



Australia's National
Science Agency

CSIRO submission to the Review of Australia's Higher Education System

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Introduction

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is Australia's national science agency. Our purpose is to solve the greatest challenges through innovative science and technology. We do this by working with industry, the Australian community and collaborating with universities to contribute to areas of strategic importance for Government and to help create national benefit. CSIRO is a destination for many university graduates and this year, we created new positions for over 200 early and mid-career researchers as part of our “Impossible without You” campaign.

CSIRO's strategic objectives, guided by the *Science and Industry Research Act 1949*, are closely aligned to our values that help us to deliver on our purpose:

- People First
- Making it Real
- Trusted
- Further Together

The challenges we are facing as a nation are complex and multidisciplinary. They include food security and quality, health and wellbeing, resilient and valuable environments, sustainable energy and resources, future industries and a secure Australia and region. We recognise that these challenges cannot be solved by one organisation alone. We can only help to solve national challenges by partnering with others, particularly the immense talent in the university sector and through our value of ‘Further Together’, we achieve so much more with others than we ever could do on our own. For this reason, we welcome this opportunity to provide a submission into the Review of Australia's Higher Education System.

In this submission, we respond to the three Terms of Reference questions that directly relate to our engagement with universities and that enable us to deliver on our aspiration to go ‘Further Together’; these are Focus Areas 2 (Access and Opportunity), 3 (Investment and Affordability) and 7 (Delivering New Knowledge Innovation and Capability).

Should it help the Panel with the inquiry, CSIRO would welcome the opportunity to discuss further any aspects of the information provided in the submission. In particular, sharing our experience working with universities to improve access and participation for First Nations students in Science, Technology, Engineering and Mathematics (STEM) and to increase Indigenous-led research and Indigenous research capacity.

CSIRO response to the Terms of Reference

Focus Area 2: Access and Opportunity

Improve access to higher education, across teaching, learning and research. This will include recommendations for new targets and reforms to support greater access and participation for students from underrepresented backgrounds (including First Nations Australians, those from low socio-economic backgrounds, people with disability, and regional and rural Australians).

STEM and digital skills will play a vital role in realising Australia's innovation and productivity potential, and CSIRO's Education and Outreach programs contributes to the STEM capabilities of young Australians, as outlined below.

Young Indigenous Women's STEM Academy

The Young Indigenous Women's STEM Academy (the Academy) is part of the \$25 million, ten-year Indigenous STEM Fund, announced by the Commonwealth Government as part of the 1967 Referendum - 50th Anniversary Indigenous Education Package.

CSIRO, in collaboration with CareerTrackers, was provided \$20 million to design and deliver a national 10-year Young Indigenous Women's STEM Academy program for 600 high achieving Aboriginal and/or Torres Strait Islander female students from Year 8 through to higher education and graduate employment.

Generation STEM

Generation STEM is a 10-year initiative to attract, support, train, and retain NSW students in STEM. Managed by CSIRO, the program is made possible by the NSW Government's \$25 million endowment to the Science and Industry Endowment Fund (SIEF). The program helps students get a head start by developing the skills that employers want and by encouraging curiosity, initiative and critical thinking.

STEM Professionals in Schools

STEM Professionals in Schools is Australia's largest national skilled volunteering program, partnering teachers with STEM professionals to bring real-world experiences into the classroom. STEM Professionals in Schools is supported by the Australian Government Department of Education and is delivered by CSIRO.

Building Indigenous STEM career pathways and Indigenous research capacity through university partnership.

A priority objective of the James Cook University (JCU)-CSIRO partnership (further information in our response to Focus Area 7 below) is to co-develop ways to build institutional and individual

capacity to grow research and employment opportunities for Indigenous students. This involves working to strengthen access and participation pathways for future Indigenous STEM leaders.

CSIRO is particularly interested in sharing information with the panel on its collaborative work across the university and research system to increase Indigenous-led research and build Indigenous research capacity.

Focus Area 3: Investment and Affordability

Explore funding and contribution arrangements that deliver equity, access, quality and longer-term investments to meet priorities in teaching, research, workforce and infrastructure. This will include a review of the Job-ready Graduates Package.

CSIRO develops and maintains a number of large-scale, critical research and education infrastructure facilities, examples of which are below. There are also many examples where CSIRO has co-invested in key infrastructure in partnership with a university.

RV Investigator

Accessible to the entire national research community, the Marine National Facility research vessel, RV Investigator, operates to provide world-class blue-water research capability and is funded by the Australian Government through the Granted Voyage Program. Outreach programs for the higher education sector are below.

- The Indigenous Time at Sea Scholarship offers Aboriginal and Torres Strait Islander university students the opportunity to join voyages of RV Investigator.
- The CSIRO Educator on Board program gives STEM teachers the opportunity to join scientists to assist with scientific operations and share their on-board experience with students across Australia through live ship-to-shore video broadcasts.
- The MNF Floating Classroom offers school teachers and students the opportunity to get on board the RV Investigator when the ship is in port to use its labs and workspaces for teaching. The vessel is a significant piece of research infrastructure used by many Australian universities.

Pawsey

The Pawsey Supercomputing Centre is one of two national high-performance computing and data facilities in Australia and provides world-class infrastructure and expertise in supercomputing, data and visualisation services which enables Australia's researchers to solve large-scale data problems and obtain critical knowledge into the challenges facing our nation. Pawsey is also currently home to 194 training programs and events and its intern program has worked on 38 projects across 15 universities and institutions across Australia. A new initiative to help school students crystallise data as a working concept was introduced in 2021.

National Vaccine and Therapeutics Lab

The National Vaccine and Therapeutics Lab is funded by the Australian Government and Victorian Government and is based at the CSIRO Clayton site. It aims to help Small to Medium Enterprises (SMEs) in bridging the gap between benchtop lab research and commercial scale - allowing for vaccine candidates and drug discoveries to be safely and precisely scaled-up and ready for clinical trials. The National Vaccine and Therapeutics Lab forms part of the broader National Biologics Facility, with branches at the University of Queensland, University of Technology Sydney and CSIRO, and is funded under the National Collaborative Research Infrastructure Strategy.

CSIRO supports ongoing initiatives (such as the National Reconstruction Fund) to continue to add value and capability to Australia's longer-term investments.

Focus Area 7: Delivering New Knowledge, Innovation and Capability

Support a system of university research that delivers for Australia, securing the future of the Australian research pipeline, from basic and translational research to commercialisation. In doing so, the Accord will explore relevant initiatives and other opportunities and to further boost collaboration between universities and industry to drive greater commercial returns.

The review will synchronise with the ARC review and consider issues raised through that review and other areas of government that impact on the capacity of the higher education system to meet the nation's current and future needs.

Current state researcher to researcher collaboration

CSIRO collaborates on research projects with most Australian universities at a 'researcher-to-researcher' level. As evidence of this collaboration intensity, **two thirds of CSIRO's annual publications include collaborations with Australian universities and research institutes.** Table 1 in Appendix 1 shows the universities where CSIRO is currently most active in researcher-to-researcher collaboration and higher degree research student supervision.

CSIRO also collaborates widely on university-led research initiatives that are funded mainly by the Australian Research Council (ARC). We are currently involved in six Centres of Excellence, 42 Discovery Projects, nine Linkage Infrastructure Equipment and Facilities, nine Linkage projects, three Industrial Transformation Research Hubs, four Industrial Transformation Training Centres, two Discovery Early Career Researcher Award, and one ARC Future Fellowship.

In addition to working directly with university-led initiatives, CSIRO collaborates with universities in many current Cooperative Research Centres (CRC) and CRC-Project programs funded by the Department of Science, Industry and Resources.

Most of CSIRO's researcher-to-researcher collaboration aligns with national research priorities and priority industry sectors. This kind of collaboration is valuable for strengthening Australia's research pipeline as it gives higher degree research students and early career researchers experience in applied and industry focussed research projects via engagement with CSIRO.

Institutional-level strategic collaborations

CSIRO works closely with universities at an institutional scale around a shared strategic purpose.

Monash University

As part of the CSIRO Precinct Strategy to work with other local R&D providers including multiple universities to build collaboration, CSIRO is a partner in the Monash MedTech Facility which provides a broad range of equipment and technical expertise, and directly supports companies to overcome translational research challenges faced by the medical technologies industry.

James Cook University (JCU)

CSIRO's longstanding co-located relationship with JCU in North Queensland is driven by a strong mutual motivation to work together to achieve greater impact in this region. This relationship includes an initiative to build the research capacity of JCU Aboriginal and/or Torres Strait Islander students, and a co-designed research program on infectious disease risk and biosecurity. Other joint initiatives are in the areas of Transition of Regional SMEs to Net Zero and Decision Support for Coastal Wetland Restoration.

Swinburne University of Technology (SUT)

The Hydrogen Technology Demonstration Facility represents a joint investment between CSIRO's Hydrogen Mission and SUT. Our Hydrogen Industry Mission launched in May 2021 and focuses on leveraging CSIRO's hydrogen research capabilities in partnership with government, industry and the research community. One of the Mission's key pillars focuses on Demonstration Projects, which are collaborative partnerships to demonstrate technologies that validate hydrogen value chains and de-risk enabling technologies to inform investment and deployment decisions. This is a key piece of research, development and training infrastructure contributing to the work of Swinburne's Victorian Hydrogen Hub (VH2).

These institutional-level strategic initiatives amplify the scale and impact of collaboration with CSIRO to strengthening Australia's research pipeline in the applied and translational research domains.

Current state skill-development for research translation

We are delighted to continue working closely with universities to meet the nation's current and future STEM and research needs – as outlined under Focus Area 2. We currently act as a service provider to support government in delivering a range of targeted, funded programs that:

- Train and develop innovation and industry-focussed, job ready graduate students in a range of high priority areas, and
- Facilitate effective connections between SMEs and early career researchers, enabling them to work together more easily and drive innovation in applied research that will benefit Australia.

ON Program

CSIRO's [ON accelerator](#) program was recently reinvigorated and we are actively seeking university participants to join teams. The ON program equips publicly funded researchers with the entrepreneurial and commercialisation skills needed to engage with business and drive greater uptake of their research and ideas.

The program consists of two main streams. On Prime is designed to help researchers explore commercial applications and business models for their ideas while ON Accelerate is designed to launch research-driven companies into market.

The ON Program 2.0 has been funded through the University Research Commercialisation Scheme. Thus, the program is available for free for another four years to researchers from all Australian universities and publicly funded research organisations.

The ON program has delivered industry-leading innovation training and support to over 3000 people from Australian universities and research institutes. It generated over 500 jobs supported by new companies formed and has seen in excess of \$115m investment capital raised by new companies.

Industry PhD Program

CSIRO's [Industry PhD Program \(iPhD\)](#) program aims to build the next generation of research leaders who can move seamlessly across the R&D ecosystem throughout their careers. It brings together an industry partner, a university and CSIRO to co-design and supervise innovation focussed industry-relevant PhD research. This program provides the PhD candidate a deep understanding and experience of working with, and within, each sector on an industry-led research project. Continued funding from the Australian Government will ensure the program can substantially grow to be accessible to all Australian universities from 2023 as one of three industry focussed graduate programs being established under the implementation of the University Research Commercialisation Package, over the next ten years.

The iPhD program has been shown to boost employability and broaden future career opportunities and create impact by conducting research relevant to an industry partner.

Next Generation Graduates Program

CSIRO is working in partnership with universities and industry to deliver a cohort-based, industry driven, multi-disciplinary graduate training program to unlock the economic opportunity offered by artificial intelligence and emerging technologies (such as robotics, cyber security, quantum computing, blockchain and data).

The program aims to train graduates in problem-based environments and equip them with the entrepreneurial thinking and skill sets needed to boost innovation in emerging or expanding tech focussed industries.

Quantum PhD Program

This program was announced in the October 2022 budget and is currently in development with the Department of Industry, Science and Resources. CSIRO is anticipating it will work with

universities to administer this new quantum targeted PhD program alongside the Next Generation Graduates Program.

Indigenous Graduate Program

CSIRO's Indigenous Graduate Program will be launched in 2023, The Indigenous Graduate Program will bring a diversity of Indigenous people into the workforce by building the capability of Aboriginal and Torres Strait Islander STEM graduates and develop a pipeline of future leaders of this innovative system.

The CSIRO Indigenous Graduate Program will enable Indigenous graduates to get on-the-job research experience, with support to transition to a HDR degree. It mirrors a key commitment in the recently updated Universities Australia (UA) Indigenous Strategy 2022 – 2025 which is to support a transition into postgraduate study, research and the fostering of research careers for Indigenous peoples.

SME Connect

CSIRO is the national delivery partner of the Department of Industry, Science and Resources' Innovation Connections program. This helps SMEs establish applied research priorities, locate suitable early career researchers to work with across all 39 domestic universities and other publicly funded research agencies, and provide access to funding to fast-track R&D projects.

Investment for research commercialisation

CSIRO, along with Australian universities, works across the whole research lifecycle to drive commercialisation.

Uniseed

Uniseed is Australia's longest running venture fund and operates to support the research commercialisation of four universities who together oversee the largest R&D portfolio in Australia (Universities of Melbourne, Queensland, Sydney and New South Wales). CSIRO has jointly co-invested with the four universities to establish the fund and sits on the Board.

Uniseed provides seed investment capital, expert guidance, access to networks, and commercial strategy development.

Main Sequence

Main Sequence was established to serve the entire research ecosystem in Australia. Main Sequence is a venture capital firm set up by CSIRO to address the 'valley of death' between research and commercialisation.

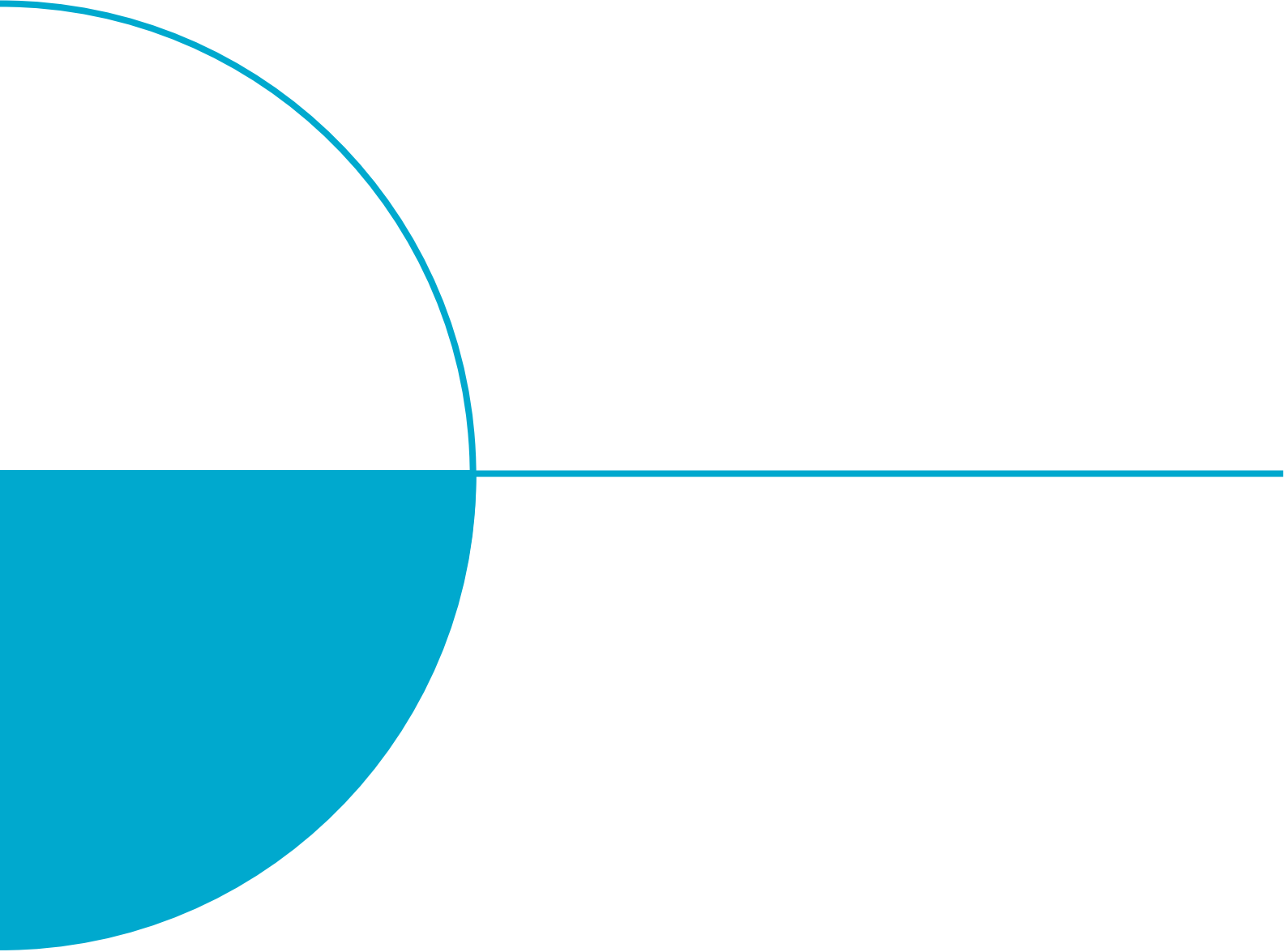
Main Sequence creates a way for venture capital to reach any relevant university research, with CSIRO acting as facilitator. Uniseed and Main Sequence play similar roles in early-stage engagement with the research catchment to facilitate commercialisation.

Main Sequence has been very successful in working closely with universities to commercialise Australian research and connecting research capability from publicly funded research sectors to assist early stage 'deep tech' companies to grow.

APPENDIX 1

Table 1: This table shows the universities and research areas with which CSIRO collaborates most, (noting these are research areas that strongly align with national priorities and challenges), as well as some specific ways in which the organisation engages (publications and co-supervision of higher degree research candidates).

UNIVERSITY	NUMBER OF COLLABORATIVE PUBLICATIONS (2017-21)	AGRICULTURAL SCIENCES	CHEMISTRY	ENGINEERING	ENVIRONMENT AND ECOLOGY	GEOSCIENCES	MATERIAL SCIENCES	PLANT AND ANIMAL SCIENCES	SPACE	CO-SUPERVISED HIGHER DEGREE RESEARCH CANDIDATES
University of Queensland	1,338	116	57	36	294	69	37	283	10	100
University of Western Australia	1,176	88	24	49	235	158	18	183	169	35
University of Melbourne	1,152	98	73	56	159	102	66	110	48	49
Monash University	1,127	19	204	66	86	98	257	17	29	83
University of Tasmania	1,098	60	11	22	275	200	0	316	76	64
Australian National University	1,093	40	25	115	201	84	28	217	119	118
University of New South Wales	951	28	68	108	100	163	58	58	40	107
University of Sydney	848	51	39	81	82	23	24	85	182	31
Curtin University	758	18	26	64	50	169	12	53	231	30
University of Adelaide	647	125	19	18	114	67	22	92	15	39



As Australia's national science agency and innovation catalyst, CSIRO is solving the greatest challenges through innovative science and technology.

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