MS RESEARCH IN AUSTRALIA

Resource Landscape Report

MS RESEARCH AUSTRALIA

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Created with generous support from the Macquarie Group Foundation

MS Research in Australia: Resource Landscape Report
MS Research Australia, Sydney.

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RESEARCH AUSTRALIA

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FOREWORD FROM PROFESSOR BILL CARROLL

As current Chairman of MS Research Australia's International Research Review Board, and chair of the MS Research Australia Research Management Council until 2014, I am pleased to introduce this valuable new resource document.

The MS research landscape across Australia is a vast and varied field, with real strengths across many research domains. This *MS Research in Australia: Resource Landscape Report* helps to crystallise the current academic field, and importantly, this living document will provide the basis to follow the growth of our national networks, facilities and infrastructure.

A document such as this plays a key role not only in bringing together in one place a collection of some of our nation's key resources, but perhaps more valuably, also highlights areas for growth and development. These will certainly assist in shaping the MS Research Australia priorities in the future, and we hope will also filter more broadly throughout other research strategy and funding bodies in Australia.

Professor Bill Carroll

Chair, MS Research Australia International Research Review Board

FOREWORD FROM DR MATTHEW MILES

The Australian MS research field is an internationally competitive and fast-growing arena. As the largest national organisation dedicated to funding and coordinating MS research in Australia, it is our priority to strengthen and expand the available Australian research resources and infrastructure. To this end, I am proud to introduce the *MS Research in Australia: Resource Landscape Report*.

We are building on the findings from our retrospective analysis in the *MS Research Australia: Research Audit 2004 – 2014,* and pursuing new avenues to advance the Australian MS research effort. This document represents a significant landmark for MS Research Australia and allows our organisation, and the MS research community generally, to take stock of the current resource landscape and identify priorities for future development. Our key focus going forward will be exploring how best to build on our strengths and fill the research gaps, to ensure Australian researchers can continue to make leaps and bounds towards fulfilling our shared mission: to understand the causes, develop better treatments, and ultimately find a cure for MS.

We are grateful to each of the researchers who gave their time to contribute to the compilation of this resource list, and to all those who dedicate their lives to researching MS. We would especially like to acknowledge the Macquarie Group Foundation for their generous support for the production of this valuable resource, which will be maintained as an online living document and continue to be updated alongside the changing research landscape.

Dr Matthew Miles

Chief Executive Officer, MS Research Australia

EXECUTIVE SUMMARY

The *MS Research in Australia: Resource Landscape Report* aims to provide key research enablers and researchers with the necessary knowledge of the current research landscape for multiple sclerosis (MS). This document was developed following a large strategic analysis of the MS Research Australia organisational objectives and goals via the Booz & Co. *MS Research Australia Strategy Review* in 2012.

To achieve outcomes targeting prevention, developing better treatments, and finding a cure for MS, a clear research strategy, a well-resourced research community, and clearly defined objectives are required.

In this pursuit, the *MS Research Australia Research Audit,* published in 2014, helped to identify key achievements and progress against the organisation's strategy since 2004. It also helped to define research priorities going forward. In order to maximise future progress into understanding MS, there is now a clear need to consolidate and 'map' the scope of the current MS research landscape to inform future development, not only for MS Research Australia but for the MS research community generally. The gaps and opportunities identified here, together with the Research Audit, and ongoing public consultation will each help to define the key strategic priorities for MS Research Australia in the future.

There is now a clear need to consolidate and 'map' the scope of the current MS research landscape to inform future priorities.

The Resource Landscape Report presents the results of a comprehensive review and surveying of stakeholders, to bring together current information relating to the academic MS research environment in Australia. First and foremost, this document is intended as a tool for researchers to reduce the fragmentation of knowledge of the tools, funding sources, and resources available to Australian researchers.

For real progress to occur, a clear scientific roadmap and a fully resourced scientific community must be present, with the necessary tools readily available to those who most urgently need them. These analyses also identify a range of key priority areas that will inform the research strategy of MS Research Australia over its second decade of existence.

This will remain a dynamic document that evolves alongside the resources and information. **Submissions or updates on available resources for inclusion in this document are welcomed via *enquiries@msra.org.au***

1 INTRODUCTION

One of the key challenges is not simply the provision of useful and effective resources, but ensuring that researchers are adequately informed.

The clinical landscape for multiple sclerosis (MS) has changed irrevocably over the past decade, as people affected by MS show increasingly better outlook and prognosis, and many more treatment options are available to prevent relapses and slow progression.

However, there is still much work to be done. Finding cure for MS remains a top priority driving research efforts. Improving options for those with progressive MS is also an international priority, and researchers are working together to share resources and accelerate discoveries.

MS Research Australia was established in 2004 with the goal to accelerate research into the cause, better treatments and prevention of MS, with the aim of ultimately finding a cure for MS. Since then, it has grown to become the largest national not-for-profit organisation dedicated to funding and coordinating MS research in Australia.

Through the generous support of individuals, organisations, state and federal governments, corporate entities, and many trusts and foundations, MS Research Australia has provided over $22 million in grant funding to over 170 research projects around Australia.

In recognition of the ten-year anniversary of the organisation, MS Research Australia recently published a Research Audit report highlighting the key achievements of the past decade that have arisen as a result of MS Research Australia funding.

The Research Audit findings have guided the development of a new strategic direction to further the mission of MS Research Australia. In order to maximise future progress into understanding MS, there is a clear need to consolidate and 'map' the scope of the current MS research landscape to inform future priorities.

For real progress to occur for people with MS, a clear scientific roadmap and a fully resourced scientific community must be present, with the necessary tools and expertise readily available to those who most urgently need them. One of the key challenges here is not simply the provision of useful and effective resources, but ensuring that researchers are adequately informed and equipped to access all relevant facilities.

Similarly, the gaps and opportunities identified will form priority targets for MS Research Australia, and other national funding bodies, in pursuing a strategic intent to support priority-driven research that aims to fill key knowledge gaps and bring the community closer to freedom from MS.

Purpose

The *MS Research in Australia: Resource Landscape Report* aims to provide key research enablers and researchers with the necessary knowledge of the current MS research landscape, by collating and clarifying the resources, infrastructure, and funding avenues currently available to academics, clinicians and allied health professionals working in the field of MS in Australia.

By providing an overview of the local MS research environment, this document aims to generate a comprehensive tool that will continue to evolve, via feedback from the Australasian MS research community, as new resources become available and new directions are forged.

1.1. Methodology

The information collated into this Resource Landscape Report reflects the most up-to-date information on the Australian MS research community and the resources available for their use, including infrastructure, funding avenues, and professional development.

In order to obtain this information, MS Research Australia has comprehensively collated the demographics of the cohort of individuals in the MS research community known to the organisation and included in its database. This includes a network of researchers, academics, clinicians and other health professionals. Individuals were identified to the organisation either as current or past grantees, by participation in conferences, events, collaborative projects, or research networks.

This document will provide an evolving reference tool of resources available to the MS research community

To gather detailed information about the research resources currently being utilised, electronic surveys were conducted of MS Research Australia affiliated researchers and health professionals. The survey was distributed to the entire MS research network. Respondents included past and current grantees as well as other researchers with an interest in MS. In total, the survey received 51 respondents from many domains of MS research. They provided a valuable and comprehensive insight into the MS research landscape. Survey responses were supplemented with manual searching for additional resources that may be relevant for application in MS research.

The scope of this overview is limited to those tools and resources available in the academic and non-commercial sectors. Resources from the commercial or pharmaceutical sectors are typically not publically listed or publically available for access.

Through comprehensive assessment of the current MS landscape, this document will provide an evolving reference tool that will facilitate greater engagement with the MS research community, promote maximum utilisation of all available MS research infrastructure, and encourage non-duplication of research facilities in development.

"The face of MS in Australia is changing rapidly. This is a complex field, and it is only by bringing all of our knowledge and resources together that we will see real progress made for people with MS. The MS Research in Australia: Resource Landscape Report is a vital tool to help us realise this goal."

– Professor Trevor Kilpatrick

Professor Kilpatrick is a Professor of Neurology and Director of the Centre for Neuroscience and the Melbourne Neuroscience Institute at The University of Melbourne. He is also a member of the MS Research Australia International Research Review Board.

2 THE MS RESEARCH COMMUNITY

MS researchers are geographically widespread, have a wide range of skills, and a large proportion of the community comprises established mid-career or senior academics

From analysis of the MS network in Australia, there are several key features that define the MS research community and have played an important role in the success of Australian MS researchers to date.

As a nation-wide cohort, MS researchers are geographically widespread, have multidisciplinary research interests and a wide range of skills, and a large proportion of the community comprises established mid-career or senior academics as well as clinician researchers. Research goals revolve around key themes for understanding MS, improving the lives of individuals living with the disease, preventing MS onset and progression, and reversing MS-related damage.

2.1. MS researchers and clinicians

The following section is based on information from comprehensive analysis of the MS Research Australia database to provide an overview of the researchers comprising the MS research community in Australia, in the context of their research focus, qualifications, and geographical distribution.

Qualifications

Within the MS Research Australia network of researchers, there is significant representation of mid-career researchers (post-doctoral researchers, senior lecturers) and senior academics (Associate Professor, Professor), with comparatively fewer undergraduate and post-graduate students (Figure 2.1). This may in part be a limitation of the dataset, as it will only capture students who have been in direct contact with MS Research Australia, for example by applying for funding or attending an event. Many students work on projects but are not named investigators on grant applications, so it is possible the number of students is under-estimated.

The research cohort also comprises a substantial number of neurologists along with many other health professionals including other types of specialist clinicians (immunologists, haematologists and psychiatrists), nurses, as well as other allied health practitioners such as physiotherapists and psychologists.

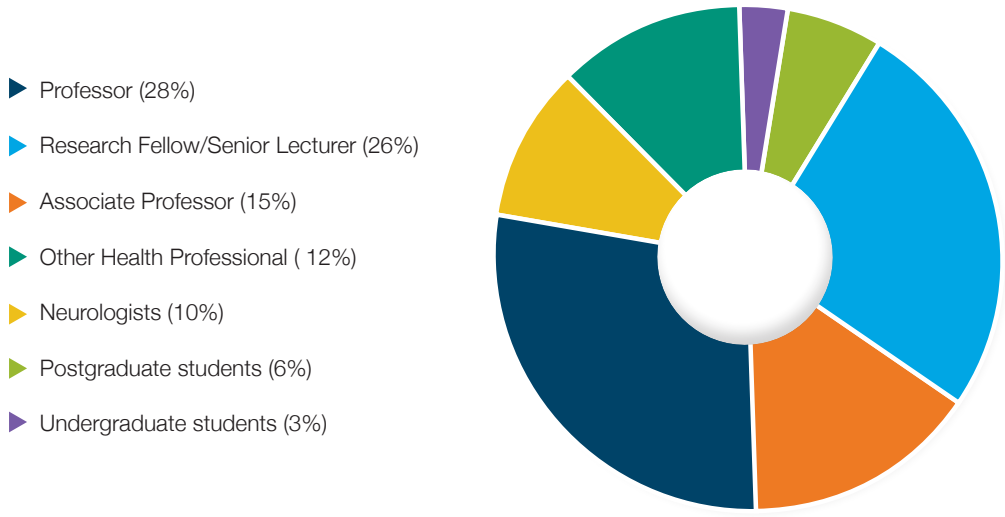


Figure 2.1 Australian MS researcher career stage

GAPS & OPPORTUNITIES

- Encourage early career research uptake and retention, potentially via new funding programs
- Create more opportunities for early career researchers and students to interact with the wider MS community via MS Research Australia

In addition to the individuals undertaking research shown in Figure 2.1, the MS Research Australia network also comprises many clinicians and health professionals who do not undertake research. The full cohort of both clinical and research-oriented individuals (shown in Figure 2.2, page 12) is comprised primarily of researchers, but also includes a number of students, neurologist-researchers, other clinician-researchers (immunologists and haematologists), and various other domains of health professionals.

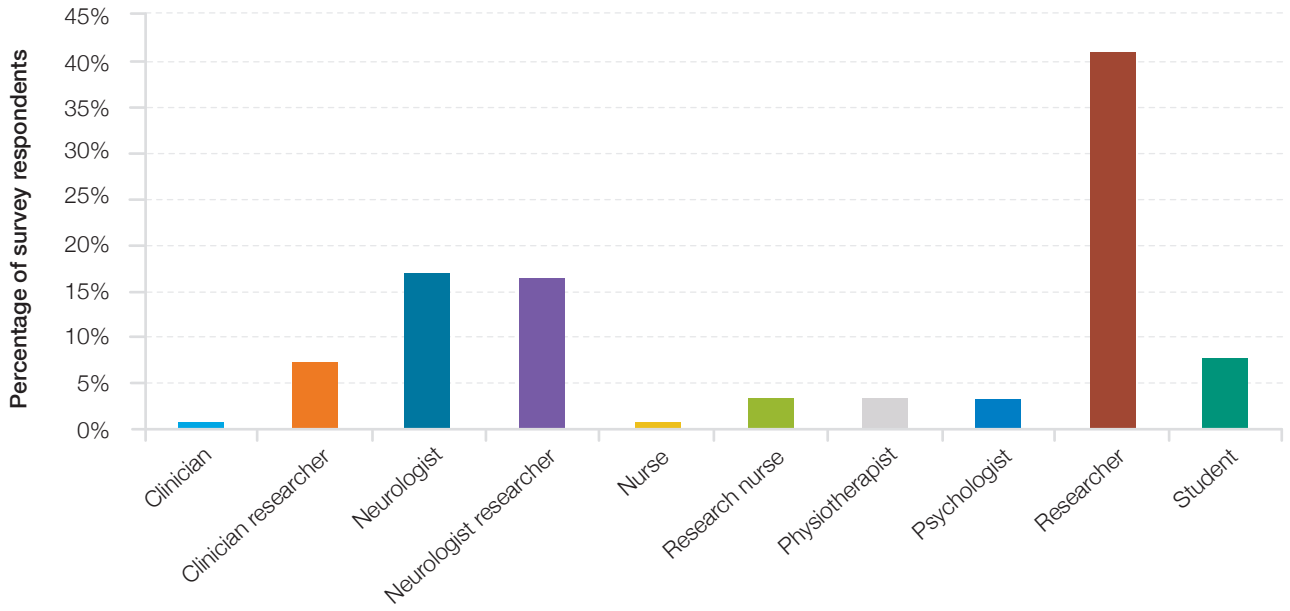


Figure 2.2 MS Research Australia network cohort

The overlap between the clinical and academic fields is substantial, and a real strength of the Australian MS cohort

The overlap between the clinical and academic fields is substantial, and a real strength of the Australian MS cohort (Figure 2.3). A large proportion of the cohort show overlapping clinical and research roles, such that one third of individuals fall into the 'overlap' category.

Figure 2.3 Overlap between clinical and academic domains

GAPS & OPPORTUNITIES

> Capitalise on the strong clinician/researcher 'overlap' to increase translational research via targeted fellowships, support for research time, and networking opportunities

Location

The MS Research Australia research cohort shows a strong representation of New South Wales and Victorian researchers (Figure 2.4). Smaller numbers of researchers are based in Queensland, South Australia, ACT, Western Australia, and Tasmania, which each have comparatively smaller population size, though each of these locations contains at least one or more key MS research hubs.

The primarily Australian-focused MS Research Australia network does not systematically collect international members, and this is reflected in the small proportion of New Zealand researchers represented, however, New Zealand contains a strong contingent of clinician-researchers with a key focus in MS, many of whom are actively involved in MS Research Australia collaborative research platforms.

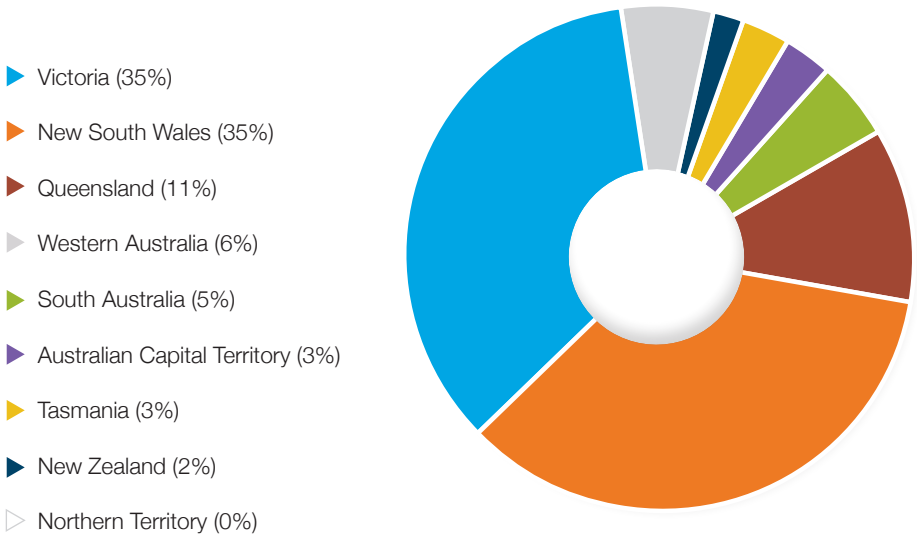


Figure 2.4 Geographical spread of MS researchers

Institute type

Researchers in the MS Research Australia database are located within a range of organisations, including universities, medical research institutes, and hospitals or other health services (Figure 2.5). This figure illustrates the individuals' primary affiliation, noting that many researchers, particularly those in a clinical-academic role, will have affiliations with both a university and a health service.

Of these, a very large range of organisations are represented, including 31 universities and 21 medical research institutes from around the country. Figure 2.6 outlines those institutes containing the largest representation of individuals in the MS Research Australia network. The full list of institutes is shown in Table 2.1.

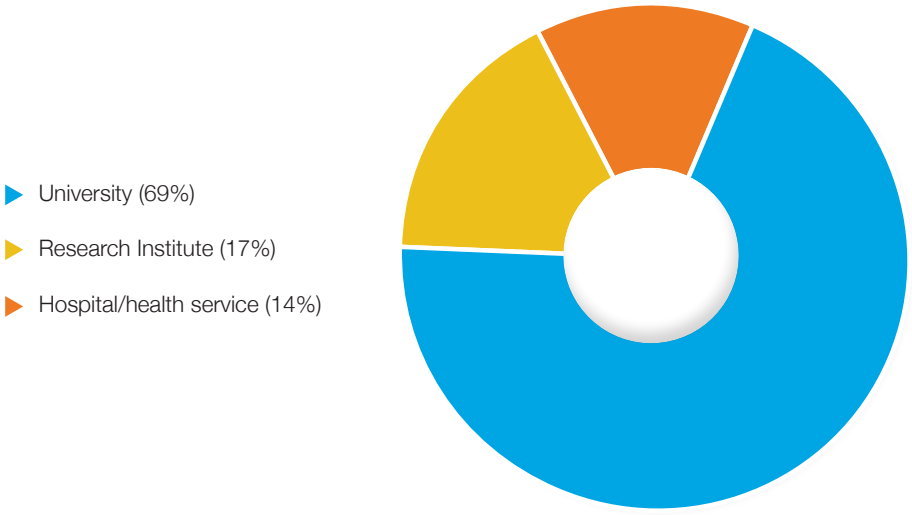


Figure 2.5 Types of organisation represented in the MS Research Australia database

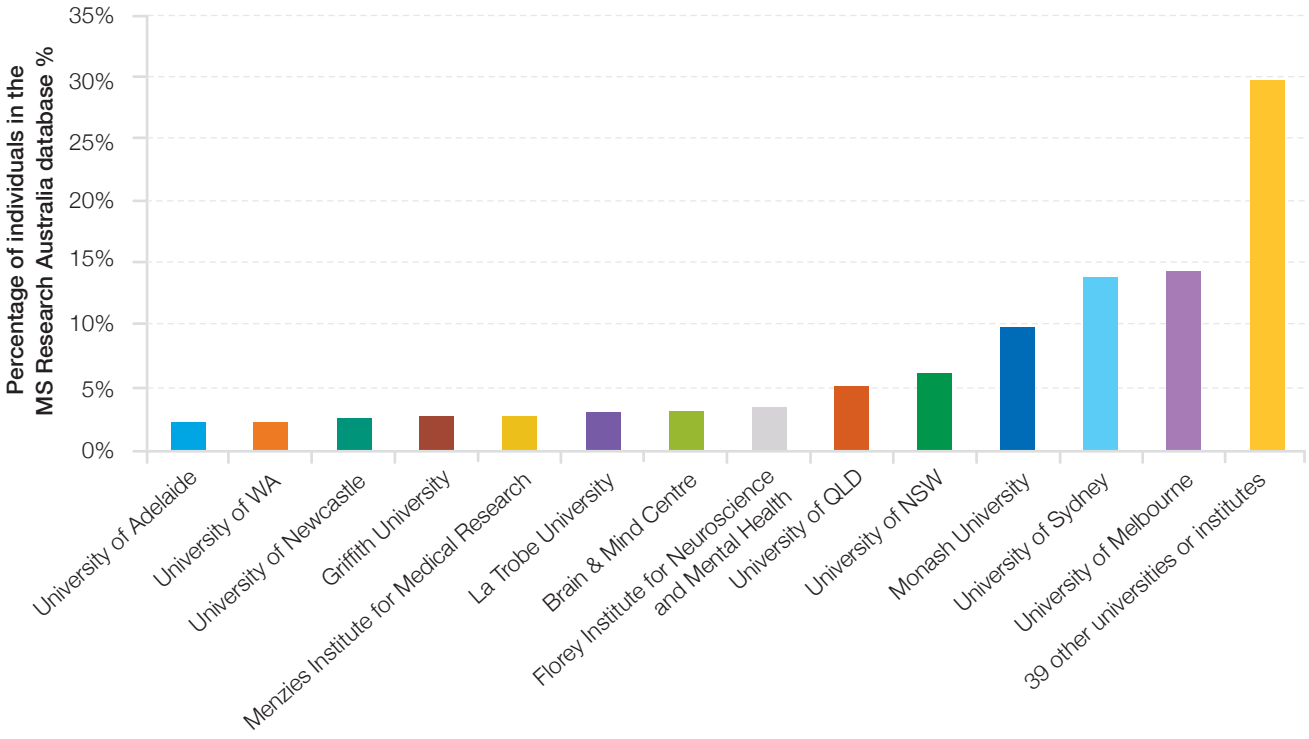


Figure 2.6 Key universities and institutes represented and percentage of individuals in the MS Research Australia database

TABLE 2.1 Universities and institutes in the MS Research Australia network	
Australian Catholic University, NSW	Murdoch University, WA
Australian College of Applied Psychology, VIC	Neuroscience Research Australia, NSW
Australian National University, ACT	Queensland Brain Institute, QLD
Baker IDI Institute, VIC	Queensland Institute for Medical Research, QLD
Brain and Mind Centre, NSW	Queensland University of Technology, QLD
Bond University, QLD	RMIT University, VIC
Burnet Institute, VIC	Swinburne University, VIC
Centenary Institute, NSW	Telethon Kids Research Institute, WA
Charles Sturt University, NSW	University of Adelaide, SA
Children's Medical Research Institute, NSW	University of Melbourne, VIC
Curtin University, WA	University of Newcastle, NSW
Deakin University, VIC	University of New England, NSW
Edith Cowan University, WA	University of NSW, NSW
Flinders University, SA	University of Sydney, NSW
Florey Institute for Neuroscience and Mental Health, VIC	University of South Australia, SA
Garvan Institute, NSW	University of Tasmania, TAS
George Institute, NSW	University of Technology Sydney, NSW
Griffith University, QLD	University of QLD, QLD
Hunter Medical Research Institute, NSW	University of Western Australia, WA
James Cook University, QLD	University of Western Sydney, NSW
Kids Research Institute, NSW	University of Wollongong, NSW
La Trobe University, VIC	Victoria University, VIC
Macquarie University, NSW	Walter and Eliza Hall Institute, VIC
Menzies Institute for Medical Research, TAS	Wesley Research Institute, QLD
Monash University, VIC	Western Australia Neuroscience Research Institute, WA
Murdoch Children's Research Institute, VIC	Westmead Millennium Institute, NSW

2.2. Research focus in Australia

The following sections outline the results of surveys of the MS research community in Australia (survey methodology detailed in section 1.1, page 8). From these surveys, several key domains of research focus were most commonly identified by the research community.

Research focus into MS is necessarily multi-disciplinary, and driven towards producing specific outcomes for people with MS

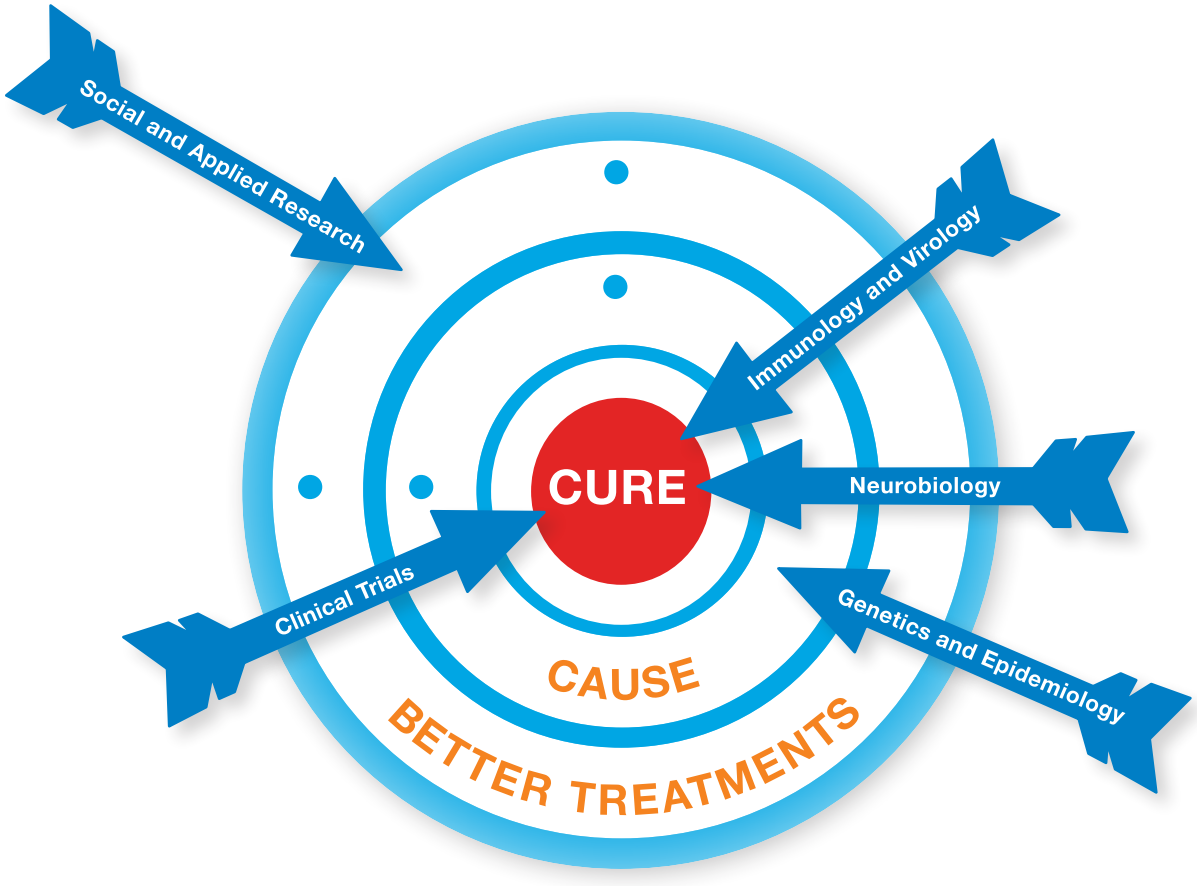
There was a spread of research effort across a range of healthcare priorities including prevention, treatments, and cure for MS. Research focus into MS is necessarily multi-disciplinary to understand the fundamental biology underlying the immunological and neurological dysfunction in MS, while also being driven towards producing specific outcomes for people with MS.

Research categories

Researchers from different disciplines are engaged in one or more fields of MS research, with the majority of survey respondents falling within key domains of genetics & epidemiology, immunology, neurobiology, and social & applied faculties (Figure 2.7). Social and applied research aims to understand the social, economic, and quality of life effects of MS, and encompasses a wide range of research including allied health and rehabilitation, psychology and cognition, health economics, and many other applied research domains.

A smaller proportion of researchers reported working within other research fields, including bioinformatics and computer science, and radiology and imaging techniques.

Crucially, a number of researchers also reported an interest in studying other diseases in addition to MS, which provides an invaluable cross-fertilisation of expertise, knowledge, and translation of research discoveries, ensuring the MS research field is at the cutting edge of emerging technologies (Figure 2.8).



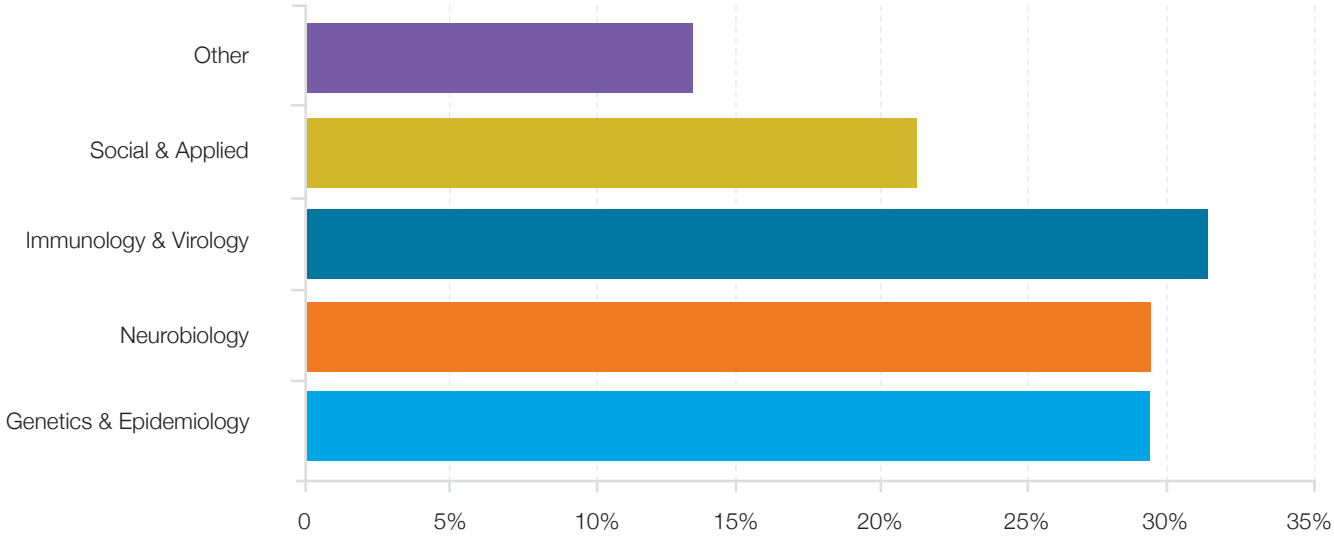


Figure 2.7 Key disciplines of MS research in Australia

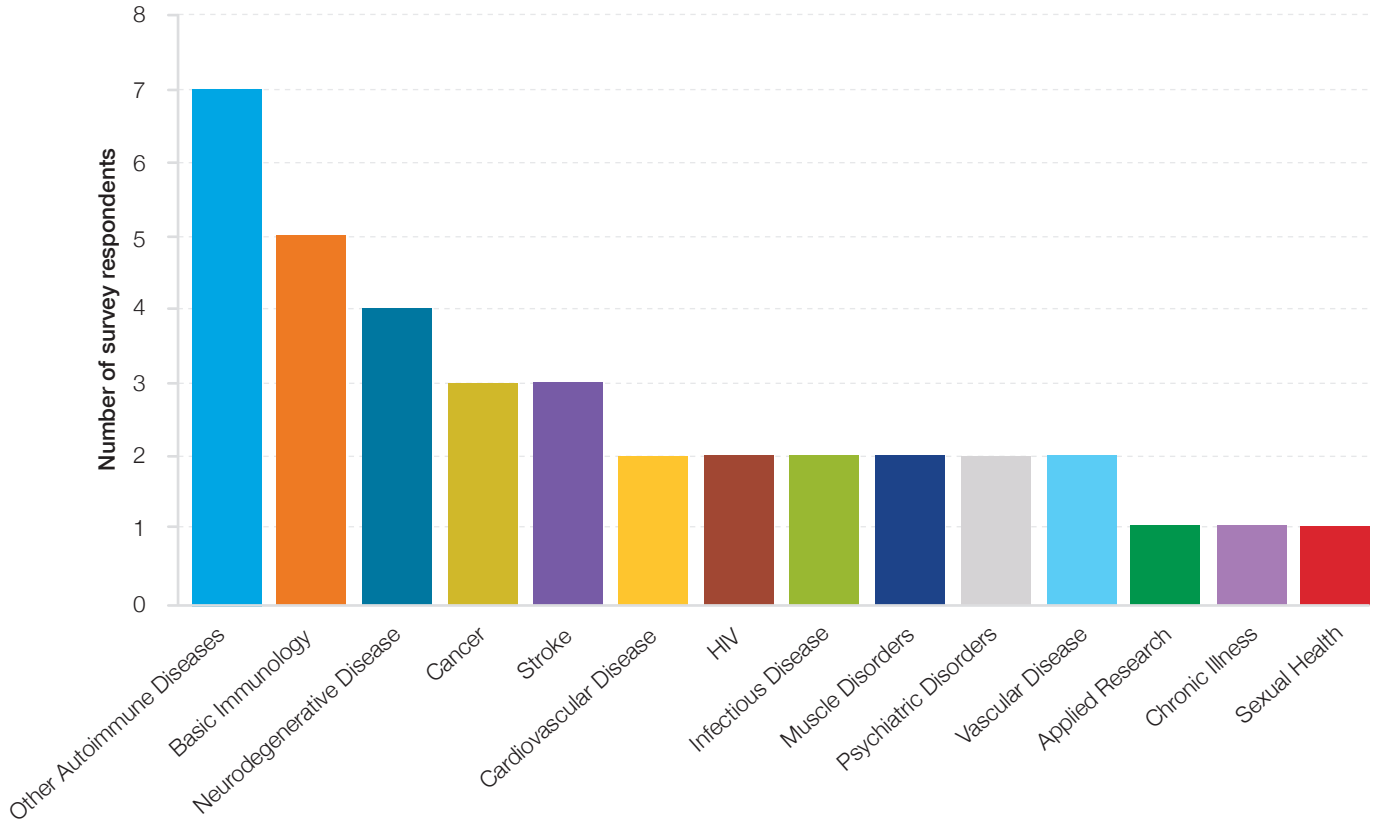


Figure 2.8 Diverse expertise of MS researchers across disease boundaries

Research goals

The majority of researchers are working to develop better treatments for MS (Figure 2.9). This category encompasses both the study of new biomedical treatment options as well as social & applied or allied health interventions for understanding and improving the lives of people with MS, which significantly broadens the range of researchers involved.

Research into triggers for MS and prevention of MS were also highly represented, followed by research into a cure for MS and other domains of research.

These research avenues, in particular the category of 'cure-driven' research, will have some degree of inevitable overlap. For example, research identifying triggers for MS or better treatments for MS could plausibly identify a solution that results in a cure for MS. For this reason, it is important that MS research investment is suitably diversified across a variety of different domains.

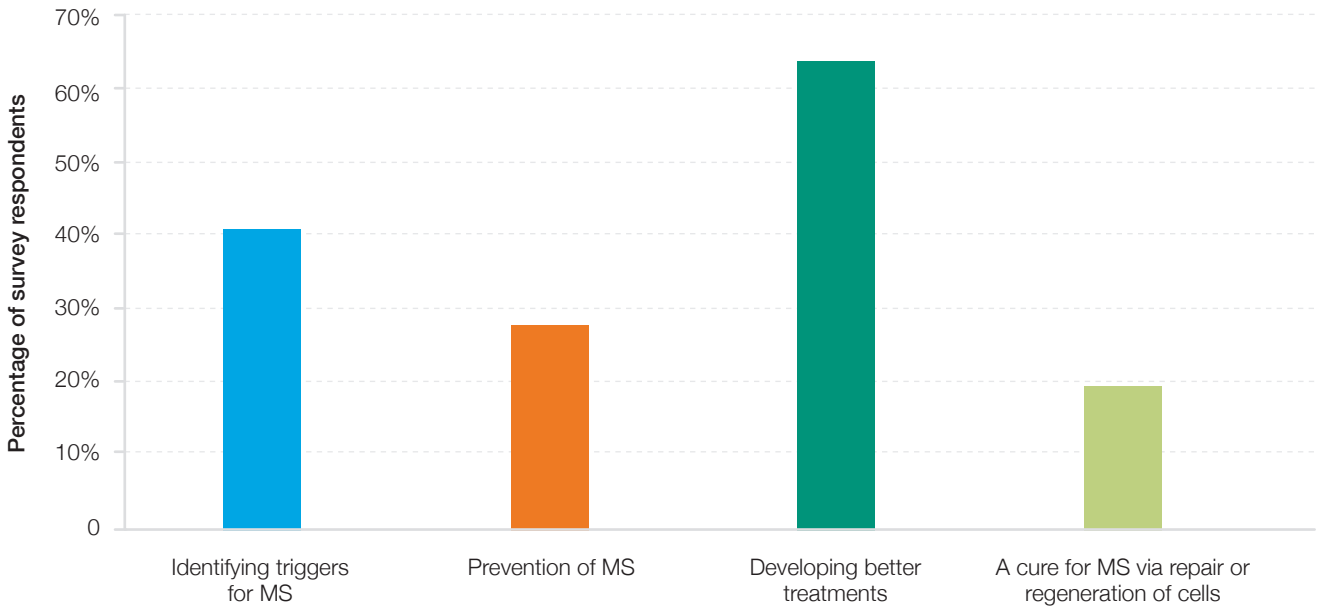


Figure 2.9 Research goals of MS researchers

Types of MS

The majority of researchers reported a primary focus on relapsing-remitting MS, however, in line with key international priorities and the recent engagement of MS Research Australia with the International Progressive MS Alliance, it is encouraging to note a high proportion of researchers also reporting focus on subtypes of progressive MS (Figure 2.10).

Other focuses of clinical application included the pre-MS Clinically Isolated Syndrome, other demyelinating disorders that are MS-related such as optic neuritis, and non-human models of MS.

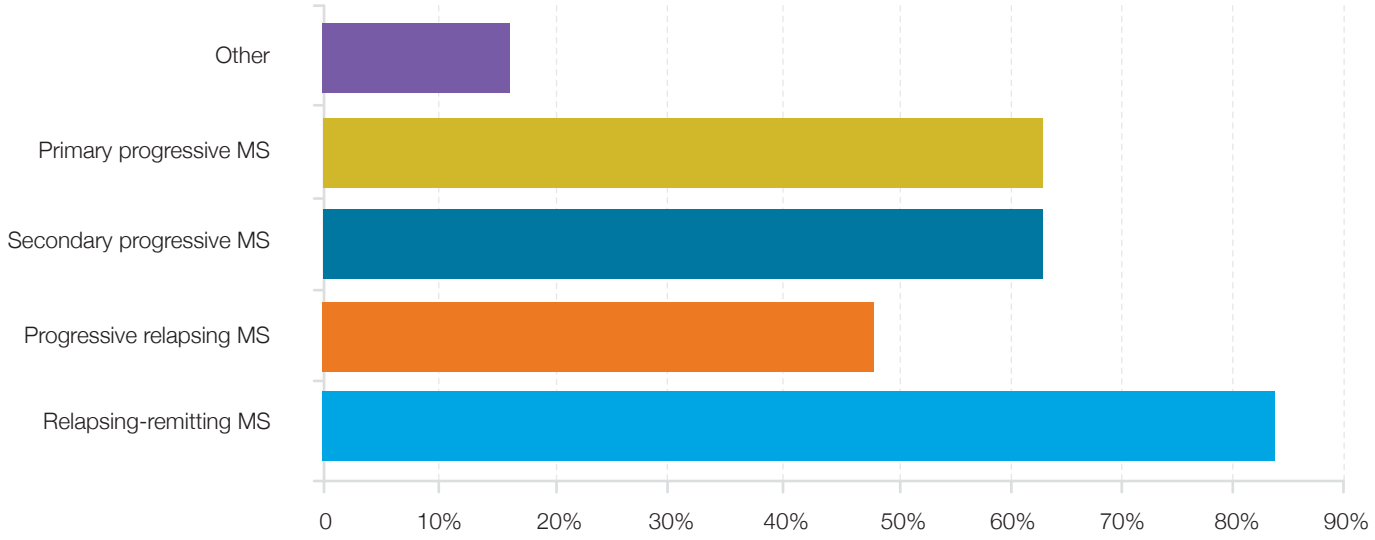


Figure 2.10 Types of MS studied by Australian researchers

GAPS & OPPORTUNITIES

- Opportunities for cross-disciplinary or cross-disorder networking and collaboration
- Encourage coordination and collaboration on research for progressive forms of MS, especially with increased international engagement

3 BUILDING AND SHARING RESEARCH NETWORKS

3.1. Current MS network utilisation

Professional memberships

The Australian MS community shows very high engagement in professional societies and professional development groups (Figure 3.1). This is of crucial importance to ensure effective engagement with the research and clinical community, to foster opportunities for collaboration both inside and outside a researcher's own discipline, and to reflect on progress being made in the national and international research arenas.

Mentorship

A comparatively smaller proportion of researchers, around two-thirds, take part in mentoring programs - as either the mentor or the mentee (Figure 3.2).

Mentorship is an invaluable means for building capacity in the next generation of researchers and clinicians, support engagement in a career trajectory, and ensuring knowledge transfer and expansion. The survey results highlight a range of levels of mentorship exist including undergraduate, postgraduate, and professional training opportunities (Figure 3.3).

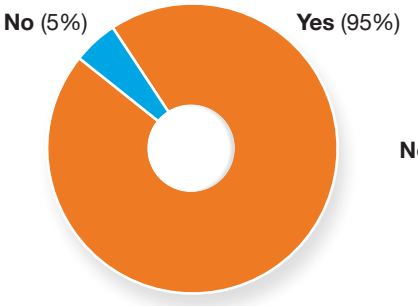


Figure 3.1 Percentage of survey respondents reporting at least one professional membership

Figure 3.2 Percentage of survey respondents who have participated in mentoring or supervisory roles

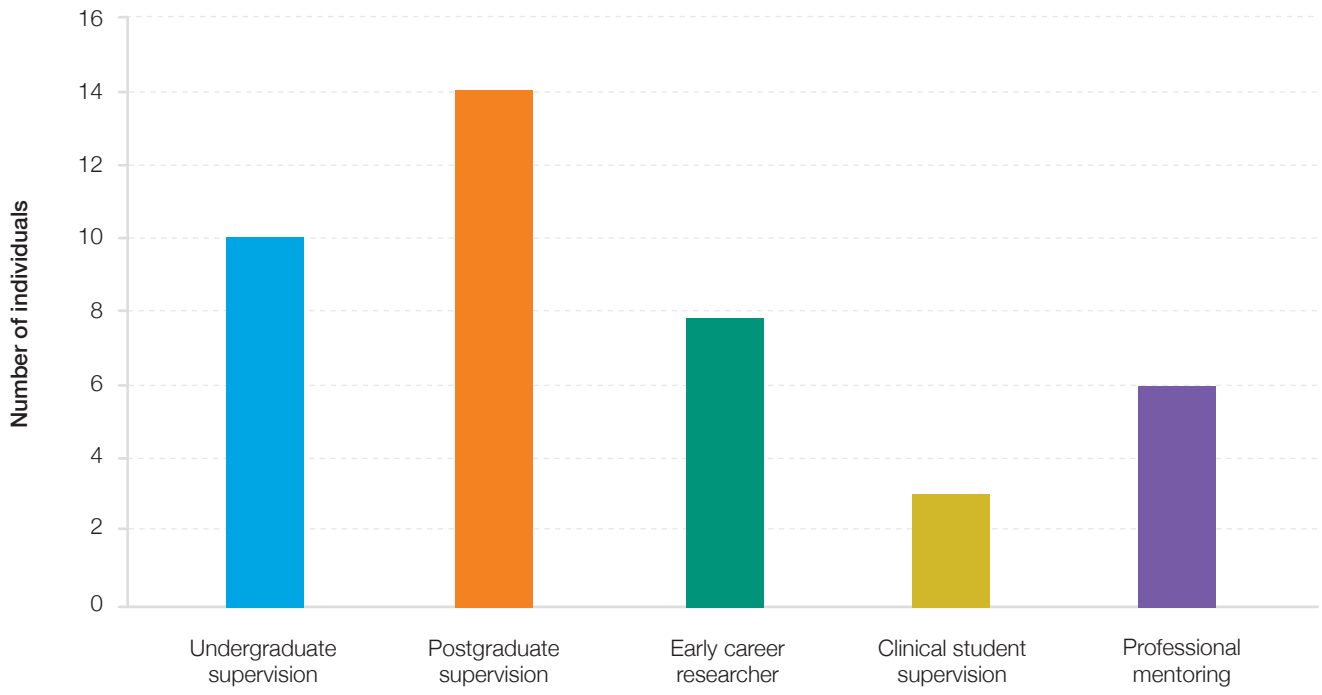
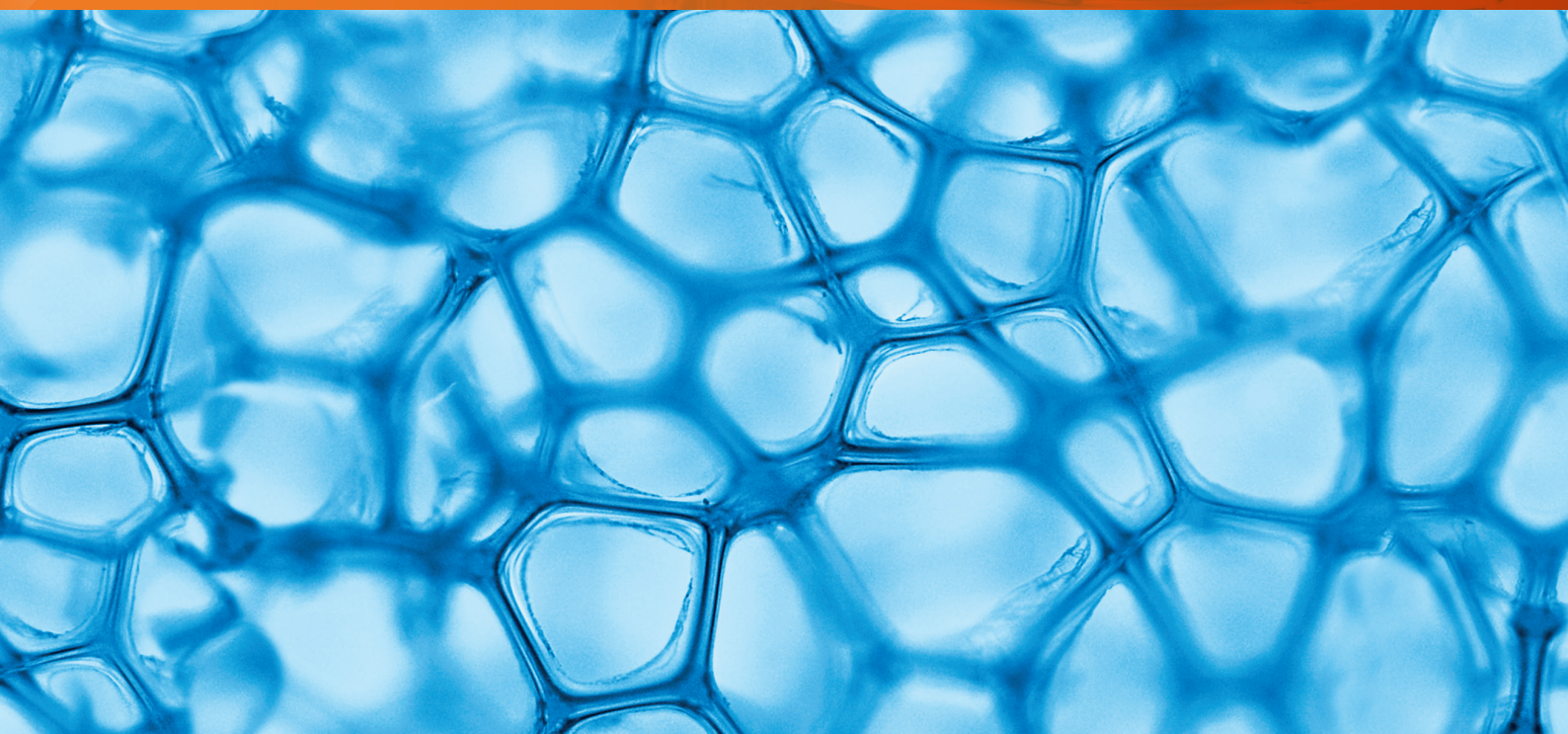


Figure 3.3 Number of survey respondents reporting different types of mentorship roles

GAPS & OPPORTUNITIES

> Opportunities for formalised mentorship of early-career and mid-career researchers

> Specific opportunities for cross-disciplinary mentorship to encourage research translation and learning from the other research fields



Collaborations

International collaborations are important for Australian and New Zealand researchers to share knowledge and build capacity

Collaborators both within and outside of the MS field are vital for the field as a whole to make greater progress than any individual researcher can achieve alone. The surveys identified that 57% of respondents have collaborations within Australia, while around 40% report international collaborators, and 38% report collaborations with researchers outside the MS field (Figure 3.4).

In particular, international collaborations are especially important for Australian and New Zealand researchers not only to share knowledge and build capacity, but also to avoid duplication of international efforts, and to bring novel techniques from other fields and apply them to MS.

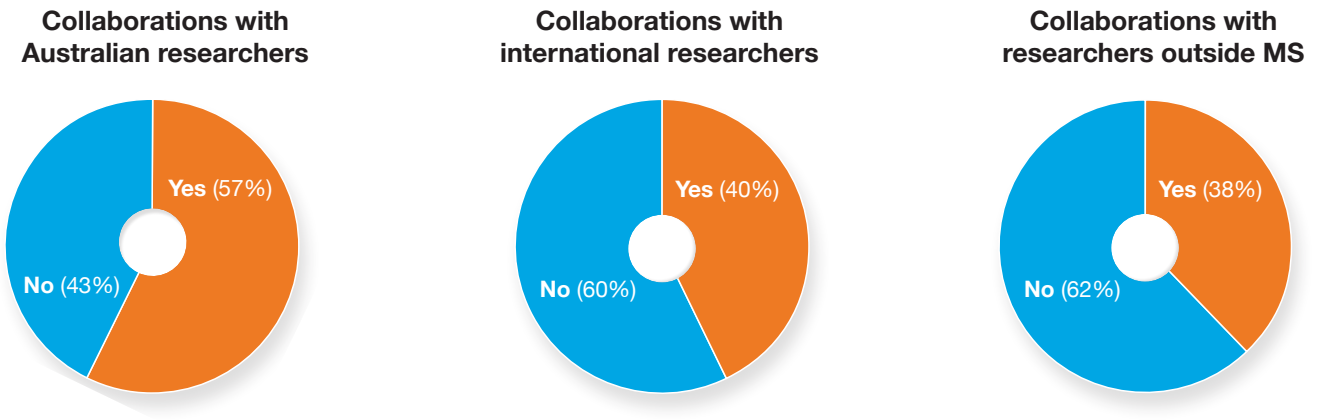


Figure 3.4 Local and international collaborations reported by the survey respondents

GAPS & OPPORTUNITIES

> Generating opportunities to formalise and incentivise international cross-disciplinary collaboration. For example, the International Progressive MS Alliance grants, and collaborations between organisations such as MS Research Australia and JDRF.

3.2. Professional societies relevant to MS

A number of professional societies are available to researchers and clinicians in Australia & New Zealand with an interest in MS. For a membership fee, these offer regular conferences and other membership benefits.

This summary presents an overview of currently available societies, but is not an exhaustive list. Submissions are welcome for additional networks to add to this list.

TABLE 3.1. Professional societies relevant to MS in Australia and internationally

Name	Focus
Asian-Pacific Society for Neurochemistry www.apsneurochem.org	The purpose of APSN is to promote research in neurochemistry via communication between members.
Australasian Neuroscience Society www.ans.org.au	The ANS facilitates the dissemination of information pertaining to neuroscience.
Australasian Proteomics Society www.australasianproteomics.org.au	APS promotes proteomics research in Australia and New Zealand.
Australasian Society for Immunology www.immunology.org.au	The aim of ASI is to encourage and support the discipline of immunology in the Australasian region.
Australian and New Zealand Association of Neurologists www.anzan.org.au	ANZAN aims to support the knowledge sharing and development of neurologists.
Australian and New Zealand Falls Prevention Society www.anzfallsprevention.org	ANZFPS promotes the multidisciplinary study and implementation of falls prevention in older people via communication and conferences.
Australian and New Zealand Society of Biomechanics www.anzsb.asn.au	The ANZSB aims to facilitate communication amongst those actively engaged in the scientific study and application of biomechanics.
Australian and New Zealand Society for Magnetic Resonance www.anzmag.com.au	ANZMAG supports the science of magnetic resonance in Australia and New Zealand.
Australasian Epidemiological Association www.aea.asn.au	The AEA facilitates the dissemination of information pertaining to epidemiology.
Australian Physiotherapy Association www.physiotherapy.asn.au	The APA is the peak body representing the interests of Australian physiotherapists and their patients.
Australian Psychological Society + special interest groups www.psychology.org.au	The APS is the largest professional association for psychologists in Australia, and also facilitates special interest groups for psychology specialties.
Australian Society for Biochemistry and Molecular Biology www.asbmb.org.au	The ASBMB fosters research, teaching and industry in Biochemistry and Molecular Biology through communication and conferences.
Australian Society for Medical Research www.asmr.org.au	The ASMR is the peak professional society representing Australian health and medical research.
Consortium of MS Centers (US-based) www.mscare.org	CMSC provides clinical education, knowledge sharing, and influences health care delivery for MS health providers around the world.

TABLE 3.1. continued. Professional societies relevant to MS in Australia and internationally

Name	Focus
Federation of Clinical Immunology Societies www.focisnet.org	FOCIS aims to foster interdisciplinary approaches to both understand and treat immune-based diseases.
Human Genetics Society of Australasia www.hgsa.org.au	The HGSA aims to provide a forum for the various disciplines collected under the title of Human Genetics.
Molecular and Experimental Pathology Society of Australasia www.mepsa.org	MEPSA aims to bring together researchers who are interested in the molecular and cellular basis of disease, promoting scientific exchange and collaboration.
MS Nurses Australasia www.msnainc.com.au	Professional society supporting health professionals with specific interest in MS.
National Disability Services www.nds.org.au	The NDS offers a Research Affiliate membership, providing networking and professional development opportunities.
Neuroimmunology Australia www.neuroimmunologyaustralia.com	Neuroimmunology Australia supports research and clinical practice for immune-mediated diseases of the central nervous system
Neuro-ophthalmology Society of Australia www.nosa.org.au	The NOSA aims to provide a meeting place for clinicians and scientific workers in the field of neuro-ophthalmology.
Pan-Asian Committee for Treatment and Research In Multiple Sclerosis www.pactrims.org	PACTRIMS is the Pan-Asian arm of ECTRIMS/ACTRIMS, and supports knowledge sharing and development of clinicians and researchers with an interest in MS.
Public Health Association of Australia www.phaa.net.au	The PHAA is an organisation dedicated to the promotion of public health. It is a forum through which members can develop professional and academic networks.
Rehabilitation in Multiple Sclerosis www.eurims.org	The RIMS network advocates best practice and research for evidence-based MS rehabilitation.
Rehabilitation Medicine Society of Australia and New Zealand www.rmsanz.net	RMSANZ aims to support rehabilitation physicians, facilitate collaboration and professional development, and advocate for patients.

3.3. Available networks and professional forums

A number of research and clinical networks and professional forums are available for the development and training of the MS research community. These networks are generally free to join and are dedicated to encouraging collaboration and communication, offering members the opportunity to connect and engage with other researchers or clinicians who share similar interests.

This summary presents an overview of currently available networks, but is not an exhaustive list. Submissions are welcome for additional networks to add to this list.

TABLE 3.2. Networks and professional forums for MS researchers and clinicians

Name	Focus
Australian and New Zealand MS Genetics Consortium (ANZgene)	Consortium of researchers and clinicians sharing data and resources to study MS genetics.
Australian Paediatric Research Network	Involves clinicians in research activities and enhances recruitment for community-based paediatric research projects.
Autoimmunity Network	International network of physicians, immunologists, rheumatologists and researchers sharing knowledge.
International MS Genetics Consortium	Increasing collaboration between genetics researchers worldwide, encouraging sharing of data and expertise.
International Paediatric MS Study Group	Aims to support international collaboration and communication among paediatric researchers.
MS Discovery Forum	An international online community and information portal that aims to inspire connections and clinical advances.
MS Health Professionals Network Victoria	Affiliate of MS Nurses Australasia, provides support and education to health professionals offering care and services.
MS Research Australia Clinical Trials Network	Supports both industry sponsored and investigator-led trials and encourages clinical trial engagement and recruitment.
NSW Falls Prevention Network	Supports collaboration and communication among falls & balance researchers.
NSW MS Research Network	Fostering collaboration and knowledge sharing among NSW MS researchers and clinician-researchers.
NSW Stem Cell Network	Supports collaboration and communication among stem cell researchers.
Paediatric Trials Network Australia	Supports collaboration and communication among paediatric clinical trials researchers.

Australian and New Zealand MS Genetics Consortium

www.msra.org.au/anzgene

ANZgene is a research consortium dedicated to furthering progress into understanding the genetics of MS. Members include researchers and clinicians from fields of neurology, geneticists, bioinformaticians and molecular biologists. Membership is via collaboration.

Australian Paediatric Research Network

www.aprn.org.au

The Australian Paediatric Research Network is a network of Australian general paediatricians to encourage new research relevant to both public and private practice, building research capacity by involving more clinicians in research activities and enhancing recruitment for community-based research projects. All Australian paediatricians are eligible to join the APRN. Membership is free.

Autoimmunity Network

www.autoimmunity-network.com

The Autoimmunity Network is a community of physicians, immunologists, rheumatologists & researchers who share the common goal of exchanging knowledge about autoimmune diseases. The network facilitates annual congresses, and members can network via online forums. Membership is by application.

International MS Genetics Consortium

eaglep.case.edu/imsgc_web

The International MS Genetics Consortium is a worldwide network of genetics researchers dedicated to furthering understanding of MS genetics. Through a network of data and expertise sharing, the IMSGC has facilitated major breakthroughs in MS gene associations. The Consortium initiates collaborative projects to fill areas of need, but are also open to collaboration on investigator-driven research. Membership is by application.

International Paediatric MS Study Group

www.ipmssg.org

The goal of the IPMSSG is to foster opportunities for collaboration to enhance understanding of the care of children and adolescents with paediatric MS and related disorders, and to maximise international participation in activities of the group. Membership is by application.

MS Discovery Forum

www.msdiscovery.org

The Multiple Sclerosis Discovery Forum (MSDF) is an international online community that aims to accelerate progress toward cures for MS. It provides an online networking resource and information portal that aims to inspire connections and clinical advances. MSDF hosts forums and discussions, and provides news, information and research resources. Access is free and open to all visitors.

MS Health Professionals Network (Victoria)

An affiliate of MS Nurses Australasia Inc, the purpose of this association is to deliver support, education, and professional development to health professionals who are providing care and services for people with MS. The association offers peer support to its members, and dissemination of information between interested health professionals and organisations. Membership is open to any qualified health professional with an interest in MS.

MS Research Australia Clinical Trials Network

www.mstrials.org.au

Facilitated by MS Research Australia via a grant from the NSW Office of Health and Medical Research, the Clinical Trials Network aims to facilitate MS clinical trials activity in Australia, with specific goals to increase the number of clinical trial sites in Australia, and improve access to new treatments for Australians with MS. The Network provides communications, assistance and information to stakeholders including people with MS, neurologists, doctors, researchers and pharmaceutical companies. Network membership is open to clinicians and clinical researchers with an interest in MS.

New South Wales Falls Prevention Network

fallsnetwork.neura.edu.au

The NSW Falls Prevention Network is a professional community aiming to share knowledge, expertise, and resources on falls injury prevention for older people. They provide expertise that may also be relevant for research into falls in people with compromised mobility. Membership is open to NSW-based researchers and clinicians with an interest in falls prevention.

New South Wales MS Research Network

Managed by MS Research Australia via a grant from the NSW Office of Health and Medical Research, the NSW MS Research Network aims to boost local MS research by increasing the number and quality of MS research projects and funding for research in NSW, and increasing the collaborative research between the MS research centres in NSW. Membership is open to NSW-based researchers (from all fields of research) and clinicians with an interest in MS.

New South Wales Stem Cell Network

www.stemcellnetwork.org.au

The NSW Stem Cell Network is a professional community with an interest in both adult and embryonic stem cells. The NSW Stem Cell Network receives financial support from the NSW Office for Health and Medical Research, and infrastructure support from Diabetes New South Wales. Membership is open to NSW-based researchers and clinicians with an interest in stem cell research.

Paediatric Trials Network Australia

www.ptna.com.au

The Paediatric Trials Network Australia is a professional community aiming to increase the quality and quantity of paediatric research in Australia. Membership is open to Australian researchers or organisations with an interest in paediatric research.

GAPS & OPPORTUNITIES

- Encouraging more active engagement of researchers within the networks and professional mentorship opportunities.
- Develop professional networking opportunities for MS researchers and health professionals in Queensland, Western Australia, South Australia, and Tasmania. Expand researcher network in Victoria.
- Expand NSW MS research network to increase engagement of health professionals (nurses, allied health) & clinicians.

4 FUNDING AVENUES TO SUPPORT MS RESEARCH

4.1. Funding options currently being utilised

Government funding

Government funding, particularly federal government funding, is the most common means for researchers to obtain financial support for both their research projects and salaries (Figure 4.1). The primary source of funding for survey respondents was the National Health and Medical Research Council (Figure 4.2), with additional funding sources including the Australian Research Council and state and federal Health or Medical Research departments.

Figure 4.1 Percentage of survey respondents who receive government funding

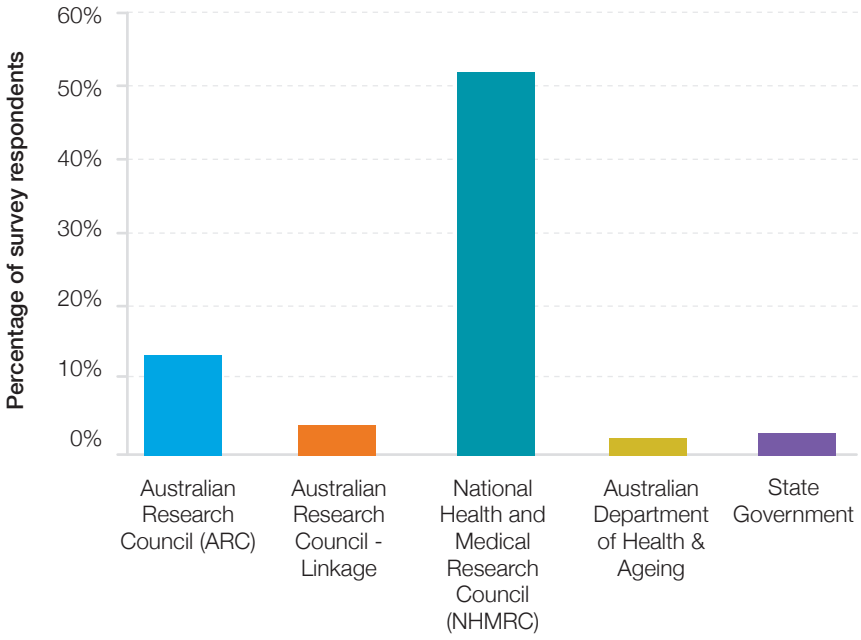


Figure 4.2 Current sources of government funding

Private or philathropic funding

Private or philathropic funding sources, including not-for-profit organisations, individual donors or trusts and foundations, provide a smaller proportion of funding for medical research (Figure 4.3).

Just over one-third (36%) of survey respondents indicated they were currently receiving funding support from private funding sources including their own institute, from MS Research Australia granting schemes, or from other not-for-profit institutes. Of these, Figure 4.4 outlines the proportion of individuals who access these different funding options.

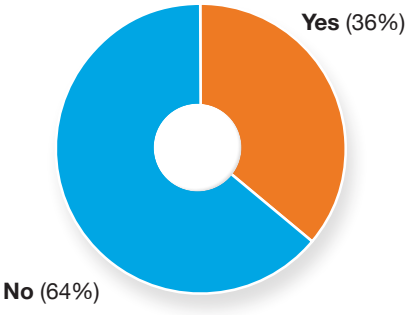


Figure 4.3 Percentage of survey respondents receiving philanthropic funding

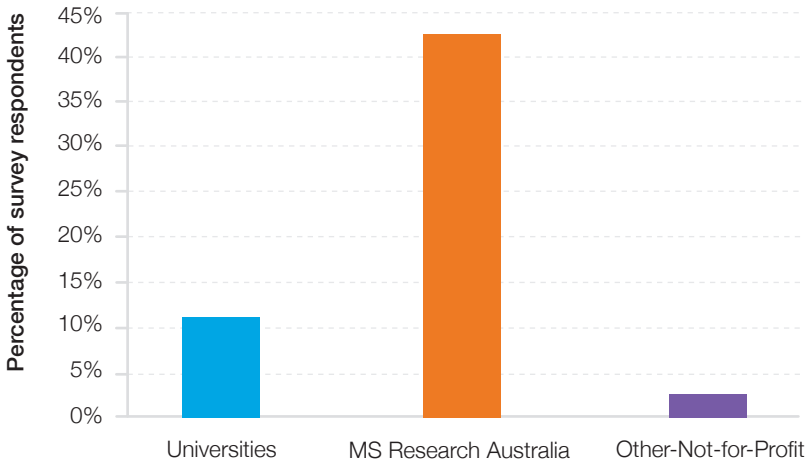


Figure 4.4 Current sources of philanthropic funding

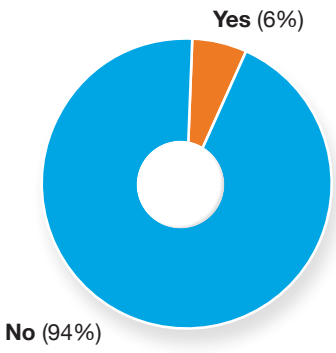


Figure 4.5 Percentage of survey respondents receiving international funding

International funding

Few survey respondents indicated they are receiving international funding support (Figure 4.5). The current grants were primarily USA-based and included the US National Institute for Health and the US National MS Society. This is a key area for development, as there are several international funding opportunities open for Australian and New Zealand researchers.

Commercial funding

Commercial funding sources were uncommon, and primarily originated from pharmaceutical support of clinical trial research, and honorariums for researcher engagement (Figure 4.6). This support is typically not available via a competitive application process, but is generally provided to support specific research activities.

Industry partnerships in research were similarly uncommon, and reported by only 15% of respondents. Some survey respondents reported partnerships with pharmaceutical companies or contract research organisations facilitating MS-relevant clinical trials (Figure 4.7). Other respondents reported interaction with biotechnology companies and medical device development, for research in earlier phases of development prior to the clinical trial phase. For several basic and pre-clinical researchers, industry partnerships also included translational collaborations with patient-facing organisations such as health services and clinics.

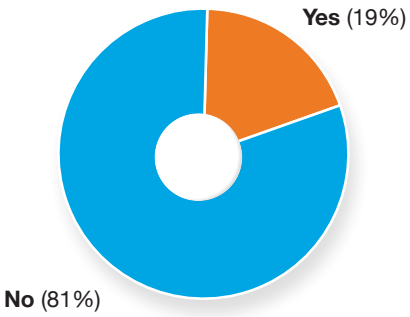


Figure 4.6 Percentage of survey respondents receiving commercial funding

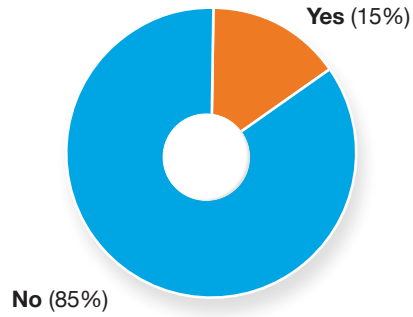
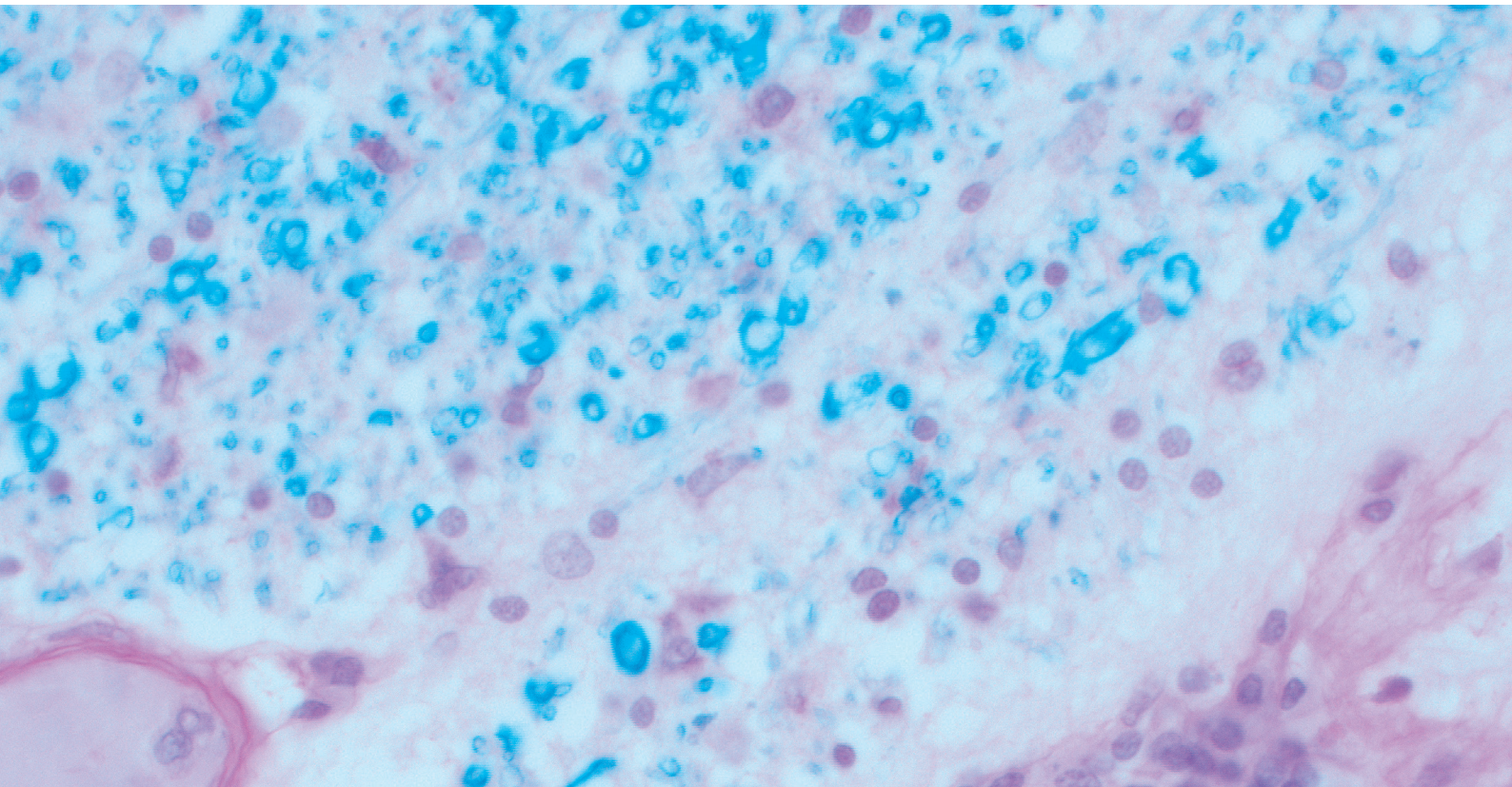


Figure 4.7 Percentage of survey respondents who have an industry partner for their work



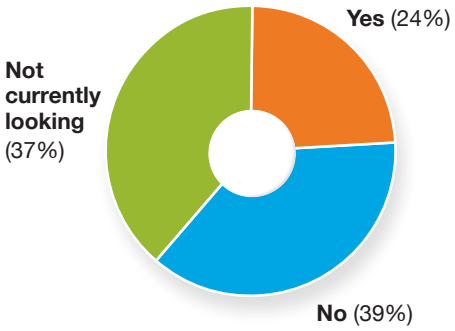


Figure 4.8 Percentage of survey respondents who have used the commercialisation department at their institute

Approximately one quarter of respondents indicated they had accessed commercialisation or innovation services at their institution. Reasons for utilising these services included to obtain advice on patenting viability and on intellectual property laws, assistance in preparing confidentiality agreements, applying for provisional patents, and to assist with the operations of research translation from pre-clinical to clinical stages. Over one-third (37%) of respondents indicated they were not currently in a position to commercialise their research, but this group indicated that they may require these services in the future.

GAPS & OPPORTUNITIES

- Encourage greater uptake of international funding opportunities alongside applications to local and national granting bodies
- Explore state government funding opportunities or partnerships
- Encourage greater utilisation of private/NFP funding sources
- Ensuring all researchers are adequately informed about the commercialisation and innovation services available through their institute, to encourage active research translation.
- Increased awareness / promotion of available funding opportunities

4.2. Current funding options

Many funding opportunities exist for Australasian researchers to apply for financial support. These fall into the same broad categories outlined in section 4.1, including governmental funding, private and philanthropic funding, and international funding opportunities.

This summary presents an overview of currently available funding opportunities, but is not an exhaustive list. Submissions are welcome for additional opportunities to add to this list.

TABLE 4.1. Funding avenues currently available to support MS research

Funding Body – Government	Focus	Relevant Grants	Timing
Australian Research Council www.arc.gov.au	The ARC's mission is to deliver policy and programs that advance Australian research and innovation globally and benefit the community.	**People support:** - Discovery Early Career Researcher Award - Future Fellowship **Project or Infrastructure:** - Discovery Project - Linkage Project - Linkage Infrastructure, Equipment and Facilities - ARC Centres of Excellence	Annual funding rounds
Australian Government Department of Health www.health.gov.au	The Department seeks to promote, develop, and fund health and aged care services for the Australian public.	- Flexible Funds awarded to organisations for major infrastructure support	Annual funding rounds
Australian Government Department of Education and Training www.education.gov.au	The Department seeks to help Australians access quality education and research.	**People support** - Australian Postgraduate Award - International Postgraduate Research Scholarships - Endeavour Scholarships and Fellowships - Endeavour Mobility Grants **Infrastructure:** - Research Infrastructure Block Grants	Annual funding rounds
National Health and Medical Research Council www.nhmrc.gov.au	To create new knowledge through support of discovery research, accelerate research translation, and build Australia's future capability for research and translation.	**People support:** - Postgraduate Scholarship - Early Career Fellowship - Career Development Fellowship - Research Fellowship - Practitioner Fellowship - Translating Research Into Practice (TRIP) Fellowship **Project or Infrastructure:** - Project Grant - Program Grant - Development Grant - Centres of Research Excellence - Partnership Programs or Centres - Equipment Grants and Infrastructure Support	Annual funding rounds April/May
Health Department in each state	Each state Health Department helps to support the broad range of local health and medical research efforts.	Primarily fund via targeted calls for major infrastructure or project funding	Varied

TABLE 4.1. continued. Funding avenues currently available to support MS research

Funding Body – Not-for-profit	Focus	Relevant Grants	Timing
Brain Foundation www.brainfoundation.org.au	The Brain Foundation is dedicated to funding research into neurological disorders, brain disease, and brain injuries.	**Project or Infrastructure** - Project Grant-in-aid in priority areas, varies yearly **People Support:** - Fellowship for Neurology trainee and Neurosurgery trainee	Annual funding round June
BUPA Health Foundation www.bupa.com.au/about-us/bupa-health-foundation/about	The BUPA Foundation is committed to improving the health of the Australian community and ensuring the sustainability of affordable healthcare.	**People Support:** - Emerging Health Researcher Award **Project or Infrastructure** - Foundation Grants Program	Annual funding round August/ September
CASS Foundation www.cassfoundation.org	Provides scholarships and grants to advance education, science and medicine, and research and practice in those fields.	**People Support:** - Travel Awards **Project or Infrastructure** - Medicine/Science Grants	Annual round of Project grants, biannual travel awards
Equity Trustees www.eqt.com.au/not-for-profit-organisations.aspx	Equity Trustees manage over 400 charitable trusts for scientific research, children's charities, and many other causes	**Project or Infrastructure:** - William Buckland Foundation Grants (Victoria) - Harold and Cora Brennan Trust (Victoria) - Hazel Peat Perpetual Trust (Victoria) **People Support:** - Queensland Medical Research PhD Scholarship - Viertel Clinical investigatorship (see more below) - Viertel Senior Research Fellowship (see more below)	Annual funding round (varied)
Financial Markets for Children Foundation www.foundationforchildren.com.au	To promote health, welfare and well-being of children in Australia.	**Project or Infrastructure** - Project Grants	Annual funding round
Ian Potter Foundation www.ianpotter.org.au	A vibrant, healthy and fair Australia. The Foundation supports a broad range of research including medical research, health & disability.	**People Support:** - Travel Awards **Project or Infrastructure:** - Project Grants	Annual funding round
MS Research Australia www.msra.org.au	To accelerate Australian research targeting the prevention, better treatment and cure for MS. *Project grants, fellowships and incubator grants qualify as Category 1 funding on the Australian Competitive Grants Register*	**People Support:** - Postgraduate Scholarship - Vacation Scholarship - Postdoctoral Fellowship - Research Fellowship - TRIP Fellowship - Travel Award **Project or Infrastructure:** - Project Grant - Incubator Grant	Annual funding round, biannual incubator round April/May

TABLE 4.1. continued. Funding avenues currently available to support MS research

Funding Body – Not-for-profit	Focus	Relevant Grants	Timing
Neurological Foundation of New Zealand www.neurological.org.nz	The Neurological Foundation of NZ aims to progress research so that significant advances can be made in the prevention and cure of neurological disorders.	**People Support:** - Postgraduate Scholarship - Postdoctoral Fellowship - Summer Studentship - Chapman (Clinical) Research Fellowship - Repatriation Fellowship - Senior Clinical Research Fellowship - Travel Grant (existing grantees only) **Project or Infrastructure:** - Project Grant - Small Project Grant	Annual funding round (varied)
New Zealand Multiple Sclerosis Research Trust http://msresearch.nz	The Trust aims to stimulate, co-ordinate and support New Zealand-based research into the cause, prevention, treatment, alleviation and cure of MS, and to obtain and disseminate research findings.	Newly established trust – grants portfolio not yet available.	Not yet available.
Perpetual Trust www.perpetual.com.au/philanthropy-funding-opportunities.aspx	Independent financial services group that manage the distribution of charitable funds in Australia.	**Project or Infrastructure:** - Project Grant awarded to organisations	Annual funding round (varied)
Ramaciotti Foundation www.ramaciotti.com.au	The Ramaciotti Foundations are private contributors to biomedical research in Australia.	**People Support:** - Biomedical Research Award - Medal for Excellence in Biomedical Research **Project or Infrastructure:** - Health Investment Grant	Biennial funding round for Research Award. Other awards annual
Rebecca L. Cooper Foundation www.cooperfoundation.org.au	To advance, promote and encourage medical research throughout Australia.	**People Support:** - Postdoctoral Fellowship - Postgraduate Scholarship **Project or Infrastructure:** - Project Grant	Annual funding round September
Sylvia and Charles Viertel Foundation www.viertel.org.au	To support the alleviation of hardship of the aged and the sick.	- Clinical investigatorship - Senior Research Fellowship	Annual funding round April

TABLE 4.1. continued. Funding avenues currently available to support MS research

Funding Body - International	Focus	Relevant Grants	Timing
National MS Society www.nationalmssociety.org	To help people affected by MS by funding research, driving change through advocacy, professional education and programs.	People Support: - Postdoctoral Fellowship - Awards Project or Infrastructure: - Project Grant	Varied. Applications accepted from non-US citizens but must also submit to other granting agencies in their own country.
National Institute for Health www.nih.gov	To seek knowledge about the nature and behaviour of living systems and the application of that knowledge to enhance health, lengthen life, and reduced illness and disability.	People Support: - Awards - Postdoctoral Fellowship - Research Fellowship Project or Infrastructure: - Project Grant - Resource Grant	Varied. Applications accepted from non-US citizens but must also submit to other granting agencies in their own country.
MS International Federation www.msif.org	To improve the quality of life of people affected by MS and to support better understanding of the treatment of MS by facilitating international cooperation between MS societies, the international research community and other stakeholders	People Support: - Young Researcher Award - Charcot Award	Awarded at ECTRIMS meeting
International Progressive MS Alliance www.progressivemsalliance.org	To better understand progression and to identify and test treatments.	**Project or Infrastructure:** - Challenge Award - Collaborative Network Award	Varied.

4.2.1. Government funders

Australian Research Council

The ARC funds research via two key elements: the Discovery Program and the Linkage Program. The ARC supports a variety of research programs including science, social science and humanities, but does not support clinical or dental research. Some domains of MS-related research may fall within the basic science, social or behavioural sciences disciplines.

Within the Discovery Program the ARC offers support for individual-led projects and fellowships at several stages, including early career fellowships (DECRA) and Future Fellowships for mid-career researchers. The ARC also supports infrastructure and equipment support via the Linkage Program, which aims to facilitate links between research facilities and across institutes, industry, and not-for-profit organisations.

Commonwealth Department of Health

The federal Department of Health does not typically support investigator-led research directly via grant schemes. A large component of the Department of Health research support is via the National Health and Medical Research Council, but the Department of Health also supports research infrastructure via major funding schemes known as Flexible Funds awarded to organisations such as MS Research Australia.

At the time of writing, planning was underway in the Department of Health to establish a new Medical Research Futures Fund (MRFF). The MRFF seeks to provide a complementary research funding structure to that provided by the National Health and Medical Research Council. The MRFF was passed by the Senate in mid-2015 with a view to being established over the course of 2015/2016.

Commonwealth Department of Education and Training

Administered by the Department of Science and Industry until 2013, the Australian Postgraduate Award scholarships are now administered by individual institutes on behalf of the Department of Education. Applications are accepted annually to support local (APA) and international (IPRS) postgraduate students who receive a fixed stipend for the duration of their candidature.

The Department of Education also provides infrastructure support to higher education institutes including the Research Training Scheme, which covers the bulk of fees for higher-degree research students, as well as Research Infrastructure Block Grants that are awarded on the basis of each institute's success in obtaining competitive funding from schemes listed on the Australian Competitive Grants Register.

Endeavour Scholarships and Fellowships

The Australian Government's Endeavour Scholarships and Fellowships, and Endeavour Mobility Grants, support two-way engagement between Australia and the rest of the world.

Endeavour Scholarships and Fellowships are merit-based awards providing opportunities for Australians to undertake study, research or professional development in other countries, and for citizens around the world to do the same in Australia. Endeavour Mobility Grants support Australian undergraduate, postgraduate and vocational education and training students to undertake short-term international travel for study, practicums, clinical placements, internships, or volunteer projects that contribute to their Australian qualification.

National Health and Medical Research Council

The NHMRC is the principal funder of health and medical research in Australia, and has been the largest funder of MS research nationwide. As outlined in section 4.1., over half of the survey respondents were currently receiving NHMRC grant support. In the past ten years, the NHMRC have awarded over $40 million to MS researchers around Australia (Figure 4.9).

A range of funding support is available from the NHMRC for investigator-led research projects and cross-institutional programs. The NHMRC also funds a range of people support schemes for early career, mid-career, and senior academics.

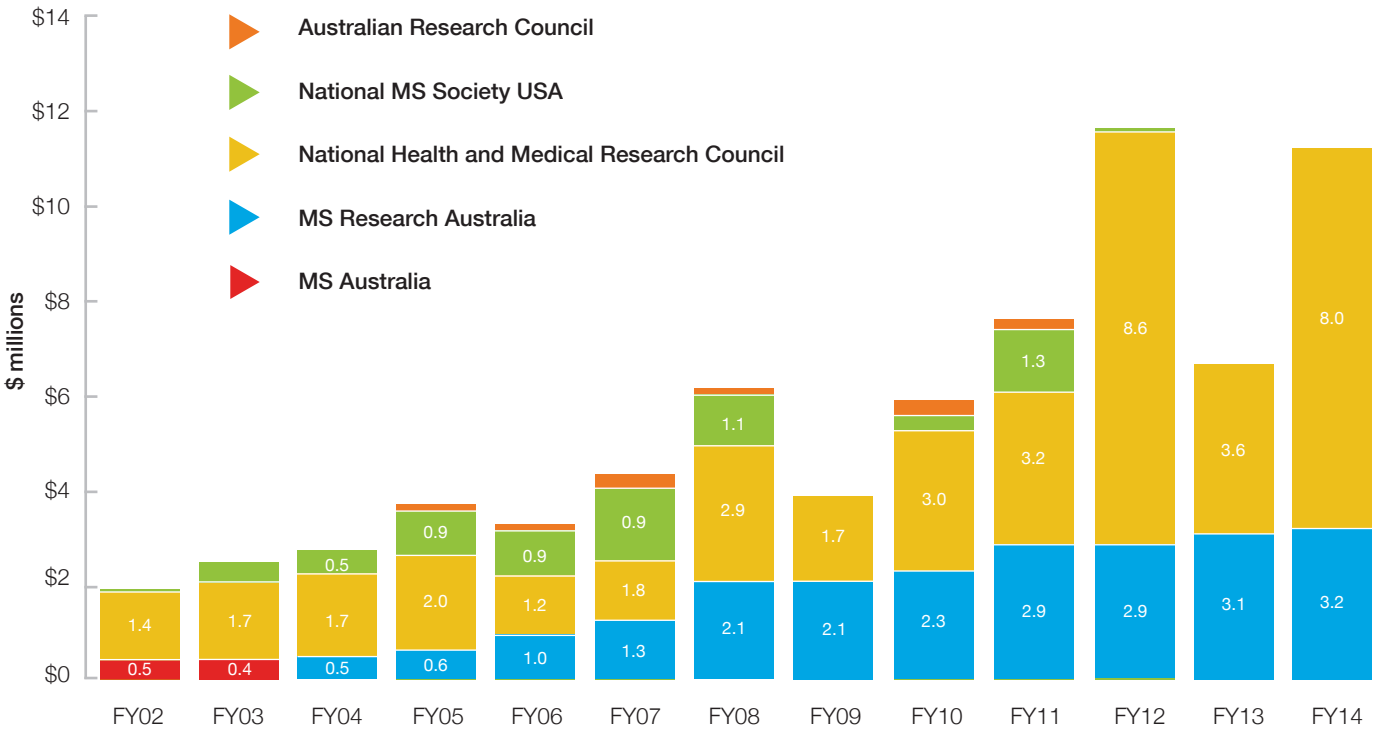


Figure 4.9 Funding awarded to MS Research Australia-affiliated researchers since 2004

State Government Offices for Health and Medical Research

The **New South Wales Office for Health and Medical Research** (NSW OHMR) is a key supporter of MS research in NSW. The NSW OHMR occasionally funds investigator-led research via an open application process, but primarily provides support for major state-wide initiatives and targeted infrastructure development. The specific funding schemes vary annually depending on the NSW OHMR strategic priorities, but have recently included a 2015 Medical Devices Fund, a 2014 Bioinformatics Collaborative Grant Program, and a 2014 Genomics Collaborative Grant Program. The NSW OHMR has provided significant support for the MS Clinical Trials and Research Network in NSW, and also supports the MS Research Australia Brain Bank.

In Victoria, the **Victorian Health Department** funds the Victorian Health Promotion Foundation (VicHealth), which offers opportunities to partner with VicHealth on both ARC Linkage and NHMRC Partnership Grants. VicHealth also offers targeted funding opportunities based on key health priorities. Major funding is available through the VicHealth Innovation Research Grant which supports innovative population health research.

The **Queensland Office for Health and Medical Research** provides direct funding support for investigator-led research in Queensland. There are a range of people support grant schemes available, including Research Fellowships and, most recently, targeted Nursing Fellowships and Physiotherapy Research Fellowships.

The **Western Australia Department of Health** offers several grant schemes for both people-and project support. This includes Clinician Research Fellowships and New Independent Researcher Infrastructure Support Awards, the Research Translation Projects, as well as Medical and Health Research Infrastructure Fund. The WA Government also supports the Lotterywest Foundation and the Healthway foundation that each fund competitive grants. Lotterywest grants are awarded to organisations, while Healthway Health Promotion grants are awarded to individuals.

4.2.2. Not-for-profit and philanthropic funders

Brain Foundation

The Brain Foundation is dedicated to funding Australia-wide clinical research into neurological disorders, brain disease, and brain injuries. Research programs are open nationally and include general project support in the form of grants-in-aid, in fields of key research priority. The Foundation also offers people support for one Neurology trainee and one Neurosurgery trainee.

BUPA Health Foundation

The Foundation is committed to improving the health of the Australian community and ensuring the sustainability of affordable healthcare. The Emerging Health Researcher Award recognises the valuable contribution of emerging health researchers to health outcomes for all Australians. The Foundation funds innovative replicable interventions and projects that empower people to prevent or better manage health conditions, and empower people to use health education and engagement to tackle health risk factors and promote healthy lifestyle habits.

CASS Foundation

The CASS Foundation is a private philanthropic foundation, established to support and promote the advancement of education, science and medicine, and research and practice in those fields. The CASS Foundation provides annual grants for research and development in science and medicine in Victoria. The travel awards program is open nationally and provides support for early career researchers to attend international conferences, with two application rounds each year.

Equity Trustees

Equity Trustees manage over 400 charitable trusts for scientific research, children's charities, and many other causes. The Trustees administer a range of granting schemes including the William Buckland Foundation Grants (Victoria), the Hazel Peat Perpetual Trust, as well as Fellowship opportunities such as the Queensland Medical Research PhD Scholarship, the Sylvia and Charles Viertel Clinical Investigatorship, and the Sylvia and Charles Viertel Senior Research Fellowship (see more page 44).

Financial Markets for Children

The Financial Markets Foundation for Children receives both corporate and individual donations to fund research programs and a wide range of other projects designed specifically to promote and improve the health, welfare and well-being of Australian children. The Foundation has allocated in excess of $17 million to over 220 projects. Grant applications are considered via an Expression of Interest process and are generally awarded for one or two years. The Foundation intends these grants to support pilot studies to encourage subsequent competitive grant applications.

Ian Potter Foundation

The Ian Potter Foundation prioritises funding for innovative programs that enhance the lives of people with disability or chronic illness and promote the health of the community. Grants are awarded to promote research and development in public health and preventative medicine initiatives aimed at improving the health of the Australian community. Programs offered include Project Grants for Medical Research and Health & Disability, as well as Travel Awards for early-career researchers.

MS Research Australia

MS Research Australia is a not-for-profit organisation dedicated to funding and coordinating MS research. The organisation offers a wide range of grants, fellowships and scholarships to support research into finding better treatments, triggers, and a cure for MS. Funding includes both investigator-driven applications and collaborative platform funding. In addition to major project grants and salary support in form of scholarships and fellowships, MS Research Australia also funds one-year Incubator Grants that provide seed funds for new projects.

Neurological Foundation of New Zealand

The Neurological Foundation of New Zealand is a not-for-profit organisation aiming to progress research so that significant advances can be made in the prevention and cure of neurological disorders. The organisation offers a wide range of grants, fellowships, and scholarships to support research to alleviate suffering from diseases and disorders of the brain and nervous system.

New Zealand Multiple Sclerosis Research Trust

The New Zealand MS Research Trust has been established to stimulate, co-ordinate and support New Zealand-based research into the cause, prevention, treatment, alleviation and cure of MS, and to obtain and disseminate research findings. The Trust was newly established in 2015, and at the time of writing had not yet published a grants portfolio.

Perpetual Trust

Perpetual distributed more than $83 million in the 2014 financial year on behalf of the charitable trusts and endowments that they manage. Non-profit organisations have the opportunity to apply for grants through their annual IMPACT Philanthropy Application Program. The grants generally range between $10,000 and $100,000 per year. National organisations can submit up to three applications in total.

Ramaciotti Foundation

The Ramaciotti Foundations are collectively one of the largest private contributors to biomedical research in Australia, and have granted almost $55 million to research projects since 1970. They contribute to individual investigators and organisations via three categories of grants in biomedical research, including the biennial Ramaciotti Biomedical Research Award, and the annual Ramaciotti Medal for Excellence in Biomedical Research and Ramaciotti Health Investment Grants.

Rebecca L. Cooper Foundation

The foundation prioritises areas of medical research that are not widely funded by other funding bodies, and currently supports six areas of medical research including brain sciences (Psychiatry and Neurology) and vision sciences. The Foundation awards grants for purchasing of equipment and consumables, as well as the Al and Val Rosenstrauss Research Fellowship. One highly scoring grant applicant is awarded a PhD Scholarship to support a student under their supervision.

Sylvia and Charles Viertel Foundation

Established to alleviate hardship for people suffering chronic illness, the Sylvia and Charles Viertel Foundation offers a Senior Medical Research Fellowship and a Clinical Investigatorship. The Fellowship is intended to provide both salary and project grant funding for mid-career researchers. The Clinical Investigatorship aims to assist the balance between the investigator's research and clinical position.

4.2.3. International MS funders

U.S. National MS Society

The Society supports fundamental as well as applied studies, non-clinical or clinical in nature, including projects in patient management, care and rehabilitation. Research grants for scientists and clinicians are a multi-year investigation fund. Postdoctoral Fellowships aim to attract and train young investigators and doctors. The Society also offers one year seeding grants to test innovative ideas. Applications are accepted from non-US citizens but they must also submit to other granting agencies in their own country.

U.S. National Institutes of Health

The National Institutes of Health (NIH) are part of the U.S. Department of Health and Human Services. NIH is the largest source of funding for medical research in the world, funding thousands of scientists in universities and research institutions around the globe. NIH's grants and funding program includes Research Grants, Awards, Research Training and Fellowships, Project/Centre Grants, and Resource Grants. Many NIH grants are available to Australian investigators and organisations.

MS International Federation

The MS International Federation (MSIF) stimulates and facilitates international collaboration on research into the understanding, treatment and cure of MS. The MSIF offers a Young Researcher Award to a presenter at the meeting of the European Committee for Treatment and Research in MS (ECTRIMS) each year. The MS International Federation gives the Charcot Award every two years for a lifetime of achievement in outstanding research into the understanding or treatment of MS.

International Progressive MS Alliance

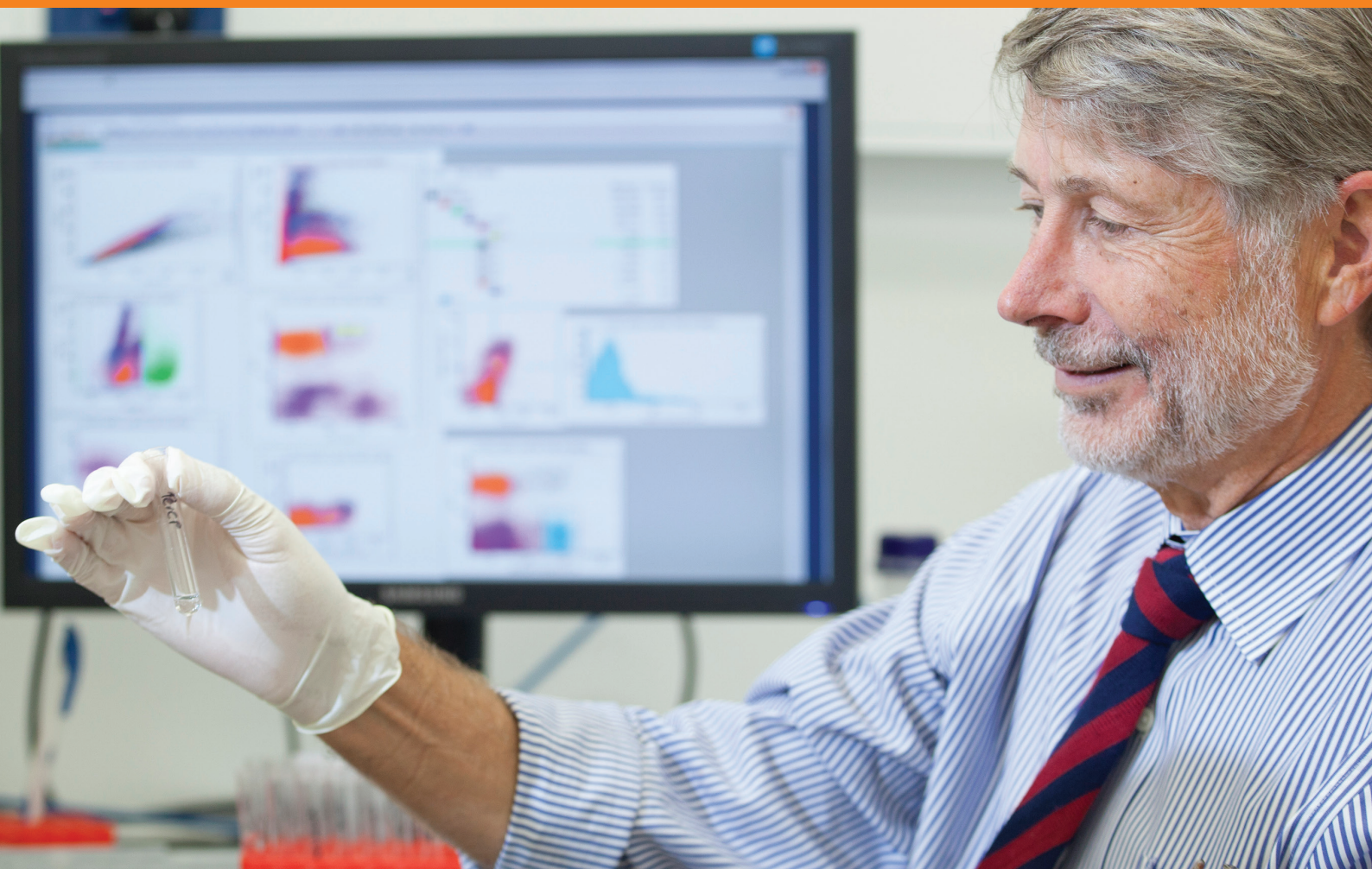
The Progressive MS Alliance has awarded its first round of research grants to investigators in nine countries (including Australia), with the goal of removing barriers to developing treatments for progressive MS. At the time of writing, the Alliance has offered two rounds of funding, including a round of project grant Challenge Awards, and a two-step Award round, including a Planning Award that will lead to major Collaborative Network Awards. These awards aim to accelerate one or more pre-clinical drug candidates for progressive MS, meaningful outcome measures, new interventions and/or validation of clinical rehabilitation strategies and interventions.

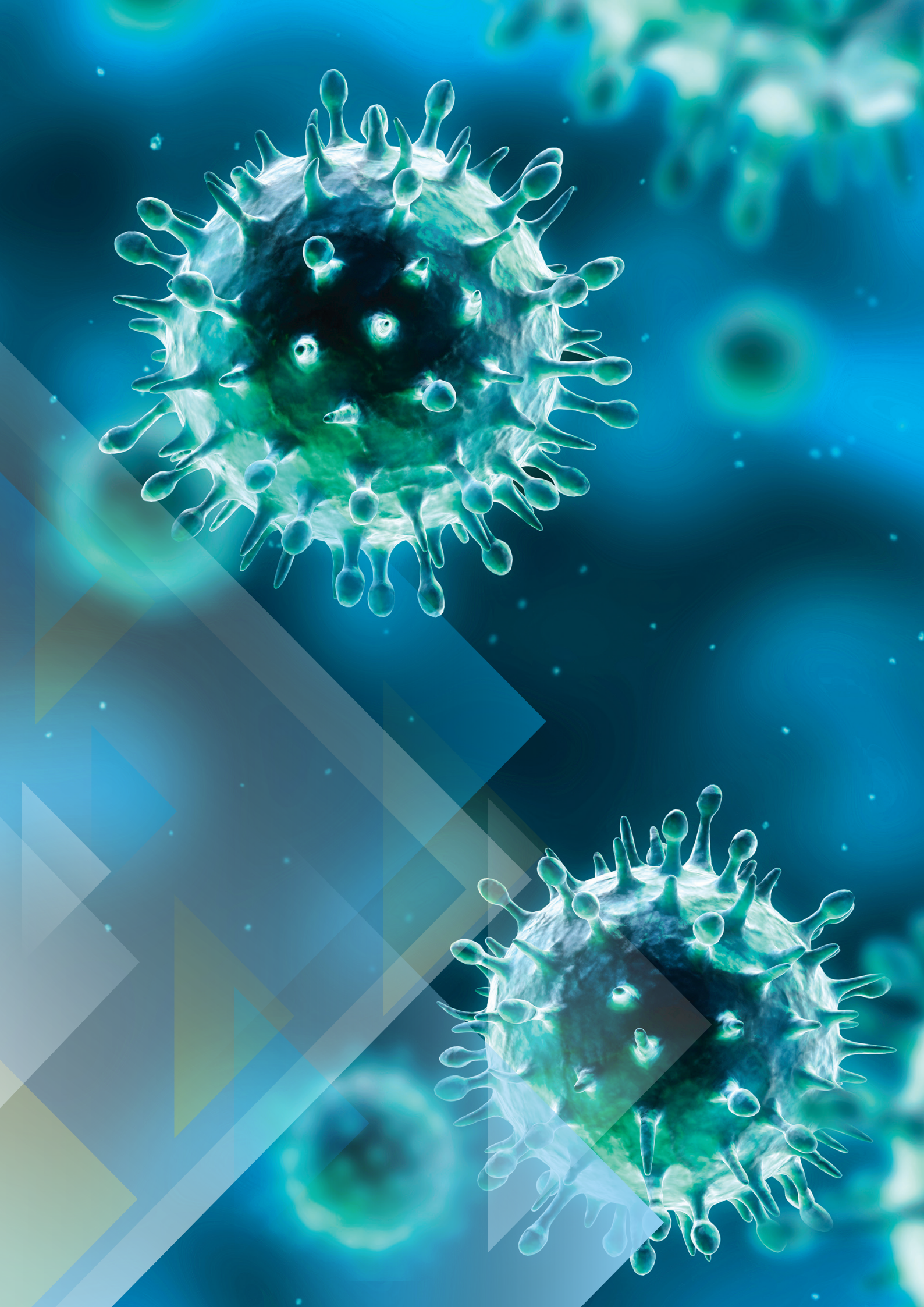
4.2.4. Commercial funders / Industry Partners

Research funding support from commercial organisations or industry partners is comparatively limited, and is primarily available for the support of clinical translation and product development. There is comparatively limited support for basic or preclinical research. As competitive funding grants are frequently not within the remit of most commercial organisations, centralised or public listings of funding opportunities are scarce. Typically these opportunities are sought by the individuals or via the commercialisation body at a research institution.

GAPS & OPPORTUNITIES

- More funding opportunities for mid-career researchers, clinician researchers, allied health research.
- More funding opportunities for enabling grants for infrastructure and core services (biobanks, data banking, bioinformatics), and major equipment grants.





5 TOOLS TO STRENGTHEN MS RESEARCH

5.1. Resources and infrastructure currently being utilised

Within the home institute

Survey respondents provided a comprehensive insight into the infrastructure and resources within their home institute, currently being utilised for their research (Figure 5.1). This primarily included specialised laboratory and analysis facilities (Figure 5.2), but the respondents also noted institutional provision of administrative and office support, general laboratory equipment, clinical and medical imaging facilities, and allied health resources such as sensory and motor analysis systems.

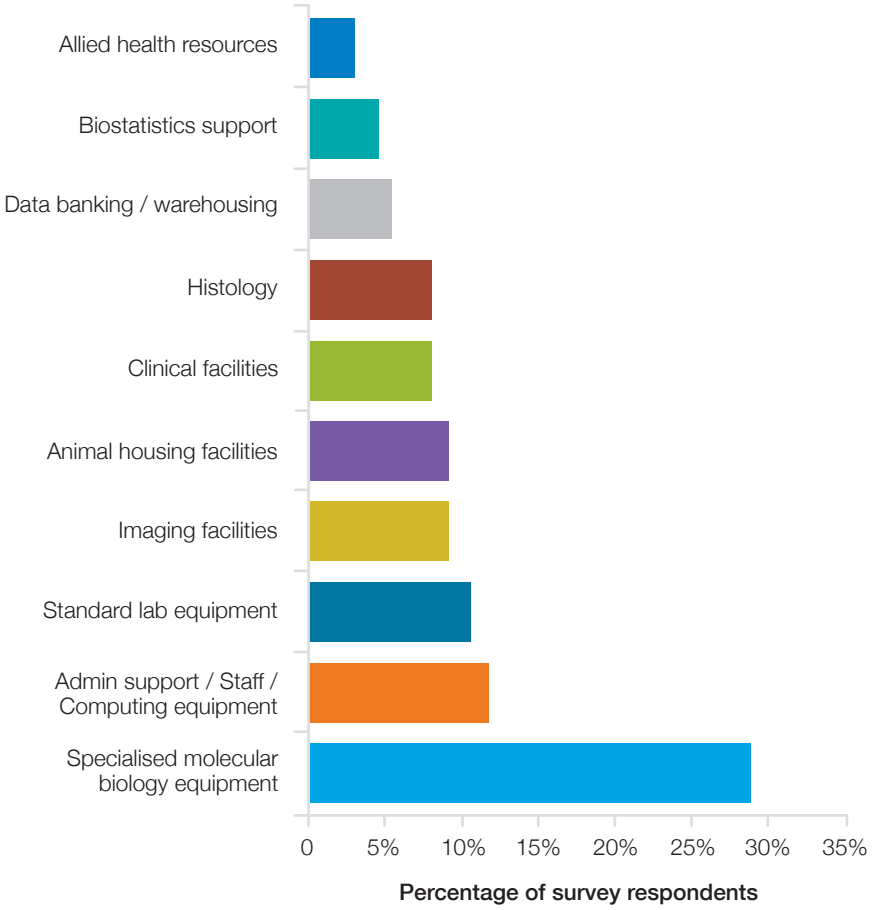


Figure 5.1 Resources utilised within the researchers' home institutes

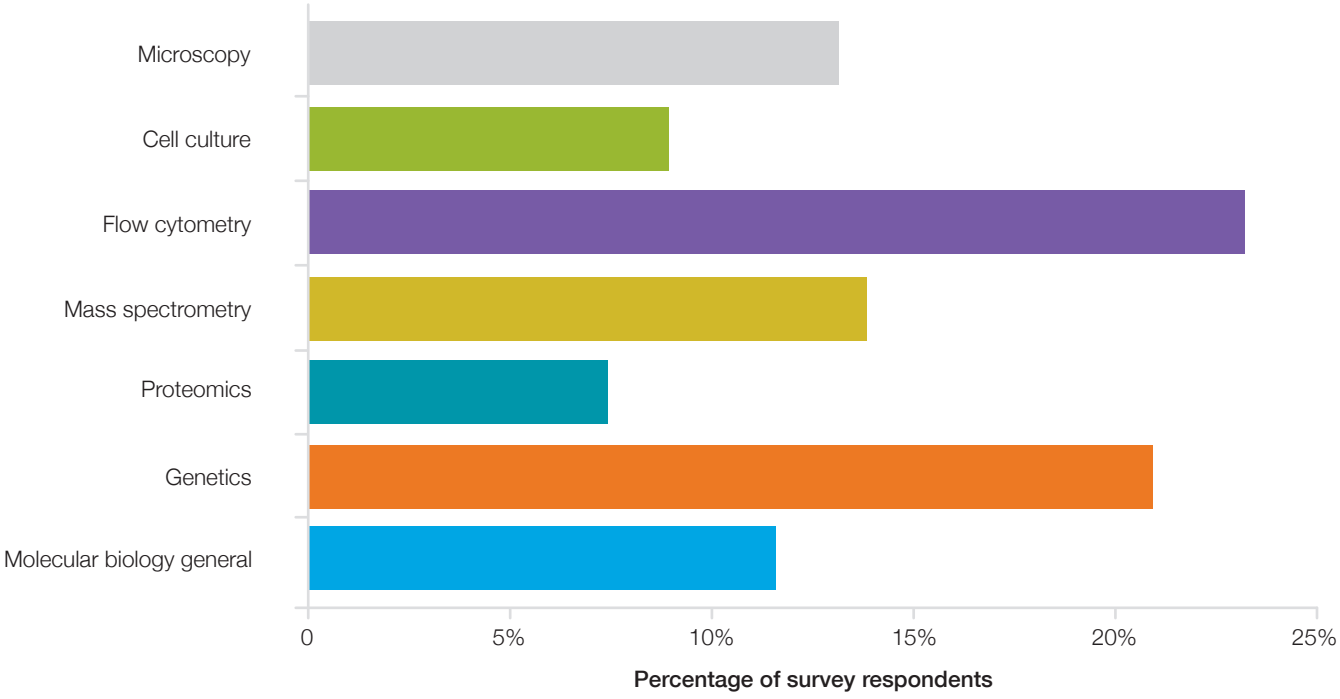


Figure 5.2 Specialised molecular biology facilities within the researchers' home institutes

External facilities

Survey respondents also outlined the external infrastructure and resources that they access outside their home institution (Figure 5.3). The most frequently accessed facilities were specialised analysis tools and equipment such as facilities for genomic sequencing, microscopy, spectroscopy, and medical imaging. The second most frequently accessed type of facility were repositories of data, samples, or tissue. The respondents also outlined a range of other infrastructure and resources such as cloud research services, external research collaborations, and commercial analysis companies.

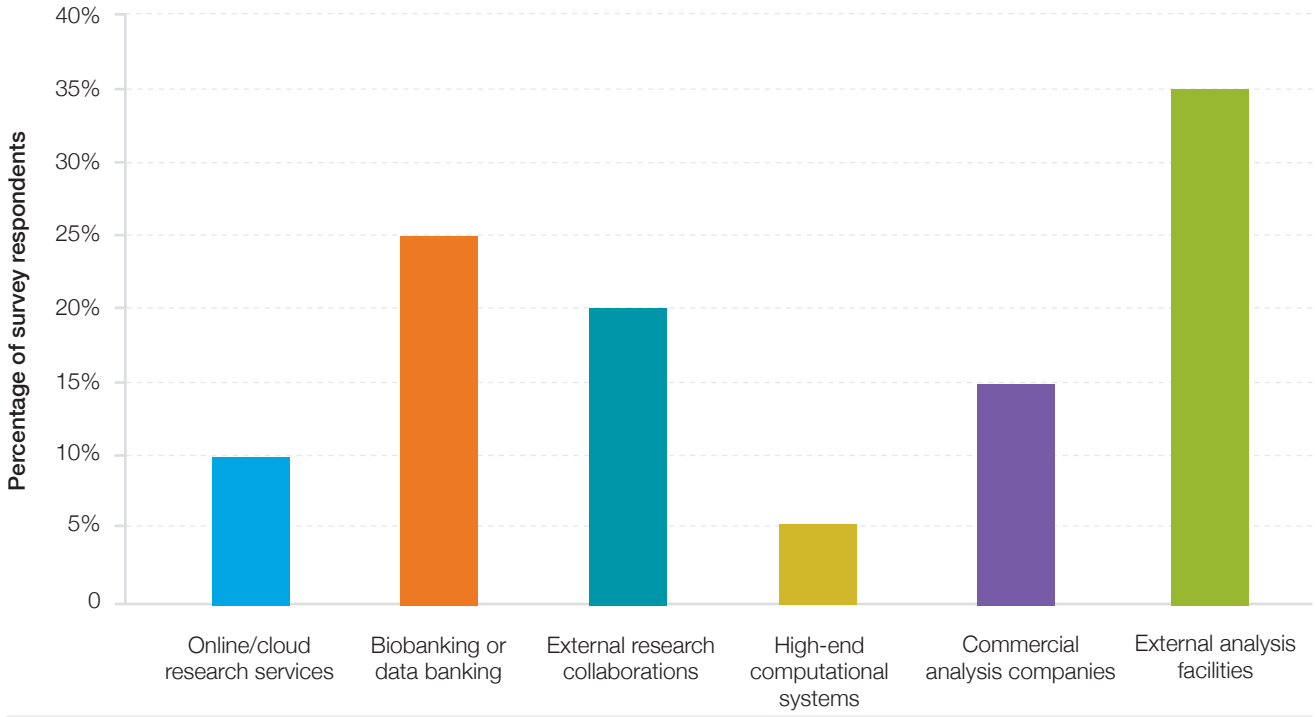


Figure 5.3 Resources utilised that are external to the researchers' home institutes

International facilities

The survey respondents indicated that international resources needed to be pursued for a variety of reasons. The cited reasons included:

- ensuring a global perspective on Australian research
- fostering international collaborations for unique expertise or data sharing
- to validate analyses already undertaken in Australia
- for a coordinated effort in data storage and interpretation
- for cost effectiveness of performing the analysis
- a lack of Australian equivalent resource, or to access larger sample sizes than available in Australia

Although 40% of respondents indicated they did not access international resources, of those who did, international expertise and data sharing was the most frequently accessed resource, utilised by over 20% of survey respondents (Figure 5.4). Smaller proportions of respondents indicated they have accessed international repositories of data or samples, clinical trials facilities, or specialised analysis tools or methods.

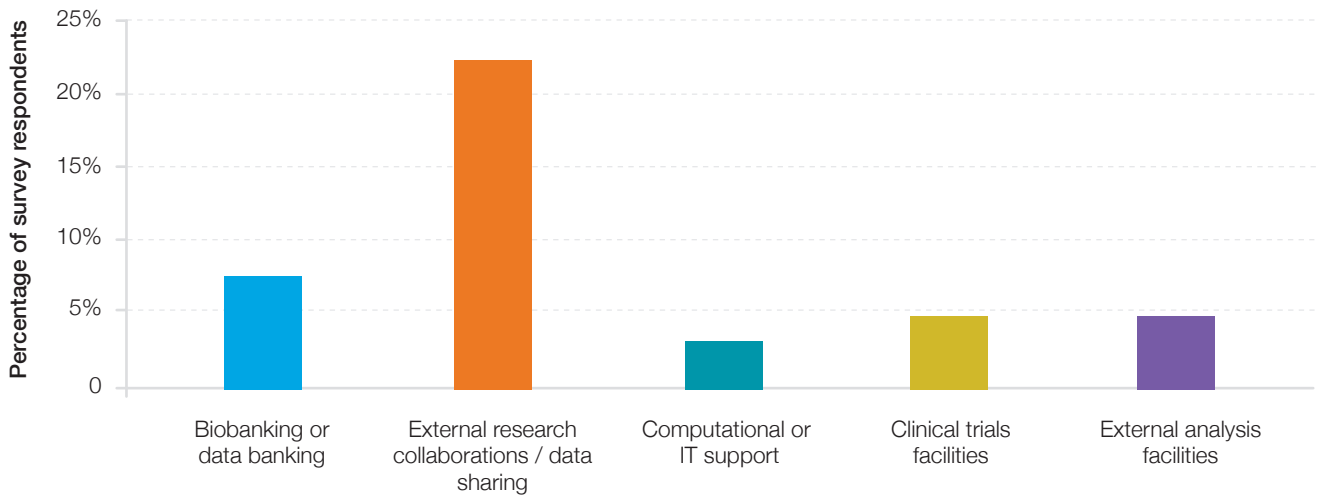


Figure 5.4 International resources accessed by Australian researchers

5.2. Current infrastructure options

This section summarises a selection of the currently available infrastructure, equipment, and facilities from around Australia. This is not a comprehensive list and includes only services identified by the researcher survey responses. This summary also does not consider resources within the pharmaceutical and biotechnology industries in Australia as these are generally not publically listed or publically available for access.

The process of collating and analysing these resources revealed a significant gap in the coordination of existing services around Australia. A vast range of services are available with no or little centralised organisation to make potential users aware of the range of resources available. Some of the resources listed below are MS-specific, but the majority are not. There is an urgent need to collate the available resources and reduce fragmentation on a national level, to enable researchers and their collaborators around the country to identify and fully utilise the available resources.

Under-utilisation of available resources is a significant problem in the Australian research industry. Greater coordination of existing infrastructure will not only help to avoid duplication of resources, it will ensure expertise within regional hubs can be utilised and shared, and will also facilitate the integration of data across these platforms to allow the initiation of large-scale multidisciplinary research endeavours.

This section presents an overview of currently available resources or facilities in a range of areas, but these are not an exhaustive list. Submissions are welcome for additional resources to add to these lists.

5.2.1. General research resources

A range of general academic resources are available for researchers and research organisations to access, including computing infrastructure, cloud and internet services, as well as centralised facility listings that help researchers to find the right facility to assist their work. Many of these resources are free or low cost.

TABLE 5.2.1. General research resources

Name	Location	Resource availability and details	Accessibility and cost
Victorian Platform Technologies Network (VPTN) www.platformtechnologies.org	Victoria, online	The VPTN is an online infrastructure resource/facility database and expertise network for Victorian research services, with booking service.	Available to Australian researchers. Database access is free.
National eResearch Collaboration, Tools and Resources (NeCTAR) www.nectar.org.au	National, online	NeCTAR encourages researchers to deploy software applications, publish their own research data, and share their knowledge quickly and easily online. NeCTAR provides Australian researchers with access to a full suite of digitally enabled data, analytic and modelling resources and eResearch tools, a Research Cloud service and a national server.	Available to Australian researchers. Many services are provided at low or no cost.
Australian National Data Service (ANDS) www.ands.org.au	National, online	ANDS helps researchers to organise and manage their research data, promote and share it with other researchers, and locate other research data in Research Data Australia (see more information in **Table 5.2.4**).	Available to Australian researchers. Many services are provided at low or no cost.
Research Data Storage Initiative (RDSI) www.rdsi.edu.au	National, online	This project offers a national network of storage for availability, management and sharing of data, to support nationally significant data intensive research.	Available to Australian researchers via 8 nodes around the country (listed below in this table).
Intersect www.intersect.org.au	New South Wales, online	Intersect services include advice and assistance, high performance computing, project management, data storage, software development and software hosting. NSW Node of the national RDSI.	Available to Australian researchers, executive and support staff. Many services are provided at no cost to staff within member institutions.
eResearch SA (eRSA) www.ersa.edu.auresearchdata	South Australia, online	eRSA services include advice and assistance, high performance computing, project management, data storage, software development and software hosting. SA Node of the national RDSI.	Available to Australian researchers, executive and support staff. Many services are provided at low or no cost.
Pawsey Supercomputing Centre (formerly iVEC) www.ivec.org	Western Australia, online	Pawsey services include advice and assistance, high performance computing, project management and workflow analysis, data storage, visualisation resources and expertise, software development and software hosting. WA Node of the national RDSI.	Available to Australian researchers. Many services are provided at low or no cost.

TABLE 5.2.1. continued. General research resources

Name	Location	Resource availability and details	Accessibility and cost
National Computational Infrastructure (NCI) www.nci.org.au	Canberra, online	The NCI offers access to national agencies and other international collections; combining datasets held by research communities into coherent collections; and providing high-end computational and data-intensive services. ACT Node of the national RDSI.	Available to Australian researchers, executive and support staff. Many services are provided at low or no cost.
Queensland Cyber Infrastructure Foundation (QCIF) www.qcif.edu.au	Queensland, online	QCIF provides high-performance services, infrastructure and support services for research. The QCIF operates two nodes of the national RDSI.	Available to Australian researchers, executive and support staff. Many services are provided at low or no cost.
Tasmanian Partnership for Advanced Computing (TPAC) www.tpac.org.au	Tasmania, online	The TPAC provides services for data storage, cloud computing, and high performance computing. TAS Node of the national RDSI.	Available to Australian researchers, executive and support staff. Many services are provided at low or no cost.
VicNode www.vicnode.org.au	Victoria, online	VicNode provides services for data storage, cloud computing, and high performance computing. VIC Node of the national RDSI.	Available to Australian researchers, executive and support staff. Many services are provided at low or no cost to staff within member institutions.
V3 Alliance www.v3.org.au	Victoria	The V3 Alliance provides specialist research services and expertise in advanced computing. Services include high performance computing, cloud, visualisation technology, decision platforms and tools.	Services available on a fee-for-service basis to Australian researchers and organisations.

GAPS & OPPORTUNITIES

> Other states / national version of VPTN website, enabling the coordination and centralised listing of available resources and equipment. Currently, equipment listings outside Victoria are highly fragmented.

5.2.2. Animal research resources

Animal research resources can include facilities to enable the breeding and housing of small animals for use in research, as well as specialist services for development of genetically modified animal strains. Several facilities offer repositories of animal disease models, imaging equipment, and behavioural testing services.

TABLE 5.2.2. Animal research resources

Name	Location	Resource availability and details	Accessibility and Cost
Australian Phenomics Network (APN) www.australianphenomics.org.au	Australian Capital Territory	This project provides Australian and international researchers with mouse models for the study of a range of diseases.	Available at a cost or via collaboration to Australian researchers
Australian Phenomics Facility (APF) apf.anu.edu.au	Australian Capital Territory	The Facility supports open access large-scale phenotyping of humans and mice to uncover the biological drivers in human disease. Resources include an animal holding and breeding facilities, specialised analysis technologies, as well as the Phenome Bank (see below).	Available at a cost to Australian researchers
Australian Phenome Bank (APB) pb.apf.edu.au	Australian Capital Territory	The APB provides and maintains a central database of genetically modified mice held in Australia either live or as cryopreserved material.	Available to Australian and international researchers. Database access is free, other services available at a cost
Australian BioResources www.abr.org.au	New South Wales	Small animal holding and breeding facility, owned by the Garvan Institute.	Available at a cost to Australian researchers
Australian Animal Health Laboratory www.csiro.au/en/Research/Facilities/AAHL	Australian Capital Territory	High-containment animal holding facility, owned by the CSIRO.	Available at a cost or via collaboration to Australian researchers
Animal Resources Centre www.arc.wa.gov.au	Western Australia	The Animal Resources Centre produces and sells laboratory mice and rats that are genetically defined with unique strain characteristics.	Available at a cost to Australian researchers
Australian Mouse Brain Mapping Consortium www.imaging.org.au/AMBMC	National	The Australian Mouse Brain Mapping Consortium is a national network of imaging facilities falling under the NIF (see **Table 5.2.3**) allowing Australian researchers to better characterise mouse models of neurological diseases.	Access to the consortium is by collaboration
Neuro Research Services www.neuroresearchservices.com	Victoria	Neuro Research Services provides academic and industry researchers access to a comprehensive rodent neuro-phenotyping facility.	Services available at a cost to Australian researchers
Melbourne Behaviour Facility www.melbournebraincentre.edu.au/content/behaviour-facility	Victoria	The behaviour facility at the Melbourne Brain Centre offers a wide battery of rodent behavioural testing equipment for internal and external academics and commercial bodies.	Services available on a fee-for-service basis to Australian researchers and organisations

5.2.3. Specialised Imaging Facilities

Imaging facilities offer a means for *in vivo* exploration of disease pathology in humans and animals. A number of advanced imaging facilities and imaging networks have been developed that offer state of the art equipment for high resolution visualisation.

TABLE 5.2.3. Imaging facilities (human and animal)

Name	Location	Resource availability and details	Accessibility and Cost
Australian National Imaging Facility (NIF) www.anif.org.au	National	The NIF has established a national network of institutions that provides state of the art imaging of humans, animals, plants and materials for the Australian research community. The NIF has node institutions providing a range of services in NSW, QLD, SA, VIC, WA (listed in this table).	Services available to Australian researchers at a cost, via each NIF node.
University of Sydney **Australian Nuclear Science and Technology Organisation** **Brain and Mind Centre**	New South Wales	Facilities across the node include biomodelling laboratory, 3T whole body MRI, pharmacology biodistribution laboratory, radiochemistry hotcells, radiolabelling facility, medicinal chemistry laboratory, beta microprobe, Inveon PET/CT/SPECT, microSPECT, microPET, cyclotron. NSW node of the NIF.	Services available to Australian researchers at a cost.
University of NSW **Neuroscience Research Australia**	New South Wales	Facilities include IVIS spectrum CT, human 3T MRI, inveon micro PET/CT, vevo2100 ultrasound, IVIS lumina, preclinical 9.4T MRI. NSW node of the NIF.	Services available to Australian researchers at a cost.
University of Western Sydney, Biomedical Magnetic Resonance Facility	New South Wales	Facilities include 11.7T MRI. NSW node of the NIF.	Services available to Australian researchers at a cost.
Centre for Advanced Imaging **University of QLD**	Queensland	Facilities include 1.5T MRI, 3T MRI, 7T MRI, ultrasound, NMR spectroscopy, MR microimaging, solid state NMR, PET/SPECT/CT, preclinical 9.4T and 16.4T MRI, cyclotron and radiochemistry, EPR spectroscopy. QLD node of the NIF.	Services available to Australian researchers at a cost.
Large Animal Research & Imaging Facility **South Australian Health and Medical Research Institute**	South Australia	Facilities include C-Arm imaging intensifier, DEXA scanner, large animal CT, large animal 1.5T MRI. SA node of the NIF.	Services available to Australian researchers at a cost.
Florey Institute for Neuroscience and Mental Health, Imaging Facility	Victoria	Facilities include human 3T MRI and preclinical 4.7T MRI. VIC node of the NIF.	Services available to Australian researchers at a cost.

TABLE 5.2.3. continued. Imaging facilities (human and animal)

Name	Location	Resource availability and details	Accessibility and Cost
Monash University	Victoria	Facilities include preclinical FLECT/CT, PET/CT/SPECT, 9.4T MRI, human 3T MRI. VIC node of the NIF.	Services available to Australian researchers at a cost.
Swinburne University of Technology **Brain and Psychological Sciences Research Centre**	Victoria	Facilities include human 3T MRI and human MEG, EEG, TMS, eye movement tracking. VIC node of the NIF.	Services available to Australian researchers at a cost.
University of Melbourne **Melbourne Brain Centre Imaging Unit**	Victoria	Facilities include human PET/CT and 7T MRI. VIC node of the NIF.	Services available to Australian researchers at a cost.
University of Western Australia **Centre for Microscopy, Characterisation & Analysis**	Western Australia	Facilities include Maestro Cri fluorescence, microCT, preclinical 9.4T MRI. WA node of the NIF.	Services available to Australian researchers at a cost.
Herston Imaging Research Facility	Queensland	Facility due to open in 2015. Equipment includes human 3T MRI, MRI/PET, PET/CT	Services available to Australian researchers at a cost.
Garvan Institute Animal Imaging Facility	New South Wales	Facilities include small animal CT, fluorescent and bioluminescent imaging as well as two intravital microscopes.	Services available to Australian researchers at a cost.
Sydney University Preclinical Imaging Facility	New South Wales	Planned to open late 2015 in the Charles Perkins Centre, facilities include high field strength MRI, microCT and optical imager.	Services available to all Australian researchers at a cost.
Hunter Medical Research Institute Imaging Centre	New South Wales	The HMRI Imaging Centre houses a Siemens MAGNETOM Prisma 3T scanner, as well as spectroscopy, EEG, and Agilent 400MHz NMR pathology magnet.	Services available to Australian researchers at a cost.

5.2.4. Clinical and epidemiological databases and registries

A number of local clinical databases and registries are available for access and collaboration for MS researchers in Australia. These registries are geared towards encouraging the reuse or reanalysis of existing data, in order to obtain maximum value of the original research investment.

TABLE 5.2.4. Clinical and epidemiological databases and registries

Name	Location	Resource availability and details	Accessibility and cost
BioGrid www.biogrid.org.au	National, online	Biogrid is an online data sharing platform that securely links across institutions, helping researchers to find and reuse large-scale data.	Data is available to Australian researchers. Services are provided at low cost or via collaboration.
Research Data Australia www.researchdata.ands.org.au	National, online	Research Data Australia is an online platform helping researchers find, access, and reuse data for research from research organisations, government agencies, and institutions. Collections include Bioplatforms Australia and the Australian Phenomics Network (see **Table 5.2.2**).	Available to Australian researchers. Much of the data is immediately accessible online via publishing partners and free to use (subject to any licence conditions).
Australian MS Longitudinal Study (AMSLS) www.msra.org.au/AMSLS	National, coordinated in Tasmania	The AMSLS is an ongoing research project designed to provide data of practical use for improving the lives of Australians living with MS. Researchers can collaborate with AMSLS investigators to access existing survey data or to include questions in future surveys.	Data and surveys available via collaboration.
MSBase www.msbase.org	International, coordinated in Victoria	MSBase is an ongoing, clinical, longitudinal observational registry dedicated to sharing, tracking and evaluating outcomes data in MS.	Membership is free to Australian and international researchers. Data access available to all members.
Paediatric MS Registry	National, coordinated in New South Wales	Coordinated by investigators at the Kids Research Institute in Westmead, Sydney, the Paediatric MS Registry collates clinical and biological data for children with MS.	Access via collaboration with chief investigators.
Autologous Haematopoietic Stem Cell Transplant (AHSCT) Registry www.msra.org.au/ahsct-steering-committee	National, coordinated in Western Australia	National registry collecting data on the effects of treatment with AHSCT for MS, including patient outcomes and long term prognosis following this procedure.	Not currently available for external access, but will be open for external collaboration in the future.
Population Health Research Network (PHRN) www.phrn.org.au	National	The PHRN provides researchers with the ability to link de-identified population health data from a range of health data sets. Includes units within NSW, ACT, VIC, WA, SA, TAS, QLD.	Data access via application by Australian researchers. Costs apply for linkage, coding or extraction requests.

GAPS & OPPORTUNITIES

> Facilitate linkage between parallel data registries containing complementary data

> Increase awareness and uptake of registry data

5.2.5. Preclinical and Clinical Trials facilities

Clinical trials facilities aim to encourage recruitment, support identification of potential new trial sites and access to resources, and provide advice and expertise on aspects of trial design and development, as well as resources to support compliance with regulatory documentation.

TABLE 5.2.5. Preclinical and clinical trials facilities

Name	Location	Key Outcomes	Accessibility and Cost
Australian & New Zealand Clinical Trials Registry www.anzctr.org.au	National, online	ANZCTR is a searchable online database of registered clinical trials in Australia and New Zealand. Maintained by the NHMRC CTC (see below).	Database access and trial listing is free to registered users
Biopharmaceuticals Australia www.biopharmaus.com.au	Queensland	BPA aims to foster Queensland's and Australia's biopharmaceutical industry sector, and to connect innovative product developers with a range of capabilities to help take drugs through developmental stages to the marketplace. Also provides Access Support Grants up to $250,000.	Services available on a fee-for-service basis to Australian researchers and organisations
Centre for Applied Disability Research www.cadr.org.au	National, based in NSW	CADR actively supports applied and collaborative research that can be quickly translated into policy and practice via knowledge-exchange events (conference, symposia, classes) and resources.	Free to become a network member and access the database
Clinical Trials Connect www.ctc.asn.au	National, online	CTC is a centralised trial listing for prospective participants in Australia & New Zealand interested in volunteering for medical research.	Trial listing available at a cost to researchers
ClinicalTrials.gov www.clinicaltrials.gov	International, online	ClinicalTrials.gov is a registry and results database of publicly and privately supported clinical studies of human participants conducted around the world.	Database access and trial listing is free to registered users
MS Clinical Trials Network www.mstrials.org.au	National	The MSCTN provides an online listing of MS trials in Australia, and also coordinates a network of experts who can provide advice and information for investigators as well as recruitment assistance.	Free to become a network member and access the database
Neuroscience Trials Australia www.neurotrialsaustralia.com	National, based in Victoria	NTA is a not-for-profit contract research organisation providing clinical trial support service, aiming to coordinate, facilitate, support and conduct clinical trials across investigators, sites and centres.	Services available at a cost to Australian researchers
NHMRC Clinical Trials Centre www.ctc.usyd.edu.au	National, based in NSW	NHMRC CTC, based at the University of Sydney, provides clinical trial expertise and support. The CTC also maintains the ANZCTR (see above).	Services available at a cost to Australian researchers
Queensland Clinical Trials Network www.qctn.com.au	Queensland	To improve the design and management of clinical trials in QLD. QCTN is the primary point of contact for organisations seeking to undertake preclinical and clinical research in Queensland. QCTN helps identify and connect organisations (sponsors) with appropriate research institutions, hospitals, CROs and other life sciences service providers.	Services available to QCTN members

TABLE 5.2.5. continued. Preclinical and clinical trials facilities

Name	Location	Key Outcomes	Accessibility and Cost
Therapeutic Innovation Australia - Queensland Node www.therapeuticinnovation.com.au	Queensland	The Therapeutics Innovation Australia Queensland Node includes facilities at UQ, QIMR, and QUT. It provides access to coordinated and integrated translational health pathways for researchers in different areas including small molecule pharmaceuticals, biopharmaceuticals, devices, biomarkers and cell based therapies.	Services available at a cost or via collaboration to Australian researchers
"Virtual Pharma" Pharmaceutical Developability Network (PDN) www.therapeuticinnovation.com.au	National	Administered by Therapeutics Innovation Australia, the PDN provides services including an expert panel with experienced translational health experts to guide research; a translational chemistry facility; primary and secondary drug screening capability; preclinical capacity with a focus on specific gaps in relation to toxicology; pharmacometric capability across the drug development sector.	Services available on a fee-for-service basis to Australian researchers and organisations
National Biologics Facility www.therapeuticinnovation.com.au	Queensland and Victoria	National Biologics Facility support development and production of biological therapeutics. The facility has two nodes at University of Queensland and CSIRO in Melbourne. Facilities include advice and expertise, molecular biology, antibody engineering, mammalian cell culture and biopharmaceutical development.	Services available on a fee-for-service basis to Australian researchers and organisations
National Regulatory Repository (NRR) www.therapeuticinnovation.com.au	National, online	The NRR provides open licence documentation which can be used to support efforts to comply with regulators such as the Therapeutic Goods Administration.	Documentation is freely available online
iQDocs www.iqdocs.org	National, online	iQDocs provides a repository of over 500 open-access generic documents to assist therapeutic development and obtaining regulatory approval.	Documentation is freely available online

GAPS & OPPORTUNITIES

> Expand clinical trials facilities/websites to include a greater level of applied and translational research support and recruitment

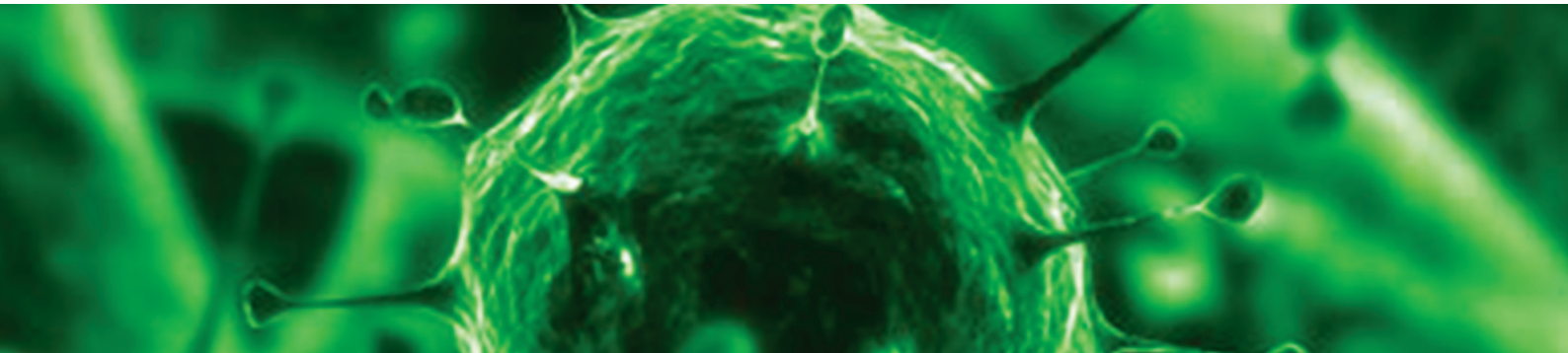
> Improve connection between trial investigators and available translational/commercialisation services

5.2.6. Cell & tissue therapy research facilities

Cell-based research facilities support the development and cultivation of cell lines, cell-based derivatives, and new therapeutic products.

TABLE 5.2.6. Cell and tissue therapy research facilities

Cell & Tissue Facilities	Location	Description	Accessibility and Cost
Victorian Consortium for Cell-based Therapies www.therapeuticinnovation.com.au	Victoria	The Consortium of over 20 organisations has installed BioSpherix Xvivo™ isolator systems within two Melbourne facilities, for use in the processing of human cell and tissues intended for preclinical use and early-phase clinical applications.	Services available on a fee-for-service basis to Australian researchers and organisations.
Stem Cell Core Facility, Stem Cells Australia www.stemcellsaustralia.edu.au/AboutUs/Our-Services/SCA-Stem-Cell-Core-Facility.aspx	Victoria	The Stem Cell Core facility provides cell lines and services for research involving human embryonic and induced stem cells, as well as providing training in stem cell culturing.	Services available on a fee-for-service basis to Australian researchers and organisations.
Cell & Tissue Therapies WA www.therapeuticinnovation.com.au	Western Australia	Biotherapeutic manufacturing facility based at Royal Perth Hospital providing a diverse range of clinical products and services.	Services available on a fee-for-service basis to Australian researchers and organisations.
Cell & Molecular Therapies www.therapeuticinnovation.com.au	New South Wales	CMT services at RPA Hospital Sydney support the development and provision of novel cellular therapy products for clinical use.	Services available on a fee-for-service basis to Australian researchers and organisations.
Sydney Cell & Gene Therapy www.therapeuticinnovation.com.au	New South Wales	SCGT at Westmead is a consortium between three research institutes and two health services. It provides facilities and expertise for cellular therapeutics and gene therapy.	Services available on a fee-for-service basis to Australian researchers and organisations.
Therapeutic Products Facility www.therapeuticinnovation.com.au	South Australia	Therapeutic Products Facility aims to provide a facility where cellular based therapies can be manufactured to the highest standards of purity, integrity, safety and strength.	Services available on a fee-for-service basis to Australian researchers and organisations.



5.2.7. Biological sample research repositories

Biological sample repositories provide a means for researchers to access specific tissue or cell samples, data types or larger sample sizes that are typically inaccessible through normal recruitment channels. Post-mortem tissue, cell lines, genetic samples, and analysis facilities are all available to researchers either via fee-for-service or via collaboration.

TABLE 5.2.7. Biological sample research repositories

Name	Location	Resource available and details	Accessibility and Cost
MS Research Australia Brain Bank www.msbrainbank.org.au	NSW based, collaboration with ABBN nodes in other states	The primary objective of the MS Research Australia Brain Bank is to coordinate the collection, storage and use of human post-mortem tissue from people with MS for use in research. Non-MS tissue available through the Australian Brain Bank Network (ABBN) nodes in Victoria, Queensland, Western Australia, South Australia (see below).	Tissue available on a cost-recovery basis to Australian and international researchers.
Victorian Brain Bank Network www.melbournebraincentre.edu.au/content/victorian-brain-bank-network-vbbn	Victoria	Collects and stores human post-mortem tissue from people with MS, healthy controls, and other disorders. Victorian node of the ABBN.	Tissue available on a cost-recovery basis to Australian and international researchers.
Queensland Brain Bank www.qldbrainbank.org	Queensland	Collects and stores human post-mortem tissue from healthy controls, and other disorders including MS. Qld node of the ABBN.	Tissue available on a cost-recovery basis to Australian and international researchers.
South Australia Brain Bank www.flinders.edu.au/neuroscience/SABrainBank.htm	South Australia	Collects and stores human post-mortem tissue from people with MS, healthy controls, and other disorders. SA node of the ABBN.	Tissue available on a cost-recovery basis to Australian and international researchers.
Western Australia Brain Bank www.austbrainbank.org.au/centres.html	Western Australia	Collects and stores human post-mortem tissue from people with MS, healthy controls, and other disorders. WA node of the ABBN.	Tissue available on a cost-recovery basis to Australian and international researchers.
Proteomics of MS research platform www.msra.org.au/proteomics-ms-1	National, based in South Australia	This platform aimed to develop state-of-the-art proteomics technologies for the Australian MS research community and use the technology to identify specific molecular changes in the CNS proteome that correlate with different stages of disease in MS.	Available by collaboration to Australian and international researchers
CellBank Australia www.cellbankaustralia.com	New South Wales	CellBank Australia is a not-for-profit facility providing validated cell lines and related services throughout Australia and the world.	Services available on a fee-for-service basis to Australian researchers and organisations
Stem Cell Core Facility, Stem Cells Australia www.stemcellsaustralia.edu.au/AboutUs/Our-Services/SCA-Stem-Cell-Core-Facility.aspx	Victoria	The Stem Cell Core facility provides cell lines and services for research involving human embryonic and induced stem cells, as well as providing training in stem cell culturing.	Services available on a fee-for-service basis to Australian researchers and organisations

TABLE 5.2.7. continued. Biological sample research repositories

Name	Location	Resource available and details	Accessibility and Cost
Genetic Repositories Australia (GRA) at NeuRA www.neura.edu.au/GRA	New South Wales based, can house samples from Australia-wide	Genetic Repositories Australia (GRA) is a national genetic repository for DNA & cell lines derived from appropriately consented disease-specific & population-based studies.	GRA operates on a cost-recovery model. Available at a cost to all Australian researchers
Australian and New Zealand MS genetics consortium (ANZgene) www.msra.org.au/anzgene	Nodes in New South Wales, Victoria, Tasmania, Queensland, South Australia, Western Australia	The research consortium focuses on identifying the genes associated with MS risk and illness features. ANZgene is a national, collaborative effort between a multi-disciplinary team of neurologists, geneticists, bioinformaticians and molecular biologists.	Genetics data available via collaboration to Australian and international researchers

5.2.8. Biochemical and molecular biology facilities

This section lists available equipment facilities for biochemical and molecular biology research. All services listed below are available either fee-for-service or via collaboration to any Australian researchers.

TABLE 5.2.8. Biochemical and molecular biology facilities

Name	State	Description
General equipment facilities		
Bioplatforms Australia (BPA) www.bioplatforms.com	National	This project provides services and scientific infrastructure in the specialist fields of genomics, proteomics, metabolomics and bioinformatics. Infrastructure investments are hosted by an Australia-wide network of leading universities, research institutions and biotech companies which ensure broad access through contracted services and research collaborations. Nodes in NSW, VIC, SA, WA, QLD. Facilities listed in the table below.
European Molecular Biology Laboratory (EMBL) Australia www.emblaustralia.org	National	EMBL Australia undertakes activities that support Australia's Associate Membership of EMBL, a hub and spoke network of Molecular Biology facilities around Europe.
Bioinformatics Resource Australia – EMBL www.emblaustralia.org/Resources/BRAEMBL.aspx	National	BRA-EMBL provides a range of data services as well as providing specialised and unique datasets, tools and services.
Australian National Fabrication Facility (ANFF) www.anff.org.au	National	ANFF provides researchers and industry with access to bio-fabrication capabilities through a network of 8 nodes around Australia, in VIC, NSW, ACT, WA, QLD, and SA.
Australian Microscopy & Microanalysis Research Facility (AMMRF) www.ammrf.org.au	National	Access microscopy and microanalysis at several locations around Australia. Flagship instruments include microprobes, tomography imaging, electron microscopy. Nodes in NSW, QLD, SA, WA, ACT.
Australian Centre for Microscopy & Microanalysis, NSW www.sydney.edu.au/acmm	New South Wales	Sydney University Microscopy & Microanalysis is the principal node of the AMMRF. The instrumentation and technical expertise are available for all researchers to access on application.
University of Western Australia Centre for Microscopy, Characterisation & Analysis, WA www.cmca.uwa.edu.au	Western Australia	AMMRF Flagship Ion Probe Facility - Secondary ion mass spectrometry, electron microscopy.
Monash Antibody Technology Facility , VIC www.matf.monash.org	Victoria	The Monoclonal Antibody Technology Facility (MATF) was established to provide national and international Life Science researchers custom-made, high-affinity monoclonal antibodies and support services.
Centre for Dynamic Imaging, WEHI, VIC	Victoria	The facility is specialised in 3D reconstruction of sub-cellular, cellular, tissue and organ structure, 4D experiments using line-scan confocal imaging and 3D in vivo imaging tomography.

TABLE 5.2.8. continued. Biochemical and molecular biology facilities

Name	State	Description
'Omics' facilities		
Australian Genome Research Facility (AGRF) www.agrf.org.au	National. Nodes in NSW, VIC, SA, WA, QLD.	The AGRF is a national genomic service network, providing accredited contract genomics services to academic, applied research and commercial markets spanning biomedicine, plant and animal science, microbiology, evolutionary biology and biodiversity using cutting edge technology and expertise.
Metabolomics Australia www.metabolomics.com.au	National. Nodes in VIC, SA, WA, QLD.	Metabolomics Australia offers high throughput metabolomics services to all life science researchers. Services are offered through a consortium of Australian universities and research institutes with world class facilities and expertise in small molecule analysis. Nodes at University of Melbourne and Bio21 Institute, Australian Wine Research Institute, University of WA, University of QLD, and Murdoch University. Each node is supported by Bioplatforms Australia.
University of Queensland Diamantina Institute - Centre for Clinical Genomics www.di.uq.edu.au/geneticgenomic-183869	Queensland	Facilities include whole genome or exome-sequencing to map monogenic diseases, gene-mapping in common diseases, RNA sequencing for genomic profiling.
QIMR Protein Discovery Centre www.qimr.edu.au/page/Lab/Protein_Discovery_Centre	Queensland	QIMR offers a proteomics facility together with expertise in post translational modification (PTM). Supported by Bioplatforms Australia.
Biomolecular Resource Facility at the John Curtin School of Medical Research www.brf.anu.edu.au	Australian Capital Territory	The BRF offers expertise in epigenomics and RNA biology, plus consultation for experimental design, sequencing service provision, and bioinformatics analysis in fields including medicine, agriculture and the environment.
Australian Proteomic Analysis Facility, Macquarie University www.proteome.org.au	New South Wales	APAF was the world's first dedicated high throughput proteomics laboratory. APAF offers a full range of services to researchers requiring access to proteomics technology and expertise.
ACRF Centre for Kinomics at CMRI Westmead and the University of Newcastle www.cmri.org.au/Research/Research-Facilities	New South Wales	The ACRF Centre for Kinomics offers kinase profiling and identification, and drug discovery support. Facilities include mass spectrometry, a flow chemistry laboratory with KinoClick beads.
Kinghorn Centre for Clinical Genomics, Garvan Institute www.garvan.org.au/research/kinghorn-centre-for-clinical-genomics/clinical-genomics	New South Wales	The Garvan Institute is equipped with a purpose built genome sequencing capability. Its Kinghorn Centre for Clinical Genomics offers two Illumina HiSeq 2500 instruments and Australia 's only HiSeq X Ten System. Supported by Bioplatforms Australia.
UNSW Ramaciotti Centre for Genomics www.ramaciotti.unsw.edu.au	New South Wales	The Ramaciotti Centre for Genomics at UNSW is a focus for the development and application of genomics and transcriptomics, and provides services and expertise in the use of sequencing, microarrays and other high-throughput technologies and genomics services. Supported by Bioplatforms Australia.

TABLE 5.2.8. continued. Biochemical and molecular biology facilities

Name	State	Description
'Omics' facilities		
University of Newcastle Centre for Bioinformatics, Biomarker Discovery and Information-Based Medicine (CIBM) www.newcastle.edu.au/research-and-innovation/centre/cibm/about-us	New South Wales	The University of Newcastle CIBM is an interdisciplinary hub providing services in bioinformatics, high-performance computing, 'omics' analysis including genomics, proteomics, and single-cell analysis, as well as high-level statistical analysis.
Monash Biomedical Proteomics Facility www.platforms.monash.edu/proteomics	Victoria	Monash Biomedical Proteomics Facility offers world class facilities and research expertise in proteomics. The facility is co-located and integrated with a wide variety of other important bioplatforms capabilities such as protein production, x-ray crystallography, the Australian Synchrotron and monoclonal antibody production allowing the seamless conduct of a wide range of commercial and academic multidisciplinary projects. Supported by Bioplatforms Australia.
Molecular Genomics Core Facility at Peter MacCallum Centre www.petermac.org/research/enabling-research/molecular-genomics	Victoria	Facilities include a next-generation sequencer and a nucleic acid digital analyser.
Sequenom Platform Facility www.mcri.edu.au/research/facilities-resources-and-training/facilities-and-services	Victoria	Sequenom Platform provides high-performance DNA analysis, plus mass spectrometry and robotics for DNA and RNA analysis.
MHTP Medical Genomics Facility, Monash www.mhtpmedicalgenomics.org.au	Victoria	The MHTP Medical Genomics Facility provides a range of genomic technologies and expertise, including next generation sequencing, bioanalyser, and single-cell genomics.
The Murdoch University Metabolomics Laboratory (MML) www.murdoch.edu.au/Research-capabilities/Separation-Science-and-Metabolomics-Laboratory	Western Australia	The Centre is equipped with an extensive range of enabling technologies for small molecule and metabolomics research using validated, in-house methodologies, and the Advanced Mass Spectrometry Facility. Supported by Bioplatforms Australia.
Proteomics International www.proteomics.com.au	Western Australia	Proteomics International is a drug discovery company and contract service provider, focused on sophisticated analysis for the biological research market. Supported by Bioplatforms Australia.
Centre for Comparative Genomics (CCG), Murdoch University www.ccg.murdoch.edu.au	Western Australia	The CCG Bioinformatics Research Laboratory has a range of capabilities including: the development of computational tools; a vast range of data analysis and high definition visualisation strategies; and the development of integrated Internet-based information management systems.
Adelaide Proteomics Centre www.adelaide.edu.au/mbs/proteomics	South Australia	The Adelaide Proteomics Centre is a joint venture of the University of Adelaide and SA Pathology, established with support from the Australian Cancer Research Foundation. The APC offers techniques such as 2-D Fluorescence Difference Gel Electrophoresis and isotopic labelling of complex protein mixtures. The APC also offers Tissue Imaging Mass Spectrometry using MALDI-TOF/TOF MS instrumentation as well as automated matrix deposition strategies.

6 RESEARCHERS KEY NEEDS

This analysis aimed not only to identify the currently available resources and infrastructure, but also to highlight the key gaps and needs within the research landscape

By surveying a group of Australian MS researchers, this analysis aimed not only to identify the currently available resources and infrastructure, but also to highlight the key gaps and needs within the overall research landscape.

These gaps will help to inform future research development, not only for MS Research Australia but for the MS research community generally. For MS Research Australia, the gaps and opportunities identified here, together with the 2014 Research Audit, and ongoing public consultation will each help to define the key strategic priorities for MS Research Australia in the future.

When asked directly about what they see as the greatest priorities for funding schemes, perhaps unsurprisingly researchers identified that **direct project funding** and **people support** represent the two biggest priorities (Figure 6.1). The availability of stable and sufficient funding is essential to enable continuity of research support and reduce the high attrition rates of academic staff. People support has long represented a key need in the Australian medical research environment, and in particular, building the research capacity of health professionals was a key component of the recommendations from the Australian government 2012 McKeon Strategic Review of Health and Medical Research. Addressing these components is vital for any real progress to be made. Furthermore, it is notable that the researchers identified **infrastructure funding** and **collaborative network funding** as the next two biggest priorities for research investment.

When asked about their primary infrastructure and resource needs to enable their research in the future, the top responses showed similar themes (Figure 6.2). Survey respondents identified that **collaboration and network facilities,** and **data access resources** such as biobanks, registries, and databases, represented the infrastructure items deemed to be of greatest need for future research.

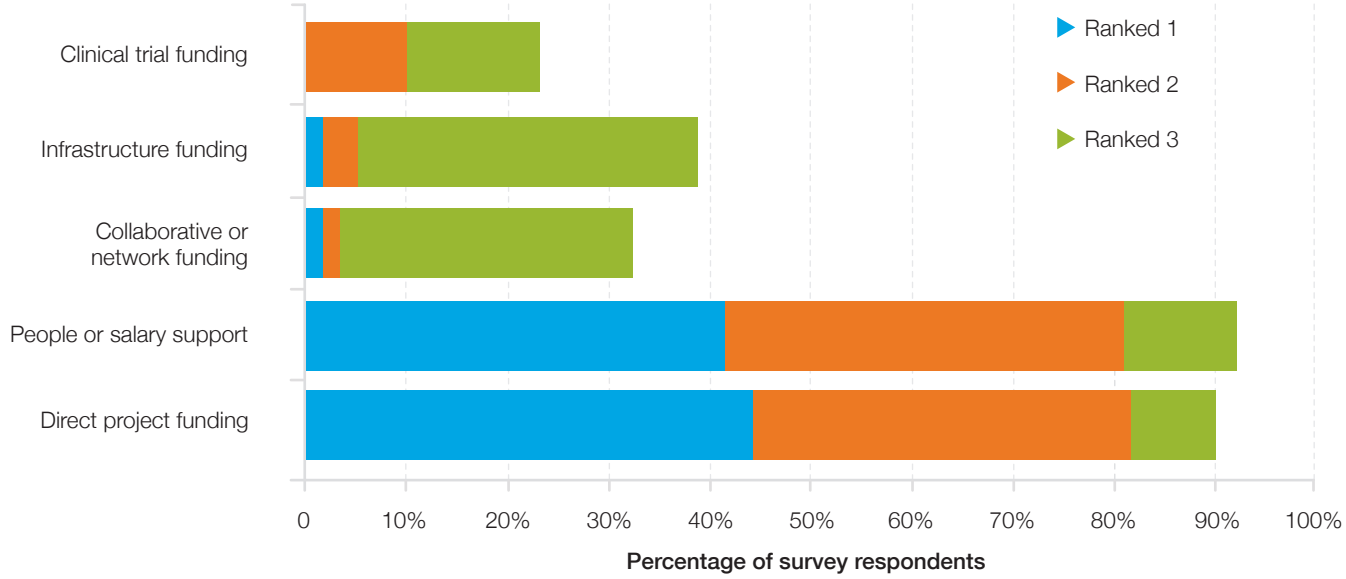


Figure 6.1 Priority funding needs identified by MS researchers

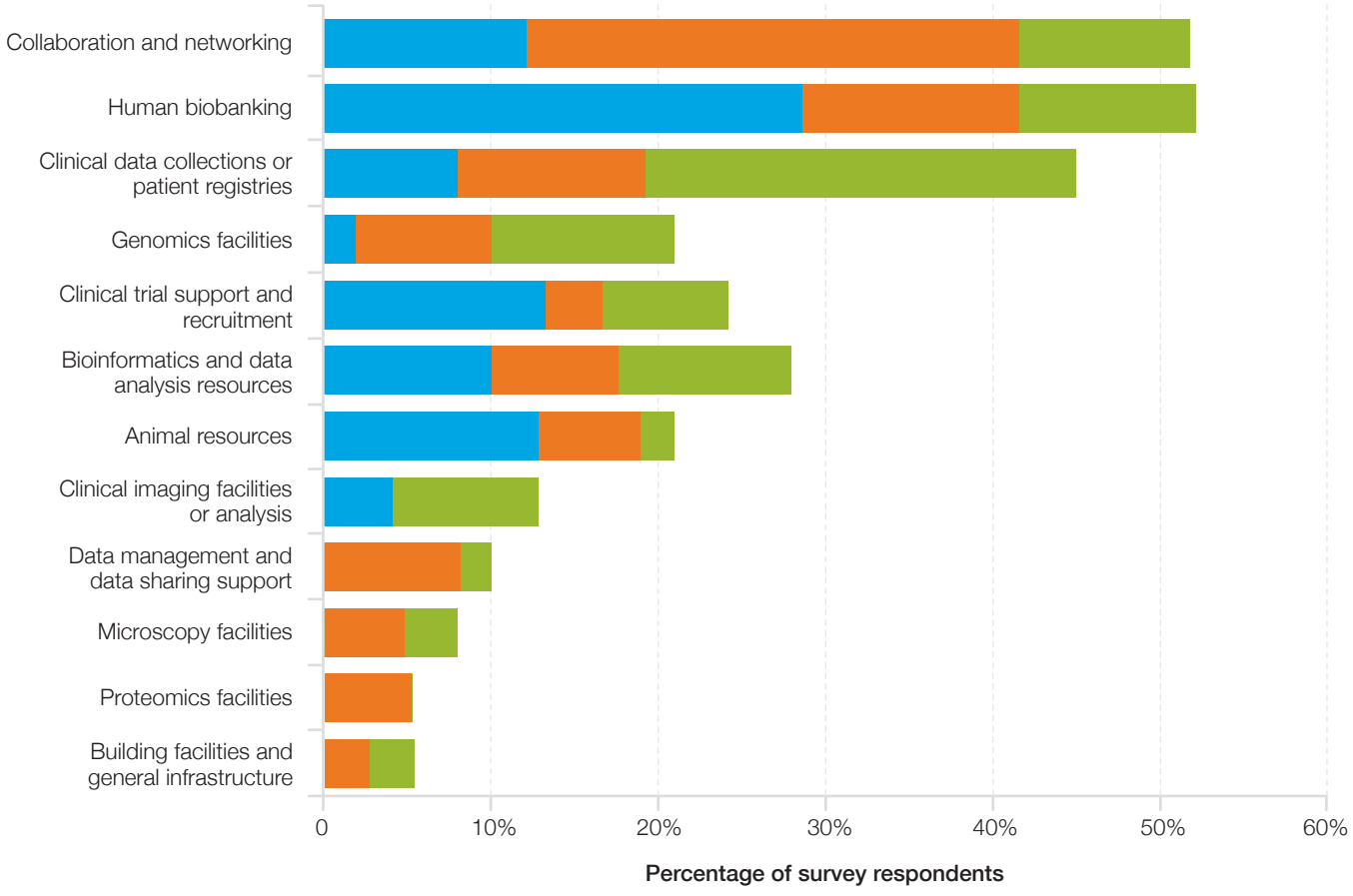


Figure 6.2 Priority infrastructure and resource needs identified by MS researchers

GAPS & OPPORTUNITIES

- > Greater funding options for people and salary support
- > Support/funding coordination of biobanking and clinical registries/data linkage
- > Explore key areas where networking and collaboration will add value

6.1. Summary of Gaps and Opportunities

The Resource Landscape Report presents the results of a comprehensive review and surveying of stakeholders, to bring together current information relating to the academic MS research environment in Australia. First and foremost, this document is intended as a tool for researchers to reduce the fragmentation of knowledge of the infrastructure, funding sources, and resources available to Australian researchers. Through these analyses, we have identified several key gaps that can be targeted by priority development and increased engagement with MS networks in Australia. For MS Research Australia, the gaps and opportunities identified here, together with the Research Audit, and ongoing public consultation will each help to define the key strategic priorities for MS Research Australia in the future.

People support

- Ensure researchers across all research domains are adequately informed of available resources and facilities.
- Encourage early career research uptake and retention, potentially via new funding programs.
- Create more opportunities for early career researchers and students to interact with the wider MS community via MS Research Australia.
- Capitalise on the strong clinician/researcher 'overlap' to increase translational research via targeted fellowships, support for research time, networking opportunities.
- More funding opportunities for mid-career researchers, clinician researchers, allied health research.

Research collaboration and mentorship

- Explore opportunities for cross-disciplinary or cross-disorder networking and collaboration.
- Specific opportunities for cross-disciplinary mentorship to encourage research translation and learning from other research fields.
- Generating opportunities to formalise (and incentivise) international cross-disciplinary collaboration.
- Encourage coordination and collaboration on research for progressive forms of MS, especially with increased international engagement.
- Explore opportunities for formalised mentorship of early-career and mid-career researchers.
- Encouraging more active engagement of researchers within the networks and professional mentorship opportunities.
- Develop professional networking opportunities for MS researchers and health professionals in Queensland, Western Australia, South Australia, and Tasmania. Expand researcher network in Victoria.
- Expand NSW MS research network to increase engagement of health professionals (nurses, allied health) & clinicians.

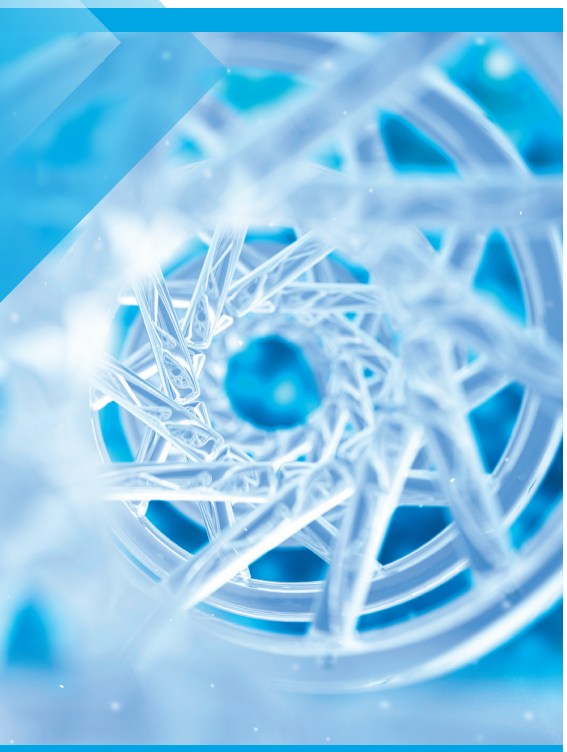
Funding opportunities

- Increased awareness / promotion of available funding opportunities.
- Encourage greater uptake of international funding opportunities alongside applications to local and national granting bodies.
- Explore state government funding opportunities or partnerships.
- Encourage greater utilisation of private/NFP funding sources.
- Ensuring all researchers are adequately informed about the commercialisation and innovation services available through their institute to encourage active research translation.

Resource development

- More opportunities for enabling grants for infrastructure and core services (biobanks, data banking, bioinformatics), major equipment grants, and clinical registries/data linkage.
- Other state / national equivalent of VPTN website, enabling the coordination and centralised listing of available resources and equipment. Currently, equipment listings are highly fragmented.
- Facilitate linkage between parallel data registries containing complementary data.
- Increase awareness and uptake of registry data.
- Expand clinical trials facilities/websites to include a greater level of applied and translational research support and recruitment.
- Improve connection between trial investigators and available translational/commercialisation services.
- Explore key areas where networking and collaboration will add value.

7 ACKNOWLEDGEMENTS



- The creation of this document was generously supported by a grant from the Macquarie Group Foundation.
- The creation of this document was a recommendation by Booz and Company (now known as Strategy&) management consulting services company, from a strategic intent analysis conducted for MS Research Australia in 2012.
- Many thanks go to the researchers who completed the Resource Landscape survey and contributed to compiling the document content, especially those who provided expert consultation on the resources list.
- Thank you to Samantha Rosenfels for contributions to data preparation

Photography

Ben Lee Photography
www.benlee.com.au

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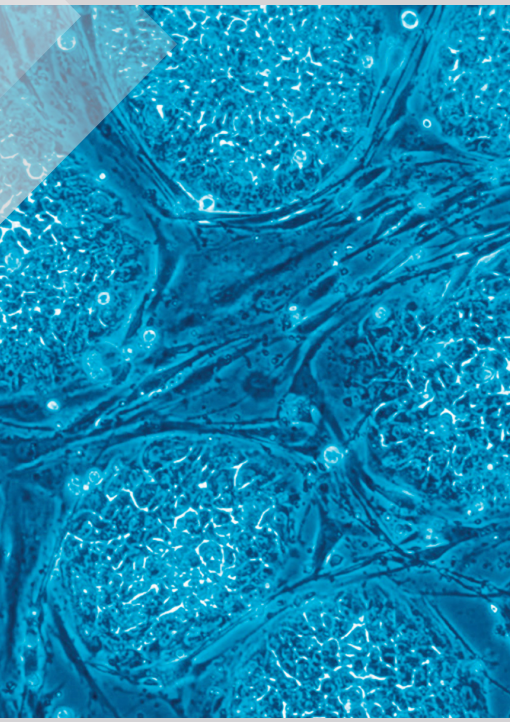
Image on page 33 courtesy of Dr Antony Harding and A/Professor Michael Buckland, Brain and Mind Centre, University of Sydney

Additional images sourced from iStockphotos.com

Graphic design

Lisa Petroff Design
www.lisapetroffdesign.com

8 REFERENCES



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