strength are those identified in Part A, as is also the case in Tables B2 to B4.

Table B2 Research Income in 2004

	Category 1[1] ($'000)	Category 2[1] ($'000)	Category 3[1] ($'000)	Category 4[1] 2003-2004 ($'000)
All research – by research cluster				
Science & Technology	42,996	3,327	13,757	5,247
Health & Medical Research	38,233	10,756	50,491	162
Arts, Humanities & Social Sciences	7,237	703	2,032	82
Total – All Research	**88,466**	**14,786**	**66,280**	**5,491**
Areas of Research Strength				
Environment, Ecology & Sustainability	7,777	372	2,433	2,130
Fundamental & Enabling Sciences	8,401	553	2,491	0
Advanced Materials	6,353	931	1,665	453
Cellular & Molecular Biology & Biotechnology	7,529	462	3,015	91
Information & Communication Technologies	3,884	436	1,142	1,345
Disease, Medical Research & Medical Biotechnologies	18,821	4,328	25,490	111
Health, Disability & Ageing	4,723	1,321	6,952	0
Public Health & Health Services Research	13,362	4,532	15,122	139
Neuroscience	3,582	542	2,966	0
Nation, Citizenship & Culture	1,376	130	115	0
Work, Economics & Finance	1,220	87	203	0
History, Prehistory & Archaeology	1,469	34	263	0
Philosophy & Society	2,050	336	437	0
Veterinary Science	2,296	34	736	525
Total – Areas of Research Strength	**82,843**	**14,098**	**63,030**	**4,794**

NOTES ON DATA PROVIDED IN TABLE B2

[1] Research income and Categories 1, 2, 3 and 4 are defined in accordance with the DEST 2005 Higher Education Research Data Collection (HERDC).

Table B3 Research Active Staff in 2004

	Number of Research Active Staff[1]	Number of Staff who Generated Research Income[2]	Number of Staff who Generated Publications[3]	Number of Staff Eligible to Supervise HDR Students[4]	Number of Staff Supervising HDR Students[5]
All research – by research cluster					
Science & Technology	515	365	515	573	504
Health & Medical Research	426	409	426	632	355
Arts, Humanities & Social Sciences	451	132	451	609	471
Total – All Research	**1,392**	**906**	**1,392**	**1,814**	**1,330**
Areas of Research Strength					
Environment, Ecology & Sustainability	78	72	78	89	86
Fundamental & Enabling Sciences	106	81	106	125	94
Advanced Materials	60	46	60	62	53
Cellular & Molecular Biology & Biotechnology	63	52	63	70	58
Information & Communication Technologies	76	37	76	82	70
Disease, Medical Research & Medical Biotechnologies	187	187	187	221	159
Health, Disability & Ageing	43	40	43	52	41
Public Health & Health Services Research	168	126	168	260	131
Neuroscience	44	41	44	54	40
Nation, Citizenship & Culture	150	34	150	204	152
Work, Economics & Finance	116	47	116	141	93
History, Prehistory & Archaeology	37	25	37	46	43
Philosophy & Society	132	38	132	180	145
Veterinary Science	34	28	34	40	36
Total – Areas of Research Strength	**1,294**	**854**	**1,294**	**1,626**	**1,201**

NOTES ON DATA PROVIDED IN TABLE B3

[1] The definition of "research active staff" was adopted by the University Research Committee in April 2000 and reviewed in September 2003 and August 2004 (http://www.usyd.edu.au/su/reschols/research/active.htm).

[2] Defined in accordance with DEST HERDC 2005.

[3] These data are estimates based on the definition of research active staff of a minimum of one publication per annum over three years. Note that publications are defined in accordance with DEST HERDC 2005.

[4] Eligibility as defined in *Postgraduate Research Higher Degree Training Supervision at The University of Sydney* (http://www.usyd.edu.au/ab/policies/PG_Rsch_Hghr_Dgree_Train_Sprvsn.pdf).

[5] Excludes the 87 supervisors who are casual staff.

Table B4 Qualifications and Activity of Staff who Supervised HDR Students in 2004

	Number of Supervisors holding a Higher Degree Qualification[1]	Number of Supervisors who Undertook Formal Supervisor Training in 2004[2]	Number of Staff who have Supervised at least one HDR Student to Completion in 2004[3]
All research – by research cluster			
Science & Technology	473	27	214
Health & Medical Research	330	44	115
Arts, Humanities & Social Sciences	439	24	183
Total – All Research	**1,242**	**95**	**512**
Areas of Research Strength			
Environment, Ecology & Sustainability	82	4	32
Fundamental & Enabling Sciences	88	7	40
Advanced Materials	49	0	22
Cellular & Molecular Biology & Biotechnology	55	1	26
Information & Communication Technologies	67	1	28
Disease, Medical Research & Medical Biotechnologies	148	13	59
Health, Disability & Ageing	38	3	17
Public Health & Health Services Research	121	21	46
Neuroscience	38	2	15
Nation, Citizenship & Culture	135	6	57
Work, Economics & Finance	90	1	29
History, Prehistory & Archaeology	39	1	20
Philosophy & Society	138	13	61
Veterinary Science	34	6	9
Total – Areas of Research Strength	**1,122**	**79**	**461**

NOTES ON DATA PROVIDED IN TABLE B4

[1] Excludes the 87 supervisors who are casual staff.

[2] The Institute for Teaching and Learning runs a number of formal workshops and an on-line course for supervisor training and development. "Formal training" means, at minimum, attendance at one workshop and/or completion two or more of the six modules in the on-line course.

[3] "Completion" means that the students were eligible for the award of their higher degree by research.

Attachment A: Contacts and Further Information

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Attachment B: Institutional Research Strengths and Relevant Data

Area of Research Strength	Underlying Themes	Total Research Income 2004 ($'000)	Share (%)	Total HDR Student Completions 2004	Share (%)	Total HDR Student Load 2004	Share (%)	Total Number of Publications	Share (%)	Total Weighted Publication Score	Share (%)
SCIENCES & TECHNOLOGY											
Environment, Ecology & Sustainability	Environment, Ecology & Sustainability Environmental Remediation Marine & Coastal Ecology Ocean Science Maintenance of Biodiversity	12,712	7.3	29	4.8	139	5.0	251	5.0	179	5.0
nuFundamental & Enabling Sciences	Chemistry Physics, Astronomy & Astrophysics Mathematics Biology Geology	11,445	6.5	34	5.5	144	5.2	412	8.2	264	7.3
Advanced Materials	Materials Characterisation Materials Design & Manufacture Nanomaterials & Nanoscience Plastics & Polymers Biomaterials & Biocompatible Materials Ceramics	9,401	5.4	18	2.8	84	3.1	288	5.8	195	5.4
Cellular & Molecular Biology & Biotechnology	Cell Biology Molecular & Structural Biology Biotechnology Genomics Proteomics Bioinformatics	11,097	6.3	27	4.3	113	4.1	238	4.8	147	4.1
Information & Communication Technologies	Communications Technology Photonic Devices Robotics Optical & Non-Optical Communications High Performance Computing Networking	6,808	3.9	27	4.3	173	6.3	403	8.1	306	8.5
Veterinary Science	Animal Genetics & Reproduction Animal Nutrition & Food Safety Invasive Pests, Diseases & Biosecurity Veterinary Biotechnologies Clinical Veterinary Science Wildlife Conservation & Animal Welfare	3,591	2.1	9	1.5	68	2.5	62	1.2	42	1.2
Science & Technology Total		**55,055**	**31.5**	**143**	**23.2**	**722**	**26.1**	**1,654**	**33.1**	**1,133**	**31.5**

NB Totals might not add due to rounding.

Area of Research Strength	Underlying Themes	Total Research Income 2004 ($'000)	Share (%)	Total HDR Student Completions 2004	Share (%)	Total HDR Student Load 2004	Share (%)	Total Number of Publications	Share (%)	Total Weighted Publication Score	Share (%)
HEALTH & MEDICAL RESEARCH											
Disease, Medical Research & Medical Biotechnologies	Cancer Research Infectious Diseases Microbiology Immunology Responses Cardio-Respiratory Diseases Integrative Physiology	48,751	27.9	79	12.8	407	14.7	909	18.2	515	14.3
Health, Disability & Ageing	Ageing Disability Psychosocial Aspects of Health	12,996	7.4	29	4.7	118	4.3	165	3.3	99	2.8
Public Health & Health Services Research	Clinical Trials Public Health Policy & Practice Indigenous Health Rural & Regional Health International Health Service & Health Policies	33,156	18.9	88	14.2	300	10.9	633	12.7	384	10.7
Neuroscience	Neurological Diseases Psychiatric Disorders Neuroscience	7,091	4.1	26	4.1	93	3.4	200	4.0	122	3.4
Health & Medical Research Total		**101,993**	**58.3**	**222**	**35.9**	**918**	**33.2**	**1,908**	**38.2**	**1,120**	**31.1**

NB Totals might not add due to rounding.

Area of Research Strength	Underlying Themes	Total Research Income 2004 ($'000)	Share (%)	Total HDR Student Completions 2004	Share (%)	Total HDR Student Load 2004	Share (%)	Total Number of Publications	Share (%)	Total Weighted Publication Score	Share (%)
ARTS, HUMANITIES & SOCIAL SCIENCES											
Nation, Citizenship & Culture	National Identity Languages Literature Australian & Indigenous Culture The Regional Context Creative, Performing & Visual Arts	1,621	0.9	88	14.2	349	12.6	229	4.6	239	6.6
Work, Economics & Finance	Organisational Management Industrial Relations Government & Public Policy Regulatory Framework Securities & Financial Markets Economic Modelling Globalisation Transport Studies	1,509	0.9	34	5.5	124	4.5	210	4.2	178	5.0
History, Prehistory & Archaeology	Classical Archaeology Near Eastern Archaeology Prehistoric & Historical Archaeology History & Prehistory Indigenous History	1,767	1.0	24	3.9	106	3.8	117	2.3	141	3.9
Philosophy & Society	Social Work Social Policy Moral, Social & Political Philosophy Anthropology Law & the Legal Framework Education, Communication, Teaching & Learning	2,822	1.6	62	10.0	260	9.4	329	6.6	328	9.1
Arts, Humanities & Social Sciences Total		**7,719**	**4.4**	**207**	**33.5**	**839**	**30.3**	**885**	**17.7**	**886**	**24.6**
ALL AREAS OF RESEARCH STRENGTH		**164,767**	**94.1**	**572**	**92.6**	**2,479**	**89.6**	**4,446**	**89.0**	**3,139**	**87.3**
Total University Research Performance		**175,023**		**618**		**2,766**		**4,995**		**3,595**	

NB Totals might not add due to rounding.