

Creating a Healthy Future

The impact of Victorian Government
investment in health and medical research



The research presented in this paper was commissioned by Victoria's Lead Scientist, Dr Amanda Caples, and the Victorian Department of Jobs, Precincts and Regions (DJPR).

We acknowledge the traditional Aboriginal owners of country throughout Victoria, their ongoing connection to this land and we pay our respects to their culture and their Elders past, present and future.

INHERENT LIMITATIONS

This report has been prepared as outlined with the Victorian Department of Jobs, Precincts and Regions in the Scope Section of the engagement letter dated 29 September 2020. The services provided in connection with this engagement comprise an advisory engagement, which is not subject to assurance or other standards issued by the Australian Auditing and Assurance Standards Board and, consequently no opinions or conclusions intended to convey assurance have been expressed.

No warranty of completeness, accuracy or reliability is given in relation to the statements and representations made by, and the information and documentation provided by the Victorian Department of Jobs, Precincts and Regions or stakeholders consulted as part of the process.

KPMG have indicated within this report the sources of the information provided. We have not sought to independently verify those sources unless otherwise noted within the report. KPMG is under no obligation in any circumstance to update this report, in either oral or written form, for events occurring after the report has been issued in final form.

©2021 KPMG, an Australian partnership and a member firm of the KPMG global organisation of independent member firms affiliated with KPMG International Limited, a private English company limited by guarantee. All rights reserved. The KPMG name and logo are trademarks used under license by the independent member firms of the KPMG global organisation.

Liability limited by a scheme approved under Professional Standards Legislation.

ISBN 978-1-76090-424-1 (Print)

ISBN 978-1-76090-425-8 (pdf/online/MS word)

DATE OF PUBLICATION

January 2021

ACCESSIBILITY

If you would like to receive this publication in an accessible format, such as large print or audio, please email lead.scientist@djpr.vic.gov.au. This publication is also published in PDF and Word formats at djpr.vic.gov.au/victorias-lead-scientist



FOREWORD

Victoria has built a globally competitive health and medical research system catalysed by a substantial program of investment in science and research capability that began over twenty years ago. Government leadership has inspired philanthropists to co-invest alongside the State and Australian Governments, taking Victoria's leading health and medical research institutions to a truly global level. And it has caught the attention of international technology companies who have chosen to make Melbourne their regional home and to secure the global headquarters of CSL.

This report looks at how we got there and the broader impact of these investments.

The *Science Technology and Innovation (STI) Initiative* and the *Healthy Futures Life Sciences Statement* together with the *Operational Infrastructure Support Program* (for independent Medical Research Institutes) and successive *Biotechnology Strategic Development Plans* have supported discovery research, research platform technologies, product development and commercialisation capabilities and industry and academic networks.

With an annual average Gross State Product to funding ratio of over 16 percent and the creation of 28,000 direct and 46,000 indirect jobs, these investments have delivered for the Victorian economy. Equally important, the lasting capability created in Victoria has underpinned the rapid, multidisciplinary response to the coronavirus pandemic.

This investment continues today. Recent Victorian Budget initiatives recognise that breakthroughs happen when talent has access to the tools, technologies and the networks needed to make new discoveries and progress them through development to everyday use.

We have an opportunity to build on the evidence base presented in this report to inform a new 10-year investment framework that continues to stimulate and sustain a strategic economic asset that has demonstrated its value in rising to urgent health challenges.



Dr Amanda Caples
Victoria's Lead Scientist

EXECUTIVE SUMMARY

Victoria has built a thriving, globally competitive health and medical research system through sustained investment in science and research infrastructure, skills and product development and commercialisation capabilities. This has created jobs, attracted investment, generated exports, delivered better healthcare and has enabled a rapid response to the coronavirus (COVID-19) pandemic.

Commencing 20 years ago, successive Victorian Governments have made a series of strategic investments in science, technology and innovation, with a strong focus on the health and medical research sector.

This report presents the impact of investments made in the 2000 to 2010 timeframe (the 'experimental period') since sufficient time has elapsed to evaluate the outcomes of these investments.

In particular, this report focuses on the impact of:

- the \$620 million *Science, Technology and Innovation (STI) Initiative* (50 percent of investments were biotechnology-related), which was delivered through two contestable rounds commencing in 1999 and 2004;
- the \$230 million *Healthy Futures: Victoria's Life Sciences Statement* in 2006; and
- the *Operational Infrastructure Support (OIS) Program*, which commenced in its current form in 2001 and continues to this day.

Alongside these investments in science and research capability, several Biotechnology Strategic Development Plans were released over the period to provide policy direction and some support to facilitate growth of the associated industry sectors. The Plans played a critical role in providing a strategic framework that informed investment decisions but were not a major grant program in and of itself.

Together, these programs worked to secure Victoria's position as a globally recognised leader in health and medical research and biotechnology. Eleven case studies are presented to illustrate the diversity and strategic intent of the programs and their impacts over time.

VICTORIA'S SCIENCE, TECHNOLOGY AND INNOVATION INITIATIVE, HEALTHY FUTURES AND OPERATIONAL INFRASTRUCTURE SUPPORT PROGRAMS DELIVERED SUBSTANTIAL ECONOMIC IMPACT AND JOBS

A series of economic evaluations have been undertaken at an individual program level and in combination.

The primary findings were that every dollar of Victorian Government funding invested to support the health and medical technologies and pharmaceuticals sectors has generated an additional Gross State Product (GSP) of \$3.66 and additional income of \$4.54 in Victoria.¹ For the three programs within focus, this equates to an annual average GSP to funding ratio of 15.7 percent for the *STI Initiative*, 20.5 percent for *Healthy Futures*, and 19.2 percent for the *OIS Program*.

Victorian Government investment over the period to 2016-17 also generated nearly 28,000 employee years of Full-Time Equivalent (FTE) direct employment, and nearly 46,000 employee years of FTE indirect employment in the broader Victorian economy.

IMAGE CREDIT: DEPARTMENT OF JOBS PRECINCTS AND REGIONS

THE OVERALL STRENGTH AND COMPETITIVENESS OF THE HEALTH AND MEDICAL RESEARCH SYSTEM AND BIOTECHNOLOGY SECTOR HAS INCREASED SINCE 2000

Victoria is now a world-class life science cluster and has a global reputation as a leading health and medical research centre of excellence. Victoria's biomedical universities and 12 independent Medical Research Institutes provide a flow of talent, knowledge, tools, technology and global relationships that support jobs across the broader economy.

Strategic Victorian Government investment has meant the State is well positioned to attract medical researchers, life sciences companies, R&D investment and medical research funding.

EVERY DOLLAR
of Victorian Government
funding generated

\$4.54

OF ADDITIONAL INCOME



Victorian Government funding generated

73,717 EMPLOYEE YEARS

of **direct and indirect full-time equivalent jobs in Victoria** over the 18-year period to 2016-17



Melbourne consistently attracts
MORE THAN

40%

of Australia's medical
research funding



Melbourne is only one of four cities in the world to have
TWO UNIVERSITIES
IN THE GLOBAL TOP 40 BIOMEDICINE RANKINGS

Victoria medtech and
pharmaceutical exports
are worth over

\$2.4 billion
EACH YEAR



Victorian medical technologies
and pharmaceutical
companies spend just under

\$1 billion

A YEAR ON RESEARCH
AND DEVELOPMENT

i This includes the three programs within the scope of this report and further related initiatives or sub-programs and represents the impact of investment beyond 2010. The 2018 report by ACIL Allen Consulting modelled the impact across 15 programs from 1999-2000 to 2016-17.




IMAGE CREDIT: DEPARTMENT OF JOBS PRECINCTS AND REGIONS

INVESTMENT HAS CREATED LASTING CAPABILITY

The *STI Initiative*, *Healthy Futures* and *OIS Program* have provided the investment to support the structure (bricks) and strength (mortar) of Victoria's health and medical research system and corresponding industry sectors. These investments have underpinned essential capabilities in:



Discovery research: through the creation of the Bio21 Institute, the expansion of the Walter and Eliza Hall Institute and the Murdoch

Children's Research Institute, the establishment of the Australian Regenerative Medicine Institute and the amalgamation of neurosciences institutes into the Florey Institute, Government investment boosted Victoria's medical research base. These, along with later investments in discovery research including the Peter Doherty Institute for Infection and Immunity, the Victorian Comprehensive Cancer Centre and the Olivia Newton-John Cancer Wellness & Research Centre, have attracted global technology firms to establish joint facilities such as the recent \$60 million Illumina-University of Melbourne Genomics Hub and the global headquarters of CSL.



Product development and commercialisation capabilities:

quality pre-clinical candidates through the Centre for Drug

Candidate Optimisation (contributing to over 260 drug discovery projects across Australian companies), early-clinical trial capability through Nucleus Network (conducting over 800 Phase I clinical trials for biotechnology and pharmaceutical companies), and early-stage product development through the Medical Research Commercialisation Fund (creating 25 new biotechnology companies in Victoria), supports the translation of Victoria's first-class research into improved health outcomes.



Research platform technologies:

ranging from major research facilities such as the Australian Synchrotron through to smaller but nevertheless impactful platforms such as the Victorian Microarray Technology Consortium, these facilities provide access to the cutting-edge and world-class capabilities needed to support research breakthroughs. Victoria hosts nine National Collaborative Research Infrastructure Strategy (NCRIS) capabilities, more than any other state and has attracted close to \$400 million of Australian Government investment since 2006.



Industry and Academic Networks:

by establishing and collaborating with organisations such as the BioMelbourne

Network, AusBiotech and the Alfred Research Alliance, Victorian Government investment supported the creation of critical mass and the building of local, national and international networks that are the hallmark of leading global research systems.



INVESTMENT HAS CREATED AN ENVIRONMENT ABLE TO RAPIDLY RESPOND TO THE CORONAVIRUS CRISIS

Victoria's response to the coronavirus pandemic has shone a light on the value of investment across areas such as infectious disease, epidemiology, immunology research, public health and advanced manufacturing and clinical trials capabilities.

A rapid and multidisciplinary response by our health and medical system has positioned Victoria at the forefront of local, national and global coronavirus responses.

This includes the development of therapies and potential vaccines, testing, diagnostics and public health advice, with notable examples including:

- The Doherty Institute was the first laboratory outside of China to grow the novel coronavirus in January 2020 and has since provided modelling work to support the government response to COVID-19.
- The Burnet Institute is progressing development of a rapid diagnostic test.
- Walter and Eliza Hall Institute of Medical Research is using the National Drug Discovery Centre to accelerate the discovery and development of new medicines for COVID-19 and other coronaviruses.
- The Murdoch Children's Research Institute is leveraging its expertise in child health to support the response, including researching the differences in the way that children experience COVID-19 infection and immunity compared to adults.
- Nucleus Network is undertaking Phase I and II clinical trials for four COVID-19 vaccine candidates.

- 360biolabs is providing specialist technical services for multiple international COVID-19 vaccine trials.
- Australia's largest multinational biopharmaceutical company, CSL, is manufacturing potential COVID-19 vaccines for roll-out in Australia, subject to regulatory approval.
- Starpharma is expediting development of a COVID-19 antiviral nasal spray.

THERE IS AN ONGOING ROLE FOR THE VICTORIAN GOVERNMENT TO CONTINUE TO SUPPORT THE SECTOR

The impact of these early programs demonstrate that investments by Government in health and medical research – both large and small – generate clear returns on investment and make a critical contribution to the establishment of a thriving system. Importantly, initial government investments are catalytic; creating a basis for further government, commercial and philanthropic funding which allow for ground-breaking research with transformational impact.

The strength of Victoria's health and medical research system has been underpinned by strategic, long-term and cross-government support and investment. Looking forward, the evidence of the impact of past investment tells us that there is a clear role for the Victorian Government to support the sector as it continues to evolve and grow – ensuring it is equipped with the right capabilities and capacity needed to address increasingly complex challenges, to contribute to a high quality healthcare system and continue powering a thriving economy.



CONTENTS

8	Overview of investments
12	The economic impact of investments
16	How the sector has grown sector since 2000
22	Lasting capability and the role of strategic government investments
30	The sector's role in the rapid response to the coronavirus pandemic
35	Appendix A: Case Studies
58	Appendix B: Stakeholders Interviewed
59	Appendix C: Operational Infrastructure Support Program Recipients
60	References

IMAGE CREDIT: DEPARTMENT OF JOBS, PRECINCTS AND REGIONS

BETWEEN 2000 AND 2010, THE VICTORIAN GOVERNMENT UNDERTOOK A SERIES OF STRATEGIC INVESTMENTS IN THE STATE'S HEALTH AND MEDICAL RESEARCH SECTOR

In 1998, the then Government's Science, Engineering and Technology Taskforce found that Victorian Government investment in science and technology was low by both international and national standards, eroding the State's research and development base. In response, successive Victorian Governments have made sustained investments in science, technology and innovation, with a strong focus on the health and medical research sector.

While many government policies, programs and investments worked to support health and medical research, this report examines the impact of three significant Victorian Government investment programs delivered over the decade 2000 to 2010 (the 'experimental period') noting that sufficient time has elapsed to evaluate the outcomes of these investments:

- the \$620 million *Science, Technology and Innovation (STI) Initiative*, which was delivered through two rounds commencing in 1999 and 2004;
- the 2006 \$230 million *Healthy Futures: Victoria's Life Sciences Statement*, and
- the *Operational Infrastructure Support Program*, which commenced in its current form in 2001 and continues to this day.

The *STI Initiative* and *Healthy Futures* were strategic investment initiatives designed to build science and research capability to support the growth of Victoria's competitive advantage in health and medical research, manufacturing and related industry sectors. The *STI Initiative* focused on investing in science, research and product development capabilities to enable sector growth; over 50 percent of *STI* investments directly or indirectly supported health and medical research. This landmark investment paved the way for *Healthy Futures*, which focused on boosting Victoria's leadership in health and medical research by expanding institute capacity, facilitating consolidation of



IMAGE CREDIT: DEPARTMENT OF JOBS PRECINCTS AND REGIONS

neuroscience and immunology institutes and establishing a new regenerative medicine institute. Another important trigger for *Healthy Futures* was the demand from philanthropic organisations to invest in health and medical research and the need to support sector growth to leverage philanthropic funding. The *OIS Program* complements these two initiatives by supporting the competitiveness of Victoria's independent Medical Research Institutes to attract competitive funding from national and international research sources and from philanthropy.

Alongside these investments in science and research capability, several Biotechnology Strategic Development Plans were released over the period to provide policy direction and some support to facilitate growth of the associated industry sectors. The Plans played a critical role in providing a strategic framework that informed investment decisions but were not a major grant program in and of itself.

To illustrate the specific impacts of the *STI Initiative*, *Healthy Futures* and *OIS Program*, this report explores 11 case studies of significant investment by the Victorian Government during this period to demonstrate the breadth of investment and seeks to understand the impacts sustained over time.ⁱⁱ A timeline of Victorian Government

investment in health and medical research over the experimental period, and the key investments featured in this report, is detailed in the figure overleaf.

While Victorian Government investment continued beyond this period, including the recently announced \$2 billion Breakthrough Fund, this timeframe has been selected as the 'experimental period' for this report to focus on the immediate and broader impacts of these watershed investments. Investments in scientific and research capability necessarily take time to demonstrate their full impact, making a comprehensive assessment in the short-term difficult. Where appropriate, other Victorian Government investments subsequent to the experimental period such as the Victorian Comprehensive Cancer Centre and the Peter Doherty Institute for Infection and Immunity are highlighted to demonstrate the impact of the Victorian Government's initial investments.

This report has been prepared following a desktop review of existing evaluations and data. Consultations were held with 25 stakeholders from Victoria's leading health and medical institutions.ⁱⁱⁱ Stakeholders also completed a survey providing detail on the direct and indirect impacts of Government investment. No additional economic analysis was completed for this report.

ⁱⁱ Detailed case studies are provided in Appendix A.

ⁱⁱⁱ A full list of stakeholders consulted is provided in Appendix B.

SCIENCE, TECHNOLOGY AND INNOVATION INITIATIVE

The \$620 million *STI Initiative* aimed to support Victoria's ideas and skills through investment in STI projects across Victoria, of which more than 50 percent of STI investments directly or indirectly supported the health and medical research sector.

The *STI Initiative* was delivered through two rounds. The \$310 million First Generation of funding was announced in 1999, followed by the \$310 million Second Generation of funding in 2002.

This funding represented the most significant investment made by a state government in science, technology and innovation at that time. It represented a substantial change in the role the Victorian Government played in building strategic capability and commercialisation.¹

HEALTHY FUTURES: VICTORIA'S LIFE SCIENCES STATEMENT

The \$230.45 million *Healthy Futures* enabled the building of a wide range of long-term strategic capital works that provided physical space, workforce development and enabling technologies for enhanced innovation and improved the quality of medical research.²

Announced in 2006, the *Healthy Futures* investment was motivated by the need to address space constraints and overcrowding of medical research infrastructure and to realise potential scale economies and increased productivity of labour from increased collaborative research efforts.³

It was supported by significant philanthropic funding and Australian Government co-investment.

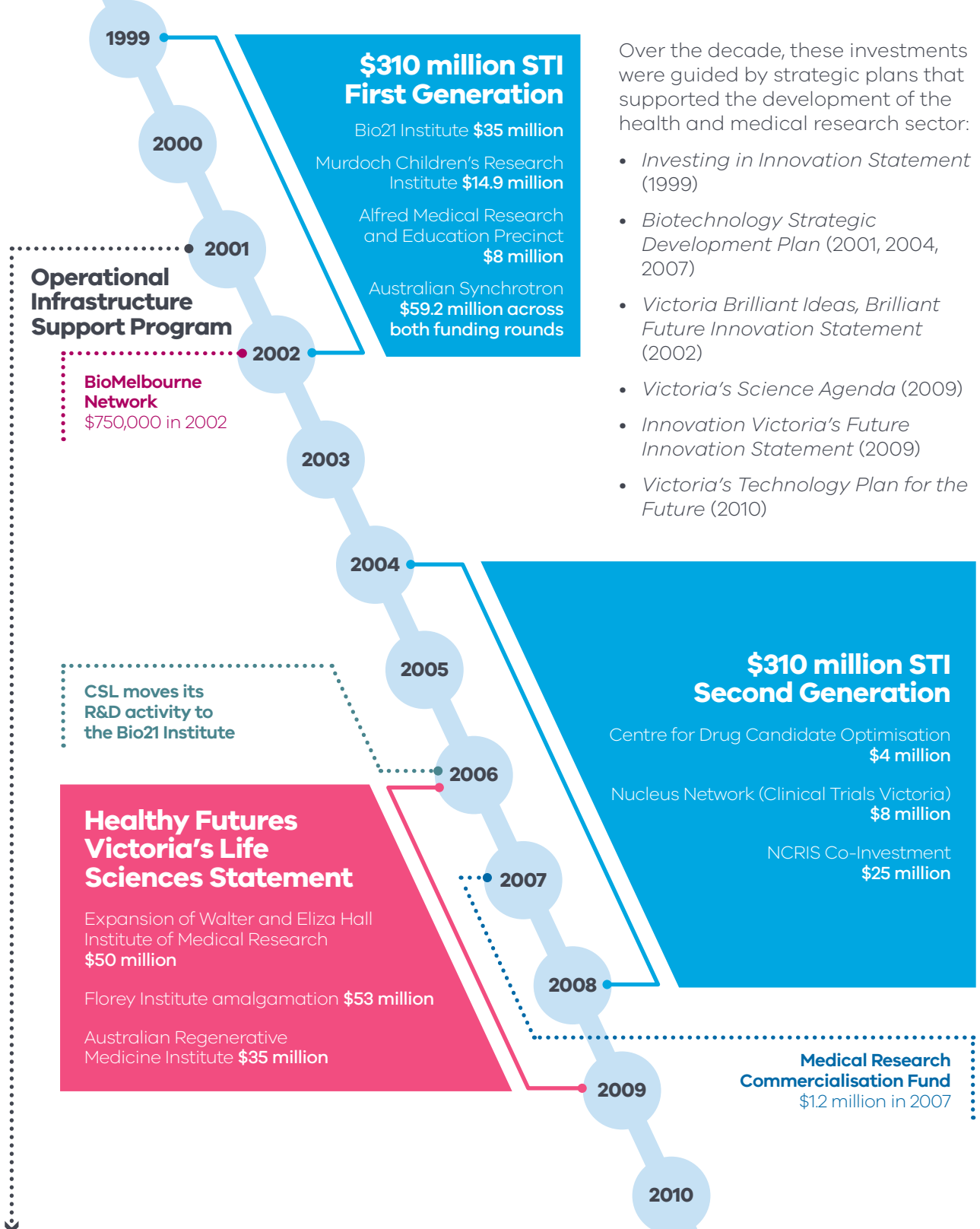
OPERATIONAL INFRASTRUCTURE SUPPORT PROGRAM

The *OIS Program* provides a small annual amount of funding to Victoria's 12 independent Medical Research Institutes for the essential infrastructure and operational costs underpinning medical research that are not provided for within competitive peer-reviewed research grants. This includes institute facilities, research commercialisation and product development costs including protecting intellectual property.^{iv}

The *OIS Program* in its existing form was established in 2001 and continues to the present day. For the 10 years to 2009-10, the Program provided \$210.7 million in funding.⁴ A smaller *OIS Program* was in place prior to 2001, at which point it was significantly transformed.

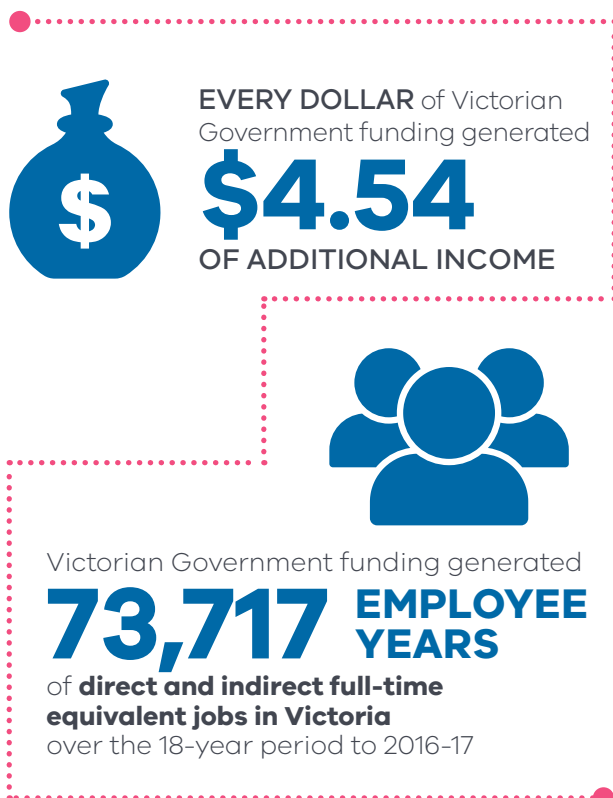
^{iv} Appendix C provides a full list of *OIS Program* recipients.

TIMELINE OF IN-SCOPE VICTORIAN GOVERNMENT INVESTMENT IN HEALTH AND MEDICAL RESEARCH AND KEY INVESTMENTS FEATURED IN THIS REPORT



VICTORIA'S STI INITIATIVE, HEALTHY FUTURES AND OPERATIONAL INFRASTRUCTURE SUPPORT PROGRAM DELIVERED SUBSTANTIAL ECONOMIC IMPACT AND JOBS

Strategic and sustained investment by the Victorian Government delivered positive economic impacts and a strong return on investment. Economic evaluations demonstrate increases in Gross State Product (GSP) and real income, which is a result of direct and indirect job creation, and leveraged funding from public, private and not-for-profit sources.



Each of the three programs in focus within the experimental period delivered economic benefits for the State. However, the economic impacts across the programs are not comparable given their different focus and intended outcomes for the health and medical research system. For example, the *STI Initiative* was focused on catalysing growth across the economy, whereas *OIS Program* support was focused on sustaining independent Medical Research Institutes.

OVERALL RETURN ON INVESTMENT AND GROSS STATE PRODUCT

Modelling estimates that every dollar of Victorian Government funding in the medical technologies and pharmaceuticals sector (across the three programs within the scope of analysis for this report and further related initiatives or sub-programs) generated additional GSP of \$3.66 and additional income of \$4.54 in Victoria, compared to if the funding had been allocated to general government expenditure.⁵ Without Victorian Government funding, it is estimated that the sector would have grown by an average of 4.5 percent a year instead of the 6.4 percent annual growth observed over the period 1999-00 to 2016-17. Over this period, cumulative sector revenue of nearly \$39.6 billion would not have been possible without government funding to the sector.⁶

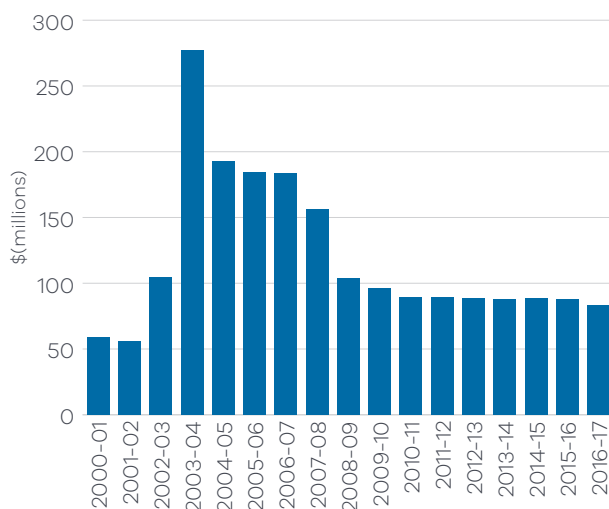


IMAGE CREDIT: DEPARTMENT OF JOBS PRECINCTS AND REGIONS

The **STI Initiative** is estimated to have generated a cumulative economy-wide rate of return of 283 percent over 18 years relative to the size of the initial investment that generated this increase. This equates to an annual average GSP to funding ratio of 15.7 percent.⁶

- *STI Initiative* investments increased the real GSP of Victoria by a total of \$2.0 billion to 2016-17.
- *STI Initiative* investments increased the real income of Victoria by \$2.6 billion to 2016-17.
- Funding through the *STI Initiative* increased the sector's revenue by a cumulative total of \$1.4 billion to 2016-17.⁴

ESTIMATED CHANGE IN REAL GSP AS A RESULT OF STI INVESTMENT⁴



Healthy Futures is estimated to have generated a cumulative economy-wide rate of return of 369 percent over 18 years relative to the size of the initial investment. This equates to an annual average GSP to funding ratio of 20.5 percent.⁶

- *Healthy Futures* increased the real GSP of Victoria by a total of \$1.2 billion to 2016-17.
- *Healthy Futures* increased the real income of Victoria by \$1.4 billion to 2016-17.
- Funding through the *Healthy Futures* increased the sector's revenue by a cumulative total of \$353 million to 2016-17.⁴

The **OIS Program** (which extends beyond the experimental period) is estimated to have generated a cumulative economy-wide rate of return of 346 percent over 18 years relative to the size of the initial investment. This equates to an annual average GSP to funding ratio of 19.2 percent.⁶

- The *OIS Program* increased the real GSP of Victoria by a total of \$1.6 billion to 2016-17.
- The *OIS Program* increased the real income of Victoria by \$2.0 billion to 2016-17.
- Funding through the *OIS Program* increased the sector's revenue by a cumulative total of \$998 million to 2016-17.⁴

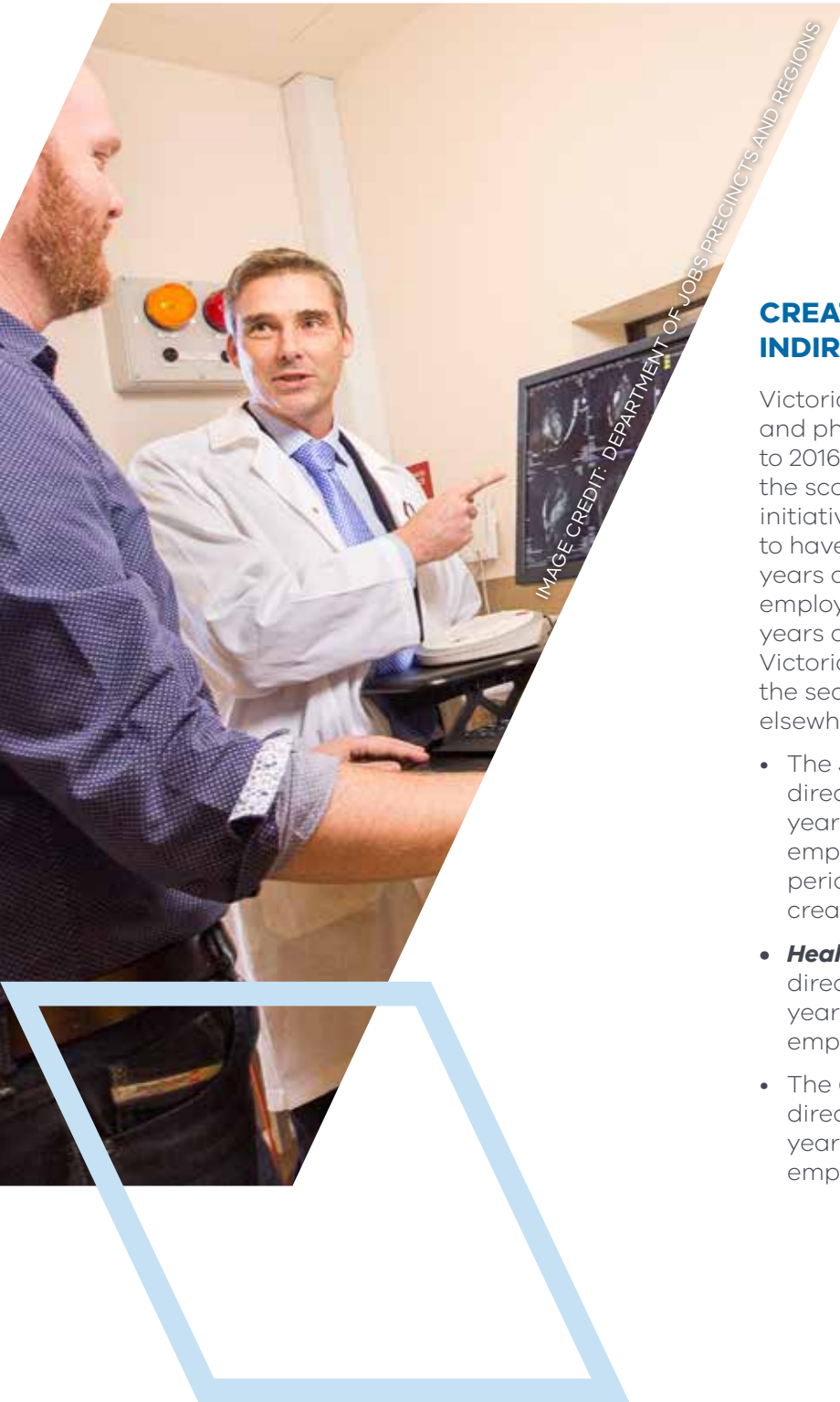


IMAGE CREDIT: DEPARTMENT OF JOBS, PRECINCTS AND REGIONS

CREATION OF DIRECT AND INDIRECT JOBS

Victorian Government medical technologies and pharmaceuticals funding from 2000-2001 to 2016-17 (across the three programs within the scope of this report and further related initiatives or sub-programs) is estimated to have generated nearly 28,000 employee years of Full-Time Equivalent (FTE)^v of direct employment, and nearly 46,000 employee years of FTE of indirect employment in Victoria.^{vi} For every direct FTE job created, the sector supported 2.63 additional FTE jobs elsewhere in the Victorian economy.⁶

- The **STI Initiative** is estimated to have directly generated around 2,623 employee years of FTE and indirectly generated 13,036 employee years of FTE. During the program period, approximately 1,000 FTE jobs were created each year on average.⁴
- **Healthy Futures** is estimated to have directly generated around 3,319 employee years of FTE and indirectly generated 6,708 employee years of FTE.⁴
- The **OIS Program** is estimated to have directly generated around 7,952 employee years of FTE and indirectly generated 7,195 employee years of FTE to 2016-17.⁴

^v Job creation is expressed in FTE employee years which is the number of full-time staff employed in one year.

^{vi} Indirect employment results when workers are employed as a result of additional expenditure and productivity induced by funded programs in the economy which generates enough demand to create additional jobs. Spikes in job creation mostly align with a program's funding profile.

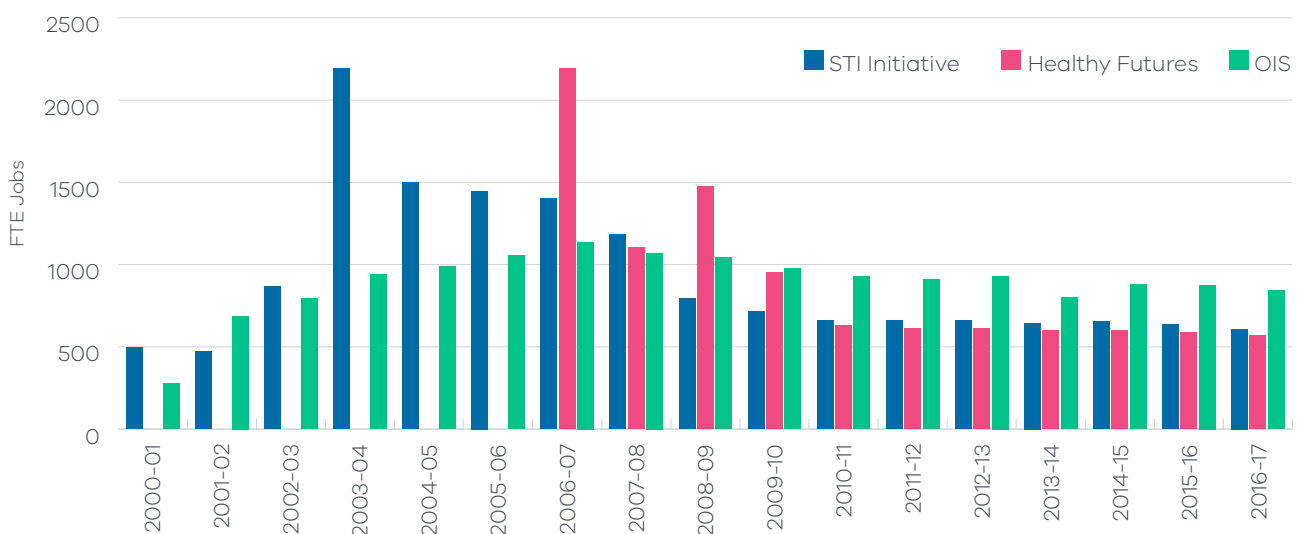
INCREASED LEVERAGED FUNDING FROM PUBLIC AND PRIVATE SECTOR SOURCES

Seed funding, joint ventures and co-contribution by the Victorian Government in health and biomedical research helped to leverage other public, private and philanthropic funding for significant projects. Additionally, early investment by the Victorian Government supported research institutes and other organisations to secure further funding as a result of their growth and reputation. The ability to attract ongoing philanthropic funding is a tangible demonstration of confidence in the Government's early investments.

- As at 2009, the **STI Initiative** leveraged \$2 billion in funding from the Australian Government, industry, philanthropic groups and overseas investors. This represents \$4.27 in leveraged funds for every \$1 of Victorian Government funding.¹

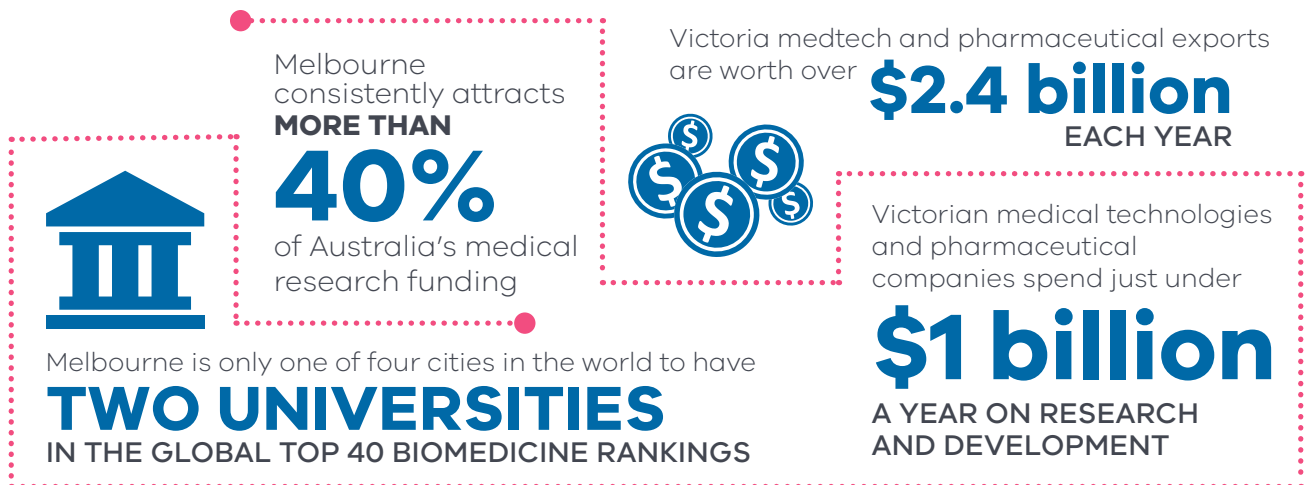
- As at 2013, **Healthy Futures** funding leveraged \$701 million from government and non-government sources. This equates to roughly \$4 in leveraged funding for every dollar invested by the Victorian Government, which varied across projects from \$1.20 to \$18.60.³
- For example, **the Walter and Eliza Hall Institute (WEHI)** has been able to attract increased competitive research grants, with total income from research grants increasing from \$19.8 million in 1996 to \$50.7 million in 2008. WEHI has also seen increased philanthropic support during this period, totalling \$78.5 million from 1996 to 2009. In 2019, WEHI received \$82.3 million in government, industry and philanthropic grants, fellowships and contracts.

ESTIMATED EMPLOYMENT GENERATED DUE TO VICTORIAN GOVERNMENT INVESTMENT⁴



THE OVERALL STRENGTH AND COMPETITIVENESS OF THE HEALTH AND MEDICAL RESEARCH SYSTEM AND BIOTECHNOLOGY SECTOR HAS INCREASED SINCE 2000

Victoria is now a world-class life science cluster, with a global reputation as a leading health and medical research centre of excellence. Strategic Victorian Government investment has meant the State is well positioned to attract talent, life sciences companies, R&D investment and medical research funding.



During the period 2000–2010, the Victorian Government provided strong leadership through successive Biotechnology Strategic Development Plans. These Plans operated alongside the major investment initiatives analysed in this report to create the vibrant biotechnology industry sector we have today.

In 2016–17, Victoria's health and medical research sector made an estimated direct and indirect contribution to the economy of \$20.5 billion, representing 5.04 percent of GSP. This was up from \$7.3 billion in total value add in 1999–00.⁶

In 2016–17, the sector directly employed 33,649 FTE, in addition to an estimated 91,331 FTE employed indirectly through demand generated from the sector. This is up by 520 percent from 22,252 FTE in direct

employment and 17,804 FTE in indirect employment in 1999–00.⁶ This reflects the economic impacts of the industry as a whole, beyond the impact of the Victorian Government investments detailed in the previous section.

In addition to employment, the sector represents around 3.5 percent of Victoria's total State exports.⁷ In 2018, Victoria exported medtech and pharmaceutical products worth over \$2.4 billion.⁸

Through sustained government leadership and investment to support a vibrant health and medical research sector, state-of-the-art R&D infrastructure and advanced manufacturing, Victoria has a strong health life sciences industry sector.



IMAGE CREDIT: DEPARTMENT OF JOBS PRECINCTS AND REGIONS

- Melbourne is home to over 250 medical technology companies.⁹ Thirty-eight percent of Australia's life sciences companies are based in Victoria;¹⁰ with 53 percent of all ASX-listed life sciences companies based in Melbourne.⁹ In 2018, Victoria's ASX-listed medtech and pharmaceutical firms had a combined market capitalisation of just above \$133 billion,⁸ up from around \$7.5 billion in 2000.
 - Total research and development spending by Victorian medical technologies and pharmaceutical companies has continued to grow, up to \$969 million in 2015 from around \$105 million in 2000.^{7,11}
 - Victoria receives 37 percent of total Australian Research Council (ARC) and National Health and Medical Research Council (NHMRC) grants. The total value of these grants has increased from \$68.9 million in 2000 to \$557.1 million in 2019.
- Victoria also received 44 percent of funding from the Medical Research Future Fund (MRFF) between 2016 and 2019, totalling \$250.2 million.¹² In 2020, Victorian institutions received over \$183 million in MRFF funding.
- Victoria received 45 percent of venture capital investments in Australian healthcare and biotechnology companies in 2016-17.¹³
 - Victoria is home to a number of national industry organisations. These include AusBiotech, Australia's leading industry body representing organisations doing business in and with the global life sciences economy; MTP Connect, Australia's Industry Growth Centre for the medical technologies, biotechnologies and pharmaceuticals sector; and the Cancer Therapeutics Cooperative Research Centre, a cancer research organisation with a focus on small molecule drug discovery.

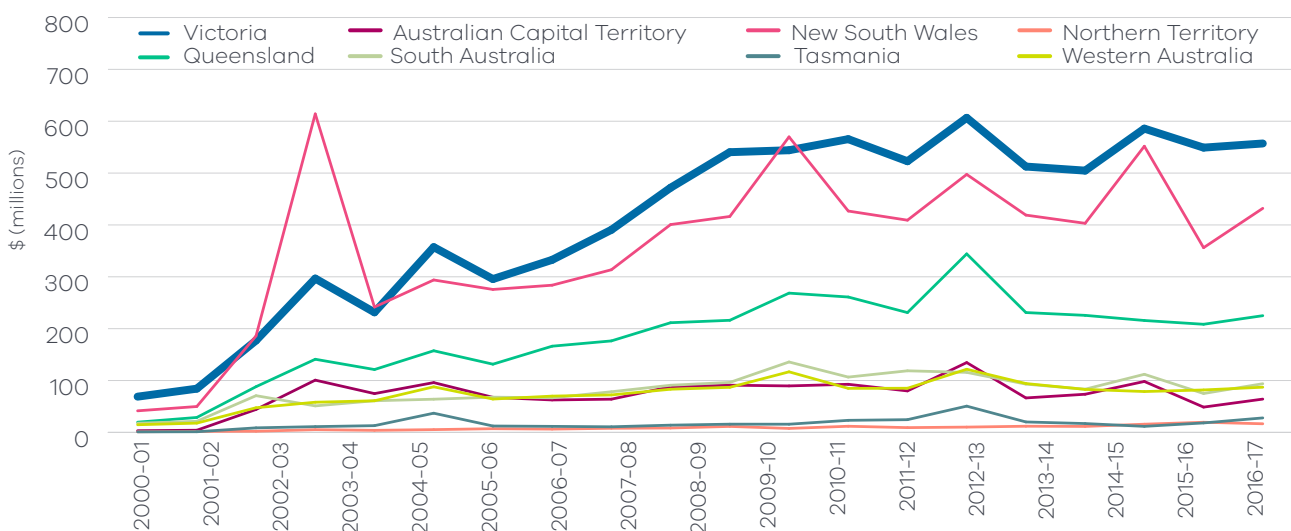
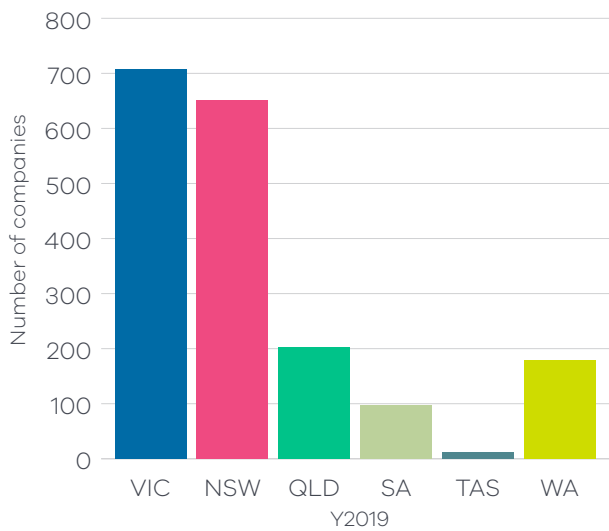
TOTAL ARC AND NHMRC FUNDING BY JURISDICTION, 2000-2019¹²

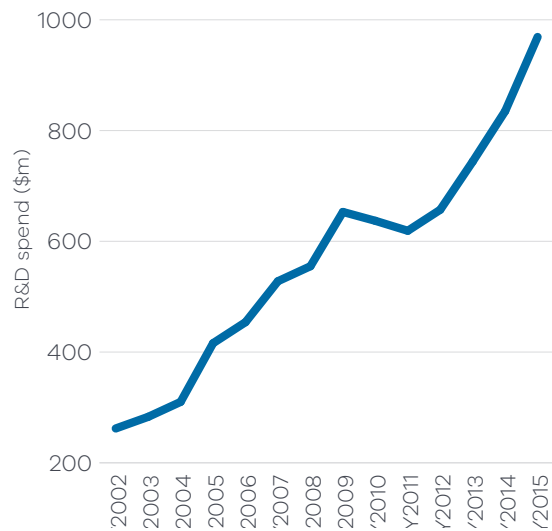


IMAGE CREDIT: DEPARTMENT OF JOBS PRECINCTS AND REGIONS

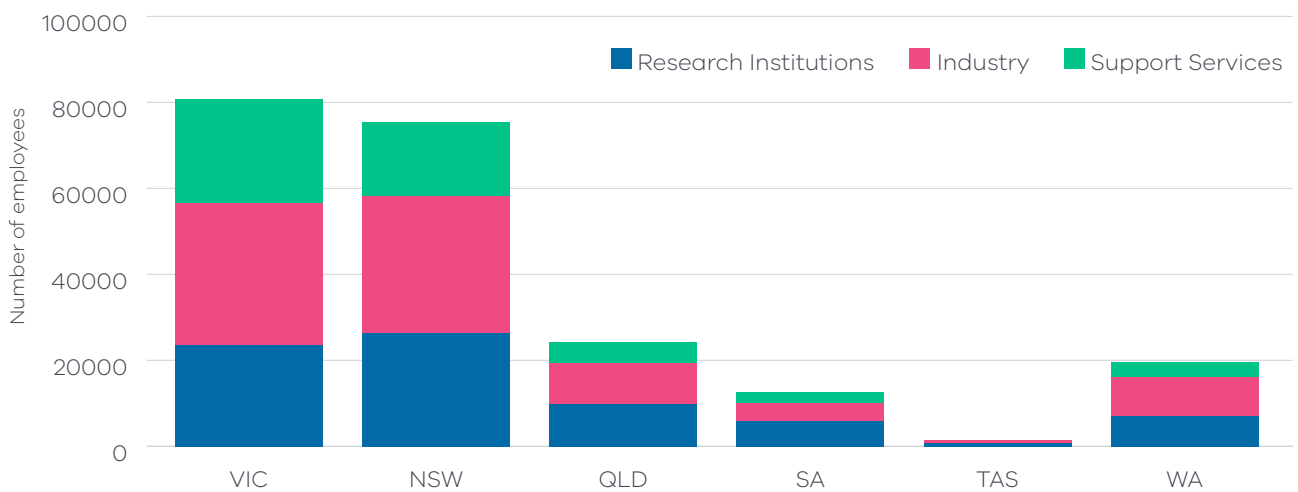
NUMBER OF LIFE SCIENCE COMPANIES BY STATE, 2019¹⁰



R&D SPEND BY VICTORIAN MEDICAL TECHNOLOGIES AND PHARMACEUTICAL COMPANIES⁷



NUMBER OF LIFE SCIENCES EMPLOYEES ACROSS SUB-SECTORS¹⁰





TOP-RANKED BIOMEDICAL UNIVERSITIES

Melbourne is one of only four cities globally to have two universities in the top 40 QS World University Rankings for medicine, alongside London, New York and Cambridge, Massachusetts. Monash University and the University of Melbourne play critical roles in the Victorian health and medical research system. They deliver a pipeline of talent and undertake impactful research and innovation in their own right, collaborating across disciplines and sectors to improve human health.

Monash University

Situated within the Monash Technology Precinct, Monash University is based in one of the largest and most diverse technology and innovation clusters in the world. Monash University's Faculty of Medicine, Nursing and Health Sciences is the University's largest research faculty, having contributed to breakthroughs in medical research relating to population health, IVF, Alzheimer's disease, cardiovascular, cancer and infectious diseases. Monash hosts key institutes including the Monash Biomedicine Discovery Institute, the Australian Centre for Blood Diseases, the Australian Regenerative Medicine Institute, the Turner Institute for Brain and Mental Health, the Centre to Impact Antimicrobial Resistance and the Monash Institute of Pharmaceutical Sciences.

Four of the Faculty's schools are located within hospital precincts at Alfred Health, Eastern Health and Monash Health. Monash University's connectedness to its precinct partners means research discoveries can be translated into real-life therapies and devices faster and more effectively across 'bench to bedside and back again' research translation. Together with its health service partners, Monash University is involved in almost a quarter of Australia's clinical trial activity.

Monash also hosts critical national infrastructure including AquaCore, which is the largest zebrafish facility of its kind in the southern hemisphere and houses marine species that support research into a variety of human diseases and conditions, and Monash Biomedical Imaging, home to Victoria's only research dedicated MR-PET scanner and a complementary suite of other imaging and clinical research facilities for preclinical and human research. Victoria's thriving biotech and medtech system includes the Australian Synchrotron, the Melbourne Centre for Nanofabrication and CSIRO's Lab22, all co-located with Monash University.

Monash University is a founding member of the M8 Alliance – an international network committed to global health improvement and development of science-based solutions to universal health challenges.

Australia's first dedicated heart hospital, the Victorian Heart Hospital, is being built on Monash University's Clayton Campus. Due to open 2022, the Hospital will embed a patient-centric model of care, underpinned by adaptable and flexible infrastructure to make it a global destination to test new approaches, therapies and technologies in cardiac care.

The University of Melbourne

The University of Melbourne is located in the Parkville Biomedical Precinct – one of the top five biomedical precincts in the world. Located within the precinct are the University's Faculty of Medicine, Dentistry and Health Sciences, the Peter Doherty Institute for Infection and Immunity, the Bio21 Molecular Science and Biotechnology Institute as well as University affiliated institutes including WEHI, the Peter MacCallum Cancer Centre, the Florey Institute of Neuroscience and Mental Health and the Murdoch Children's Research Institute. The University's research in biomedical and health sciences is led by the Faculty of Medicine, Dentistry and Health Sciences, in collaboration with research activities in Engineering, Law, Science and Veterinary Science. The Faculty has annual research income of more than \$350 million, including \$137 million in NHMRC, ARC and MRFF grants. The Faculty has over 1,700 staff, including 1,300 research academics and publishes over 4,000 peer-reviewed papers each year.

The Faculty has research strengths across cancer, child health, infection and immunity, and neuroscience and mental health. Notable medical research discoveries include the discovery of lithium therapy as an effective treatment for bipolar disorder, the development of the bionic ear, the discovery of the human Rota virus and development of a vaccine for infants and young children, the identification of the first gene implicated in the development of epilepsy, and eye health research and policy recommendations resulting in halving the gap in the rates of blindness in Indigenous communities.

The University has strong research linkages with partner hospitals through the Melbourne Academic Centre for Health, and a strength in biomedical engineering and digital health in the Melbourne School of Engineering. A range of initiatives support medtech innovation, including the Graeme Clark Institute, the hospital innovation program, and programs such as SPARK, BioDesign and TRaM (Translating Research at Melbourne).

Monash University and the University of Melbourne also work collaboratively on a range of ventures. For example, with \$10 million in support from the Victorian Government, the two universities jointly formed BioCurate in 2016 to support the translation of medical research outputs into high quality pre-clinical candidates.

More recently, the Victorian Government collaborated with the University of Melbourne and Illumina to secure a \$60 million investment for the Illumina-University of Melbourne Genomics Hub. The Hub will

give local researchers and innovative businesses access to world-class genomics, bioinformatics and health economics technologies and support analysis of vast amounts of data to better understand the human genome and translate this to new commercial applications.

Other Victorian universities make important contributions to the State's health and medical research system including Deakin University, La Trobe University, RMIT, Swinburne University, Victoria University and the Australian Catholic University.

IMAGE CREDIT: WEHI

LEADING INDEPENDENT MEDICAL RESEARCH INSTITUTES

Victoria is home to 12 independent Medical Research Institutes, which are a vital part of the State's leadership in health and medical research. Rather than acting as competitors, they are well connected with each other and Victoria's biotechnology universities. Together, Victoria's Medical Research Institutes directly employ more than 4,800 people and have over 876 partnership agreements across government, health, university and industry sectors in Victoria, interstate and abroad. In 2018-19, the 12 Medical Research Institutes spent \$365 million on research activities, ran 598 active clinical trials, spun-out five start-up companies and received \$223 million in competitive grant income from government and philanthropic organisations.¹⁴ Victoria's 12 independent Medical Research Institutes all receive a small amount of annual funding through the *OIS Program*, which has helped these organisations to build a strong workforce through the provision of operational support.

Victoria's largest independent Medical Research Institutes include:^{vii}

- The **Walter and Eliza Hall Institute of Medical Research** is working to improve the understanding, diagnosis, prevention and treatment of infections, immune disorders, cancer, developmental disorders and diseases of ageing.
- The **Murdoch Children's Research Institute** works to prevent and treat childhood conditions, working in five key areas: infection and immunity, cell biology, clinical sciences, genetics and population health.
- The **Florey Institute of Neuroscience and Mental Health** works to find cures for common neurological conditions such as multiple sclerosis, stroke and neurodegenerative diseases.
- The **Burnet Institute** aims to achieve better health for vulnerable communities by accelerating the translation of research, discovery and evidence into sustainable health solutions.
- The **Baker Heart and Diabetes Institute** researches the diagnosis, prevention and treatment of diabetes and cardiovascular disease.
- The **Hudson Institute of Medical Research** is delivering better health outcomes for cancer, inflammation, reproductive health and pregnancy and infant and child health by taking laboratory discoveries through to their application as new diagnostics, treatments and cures.
- The **St Vincent's Institute of Medical Research** investigates the cause, prevention and treatment of common, serious diseases including diabetes, obesity, heart disease, cancer, bone diseases and Alzheimer's.

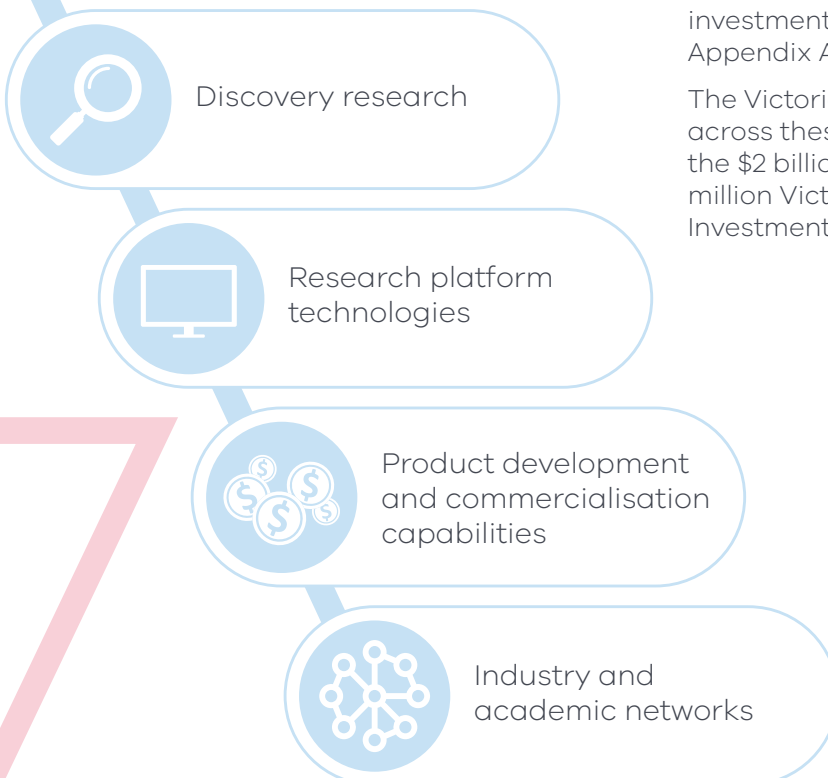
^{vii} Medical Research Institutes with annual operating expenditure of \$30 million or more are included. Other Victorian independent Medical Research Institutions include the Bionics Institute, the Institute for Breathing and Sleep, the Centre for Eye Research Australia, the National Ageing Research Institute, and the Olivia Newton-John Cancer Research Centre.

STRATEGIC GOVERNMENT INVESTMENTS HAVE CREATED LASTING CAPABILITY

Through investments in infrastructure for discovery research, research platform technologies, product development and commercialisation capabilities and industry and academic networks, the Victorian Government has created lasting capability which delivers ongoing economic and health benefits.

Although these investments differ in type, the *STI Initiative*, *Healthy Futures* and *OIS Program* provided the bricks and mortar needed to support the growth of the sector. Through the *STI Initiative* and Biotechnology Strategic Development Plans, the Government invested across the research value chain from basic research and platform technologies, to product development and commercialisation. *Healthy Futures* continued the consolidation and growth of research excellence. The *OIS Program* supports the services and infrastructure that support these research activities through the provision of a small amount of annual funding. Profiles for 11 case studies, selected to demonstrate the breadth and impact of Victorian Government investment, are presented in detail in Appendix A.

The Victorian Government continues to invest across these pillars. The 2020 Budget included the \$2 billion Breakthrough Fund and the \$350 million Victorian Higher Education Strategic Investment Fund.



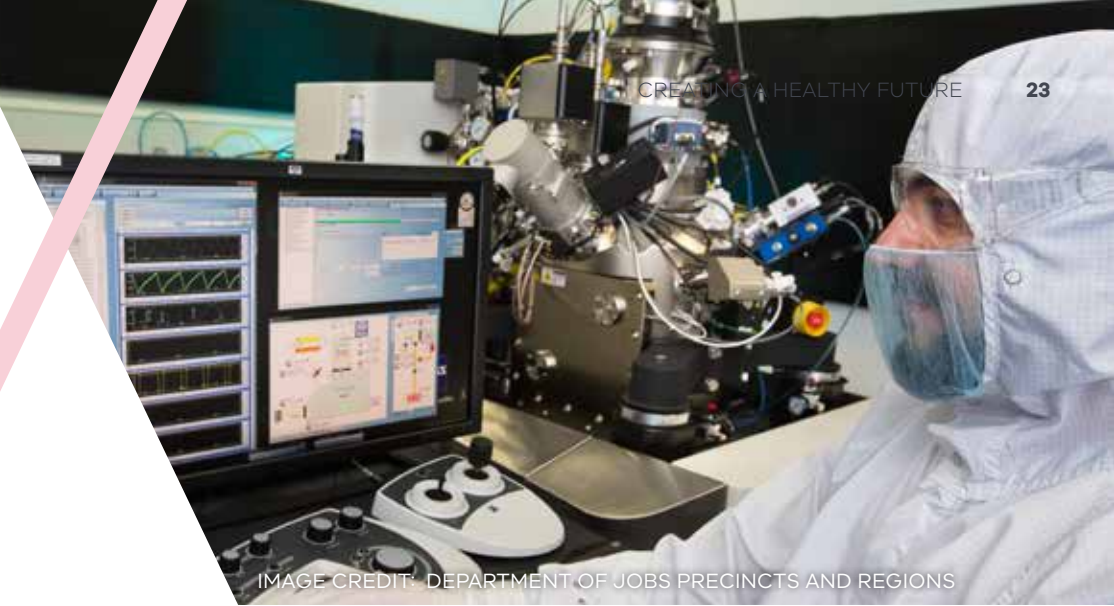


IMAGE CREDIT: DEPARTMENT OF JOBS PRECINCTS AND REGIONS



DISCOVERY RESEARCH

Investments across the experimental period supported the construction of capital projects and infrastructure, boosting basic research capacity within Victoria.

- As part of a broader \$35 million investment through the *STI Initiative*, the Victorian Government invested \$15 million in the creation of the **Bio21 Institute** to provide a life science focused, cross-disciplinary hub of research, development and commercialisation that would attract talent and investment from around the world. The Bio21 Molecular Science and Biotechnology Institute now houses more than 800 research scientists, students and industry tenants. Australia's largest multinational biopharmaceutical company, CSL, has co-located its global Research and Translational Science hub at Bio21 in Melbourne due to the reputation, facilities and research environment of Bio21 and surrounds. For further information on the impact of the Victorian Government investment on the Bio21 Institute and CSL, refer to Case Study 1 and Case Study 6.
- The Victorian Government provided \$50 million to support the expansion of **WEHI**. The expansion doubled WEHI's floor space and enabled an additional 270 researchers to be employed by 2012. The redevelopment proved essential in enabling WEHI to have the critical mass and quality infrastructure necessary to attract exceptional talent and deliver remarkable health outcomes through new scientific discoveries and commercialisation capabilities. For further information on the impact of the Victorian Government investment, refer to Case Study 2.
- \$53 million in funding was allocated to support the amalgamation of the Howard Florey Institute, the Mental Health Research Institute, the National Stroke Research Institute and the Brain Research Institute, building the critical mass needed to become a powerhouse of neuroscience. **The Florey Institute of Neuroscience and Mental Health** is now home to 600 researchers and is the largest brain research group in the Southern Hemisphere. For further information on the impact of the Victorian Government investment, refer to Case Study 3.
- The Victorian Government invested \$35 million towards the establishment of the **Australian Regenerative Medicine Institute**, to consolidate platform technology capabilities related to regenerative medicine in a central facility, and establish the critical mass to promote an integrated, interdisciplinary approach to regeneration. In turn, this facilitated Australia's Associate Membership of the European Molecular Biology Laboratory (EMBL), headquartered at Monash University, and has led to the establishment of a suite of EMBL Australia Partner Laboratories across the country. For further information on the impact of the Victorian Government investment, refer to Case Study 4.
- The Victorian Government invested \$14.9 million towards the development of the Research Precinct Building for the **Murdoch Children's Research Institute**. The construction and design of the 10-storey building facilitated the consolidation of research activities which drove collaboration and generation of new ideas between scientists and clinician researchers, and



IMAGE CREDIT: DEPARTMENT OF JOBS PRECINCTS AND REGIONS

across disciplines, to address important health challenges facing children and young people. The investment played a key role in establishing the Murdoch Children's Research Institute's nationally and internationally leading strategic initiatives in genomics, stem cell medicine, population health and large population cohorts (GenV) and global health. For further information on the impact of the Victorian Government investment, refer to Case Study 5.



RESEARCH PLATFORM TECHNOLOGIES

Investment in platform technologies – medical research equipment and tools that are shared and accessible across multiple users in a system – is important to ensure research competitiveness through access to cutting-edge technologies. These platforms attract and retain leading talent from around the world to Victoria, and promote networking, collaboration and interaction within the health and medical research sector.

More than \$200 million has been invested in platform technologies ranging from major research facilities such as the Australian Synchrotron through to smaller but nevertheless impactful platforms. Some examples include:

- The **Australian Synchrotron** was secured with an initial \$59.2 million contribution from the *STI Initiative*.^{viii} The Australian Synchrotron is one of the nation's most significant pieces of scientific infrastructure. Using the largest particle accelerator in the Southern Hemisphere, the Synchrotron produces powerful beams of light allowing individual experimental beamlines to examine materials. More than 5,000

researchers a year use synchrotron instruments, carrying out up to 1,000 experiments. The facility has been directly involved in the generation of more than 7,200 peer-reviewed publications, 100 international patents and 250 clinical trials for new medicines.¹⁵

- In 2000, the **Peter MacCallum Cancer Centre (Peter Mac)** was part of the Victorian Microarray Technology Consortium that received \$4.42 million in funding under round one of the *STI Initiative*. The funding was provided for Peter Mac to establish a Microarray platform, then the first of its kind in Australia, to allow for high-throughput measurement of gene expression and mutation. In 2006, through the Biotechnology Strategic Development Plan a further \$489,900 was invested enabling the Peter Mac to establish the Victorian Centre for Functional Genomics (VCFG), a high throughput RNAi screening facility, to support whole genome screening experiments. This investment saw the purchase and implementation of further technology advancements that have led to the establishment of the Molecular Genomics Core positioning the Peter Mac at the forefront of Personalised Cancer Medicine. Molecular testing at Peter Mac underpins many of the more than 200 early phase clinical trials being performed across the Parkville precinct through the Parkville Cancer Clinical Trials Unit (PCCTU), providing innovative therapeutic options for Victorian cancer patients. It is estimated that initial funding has leveraged at least an additional \$9.3 million in direct funding and has been critical to Peter Mac's early leadership in clinical genomics.

^{viii} For further information on the impact of the Victorian Government investment, refer to the 2020 ACOLA report, *Stimulating the Science and Research Ecosystem Creates Jobs and Investment*.



- As part of its establishment, the **Bio21 Institute** was provided \$16 million to support a range of platform technologies that currently include Magnetic Resonance Imaging, Advanced Electron Microscopy, Protein Characterisation facilities, Systems and Computational Biology facilities, and a major Mass Spectrometry facility. Some of these platforms are the biggest in Australia and are now located in purpose-built buildings at Bio21 named in honour of famous Australian women scientists, Nancy Millis and Ruth Bishop. There is open access to these platforms around the Parkville precinct and beyond which enables discovery, knowledge translation and commercialisation. Indeed, these platforms have now come together to constitute Bio21's early stage drug discovery pipeline.

Platform technologies in Victoria received a major boost in 2005 with the launch of the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS). In addition to earlier *STI Initiative* investments in platform technologies, a \$25 million pool of funding from the second round of the *STI Initiative* was set aside in 2005 to attract NCRIS funding for Victorian facilities. In this context, Victoria hosts more NCRIS capabilities than any other state and has successfully invested and administered close to \$400 million of Federal NCRIS funding since the scheme commenced. Along with this co-investment from the Australian Government, this pool of funding supported the establishment of the Victorian Node of the Australian Phenomics Network, the Victorian Node of Genomics Australia, the Melbourne Centre for Nanofabrication, hosted at Monash University, and the Victorian Node of Metabolomics Australia, co-located in the Bio21 Institute.¹

This investment was supplemented by a contribution of \$1.37 million from the Biotechnology Strategic Development Plan to support the formation of a Victorian Platform Technology Network (VPTN) to allow integration and collaboration of all Victorian technology platforms to facilitate easy searching and access to any capability and expertise across Victoria for industry and academic researchers.

Significant Victorian Government investments in research platforms were also made at Monash University and now operate under a single professionally run business unit branded 'The Monash Technology Research Platforms' (MTRP). Easy access and platform ISO certification provide industry great confidence and sets Monash apart in terms of supporting and enabling research and industry engagement. Access to this high-quality network of platforms has been a game-changer for how the university collaborates with industry. The MTRP has generated \$202 million in industry income across 240 projects, and \$287 million in grant income across 585 grants. Key platform technologies include the \$5 million Monash Centre for Electron Microscopy, the \$8.6 million Victorian Biomedical Imaging Capability, and the \$15 million Melbourne Centre for Nanofabrication.



IMAGE CREDIT: MEDICAL RESEARCH COMMERCIALISATION FUND



PRODUCT DEVELOPMENT AND COMMERCIALISATION CAPABILITIES

In addition to supporting discovery research, the Victorian Government boosted the State's product development and commercialisation capabilities, which are supporting the translation of Victoria's first-class research into improved health outcomes. While the Victorian Government has invested across a range of institutions, the following three examples illustrate the impact of Government investment.

- Founded in 2002 with \$4 million in *STI Initiative* funding, the **Centre for Drug Candidate Optimisation** fills a crucial gap between discovery and development by integrating medicinal chemistry and biology with pharmaceutical sciences to provide a means to identify drug candidates suitable for progression into pre-clinical and clinical development. Prior to the establishment of the Centre, access to pharmaceutical lead optimisation did not exist in Australia within a coordinated, validated and high-quality framework. As individual companies tend not to require lead optimisation regularly, there is not sufficient incentive to invest in the required costly state-of-the-art infrastructure and equipment themselves. For further information on the impact of the Victorian Government investment, refer to Case Study 7.

- Victorian Government investment in **Nucleus Network** (then known as Clinical Trials Victoria) aimed to increase the capability and capacity in early phase clinical trials. Prior to this investment, there was limited early phase clinical trial capability within Victoria and very few other sources of financial support. Nucleus Network is now Australia's largest Phase 1 clinical trial organisation, having conducted over 800 Phase 1 clinical trials for biotechnology and pharmaceutical companies. For further information on the impact of the Victorian Government investment, refer to Case Study 8.
- The **Medical Research Commercialisation Fund** plays an invaluable role helping research organisations fulfil their mandate of translating first class research into improved health outcomes. Investment by the Victorian Government to support the operations of the Fund helped bring capital and expertise in commercialisation to the State, raising commercialisation capability within research organisations. For further information on the impact of the Victorian Government investment, refer to Case Study 9.

Victorian Government investment across the research value chain has supported the commercialisation of numerous novel drugs and medical technologies. For example, to support the development and commercialisation of early-stage biomedical discoveries, the Medical Research Commercialisation Fund leverages \$45 in investment for every \$1 in Victorian Government funding. To date, MRCF has supported the establishment of around 25 new biotechnology companies in Victoria, which are generating value and improving health outcomes for Victorians. These include:

- Fibrotech's development of novel drug candidates for the treatment of the fibrosis prevalent in chronic kidney disease, chronic heart failure, pulmonary fibrosis and arthritis. This research was undertaken within the Bio21 Institute.
- Denteric's development of vaccines to treat and prevent severe periodontal disease and its complications, based on research conducted at the University of Melbourne.
- PolyActiva's development of ocular implants that provide controlled delivery of drugs to both the front and back of the eye.
- Certa Therapeutics' novel drugs which block a receptor that is a key driver of scarring of the kidney.
- Global Kinetics Corporation's development of a wrist device that records Parkinson's disease symptoms and reminds a patient when to take their Parkinson's disease medication as prescribed by their doctor. The device was developed by the Florey Institute of Neuroscience and Mental Health.

As a further example of the translational health benefits of Victorian Government investment, the expansion of WEHI provided the additional space and facilities to build a world-class interdisciplinary team to focus on developing an entirely new class of cancer drug. Produced in collaboration with Genentech and Abbvie, Venetoclax is now used to treat refractory chronic lymphocytic leukemia and is registered in over 50 other countries. It is also currently used in over 140 clinical trials for five major blood cancers and breast cancer.



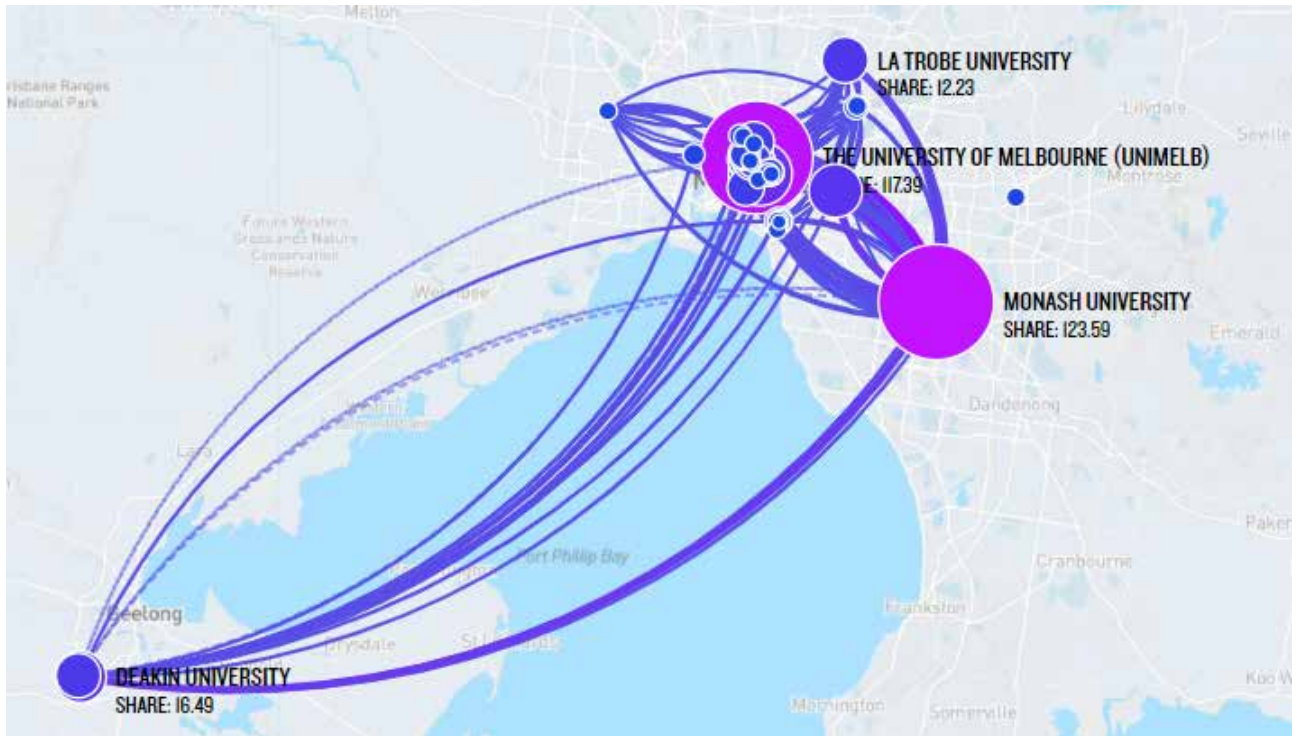
INDUSTRY AND ACADEMIC NETWORKS

High-impact, transformational and value-generating research requires collaboration which in turn is based on complex networks of relationships.

Facilitation of both industry and academic networks – local, national and international – has been a key feature of Victoria's approach to developing the health and medical research and biotechnology industry sectors.

- The **Alfred Research Alliance** is a leading medical and education precinct, with more than 8,000 health professionals, researchers, students and support staff from across eight institutions across biomedical, translational, clinical and public health research, and in education and health care. Supported by \$8 million in STI funding, the Alfred Medical Research and Education Precinct brings various partners together and hosts the complete translational research cycle at the one site. A further \$16 million from *Healthy Futures* supported the construction of the Alfred Centre 2, facilitating the merger of the Austin and Burnet Institutes, the co-location of a range of health services and facilitating the subsequent merger of the International Diabetes Institute with the Baker Institute. For further information on the impact of the Victorian Government investment, refer to Case Study 10.
- The **BioMelbourne Network**, established with the support of a Biotechnology Strategic Development Plan grant in 2002, plays a critical role connecting clinicians, researchers, industry and service providers. As the first and only state-based biotechnology industry body in Australia, it has established relationships with international industry associations, facilitates introductions for members to drive collaboration and partnerships, and hosts events that provide access to members, key stakeholders and decision makers, local and international industry intelligence and networking opportunities. For further information on the impact of the Victorian Government investment, refer to Case Study 11.
- Headquartered in Melbourne, Australia's only national biotechnology industry body, **AusBiotech**, has been connecting the entire ecosystem nationally and internationally for more than 35 years. With chapters in each state, AusBiotech is the largest network of organisations dedicated to the development, growth and prosperity of the Australian life science industry, by providing initiatives to drive sustainability and growth, outreach and access to markets, and representation and support for members nationally and around the world. Its key strength is in connecting state-based organisations with federal and international policy, providing a platform for companies to meet investors, and AusBiotech hosts the industry's largest conference at its annual gathering and leads the Australian and state delegations to the BIO trade association conference in the United States.

IMAGE CREDIT: THE ALFRED

COLLABORATION BETWEEN MELBOURNE'S LIFE SCIENCE INSTITUTIONS, 1 OCTOBER 2019 TO 30 SEPTEMBER 2020 ¹⁶

INVESTMENT HAS CREATED AN ENVIRONMENT ABLE TO RAPIDLY RESPOND TO THE CORONAVIRUS PANDEMIC

Leading Victorian institutions have contributed to the global understanding of SARS-CoV-2, the development and manufacture of therapies and potential vaccines, and testing and diagnostics. Experts from many Victorian institutions also provide key advice to governments.¹⁷

Catalytic Victorian Government investments during and subsequent to the experimental period created lasting capability and capacity. Victoria's cutting-edge research infrastructure, reputation and international linkages allowed the Victorian health and medical research sector to play such an important role in the response. In particular, the strong networked linkages that exist within the Victorian system allowed for a rapid and multidisciplinary response.

Many of the research institutions that played a leading role, individually and collectively, in the response to the pandemic have received support from the Victorian Government over the past 20 years, including funding from the *OIS Program*. This ongoing investment in the Victorian health and medical research sector is currently being supplemented through additional funding made available through the \$5.5 million Victorian COVID-19 Research Fund.

The recently announced \$550 million Australian Institute for Infectious Disease will create the largest centre of expertise in the Indo-Pacific region and cement Victoria's position of global leadership in infectious diseases. A new \$1 billion high-tech vaccine manufacturing facility will be developed in Melbourne to secure Australia's long-term supply of critical health products including pandemic influenza vaccines and lifesaving antivenoms.

IMAGE CREDIT: DR JASON ROBERTS

EXAMPLES OF HOW THE SYSTEM RESPONDED TO THE CORONAVIRUS PANDEMIC

- The **Doherty Institute** was the first lab outside of China to grow the novel coronavirus in January 2020, providing international laboratories and the World Health Organisation with crucial information to help combat the virus. This allowed researchers to validate test results and commence work on better diagnostic tests, treatments and a vaccine. The Doherty Institute has also released modelling work that has been utilised by governments to support the public health response to COVID-19.
- The **Murdoch Children's Research Institute** is leveraging its expertise in child health to support the response to COVID-19. In addition to focusing on the health and wellbeing of children, the Institute has pivoted its expertise in infectious disease, clinical trials, genomics, stem cell medicine and population health to investigate novel approaches to prevent and treat COVID-19. This includes:
 - Using human-derived stem cells to better understand the virus' effects on different organ systems in the body
 - Researching the differences in the ways that children experience COVID-19 infection and immunity compared to adults
 - Undertaking the largest longitudinal study following parents and newborn babies this century (Generation Victoria), delivering a deeper evidence base about the effects of COVID-19
 - Testing whether the BCG vaccine is effective in reducing the incidence and severity of COVID-19 in healthcare workers
 - Advising the Victorian Government on the risk of infection in school settings
- The **Burnet Institute** is working directly with the Australian Department of Health and the then Victorian Department of Health and Human Services to support the response, providing data-driven technical briefs and policy options across a range of policy, public health and clinical responses. The Burnet Institute is also progressing the development of a rapid diagnostic test and is contributing to profiling the immune response to assist diagnostic and immunotherapies. It is also screening novel drugs for their ability to prevent or treat COVID-19 infection.
- The **Alfred Research Alliance** has conducted over 30 COVID-19 related projects. Some examples of this include:
 - A team at the Baker Institute in conjunction with colleagues at the Bio21 Institute and University of Melbourne, has developed the 'COVID-3D' tool to monitor mutations that make it difficult to develop SARS-CoV-2 vaccines and drugs.

- Phase 1 and 2 clinical trials are underway at Nucleus Network for vaccine candidates including Novavax.
- 360biolabs obtained SARS-CoV-2 virus stocks from The Doherty Institute and developed a range of assays to assess the immunological response of vaccine candidates. These assays were used to provide data for the first COVID-19 clinical vaccine trial to be conducted in Australia, amongst others. Using its specialist PC3 biosecurity facility, 360biolabs is also supporting research into potential new therapies, repurposed antivirals, innovative COVID-19 diagnostics, and products which could benefit Australia's front-line workers and reduce the burden of disease within our community.
- The Baker Institute has expanded its PREDICT study to explore the mental and physical impacts of lockdown restrictions on people living with diabetes, while Deakin University researchers are looking into the impacts of restricted family visiting in ICUs.
- The Alfred has taken a lead in the hotel furloughing for medical staff, testing travellers and supporting the wellbeing of health care professionals. Alfred Health was also called on in response to outbreaks in residential aged care facilities, to help contain the virus and ensure residents received optimal care in their familiar environment.
- **WEHI** is using the National Drug Discovery Centre to accelerate the discovery and development of new medicines for COVID-19 and other coronaviruses. The Institute is leveraging its longstanding expertise in infectious diseases research and drug discovery to better understand immunity to COVID-19, assess potential antiviral medicines for activity against coronavirus, identify risk factors for developing serious COVID-19 complications, and identify antibodies that can block coronavirus infection.
- **CSL** has a contract with AstraZeneca to manufacture 50 million doses onshore of the Oxford University vaccine for the Australian population. The manufacturing program is currently underway, and first doses are planned for release in the first half of 2021, subject to regulatory approval.
- Researchers at the **Monash Institute of Pharmaceutical Sciences** produced Australia's first known mRNA vaccine candidates. Researchers produced three new vaccine candidates within the space of four weeks using a new genetic method that eliminates the time-consuming process of growing the virus. The vaccines are now proceeding to the first stage of testing to assess which candidate gives the most promising antibody response. This new approach means that if the virus mutates, a new vaccine can be tested within a few weeks.
- The **CSIRO Australian Centre for Disease Preparedness** in Geelong is involved in key research in the rapid global response to the COVID-19 outbreak. As one of only six high-containment animal research centres in the world, CSIRO used this facility to conduct preclinical studies on two COVID-19 vaccine candidates in partnership with the Coalition of Epidemic Preparedness Innovations. The CSIRO monitored the evolution of the virus through genomic analysis and confirmed in an experimental study that current vaccines in development are still effective against the dominant G-strain of the novel coronavirus.

The CSIRO also led research on how long the virus can survive on different surfaces and how it is impacted by environmental factors like temperature and humidity. The CSIRO has also opened the first accredited testing facility in Melbourne for single use surgical face masks.

- **Starpharma**, an ASX300 company located in Melbourne, has developed a novel antiviral nasal spray, VIRALEZE™, which inactivates more than 99.99 percent of SARS-CoV-2, the virus that causes COVID-19. VIRALEZE™ is a broad spectrum antiviral nasal spray and is virucidal against SARS-CoV-2 and works by blocking the spike proteins on the SARS-CoV-2 and preventing them from binding to host cells thus preventing infection. Starpharma is finalising regulatory documents and manufacturing product in preparation for launch which is planned for the first quarter of 2021. Apart from VIRALEZE™ being a Victorian discovery, critical antiviral testing of the spray was conducted at 360Biolabs at the height of the pandemic in March 2020. Had this testing not been available locally the rapid development of the product would have been significantly compromised. Starpharma was awarded \$1 million in MRFF funding to expedite development and commercialisation of VIRALEZE™.



IMAGE CREDIT: WEHI



IMAGE CREDIT: DEPARTMENT OF JOBS, PRECINCTS AND REGIONS

APPENDIX A: CASE STUDIES

Eleven case studies have been selected to highlight, in detail, the breadth and impact of Victorian Government investments during the experimental period.

DISCOVERY RESEARCH

Case Study 1: Bio21 Institute

Case Study 2: Walter and Eliza Hill Institute of Medical Research

Case Study 3: Florey Institute

Case Study 4: Australian Regenerative Medicine Institute

Case Study 5: Murdoch Children's Research Institute

PRODUCT DEVELOPMENT AND COMMERCIALISATION CAPABILITIES

Case Study 6: CSL

Case Study 7: Monash Institute of Pharmaceutical Sciences
– Centre for Drug Candidate Optimisation

Case Study 8: Nucleus Network (Clinical Trials Victoria)

Case Study 9: Medical Research Commercialisation Fund

INDUSTRY AND ACADEMIC NETWORKS

Case Study 10: Burnet Institute and the Alfred Medical Research and Education Precinct

Case Study 11: BioMelbourne Network

CASE STUDY 1: **BIO21 INSTITUTE**



Victorian Government investment in the construction of the Bio21 Institute supported the development of a multidisciplinary hub, bringing industry and researchers together to maximise health and research outcomes.

IDENTIFIED PROBLEM/GAP

Leaders from the University of Melbourne, Melbourne Health and WEHI identified the need for greater linkages between biotechnology research, translation and commercialisation activities within Victoria. These entities partnered with the Victorian Government to establish Bio21 Australia Limited, which expanded to become the Bio21 Cluster representing more than 21 hospitals and medical research institutions. The overall aim of the Project was to create a medically focused hub of research, development and commercialisation that would attract talent and investment from around the world.

The Bio21 Molecular Science and Biotechnology Institute was formed out of the Bio21 Australia partnership as a formal institute and new premises. The Bio21 Institute aimed to specialise in interdisciplinary research, industry engagement and state-of-the-art platform technologies, providing critical mass (the minimum amount of resources necessary to become self-sustaining) to maximise health and research outcomes, encouraging institutions to work collaboratively.

OVERVIEW OF THE INVESTMENT

The Victorian Government provided \$35 million in funding through the STI First Generation (Other Funding) for the construction and establishment of the Bio21 Institute and associated infrastructure. The \$35 million was distributed between the Bio21 Institute (\$15 million), the Ludwig Institute for Cancer Research and WEHI Joint Proteomics Facility (\$5 million) and a Bio21 STI strategic development fund for seeding research infrastructure investments and collaborations between Bio21 Australia members (\$15 million). Victorian Government funding for the Bio21 Institute was supplemented by additional funding from the University of Melbourne (\$50 million), the Atlantic Philanthropic Foundation (\$30 million), the Australian Government (\$9.5 million) and industry. A further \$1 million in Victorian Government funding was provided for the Bio21 Clean Room through the STI Second Generation (Strategic Projects).

The Bio21 Institute
now houses

MORE THAN

500

research scientists,
students and
industry participants.





IMAGE CREDIT: PETER CASAMENTO/BIO21 INSTITUTE

The Bio21 Institute houses a range of **platform technologies**

Including:

- Magnetic Resonance
- Advanced Electron Microscopy
- new Protein Characterisation facilities
- Systems and Computational Biology facilities
- a major Mass Spectrometry facility.

IMPACT

The Bio21 Institute now houses more than 800 research scientists, students and industry participants. It plays an important role in building a pipeline of talent, currently training around 380 early career researchers, post-doctorates and PhD students. It also supports Year 11 and Year 12 students to take their VCE studies out of the classroom into Bio21 Institute labs.

The Bio21 Institute houses a range of platform technologies, employs managers to run them, and educates researchers to use them. Platform technologies include Magnetic Resonance Imaging, Advanced Electron Microscopy, new Protein Characterisation facilities, Systems and Computational Biology facilities, and a major Mass Spectrometry facility. Access to these platforms by researchers enables discovery, knowledge translation and commercialisation. The platform technologies also attract leading scientists from around the world to Victoria.

Australia's largest multinational biopharmaceutical company CSL has based its global Research and Translational Science hub in Melbourne due to the reputation, facilities and research environment of Bio21 and surrounds. CSL has been a partner of the Bio21 Institute since 2007, and now has around 170 scientists co-located at the facility.

The Bio21 Institute has played a role in improving health outcomes. This includes a potential treatment for Motor Neurone Disease and Parkinson's Disease, a new approach to eradicating dengue fever, a more effective malaria treatment, and 3D modelling of tuberculosis mutations to allow doctors to rapidly tailor individual treatments.

As a successful model of industry-academic relationships, the Bio21 Business Incubator has added to the pipeline of new Victorian businesses. Patrys Ltd, an ASX-listed company, is developing antibody therapies in oncology. Sienna Cancer Diagnostics focuses on the development of novel in vitro diagnostic cancer tests. Bioscreen has developed into a commercial faecal microbiome testing business linked with the personal healthcare industry.

Many collaborations have also had commercial impact. For example, a collaboration between Bio21 researchers and Telix Pharmaceuticals, an Australian biopharmaceutical company, has led to a new Industrial Manufacturing Cooperative Research Centre. The Centre will translate new molecules to provide more effective and personalised cancer therapeutics, that were invented in the Bio21 Institute, to commercial manufacture.¹⁸



CASE STUDY 2:

WALTER AND ELIZA HILL INSTITUTE OF MEDICAL RESEARCH

WEHI is Australia's leading biomedical research institute. The contribution by the Victorian Government to expand and effectively double the Institute's size in 2008 was critical in helping the Institute grow to becoming the global success it is today.

IDENTIFIED PROBLEM/GAP

In the early 2000s, WEHI experienced severe limitations in physical space, which was impeding its potential to undertake new scientific and technological programs and attract new scientific talent. At the time, a review of similar major competing organisations abroad led to WEHI concluding that without expansion, WEHI would be unable to continue competing at the highest level internationally and would experience inevitable decline.

OVERVIEW OF THE INVESTMENT

The Victorian Government provided \$50 million through the *Healthy Futures* program in 2006 to support the expansion of WEHI to ensure the Institute could rival the world's best. The seven-storey western wing at WEHI's Parkville laboratories was estimated to cost \$130 million, with the Australian Government providing \$50 million and Atlantic Philanthropies providing the remaining \$30 million.

Officially opened in 2012, the redevelopment included Australian-first research services across seven new levels of laboratories and scientific support services. This included a

new personalised medicine research centre, volunteer blood donor registry, an insectary for breeding malaria-carrying mosquitos, and a clinical translation centre.

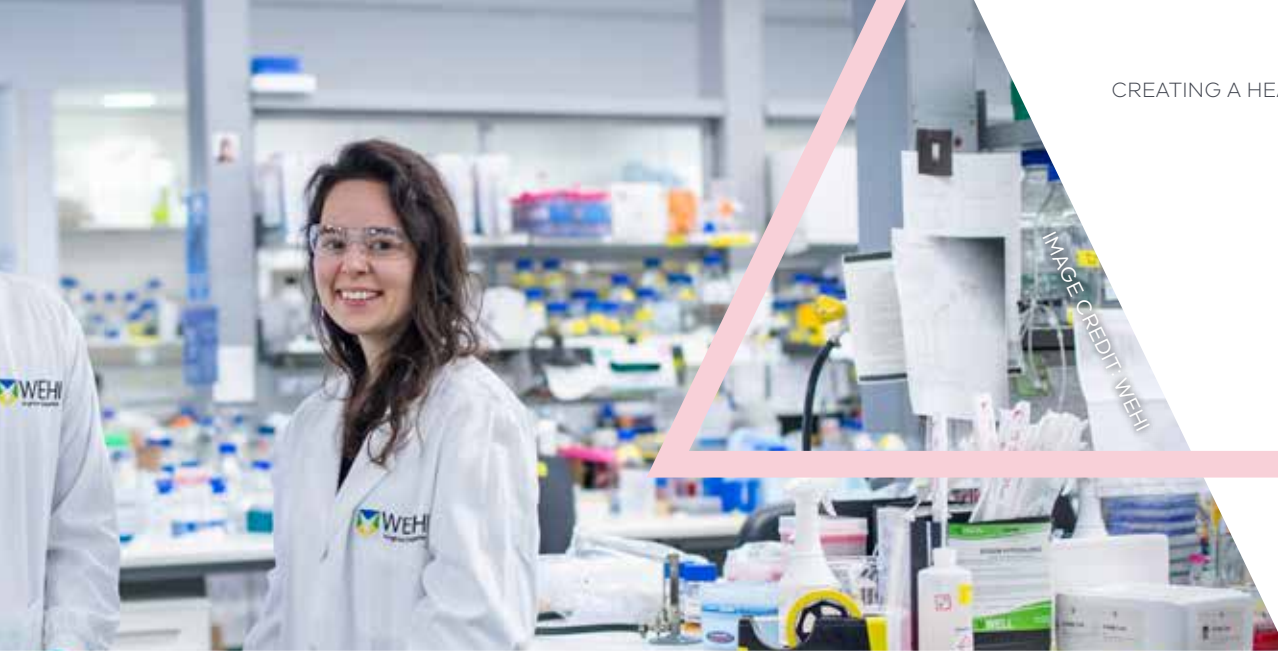
IMPACT

The expansion doubled WEHI's floor space and enabled an additional 270 researchers to be employed by 2012. Growth of this scale has only been possible by having the necessary space, quality infrastructure, reputation and funding to house the world's leading scientists.

Ten years on, it is clear that the expansion has been transformative for WEHI. Not only are the state-of-the-art laboratories, support facilities and office space still being utilised by WEHI, the redevelopment proved essential in enabling WEHI to have the critical mass and quality infrastructure necessary to attract exceptional talent and deliver remarkable health outcomes through new scientific discoveries and commercialisation capabilities.

The expansion enabled WEHI to establish new strategic research initiatives, most notably in genomics, bioinformatics, breast cancer, structural biology, medicinal chemistry, developmental biology and systems biology. WEHI's enhanced research capacity was also able to attract increased competitive research grants. By 2019, revenue from government and industrial and philanthropic grants has grown to over \$80 million per annum.

These new research opportunities and initiatives have also led to an increase in high quality jobs, which have been filled with leading talent from Australia and abroad. Growing from 320 staff in 1997, today WEHI



has 1,160 staff comprising 89 senior scientists, 286 scientists, 569 research laboratory staff, and 216 support staff. Additionally, WEHI supports 203 research students completing honours, Masters, and PhD studies. In the period 2000–2009, WEHI authored 2,190 peer reviewed publications. In the subsequent decade, this figure grew to 3,700 peer reviewed publications.

Today, there are more than 300 research projects underway at WEHI – in cancer, immunology, infectious diseases, and healthy development and ageing – creating a robust discovery and development pipeline. For instance, WEHI has received more than \$16 million in funding from global charity Wellcome Trust to identify and investigate ‘drug-like’ molecules for treating malaria in partnership with biopharmaceutical company Merck Sharp & Dohme. WEHI’s longstanding collaborative relationship with CSL has yielded several new biological drugs that are now in clinical development for inflammatory diseases, and the two organisations continue to work closely on a range of translational research. In 2019, WEHI’s annual income from its commercialisation activities totalled \$43 million.

Innovations at WEHI have also led to the foundation of several spinout companies, such as IonOpticks, which manufactures innovative analytical tools used by researchers worldwide, and Anaxis Pharma, a joint venture between WEHI and Synthesis Research to develop novel drugs for the treatment of inflammatory

diseases. To continue to build a diverse pipeline of WEHI spinouts, the Institute initiated an entrepreneurship program in 2018, which is designed to encourage and support the entrepreneurial activities of all staff and students. In addition, WEHI’s intellectual property is currently the subject of more than 200 clinical trials being conducted worldwide.

Attraction of talent has been an enduring focus for the Institute, with a sustained focus on ensuring WEHI attracts the best and brightest people through initiatives to support gender equity and the promotion of science as a career pathway to secondary and tertiary students. The Institute is a founding partner of the Gene Technology Access Centre, which aims to increase science literacy in the community and to inspire students to undertake tertiary studies in STEM.

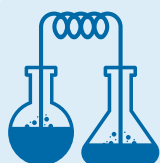
VICTORIAN GOVERNMENT'S INVESTMENT IN WEHI WAS transformative



1,160
staff

203
research
students

3,700
peer reviewed
publications



**MORE THAN
300**
research
projects
underway

Annual income from
commercialisation
activities

\$43 million



CASE STUDY 3: FLOREY INSTITUTE

Victorian Government investment to support the amalgamation of neuroscience institutes in Victoria built a powerhouse of discovery and funding. The Florey Institute is now one of the largest and most highly respected brain research centres in the world.

IDENTIFIED PROBLEM / GAP

In the early 2000s, Victoria had an established reputation in neurosciences – an important and growing field encompassing research into the prevention, diagnosis, treatment and cure of neurological and psychiatric conditions. Several neuroscience institutes operated across Victoria. However, many of these institutes were operating in dated facilities that required significant investment to remain viable.

In this context, a clear opportunity arose to merge Victoria's neuroscience institutes, both to address infrastructure challenges and to also create the critical mass of capabilities, talent and skills needed to boost Victoria's leadership in neuroscience.

OVERVIEW OF THE INVESTMENT

To support the collaboration of neuroscience institutes, the Victorian Government contributed \$53 million through the *Healthy Futures* program towards the merging of the Florey Institute, the Mental Health Research Institute, the National Stroke Research Institute and the Brain Research Institute, to build a powerhouse of discovery and funding. These institutes collectively now operate under the guise of the Florey Institute of Neuroscience and Mental Health.

This capital funding provided the infrastructure and space for these institutes to co-locate together. It also addresses research infrastructure needs, including dry laboratory space, wet lab space, and new capital equipment.





IMAGE CREDIT: THE FLOREY INSTITUTE

OVER
300 FTE



TOTAL INCOME OF
\$85.5 million

in 2019 including \$45.2 million in grants



**LARGEST BRAIN
RESEARCH GROUP**

in the Southern Hemisphere

IMPACT

Today, the Florey Institute is one of the largest and highly respected brain research centres in the world. The Institute is the largest brain research group in the Southern Hemisphere and is one of the world's top five brain research centres.

The Institute provides scientists and students with world-class facilities and the opportunity to improve lives. The Institute works on a range of serious diseases including stroke, epilepsy, Alzheimer's, Parkinson's and motor neurone diseases, depression and addiction. The Florey Institute is also a world leader in imaging technology, stroke rehabilitation and large population studies to improve patient care around the world.

For example, the Australian National Imaging Facility (NIF), which is lead out of Queensland and is a key partner of the Florey Institute, is a \$300 million project that provides state-of-the-art imaging capability of humans, animals, plants and materials for the Australian research community. NIF was established as an unincorporated joint venture in 2007 with 11 participants. It received substantial funding through the Commonwealth Government's National Collaborative Research Infrastructure Strategy (NCRIS) and co-funding by state governments and other partners.

This reputation has also helped the Florey Institute to secure further funding and opportunities for the Institute. The Florey Institute currently has over 300 FTE and in 2019 received a total income of \$85.5 million, including \$45.2 million in grants. The Florey Institute also continues to attract significant philanthropic investment, including from the Myer and Potter Foundations.

In recent times, the Florey Institute has focussed on translation and commercialisation, substantially increasing its interaction with industry partners in Australia and throughout the world. This has resulted in several large industry funded drug development projects in indications such as epilepsy and dementia and allowed the Florey Institute to substantially increase its impact from a clinical perspective. The Florey Institute has also been cognisant of ensuring that there is a reasonable commercial return for these efforts to ensure sustainability into the future which will underpin the success of future generations of neuroscientists.

CASE STUDY 4:

AUSTRALIAN REGENERATIVE MEDICINE INSTITUTE

The Victorian Government funding helped establish the Australian Regenerative Medicine Institute as a pre-eminent research institute that has forged the way in regenerative medicine, attracting exceptional talent, building lasting international partnerships and making remarkable discoveries that have changed how disease and injury are treated.

IDENTIFIED PROBLEM/GAP

In the mid-2000s, regenerative medicine was recognised as one of the most revolutionary and emerging fields in medical science. At Monash University, the Australian Stem Cell Centre, the Monash Immunology and Stem Cell Laboratory and stem cell companies were gaining significant traction in this area, forming a centre of excellence in regenerative medicine that was already attracting international attention.

There was a clear opportunity to leverage these existing strengths and catapult Monash University's leading role in regenerative medicine, both nationally and globally.

OVERVIEW OF THE INVESTMENT

As part of the *Healthy Futures* Program, the Victorian Government entered into a joint venture with Monash University to build a new Australian Regenerative Medicine Institute – the first of its kind in Australia.

The Victorian Government invested \$35 million towards the \$138 million project to construct one of the world's largest stem cell research hubs to consolidate platform technology capabilities related to regenerative medicine in a central facility, and establish the critical mass to promote an integrated, interdisciplinary approach to regeneration. Officially opened in 2009, the Institute was also built to provide a focus on cutting edge research, clinical applications and the development of commercial products in one of the most significant and innovative fields of medical science. It was also intended to build international links, attract talent and provide a unique training environment for Victoria's young scientists.

IMPACT

ARMI has established a strong reputation as a pre-eminent research institute that has forged the way in regenerative medicine, attracting exceptional talent, building lasting international partnerships with the global scientific community and making remarkable and life-changing discoveries that have and will transform how we treat disease and injury.

ARMI led Australia's Associate Membership of the European Molecular Biology Laboratory (EMBL). ARMI attained the appointment of the first two Australian EMBL Group leaders for the newly established EMBL Australia Partner Laboratory Network.

The EMBL Network has since played a critical role in the growth and international reputation of Australia's scientific community – internationalising Australian research,



empowering and training Australia's best early-career researchers and future scientific leaders and embedding powerful new enabling tools, such as bioinformatics and systems biology, in Australian life sciences. Without the leadership role that ARMI played, this Network may not have otherwise been formed.

Today, ARMI has 18 research groups with up to 250 staff and students, a comprehensive teaching program and plans for continued growth including the development of a new purpose-built hub facility suitable for research and manufacturing to also accommodate local regenerative medicine start-up companies. Initiating and leading the Centre for Commercialisation of Regenerative Medicine (CCRM) Australia, a national initiative to support translation and commercialisation of Australia's growing regenerative medicine sector not only underscores the Institute's

support for regenerative medicine but also provides the commercialisation expertise for ARMI's research pipeline.

ARMI's researchers have also secured significant competitive research funding, established unique enabling research infrastructure and have expanded in size and scope because of the targeted recruitment of exceptionally talented scientists and developed undergraduate and postgraduate education programs.

Of the 24 research group leaders recruited since inception, 20 were international recruits from leading institutes in North America (University of Toronto, Harvard University), Japan (Osaka University) and Europe (European Molecular Biology Laboratory). Except for two of these initial recruits, all have continued their research career within Australia.



SOME OF ARMI'S REMARKABLE DISCOVERIES

- Discovery of how areas of the brain that are responsible for vision could potentially adapt to injury or trauma and ultimately prevent blindness.
- Unlocking a mechanism that triggers stem cell production in the blood.
- Developing the first research model for stroke that most closely resembles what happens in the human brain.
- Uncovered a vital mechanism underlying the process of myelination, a key characteristic of multiple sclerosis.
- Developed technology to speed up the mending of damaged bone, skin and, potentially, other tissue.

CASE STUDY 5: MURDOCH CHILDREN'S RESEARCH INSTITUTE

Victorian Government investment during the early formative development of the Murdoch Children's Research Institute (MCRI) played a key role in establishing the Institute as one of the top 3 children's health and medical centres globally. The investment in a building to house MCRI as a dedicated research institute within The Royal Children's Hospital (RCH) was key to accelerating solutions to health issues facing children and young people within Victoria and around the world.



OVER 2,000
staff and students

INCOME INCREASED to around
\$200 million
in 2019



**MCRI IS RANKED WITHIN THE
top 10
institutions**
receiving federal grant funding
for the last five years

**MCRI IS RANKED WITHIN THE
top three**
children's health and medical
research centres globally



INVESTMENT RATIONALE

Following the merger of the Murdoch Institute and the Royal Children's Hospital Research Institute in 2000, to form MCRI, a dedicated space for research was needed to leverage the unique opportunity of a campus where MCRI and RCH staff worked closely and seamlessly across research and clinical care. The campus offered the potential to create a globally unique approach to solving health challenges; one where research could be brought to the frontiers of healthcare and scaled out to communities across Victoria and Australia, and health systems around the world.

OVERVIEW OF THE INVESTMENT

The Victorian Government provided \$14.9 million in 2002 through the STI Initiative to support the development of the Research Precinct Building. The construction and design of the 10-storey building dedicated to research discovery and translation housed basic, clinical and population health research, Genetic Health Services Victoria (now known as the Victorian Clinical Genetics Service) as well as scientific enablers including the Clinical Epidemiological and Biostatistics Unit, biobanking facility and small and large animal modelling facilities.



IMAGE CREDIT: MURDOCH CHILDREN'S RESEARCH INSTITUTE

IMPACT

Investment by the Victorian government has helped position MCRI as an impact organisation powered by research. The dedicated research building facilitated the consolidation of research activities which drove collaboration and generation of new ideas between scientists and clinician researchers, and across disciplines (laboratory-based, clinical and population health research), to address important health challenges facing children and young people.

The investment played a key role in establishing MCRI's nationally and internationally leading strategic initiatives in genomics, stem cell medicine, population health and large population cohorts (GenV) and global health – with a particular focus on applying research expertise and innovative technologies to solving real world problems affecting children and adolescents. For example:

- MCRI is leading the case to incorporate genomic medicine into healthcare to accelerate genetic diagnosis and guide tailored treatment as leaders of Australian Genomics.
- MCRI were the first in the world to grow mini-kidneys from stem cells as a new possible treatments for chronic kidney disease.
- MCRI established one of the world's largest longitudinal studies of children to advance health and well-being of Victorian children, GenV.

- MCRI's global health program is working with over 30 low-income countries to address major health threats affecting children.

The profile of MCRI as a leading medical research institute nationally and internationally was established as a result of Victorian Government investment, making MCRI attractive to key talent who have established and lead innovative and translational research programs. MCRI grew from around 40 researchers to over 2,000 staff and students by 2019, research output (number and quality of publications) increased each year, and income increased from around \$11 million in 2000 to around \$200 million in 2019, including from competitive grants which continues to increase each year. MCRI is now ranked within the top 10 institutions receiving federal grant funding for the last five years and is ranked within the top three children's health and medical research centres globally.

The investment also played a key role in driving innovation and research translation and attracting industry partners. Key examples include the development of a Rotavirus vaccine, based on MCRI's world first discovery of Rotavirus, development of a treatment for food allergy, and new diagnostic tests offered to families through the Victorian Clinical Genetics Service.

CASE STUDY 6: CSL

CSL has recently announced it will build a new global headquarters in Melbourne by 2024. The strong presence and linkages CSL has formed in the Parkville Biomedical Precinct, as well as the strengths of the Precinct, supported by Victorian Government investment, was a key driver in CSL's decision.

CSL is a leading global biotechnology company with a dynamic portfolio of life-saving medicines, including those that treat haemophilia and immune deficiencies, as well as vaccines to prevent influenza. CSL, including its two businesses, CSL Behring and Seqirus, provides life-saving products to more than 70 countries and employs more than 27,000 people.



IMAGE CREDIT: CSL



IMAGE CREDIT: CSL – ARTIST IMPRESSION OF NEW HEADQUARTERS

In 2019, CSL announced that it will be building a new global headquarters, which will accommodate more than 800 CSL employees, in the Parkville Biomedical Precinct. The Precinct's global reputation, as well as the strong research ties and collaborations established by CSL in the Precinct, were key drivers in the company's decision.

In the early 2000s, strategic investments by the Victorian Government had helped to assemble the key components necessary to grow the Precinct's density and quality of medical research activity.

One of these investments was \$35 million to support the establishment of the Bio21 Precinct, including the construction of the Bio21 Institute. The Institute now houses more than 800 research scientists, students and industry participants and a range of platform technologies.

In 2007, CSL moved its global research and development activity to the Bio21 Institute, and now has a strong presence in the Precinct, with over 170 scientists working in the Institute. CSL is part of a strong network of industry and research institutes operating in close proximity, enabled and facilitated by Victorian Government efforts to strengthen the collaborative ties in the Precinct. For example, CSL works closely with the WEHI to accelerate the development of new therapeutics and translate WEHI's research.

Other key institutes that make the Melbourne precinct a vibrant research hub include the Doherty Institute for Infectious Disease, The Murdoch Children's Research Institute, the Victorian Comprehensive Cancer Centre, the Royal Melbourne Hospital, the Royal Women's Hospital, The Peter MacCallum Cancer Centre and the Royal Children's Hospital. Victorian Government investment has supported all of these institutions.

In 2014, with support from the Victorian Government, CSL opened the Biotechnology Manufacturing Facility in Broadmeadows, for the large-scale manufacture of novel recombinant therapies for international clinical trials, and in December 2015 opened the Turner Facility for the manufacture of an immunoglobulin therapy. In 2017, CSL also expanded its facilities with a \$230 million advancement manufacturing facility at its CSL Behring site in Broadmeadows. The facility is expected to produce therapies with an estimated annual market value of \$850 million as well as generate up to 200 new jobs by 2026.

In November 2020, CSL announced it will invest \$800 million in a cell-based influenza vaccine manufacturing plant at the Melbourne Airport Business Park, with operations expected to start in 2026. The investment is the largest made in the local pharmaceutical sector since the construction of CSL Behring's Broadmeadows plant.

CSL...



PROVIDES
LIFE-SAVING PRODUCTS
**TO MORE THAN
70 countries**

EMPLOYS
**MORE THAN
27,000**



PEOPLE

CASE STUDY 7:

MONASH INSTITUTE OF PHARMACEUTICAL SCIENCES – CENTRE FOR DRUG CANDIDATE OPTIMISATION

IMAGE CREDIT: MONASH INSTITUTE OF PHARMACEUTICAL SCIENCES

Victorian Government investment in the Centre for Drug Candidate Optimisation created a footprint in drug discovery in Victoria. Since then, the Centre has been self-funded and has become part of the national infrastructure in drug discovery, contributing to the growth of the Monash Institute of Pharmaceutical Sciences (MIPS).

INVESTMENT RATIONALE

Drug candidate optimisation is a critical part of the medical research system, working to identify drug candidates with necessary properties for successful progression into pre-clinical and clinical development. The Centre for Drug Candidate Optimisation was formed to fill a critical gap in the Australian drug discovery system by providing expertise and infrastructure in pharmaceutical drug candidate optimisation for improved compound design, selection and progression.

Prior to the establishment of the Centre, access to pharmaceutical lead optimisation did not exist in Australia in a consistently coordinated, validated and high-quality way. As individual companies tend not to require lead optimisation regularly, there was not sufficient incentive to invest in the required costly infrastructure and equipment.

Researchers were forced to either work with overseas contract research organisations that typically provide only minimal data interpretation or utilise ad hoc local expertise of varying quality, limiting product development and commercialisation activities.

OVERVIEW OF THE INVESTMENT

The Centre was established in 2002 with \$4 million in funding through the Second Round of the STI First Generation Infrastructure Program. This funding provided for the purchase of new equipment and infrastructure, the development of new R&D programs and the appointment of scientific and administrative staff. Since the initial Victorian Government investment, the Centre has leveraged a further \$52.6 million in funding to 2020 from other sources, including \$44.1 million in funding from research projects.

IMPACT

The Centre for Drug Candidate Optimisation, located within MIPS in Monash University, has provided a rigorous and successful model for national and international collaboration. It plays an important role within the system, providing expertise and infrastructure to advance basic Australian biological discoveries into drug candidates that are well-positioned for further clinical development, investment and commercialisation.



OVER THE PAST 18 YEARS THE CENTRE HAS:

- Contributed to over 260 drug discovery projects across Australian companies, Australian and international academic groups, and international not-for-profit and commercial drug discovery organisations.
- Contributed to the progression of 34 novel drug candidates into human clinical development by partner organisations, of which 26 candidates are from Australian companies.
- Contributed to more than nine successful licencing deals for Australian companies with large pharmaceutical companies, with upfront payments to companies of over \$175 million and total potential milestone payments of over \$2 billion.
- Contributed to two academic collaborations in the past three years that have spun out to form new companies.
- Played a major role in the progression of seven novel drug candidates into international clinical trials for the treatment of malaria. One candidate, Arterolane, has been registered in India and used in India and Africa to treat millions of malaria patients, while the others are still undergoing clinical development.



A total of 87 staff have spent time working at the Centre since 2003. The Centre has served as a training ground for industry and research organisations, with the majority moving into industry roles, research or academic roles within universities or medical research organisations, or future education. The initial Victorian Government investment has also had an indirect impact on job retention in Victoria and Australia through the 15 to 20 commercial partner organisations that are supported by the Centre each year. The success of these organisations depends heavily on their ability to advance compounds through a discovery pathway.

The strengths of the Centre contributed to the establishment of the MIPS in 2008, and the strength of MIPS as a beacon for

attracting talent to Melbourne and anchoring Monash University's global strengths in pharmaceutical research and training. MIPS has been ranked within the top-two universities in the world for pharmacy/pharmacology since 2016. Access to the Centre and MIPS was a critical driver in the formation of the Cooperative Research Centre for Cancer Therapeutics in 2007, the attraction of a significant internationally renowned Metabolic G Protein-Coupled Receptor biology research group to MIPS in 2009, and a major initiative to form the Australian Translational Medicinal Chemistry Facility at MIPS in 2012. The Centre is also part of the Monash University Technology Research Platform Network and continues to support the internal drug discovery activities of the Institute.

CASE STUDY 8:

NUCLEUS NETWORK (CLINICAL TRIALS VICTORIA)

The Victorian Government's investment in Clinical Trials Victoria was instrumental in building the State's current strength in early-phase clinical trials through what is now known as the Nucleus Network. This capability would not have existed without this support from the Victorian Government.

AUSTRALIA'S LARGEST

Phase 1 clinical
trial organisation

**MORE THAN
800**

Phase 1 clinical trials
for biotechnology and
pharmaceutical companies



**OVER 200
beds**

across Australia and
the United States

AUSTRALIAN
WORKFORCE
OF AROUND

400 specialists

IDENTIFIED PROBLEM/GAP

Victorian Government investment in Clinical Trials Victoria aimed to increase the Victorian systems' capability and capacity in early clinical trials. Prior to this investment, there was limited clinical trial capability within Victoria and very few other sources of financial support. Existing capability was mostly limited to cancer research. Clinical research organisations that conduct early clinical trials usually go on to secure later trials, hence the identified gap in early-stage trials was limiting for Victoria's entire clinical trials capacity.

OVERVIEW OF THE INVESTMENT

Originally known as Clinical Trials Victoria, the organisation was part of a consortium that received \$8 million in funding in 2003 through the Second Round of the STI First Generation Infrastructure Program. Clinical Trials Victoria received approximately \$2 million in funding for its operational costs, with the Centre for Clinical Studies and Cancer Trials Australia sharing the remainder. Clinical Trials Victoria was required to administer the \$2 million to develop a 24-bed Phase 1 trials unit as part of a Centre for Clinical Studies. The funding provided to Cancer Trials Australia was used to establish and operate two research Positron Emission Tomography scanning machines, along with laboratory capacity at Royal Melbourne Hospital.

In 2005, the Baker Heart Research Institute took over Clinical Trials Victoria to improve its reach and impact. The Baker Institute merged the Centre for Clinical Studies with Clinical Trials Victoria to form the Nucleus Network. In 2018, Nucleus Network was sold to an Australian private equity firm, Crescent Capital Partners, which continues to invest in the organisation today.



IMAGE CREDIT: PATRICK ROCCA/ABC

IMPACT

The formative funding provided to Clinical Trials Victoria was integral to its establishment. Nucleus Network is now Australia's largest Phase 1 clinical trial organisation. With clinics in Melbourne, Brisbane and the United States, Nucleus Network has conducted more than 800 Phase 1 clinical trials for biotechnology and pharmaceutical companies. It has over 200 beds and an Australian workforce of around 400 specialists. Within Victoria, Nucleus Network employs around 170 staff, with support from additional casual staff. Its facility in Melbourne is co-located with the Alfred Research Alliance Precinct, which houses 2,000 to 3,000 medical professionals and researchers.

In 2008, 75 percent of Nucleus Network's revenue came from international customers. This has increased to over 90 percent today. In recognition of the important role Nucleus Network played in building an export capability for the State, the Nucleus Network received the Victorian Export Award for Innovation Excellence and the Emerging Exporter Award at the 2008 Governor of Victoria Export Awards. A 2009 review of the *STI Initiative* estimated that export revenues to that point had generated around 85 new permanent jobs and 50 part-time jobs at Nucleus Network.¹

The education arm of Nucleus Network also played an important role in training staff in the clinical trials sector to raise the awareness

and standard of Good Clinical Practice. This work enabled the success of other clinical trial organisations across Australia. Between 2003 and 2008, Nucleus Network Education trained 1,198 industry professionals across Australia and in New Zealand.²⁰

The work of Nucleus Network also generates indirect flow-on benefits for the Victorian economy. A 2009 review of the *STI Initiative*, found that each trial conducted generates additional activity from local trial monitors, from sponsor companies or from other contract research organisations. The flow-on benefits are estimated to be around 30 percent of the revenue earned by Nucleus Network. This additional activity would not have occurred without the initial investment and was estimated to have generated an additional 30 FTE jobs.¹ In addition, Nucleus Network helped establish Pharmaceutical Packaging Professionals Pty Ltd, a company dedicated to specialist drug development and manufacturing.

In April 2020, Nucleus Network was tasked by biotechnology company Novavax to begin Phase 1 clinical trials of a new COVID-19 vaccine – the first time a COVID-19 drug had been trialled in humans outside of the United States and the United Kingdom. Nucleus Network had previously worked with Novavax as part of the development of their Ebola vaccine in 2015. Nucleus Network is also working with the Serum Institute of India and Accelagen on Phase 1/2 trials for another COVID-19 vaccine.

CASE STUDY 9:

MEDICAL RESEARCH COMMERCIALISATION FUND

The Medical Research Commercialisation Fund (MRCF) plays an invaluable role helping research organisations fulfil their mandate of translating first class research into improved health outcomes. Investment by the Victorian Government to set up the Fund helped bring capital and expertise in commercialisation to the State, raising commercialisation capability within research organisations as well as driving capital into the sector.

IDENTIFIED PROBLEM/GAP

The MRCF was created to help research organisations fulfil their fundamental mandate of translating first class research into improved health outcomes and recognised that while Victoria was a leader in health and medical research, the sector often did not have the capital or expertise to translate research into successful start-ups. The Fund was set up to provide research institutes in Victoria with:

- Ready access to proof of concept capability, investment funding and expertise.
- A structured and collaborative investment process to commercialise intellectual property.
- Training and exposure to the commercialisation process.

OVERVIEW OF THE INVESTMENT

The MRCF was established in 2007 with an initial grant from the Victorian Government of \$1.2 million. To 2020, the Victorian Government has provided \$8.4 million in grants to the MRCF.

IMPACT

The MRCF is the largest life science investment fund in Australia and New Zealand. It has been successful in increasing access to capital, maturing the sector, creating jobs, and advancing biotechnology companies further along the value creation chain. It now has more than 50 members, with the largest proportion based in Victoria.

To date, the majority of MRCF's investments have been in Victoria. To 2020, the Victorian Government has provided \$8.4 million in grants to the MRCF, leading to \$379.9 million in total funding in Victorian companies from MRCF investment, syndicate investment and non-dilutive funding. This means that for every \$1 invested by the Victorian Government in supporting the MRCF, \$45 has been invested in Victorian life science companies.

MRCF has also played a role in improving commercialisation capability within research organisations, which traditional investment firms would not support. It hosts commercialisation training workshops for member institutes and government agencies. It also runs an internship program, providing 10-12 interns from member institutes each year with training and exposure to venture capital investment. The Fund also offers subsidised offices in the MRCF Melbourne offices for early-stage portfolio companies.



IMAGE CREDIT: MEDICAL RESEARCH COMMERCIALISATION FUND



The MRCF now has
**MORE THAN
50 MEMBERS**

with the largest
proportion based
in Victoria.



To date, **MRCF has supported the establishment of around 25 new biotechnology companies in Victoria**, which are generating value and improving health outcomes for Victorians. These include:

- Fibrotech's development of novel drug candidates for the treatment of the fibrosis prevalent in chronic kidney disease, chronic heart failure, pulmonary fibrosis and arthritis. This research was undertaken within the Bio21 Institute.
- Denteric's development of vaccines to treat and prevent severe periodontal disease and its complications, based on research conducted at the University of Melbourne.
- PolyActiva's development of ocular implants that provide controlled delivery of drugs to both the front and back of the eye.
- Certa Therapeutics' novel drugs which block a receptor that is a key driver of scarring of the kidney.
- Global Kinetics Corporation's development of a wrist device that records Parkinson's symptoms and reminds a patient when to take their Parkinson's disease medication as prescribed by their doctor. The device was developed by the Florey Institute of Neuroscience and Mental Health.
- Osprey Medical's development of a novel cardiovascular device that reduces contrast dye reaching kidneys to make angiography safer for Chronic Kidney Disease patients. The company's core technologies originated from research conducted at Melbourne's Baker Institute.

CASE STUDY 10:

BURNET INSTITUTE AND THE ALFRED MEDICAL RESEARCH AND EDUCATION PRECINCT

Initial seed funding by the Victorian Government to create a new academic precinct on the Alfred Hospital campus supported strong collaborations and partnerships between universities, hospitals and research institutes. This partnership, now known as the Alfred Research Alliance, has been able to take research from bench to bedside.

IDENTIFIED PROBLEM/GAP

Agglomeration of medical bodies has the power to create the critical mass necessary to achieve exceptional health outcomes and create linkages from discovery through to commercialisation and better patient treatment and care. In 1998, a group of universities, hospitals and medical institutes in Victoria set out to achieve this.

The Inner & Eastern Healthcare Network (including The Alfred Hospital), Baker Medical Research Institute, Macfarlane Burnet Centre for Medical Research and Monash University agreed to establish a new academic precinct on the Alfred Hospital campus. The newly formed partners sought funding from the Victorian Government to support this vision.

OVERVIEW OF THE INVESTMENT

Through the First Generation *STI Initiative*, the Victorian Government provided an \$8 million infrastructure grant for the construction of the Alfred Medical Research and Education Precinct (AMREP) to bring these various partners together. This was the cornerstone for another \$90 million contributed by partners, philanthropic organisations and the Australian Government.

In 2002, AMREP was officially opened. The Institute included the Baker Institute building, Monash laboratories, the Ian Potter Library, Precinct Animal Centre and the AMREP Education Centre. It also included the opening of Burnet Tower and relocation of the Burnet Institute from the Fairfield Infectious Diseases Hospital.

A further \$16 million provided as part of *Healthy Futures* in 2006 was used to create a new research 'super institute' which supported the merger of the Austin Research Institute and the Burnet Institute to create the Southern Hemisphere's largest infectious disease institute to fight global diseases.

IMAGE CREDIT: 360BIOLABS

TAKING RESEARCH FROM BENCH TO BEDSIDE

Discoveries in laboratories can be tested in clinical trials, and then carried through into clinical practice at The Alfred, one of Australia's largest hospitals.

IMPACT

Since initial establishment, the AMREP partnership has continued to evolve and made a demonstrable impact on the health of Victorians through its core research strengths. In 2018, AMREP rebranded itself as the Alfred Research Alliance, acknowledging that collaboration and commitment of their partners defies place, and that it is the people who make the partnership exceptional.

The Alliance now brings together eight independent and diverse organisations to create a community of excellence in medical research and education in Melbourne. The members are recognised as leaders in their fields, and include Alfred Health, Monash University, the Baker Heart & Diabetes Institute, the Burnet Institute, Deakin University, La Trobe University, Nucleus Network, and 360biolabs.

The Alliance is particularly unique in its ability to take research from bench to bedside. Discoveries in laboratories can be tested in clinical trials, and then carried through into clinical practice at The Alfred, one of Australia's largest hospitals. These learnings in the clinical setting can then inform decision-making for health policy or future research, completing the translational research loop.

These capabilities across the research loop are being utilised to solve health challenges across eight core research strengths, including blood diseases and cancer, cardiovascular disease, diabetes and obesity, and infection and immunity. These are complemented by comprehensive capacity in pre-clinical research and Phase I to IV clinical trials, co-located start-ups and businesses, and the clinical environment of The Alfred.

The new facilities constructed through *Healthy Futures*, Alfred Centre Stage 2, also doubled the capacity of Burnet's laboratory facilities and floor space to ensure future growth across programs. The new facilities facilitated the final phase in the merger with the Austin Research Institute enabling the relocation of all staff to the AMREP campus.

In 2019, the Alliance received \$133 million in external research funding and published over 1,895 original research papers. In the same year, it also received 14 provisional patent applications, eight international patent applications, 37 national phase entry patents, and had three patents granted. A total of 671 clinical trials were underway at the Alfred Research Alliance.

CASE STUDY 11: BIOMELBOURNE NETWORK

Victorian Government investment helped set up the BioMelbourne Network, which has played a pivotal role in improving linkages within the sector and helped drive the development of the industry in Victoria.

IDENTIFIED PROBLEM/GAP

The BioMelbourne Network was established in February 2001 as an initiative of the Committee for Melbourne. This was in response to a finding that while Victoria was the leading biotechnology research and development hub in Australia, an important expertise gap was present which threatened the development of ongoing commercial opportunities. The Network aimed to correct this by:

- Improving existing, and creating new, linkages to assist the drive to position Melbourne and Victoria as a leading regional and global biotechnology centre.
- Creating a vital and sustainable biotechnology industry in Victoria by encouraging cooperative ventures and partnerships amongst industry participants.

OVERVIEW OF THE INVESTMENT

The Victorian Government provided a \$750,000 three-year establishment grant in 2002 to provide critical funding to launch the Network as an independent industry-led membership organisation and to develop its revenue base. The Network is now mostly funded through membership subscriptions and sponsorships.

The Victorian Government continues to provide sponsorship funding for packages of events beyond this initial investment to support the establishment of the BioMelbourne Network's marque events, such as its Devices and Diagnostics lab event, Women in Leadership program, as well as specific workshops to assist companies export to international markets such as the Going Global Program.



IMAGE CREDIT: BIOMELBOURNE NETWORK



IMAGE CREDIT: BIOMELBOURNE NETWORK

IMPACT

Since then, BioMelbourne Network remains the first and only state-based biotechnology industry body in Australia, playing an important role in confirming Victoria's leadership position as Australia's biotechnology capital. It has broadened its scope to the health industry, encompassing biotechnology, medtech devices, diagnostics and digital health. It has helped establish relationships with international industry associations, hosted business development activities, obtained industry intelligence regarding service requirements and revenue raising opportunities for the sector, and identified international promotional opportunities for Victoria's health industry capabilities. All of these have had positive outcomes for the broader sector.

- The Network's relationships with national and international industry associations include AusBiotech and organisations in the United States, Canada, the United Kingdom, New Zealand, Ireland and Singapore. It has also developed a formal network of regional associations using the 'Best Cities' relationship model, which includes Melbourne, Boston, Vancouver, Edinburgh and Copenhagen.
- The Network has hosted hundreds of events, providing access to members, key stakeholders and decision makers, local and international industry intelligence and networking opportunities. It also offers facilitated introductions for members to drive collaboration and partnerships.

- The Network delivers programs to develop local talent and provide pathways to upskill and generate business acumen. It also continues to develop emerging talent, fostering professional development by hosting internship placements and volunteering opportunities for undergraduate and postgraduates of member organisations.
- The Network has been involved in advocacy projects relating to stem cell legislation, research and development tax incentive reform and the development of the state and federal biotechnology policy and programs to support the sector's growth.

Its strengths come from its access to high-level decisionmakers to help develop and drive the industry development agenda; its reach into the broader business community beyond core biotech interests; its broad-based membership encompassing multiple fields and including research and its application; its ability to run credible, high-level events that attract prominent scientific and industry leaders; and its ability to promote working partnerships and alliances between stakeholders to address industry concerns.

In 2020, the BioMelbourne Network had 194 member organisations, with 2,552 people in its member network. It held 27 events reaching 1,605 industry professionals from 495 organisations.¹⁶ As the sector has developed, its focus has shifted from connecting researchers to focusing on supporting the translation and commercialisation of research and the building of the necessary supply chains. Its current focus is on value-adding locally while ensuring significant competitiveness in Australian and overseas markets.

APPENDIX B:

STAKEHOLDERS INTERVIEWED

Professor Garry Jennings AO	Founding Chair, Nucleus Network
Robert Nicholson	Former Chair, Nucleus Network
Professor Chris Porter	Director, Monash Institute of Pharmaceutical Sciences
Professor Susan Charman	Director, Centre for Drug Candidate Optimisation
Professor Kathryn North AC	Director, Murdoch Children's Research Institute
Professor Mark Hargreaves	Pro Vice-Chancellor, Research Collaboration and Partnerships, University of Melbourne
	Director, Florey Institute
Professor Ricky Johnstone	Executive Director Cancer Research, Peter MacCallum Cancer Centre
Professor Richard Wettenhall	Former Director, Bio21 Institute
Professor Michael Parker	Director, Bio21 Institute
Dr Chris Nave	Founding Partner & Managing Director, Medical Research Commercialisation Fund
Professor Peter Currie	Director of Research, Australian Regenerative Medicine Institute
Silvio Tiziani	Director External Strategy and Planning, Australian Regenerative Medicine Institute
Professor Edwina Cornish AO	Former Deputy Vice Chancellor Research, Monash University
Associate Professor Stella Clark	Former Chief Executive Officer, Bio21 Cluster
Lusia Guthrie	Chair, BioMelbourne Network
Professor Ross Coppel	Deputy Dean and Director of Research, Faculty of Medicine, Nursing and Health Sciences, Monash University
Professor Andrew Cuthbertson AO	Senior Advisor and Executive Director, CSL
Dr Andrew Nash	Chief Scientific Officer, CSL
Professor Jim McCluskey	Deputy Vice-Chancellor, Research, University of Melbourne
Professor Steve Petrou	Director, Florey Institute
Professor Geoffrey Donnan AO	Former Director, Florey Institute
Professor Suzanne Cory AC	Former Director, WEHI
Professor Doug Hilton AO	Director, WEHI
Professor Brendan Crabb AC	Director and CEO, Burnet Institute
Professor Stephen Jane	Director of Research, Alfred Health

APPENDIX C:

OPERATIONAL INFRASTRUCTURE SUPPORT PROGRAM RECIPIENTS

The below table summarises the total allocations to each research institute from the *Operational Infrastructure Support Program* during the period 2002-03 to 2010-11.¹²

Baker Medical Research Institute	\$21.4 million
O'Brien Institute	\$2.0 million
Bionic Ear Institute	\$3.1 million
Brain Research Institute	\$1.4 million
Burnet Institute	\$29.7 million
Centre for Eye Research Australia	\$3.8 million
Florey Neuroscience Institutes	\$16.7 million
Ludwig Institute for Cancer Research	\$10.1 million
Mental Health Research Institute	\$4.7 million
Monash Institute of Medical Research	\$12.9 million
Murdoch Children's Research Institute	\$19.7 million
National Stroke Research Institute	\$1.6 million
Prince Henry's Medical Research Institute	\$9.0 million
St Vincent's Institute of Medical Research	\$13.1 million
Walter and Eliza Hall Institute of Medical Research	\$64.0 million

NB: Some institutions have merged or changed their name since this period.

REFERENCES

- 1 Deloitte. *Impact Assessment of the Science Technology and Innovation Initiative*. Melbourne: Department of Innovation, Industry and Regional Development, 2009.
- 2 Department of Innovation, Industry and Regional Development, *Victorian Healthy Futures: The Victorian Life Sciences Statement*. Melbourne: Victorian Government, 2006.
- 3 The Centre for International Economics, *Interim evaluation of the Victorian Life Sciences Statement: Healthy Futures – Executive Summary*. Melbourne: Department of Business and Innovation, 2013.
- 4 ACIL Allen Consulting. *Medical Technologies and Pharmaceuticals Sector Impact Evaluation – Technical Report*. Melbourne: Department of Economic Development, Jobs, Transport and Resources, 2018.
- 5 ACIL Allen Consulting. *Medical Technologies and Pharmaceuticals Sector Impact Evaluation – Executive Summary*. Melbourne: Department of Economic Development, Jobs, Transport and Resources, 2018.
- 6 ACIL Allen Consulting. *Medical Technologies and Pharmaceuticals Sector Impact Evaluation – Final Report*. Melbourne: Department of Economic Development, Jobs, Transport and Resources, 2018.
- 7 Department of Jobs, Precincts and Regions. *State of the Sector: Medical Technologies and Pharmaceuticals 2017*. Melbourne: Victorian Government, 2017.
- 8 Department of Jobs, Precincts and Regions. *Priority industries and sectors: Medical technologies and pharmaceuticals*. Published 28 October 2019. Accessed 19 November 2020. <https://djpr.vic.gov.au/priority-industries-sectors/medical-technologies-and-pharmaceuticals>
- 9 Invest Victoria. *Melbourne: A World Leading Biotech Hub*. Melbourne: Victorian Government, 2016.
- 10 AusBiotech. *Australia's Life Sciences Sector Snapshot 2019*. Melbourne: AusBiotech, 2019.
- 11 Department of Innovation, Industry and Regional Development. *Biotechnology Strategic Development Plan for Victoria 2004*. Victorian Government, Melbourne, 2004.
- 12 Data provided by the Department of Jobs, Precincts and Regions.
- 13 Research Australia. *Non-Government Funding for Victorian Health and Medical Research*. Melbourne: Research Australia, 2018.
- 14 Association of Australian Medical Research Institutes. *Operational Infrastructure Support Program 2018-19: Highlights from 12 Victorian independent medical research institutes*. Melbourne: Association of Australian Medical Research Institutes, 2020.
- 15 ACOLA. *Stimulating the Science and Research Ecosystem Creates Jobs and Investment*. Melbourne: Department of Jobs, Precincts and Regions, 2020.

- 16 Nature Research. *Nature Index: Melbourne collaborations*. Published 2020. Accessed 19 January 2021. <https://www.natureindex.com/collaboration-maps/melbourne>
- 17 Research Australia. *COVID-19: How Australia's health and medical research sector is responding*. Sydney: Research Australia, 2020.
- 18 The University of Melbourne. *The Bio21 Institute: A Case Study of Multidisciplinary Collaboration and Innovation*. Melbourne: Bio21 Institute, 2020.
- 19 BioMelbourne Network. *Annual Report 2020*. Melbourne: BioMelbourne Network, 2020.
- 20 Nucleus Network. *Nucleus Network Company Report 2008*. Melbourne: Nucleus Network, 2008.

NB: References have not been included where data has been provided directly by stakeholders.

IMAGE CREDIT: DEPARTMENT OF JOBS PRECINCTS AND REGIONS





FRONT AND BACK COVER IMAGE CREDIT: DEPARTMENT OF JOBS PRECINCTS AND REGIONS