



# Queensland Government research and development expenditure report

2022-23



**Queensland  
Government**

**Prepared by: Office of the Queensland Chief Scientist**

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#### **Acknowledgements**

The Office of the Queensland Chief Scientist has been working with Queensland Government departments and organisations since 2004 to identify and report R&D that is carried out or funded by the Queensland Government.

The data is used to monitor R&D investment over time.

Thank you to all the staff—internal and external to government—for assisting the Office of the Queensland Chief Scientist with gathering and validating the extensive data. Collection and finalisation of robust data is an intense process that requires a high level of accuracy.

Past reports are published on the Office of the Queensland Chief Scientist website, and detailed data from all the reports is available on the Queensland Government open data portal.

Thank you to Nicolo Agliata for his involvement in the preparation of this report

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# Report overview

The Queensland Government R&D expenditure report is published annually. This report provides information on:

- government's longitudinal R&D expenditure displaying research investment trends over time
- the research fields with the highest R&D expenditure as well as their alignment with the government's socio-economic priorities
- the collaborations between the government and partner organisations
- the benefits of R&D to Queenslanders, as demonstrated in the case studies for this edition.

R&D is one of the major driving forces behind economic growth, as shown by the existence of a positive correlation between a country's R&D intensity and gross domestic product (GDP) per capita. R&D directly influences the strength and competitiveness of industry by providing a basis for technological change and thereby encouraging economic development. Investment in R&D not only monetises benefits to the economy but addresses various societal challenges faced in today's world, such as climate change, waste minimisation, food security, etc., resulting in good jobs, better services, and great lifestyle.

On 18 May 2023, the Public Sector Commission announced a summary of changes affecting departments of the Queensland Government. Under the new administrative arrangements, some functions were transferred to other departments from 1 June 2023. As the machinery of government changes occurred late in the 2022-23 year, the R&D data was collected, collated, and presented under the original organisational structure.

# Key findings

A total of \$464 million was spent by the Queensland Government (the government) on research and development (R&D) in 2022-23, which represents an increase of 17 per cent from 2021-22 where the total expenditure was around \$394 million.

R&D expenditure for 2022-23 includes capital and current expenditure:

- capital expenditure refers to infrastructure spending such as buildings, land, and equipment.
- current expenditure refers to operational spending such as employee expenses, salaries, and other R&D related expenditure.

Approximately 94 per cent of the total expenditure, about \$438 million, was related to current expenditure.

About 64 per cent, or \$298 million of the total R&D expenditure for the year was conducted at Queensland Government sites.

Out of the \$464 million that was spent on R&D, funds from external sources made up approximately \$230 million or 49 per cent of the reported expenditure. By comparison, in 2021-2022 external funds made up approximately \$177 million or 45 per cent of the reported expenditure.

The department reporting the highest R&D expenditure was Queensland Health (not including QIMR Berghofer Medical Research Institute) totalling \$134 million, equivalent to 29 per cent of the total R&D expenditure for the year, followed by the Department of Agriculture and Fisheries at \$113 million or 24 per cent of the reported R&D expenditure.

Of the \$70 million increase from 2021-2022, the largest contributor was the Department of State Development, Infrastructure, Local Government and Planning at \$22 million (31 per cent of the \$70 million), comprising investment in a range of projects, including the Future Energy Export CRC to help sustain Australia's position as a leading LNG exporter and to drive hydrogen exports.

# Defining research and development

For the purpose of this report, and in line with the guidelines provided by the Organisation for Economic Cooperation and Development (OECD), the definition of R&D used by the government is:

*... creative and systematic work undertaken in order to increase the stock of knowledge—including knowledge of humankind, culture and society—and to devise new applications of available knowledge.*

– Frascati Manual, 2015

To fall under this definition, and therefore being eligible as R&D, an activity must be:

- novel
- creative
- uncertain
- systematic
- transferable and/or reproducible.

Some examples of R&D activities include (and are not limited to):

- laboratory research aimed at discovery of new knowledge
- searching for applications of new research findings or other knowledge
- conceptual formulation and design of possible product or process alternatives
- evaluation of product or process alternatives
- modification of the formulation or design of a product or process
- design, construction, and testing of preproduction prototypes and models
- design and development of tools used to facilitate R&D or components of a product or process undergoing R&D activities.

R&D excludes:

- market surveys
- extension or commercialisation of R&D
- routine computer programming and maintenance
- general purpose data collection using standard techniques without a research question
- policy-related studies using existing methodologies
- any other related activities that do not consist of elements of novelty or understanding causal relationships.

# Expenditure over time

In 2022-23, Queensland Government agencies reported spending \$464 million on R&D, which represents a 17 per cent increase from the previous year's expenditure of \$394 million.

Figure 1 shows the R&D expenditure by the government over the last 19 years. Through the Smart State strategies which ran from 1998 to 2012, there was significant R&D expenditure on major research infrastructure that peaked at \$701 million in 2010-11. These projects included: the Ecosciences Precinct at Dutton Park, Health and Food Sciences Precinct at Coopers Plains, QIMR Berghofer Medical Research Institute, and the Translational Research Institute, to name a few. The decline in R&D expenditure from 2012 to 2015 partly relates to the completion of various infrastructure projects and the cessation of the Smart State strategies. Since 2015, and except for 2021-22, investment in R&D by the government has been on a consistently increasing trend.

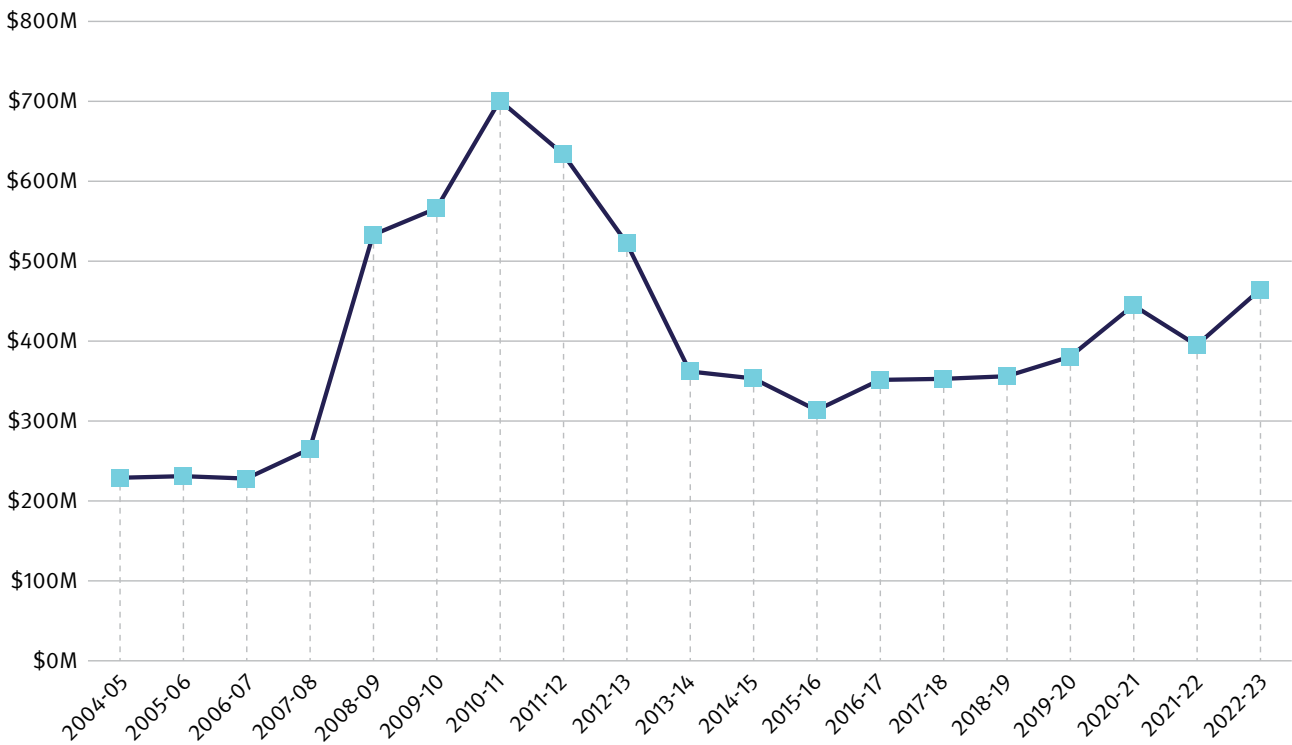


Figure 1: Expenditure over time



# Capital and current expenditure over time

In 2022-23, out of the \$464 million spent on R&D by the Queensland Government, capital expenditure accounted for \$26 million while current expenditure accounted for \$438 million of the total budget. The largest amount spent on capital expenditure was reported by the Department of Transport and Main Roads at \$16 million or 65 per cent of the total capital expenditure for the year, followed by the Department of Agriculture and Fisheries at \$5 million or 21 per cent of the total capital expenditure for the year.

Capital expenditure refers to infrastructure spending such as buildings, land and equipment, while current expenditure refers to operational spending such as employee expenses, salaries and other R&D related expenditure. The year 2009-10 was the first year where capital and current expenditure were reported separately. Prior to this period, they had always been reported as a combined total amount.

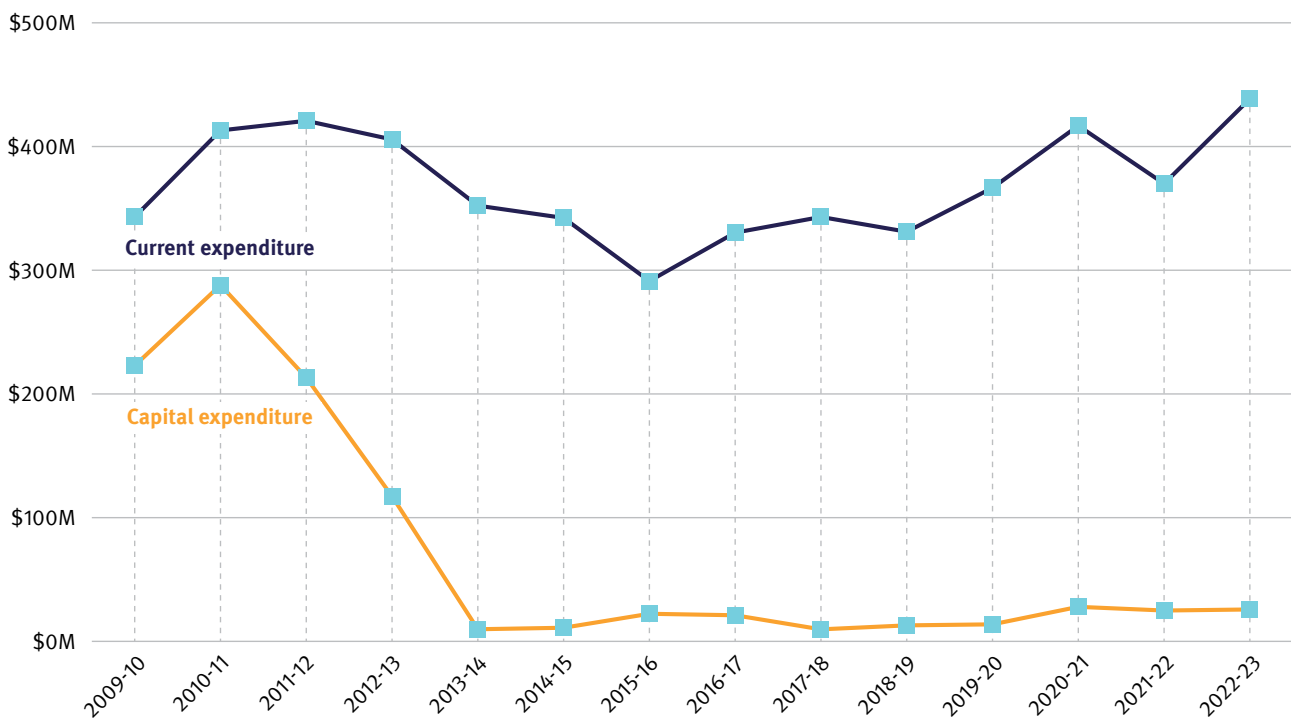


Figure 2: Capital and current expenditure over time



# Research location over time

Figure 3 reports the location where the R&D funding was spent as either in-house or external. In-house refers to R&D being conducted at Queensland Government sites. R&D activity occurring at non-Queensland Government facilities has been categorised as external.

From 2004 to 2010, R&D carried out in government facilities exceeded R&D at external sites. From 2010 to 2014, in line with the increase in capital expenditure and noting that the definition of R&D as used in this publication and based on the OECD Frascati Manual includes construction of research facilities, the trend shifted to having the larger portion of R&D expenditure at external sites. From 2014 onwards, the trend reverts to higher expenditure on in-house R&D activities.

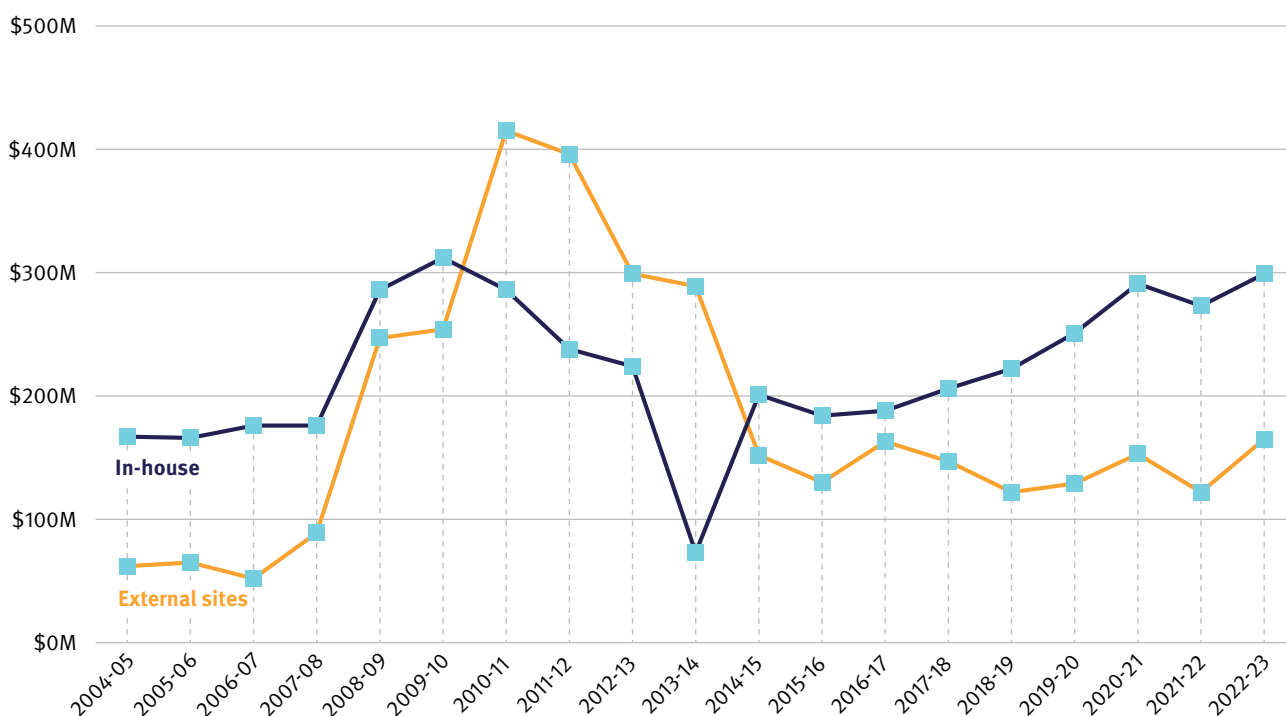


Figure 3: Research location over time

# Total expenditure by agency in 2022-23

Queensland Government agencies reported spending a total of \$464 million on R&D in 2022-23. The three agencies with the highest expenditure were:

- Queensland Health - \$134 million accounting for 29 per cent of total R&D expenditure
- Department of Agriculture and Fisheries - \$113 million accounting for 24 per cent of total R&D expenditure
- QIMR Berghofer Medical Research Institute - \$45 million accounting for 10 per cent of total R&D expenditure

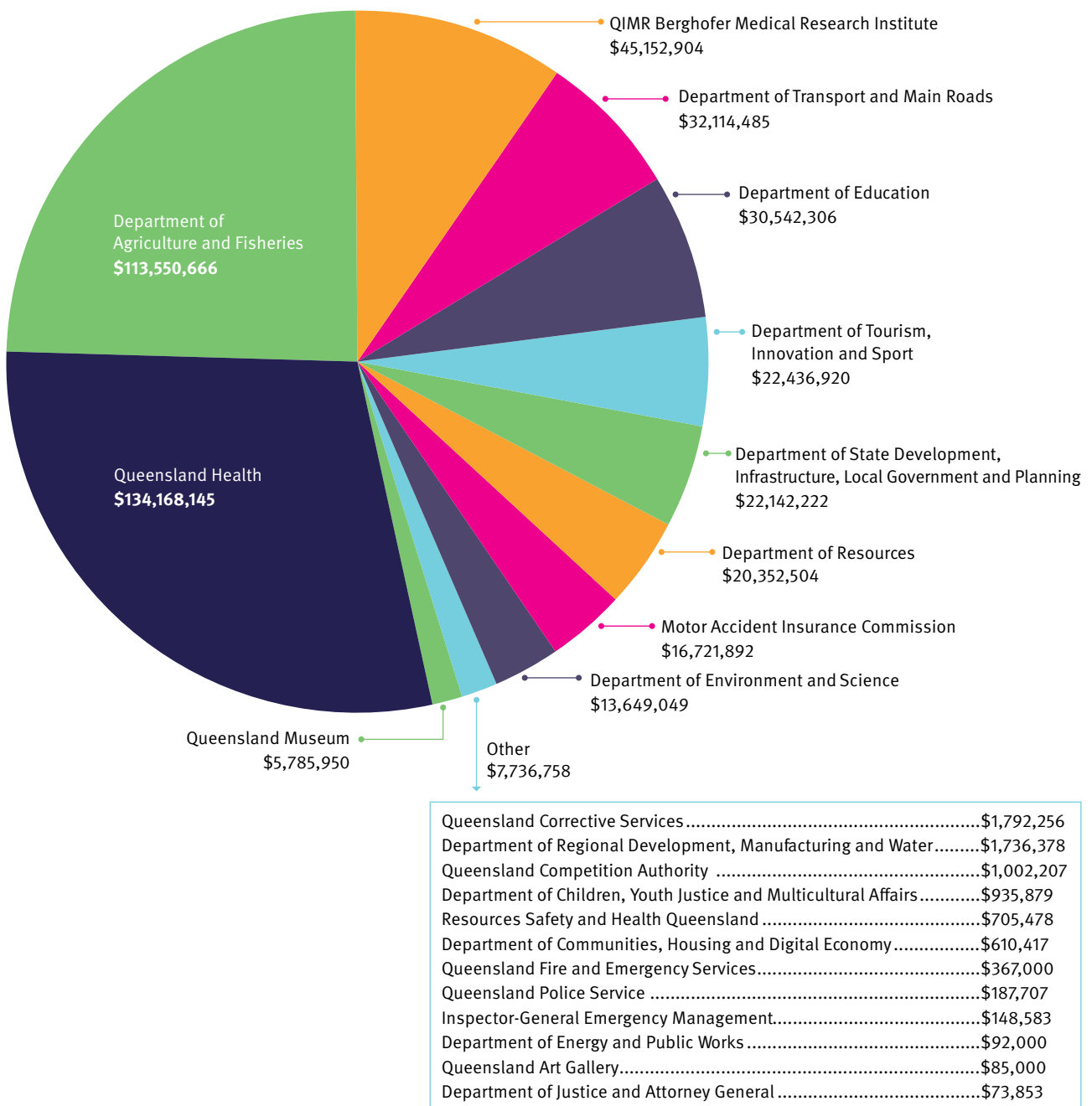


Figure 4: Total expenditure by agency in 2022-23

# Year-on-year expenditure by agency

Figure 5 reports the year-on-year (YoY) expenditure by agency. The largest dollar amount increase was reported by the Department of State Development, Infrastructure, Local Government and Planning at \$22 million YoY, followed by the Department of Education at \$17 million YoY, and the Department of Resources at \$8 million YoY. The largest dollar amount decrease was reported by the Department of Tourism, Innovation and Sport at \$6 million YoY. Out of the 24 departments involved in this report, 19 agencies reported an increase in YoY R&D expenditure, while five agencies reported a decrease.

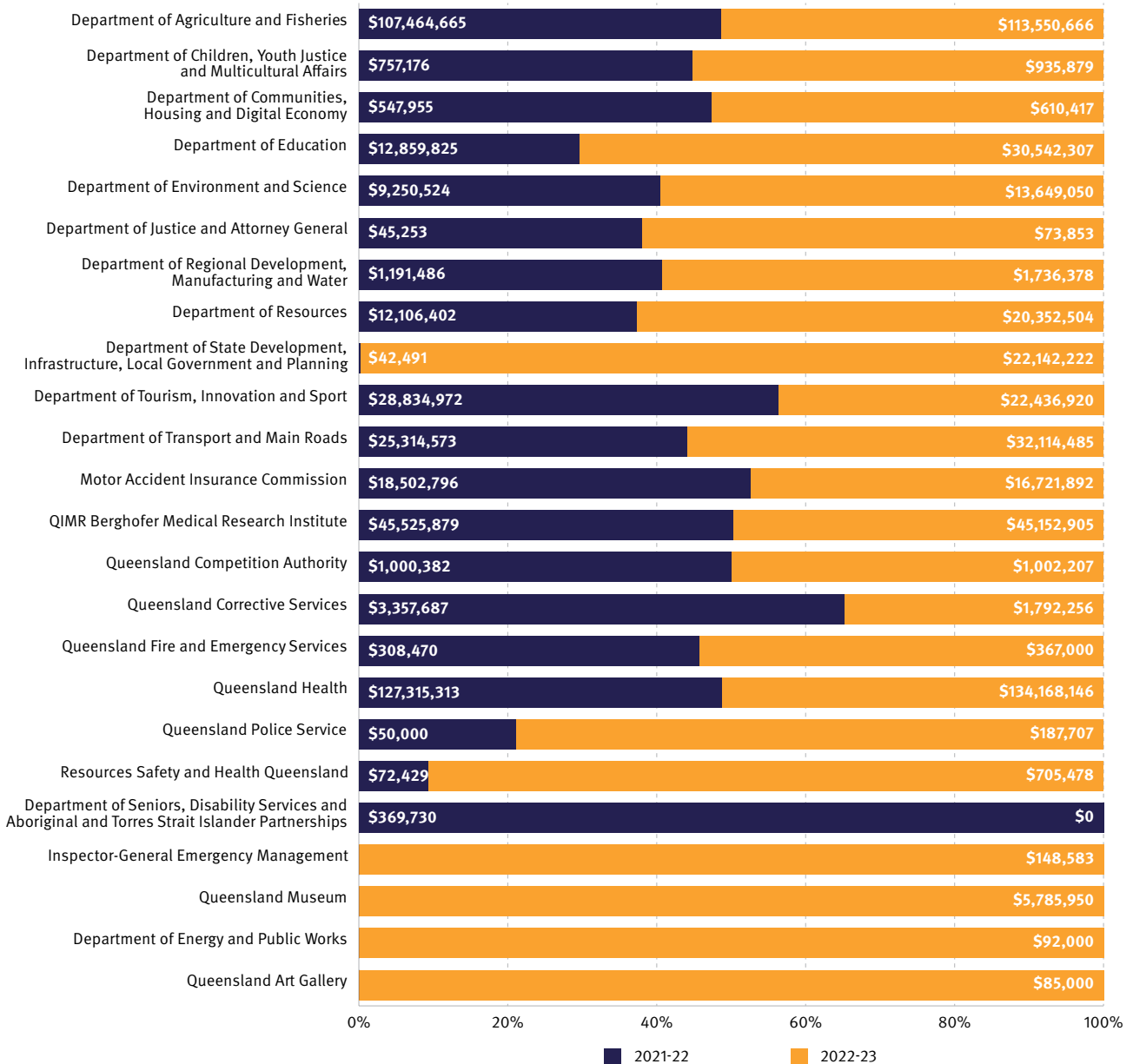


Figure 5: Year-on-year expenditure by agency

# Queensland Government funds and external funds by year

Queensland Government funds are those spent directly from the state budget allocation. External funds refer to cash contributions from external organisations towards R&D projects funded or performed by the government. The trend reported below shows that overall external funds have often been slightly lower than Queensland Government investment. A significant exception to this trend occurred from 2009-10 to 2012-13, where external funds (philanthropic plus Commonwealth Government plus university funding) were attracted to the state for construction of major research infrastructure.

The Atlantic Philanthropies has made significant funding contributions to support the development of Queensland’s science and research infrastructure. From 1998 to 2011, The Atlantic Philanthropies invested \$288 million in research initiatives in Queensland. Although this funding was committed in that period, the funds were expended primarily from 2009-10 to 2012-13 as infrastructure milestones were met for these major building projects.

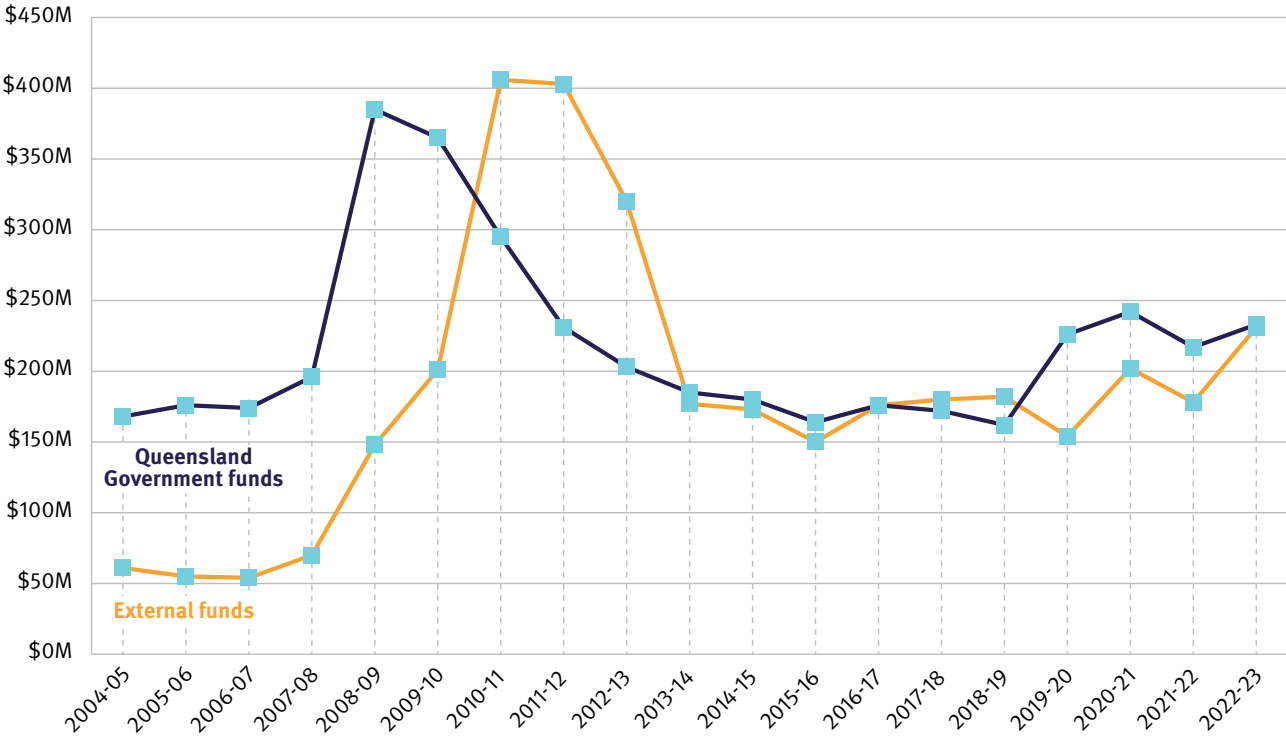


Figure 6: Queensland Government funds and external funds by year

# Source of funds in 2022-23

In 2022-23, out of the \$464 million that was spent on R&D, the Queensland Government attracted \$230 million or 49 per cent of the yearly R&D expenditure from external sources. This proportion of funds from external sources was higher than in 2021-22, where 45 per cent of the \$177 million was from external sources.

Queensland Government's funds include in-house, government bodies and statutory authorities, and other government departments (orange bars). External funding was sourced from the Australian Government, universities, private non-profit organisations, overseas locations, other state/local government, other Australian locations, joint business/government organisations e.g. cooperative research centres (CRCs), and businesses (green bars).

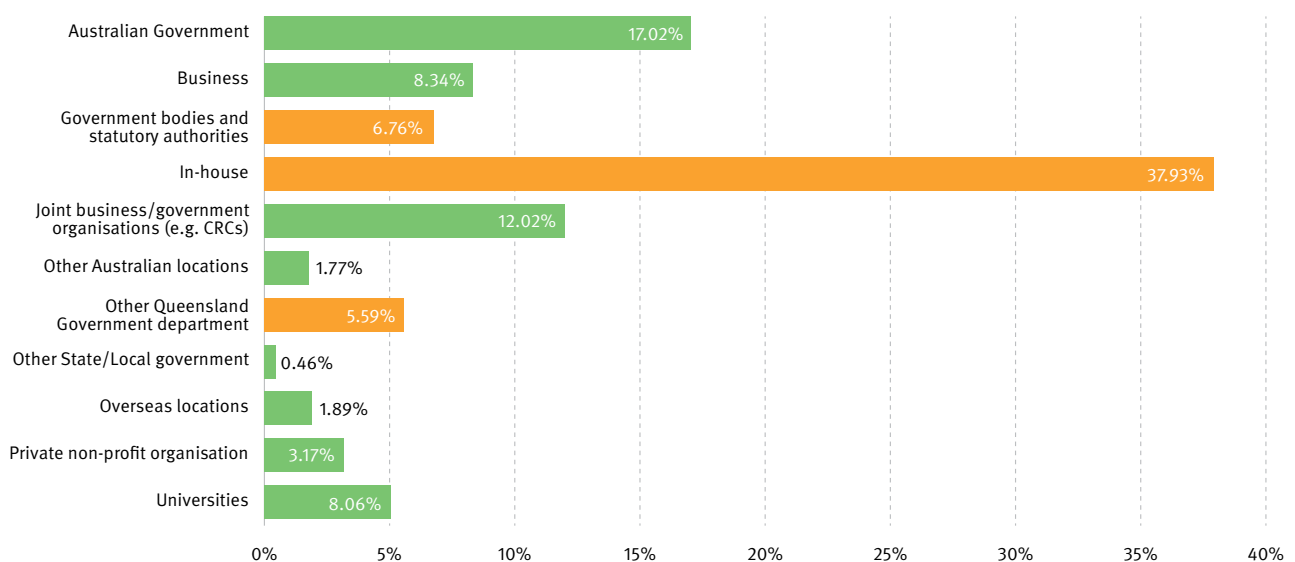


Figure 7: Source of funds in 2022-23

# Cooperative research centres

In 2022-23, out of the \$464 million that was spent on R&D, \$42 million were allocated to CRCs. The Future Energy Export CRC secured the predominant share of R&D funding, receiving \$16 million or 39 per cent of the total expenditure allocated to CRCs. Following is MinEx CRC, which received \$15 million or 36 per cent of the total expenditure. Meanwhile, SmartSat CRC received \$4million or 9 per cent of the overall spending.

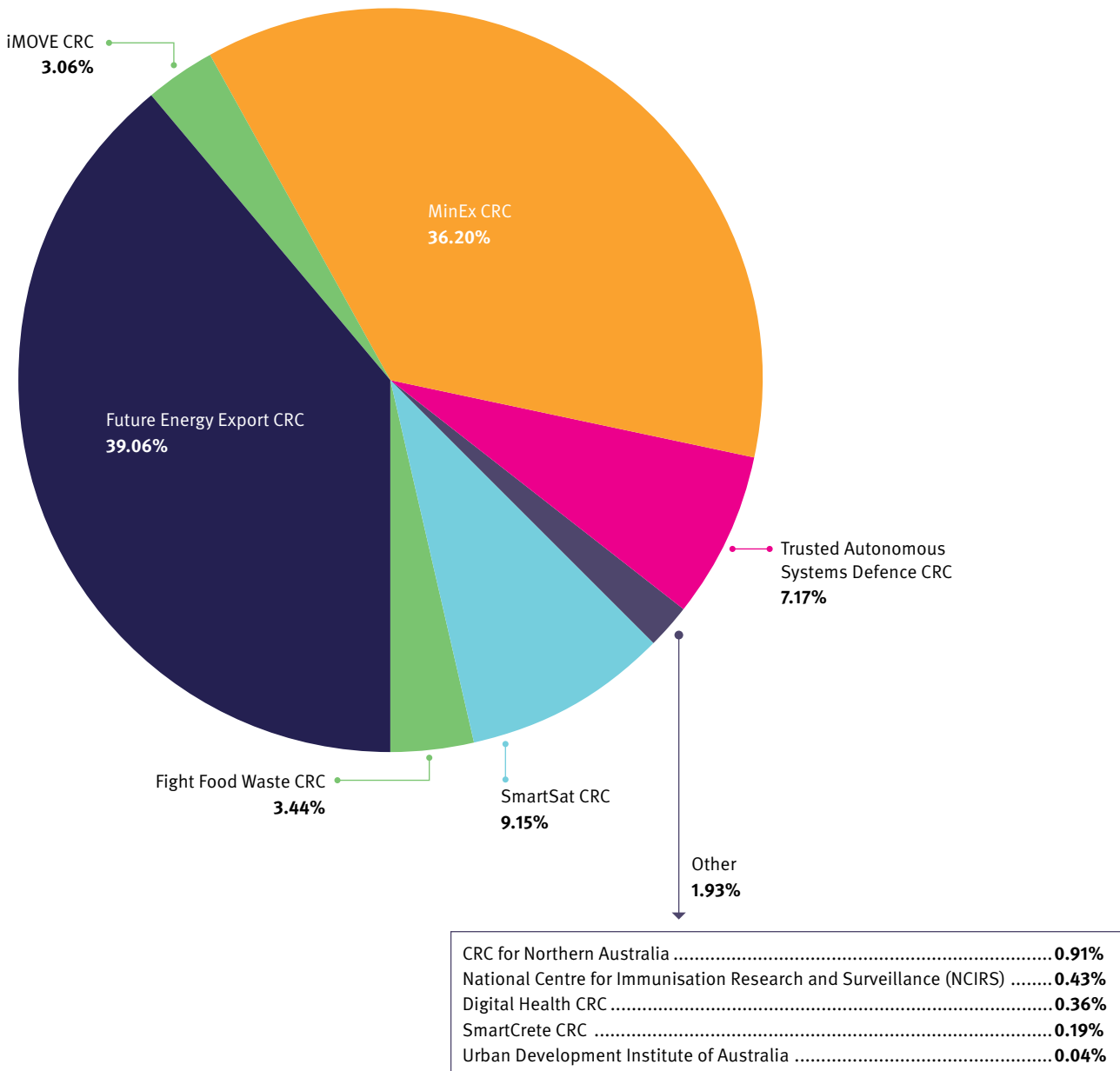


Figure 8: Cooperative research centres

# Socio-economic objectives

Agencies classify R&D investment according to the Australian Bureau of Statistics' socio-economic objectives. The objectives relate to the impact of the research and are standardised fields. The distribution of expenditure reflects the socio-economic focus of the government policy priorities at the time.

In 2022-23, the greatest reported expenditure was allocated to health objectives. This investment accounted for 42 per cent (\$197 million) of the R&D expenditure for the year. The second largest expenditure at 15 per cent (\$71 million) was for research on plant production and plant primary products followed by transport accounting for 8 per cent (\$39 million). This allocation is in line with what happened in 2021-22 where health accounted for 50 per cent (\$197 million) of the overall R&D expenditure, followed by plant production and plant primary products at 18 per cent (\$69 million), and transport at 8 per cent (\$31 million).

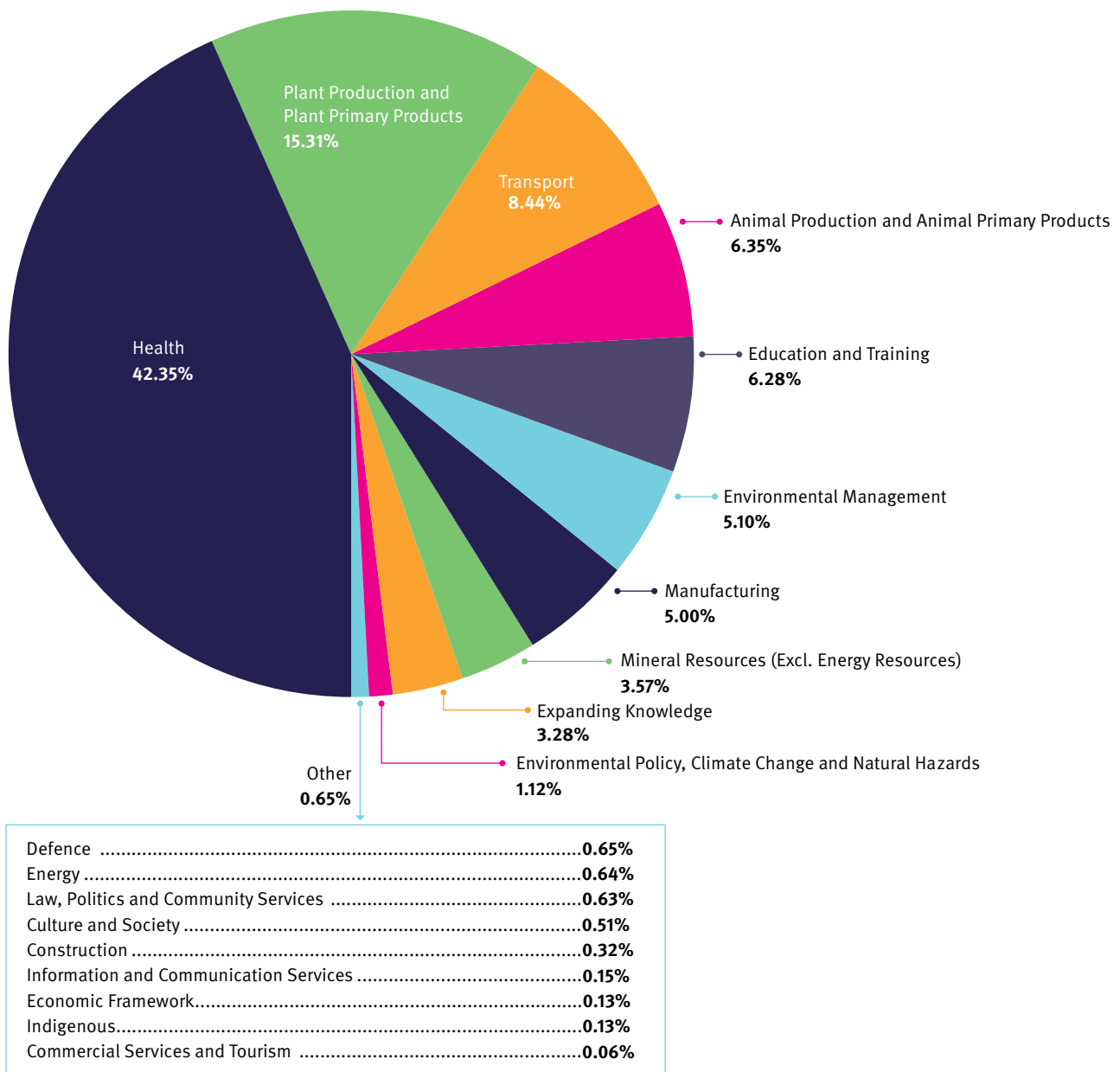


Figure 9: Socio-economic objectives



# Field of research

Similar to socio-economic objectives, fields of research are also defined by the Australian Bureau of Statistics.

In 2022-23, the top three reported fields of research were: agricultural, veterinary and food sciences accounting for 23 per cent (\$108 million), followed by health sciences accounting for 22 per cent (\$100 million) and biomedical and clinical sciences accounting for 21 per cent (\$96 million). This categorisation shows that 76 per cent of the total expenditure is concentrated in just three of the 23 fields of research. This concentration mirrors the highest spending agencies, namely Queensland Health, the Department of Agriculture and Fisheries, and QIMR Berghofer Medical Research Institute. This trend is in line with what was reported in 2021-22 in which biomedical and health sciences accounted for 53 per cent (\$210 million) of the overall expenditure, followed by agricultural and veterinary sciences at 26 per cent (\$104 million).

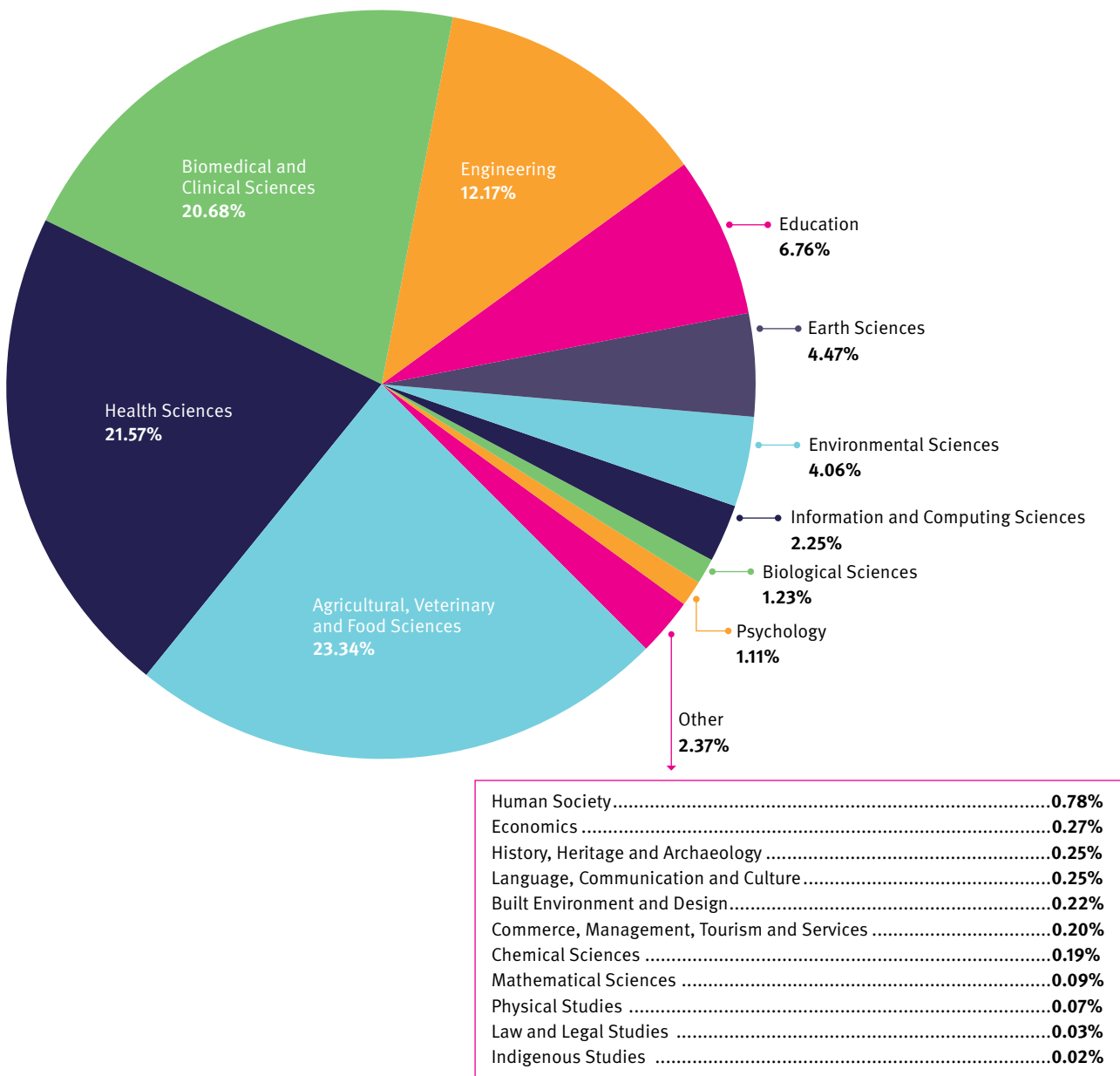


Figure 10: Field of research

# Queensland Government priorities

Figure 11 reports the weighted percentage of Queensland Government priorities for the community in 2022-23. The highest percentage was for *keeping Queenslanders safe* at 21 per cent, followed by *backing our frontline services* at 20 per cent, and *protecting the environment* at 17 per cent. The chart slightly differs from what was reported in 2021-22 where *backing our frontline services* accounted for 29 per cent, *growing our regions* at 15 per cent, and *protecting the environment* at 13 per cent.

'Other' relates to projects that did not align with government priorities and in 2022-23 accounted for 8 per cent of the overall projects. This allocation is lower than what was reported in 2021-22 where 'other' accounted for 13 per cent of the overall projects.

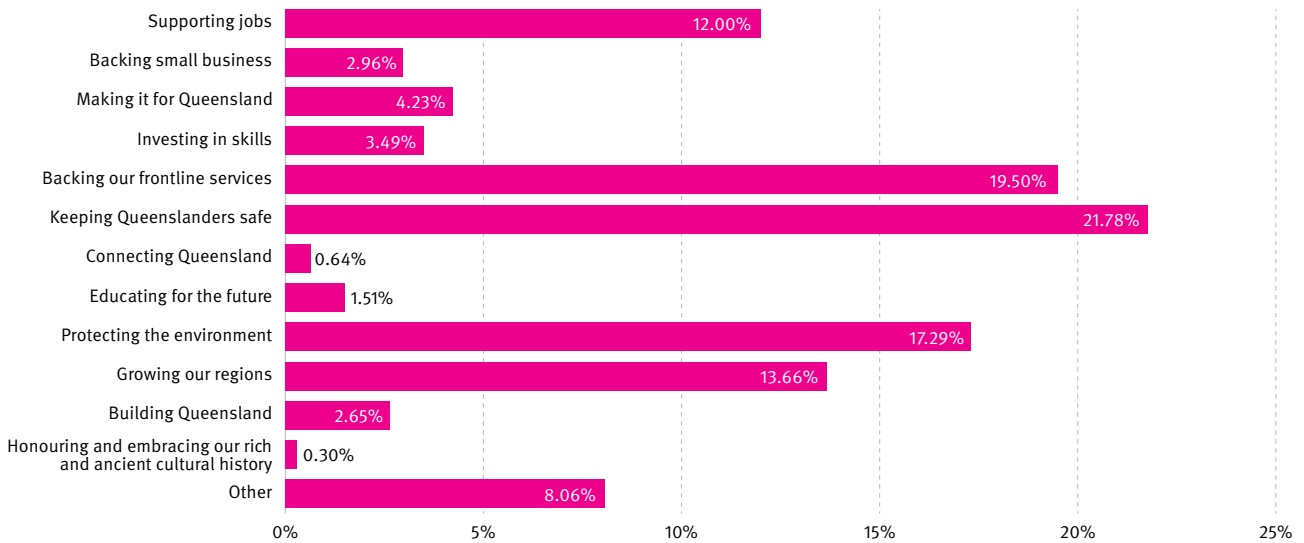


Figure 11: Queensland Government priorities

# Highlights of research and development delivering for Queenslanders

## World-First Study Delivers an Accurate Measure of Lung Function in First Nations Children



Figure 12: Respiratory scientist Anthony Collaro

Respiratory researchers at Children’s Health Queensland have led a world first study to develop an accurate way to measure lung function in First Nations children as they grow.

The cough and airways research group, led by Professor Anne Chang, assessed the lung function of over 1,400 healthy First Nations children and adults in Queensland and Western Australia over an eight-year period. These assessments have established new reference values for lung health in First Nations people.

As part of his PhD study, respiratory scientist Anthony Collaro, investigated how the lung function of First Nations peoples tracked over time and used this to evaluate the benefit of paediatric respiratory outreach care. Lung function was chosen as it has a profound effect in later life – poor lung function in children increases the risk of respiratory and cardiovascular diseases in adults.

First Nations peoples are more than twice as likely to develop a chronic respiratory condition compared to non-First Nations people. Using this new tool the effectiveness of treatment of respiratory infections in children can be tracked leading to improved health outcomes as they progress to adulthood.

## Steak n Wood: Opportunities for carbon neutrality and income diversification



Figure 13: Steak n Wood

Silvopastoral systems combine natural forests or planted trees with pasture and livestock. There are environmental and financial benefits of implementing silvopastoral systems. The benefits include water quality improvement, soil conservation, carbon sequestration and wildlife habitat.

Agri-Science Queensland within the Department of Agriculture and Fisheries is working with university partners and industry collaborators to better understand the benefits of implementing silvopastoral systems in Queensland. The project collaborators are Meat and Livestock Australia, the University of the Sunshine Coast, University of Queensland, Queensland Department of Environment and Science as well as producers and representatives from the meat, forestry, and energy industries.

The project aims to establish silvopastoral systems in private native forests, develop new planting configurations, improve tree carbon calculators, assess the economic performance of silvopastoral systems, and evaluate the biodiversity and environmental benefits of integrating trees on farm.

The Steak n Wood project has established 13 experiments from Rockhampton to northern New South Wales, covering an area of almost 900 hectares, including six private native forest sites and seven hardwood plantations sites, with the project team planting 34 hectares of trees.

## Future Proofing Queensland's Infrastructure through Climate Resilient Concrete Technologies



Figure 14: Future Proofing Queensland's Infrastructure

Professor Allan Manalo from the University of Southern Queensland in Toowoomba received a \$300,000 Advance Queensland Industry Research Fellowship to develop new, structurally efficient and climate resilient concrete technologies to future proof Queensland's marine infrastructure.

Steel-reinforced concrete, which is typically used for marine infrastructure like jetties and boat ramps, easily corrodes and deteriorates in coastal areas reducing the life of these structures. Professor Manalo's solution uses glass fibre reinforced polymer bars which can withstand the unstable conditions in marine environments. The polymer bars which do not corrode and are strong, lightweight, and sustainable will future proof Queensland infrastructure against climate change for many years to come. The newly developed climate resilient concrete technologies have already been installed at waterfront sites in Queensland.

A key partner of the project is the Department of Transport and Main Roads who has estimated that the new resilient product could significantly reduce the amount of maintenance and inspections of boating and marine infrastructure leading to savings of up to \$10 million each year.

Subsequent funding of over \$1 million from the Australian Government will allow Professor Manalo to investigate how renewable and recycled materials could be incorporated into glass fibre reinforced polymer bars to produce a cost-effective solution.

## Use Of Multi-Beam Sonar for The Detection of The Estuarine Crocodile

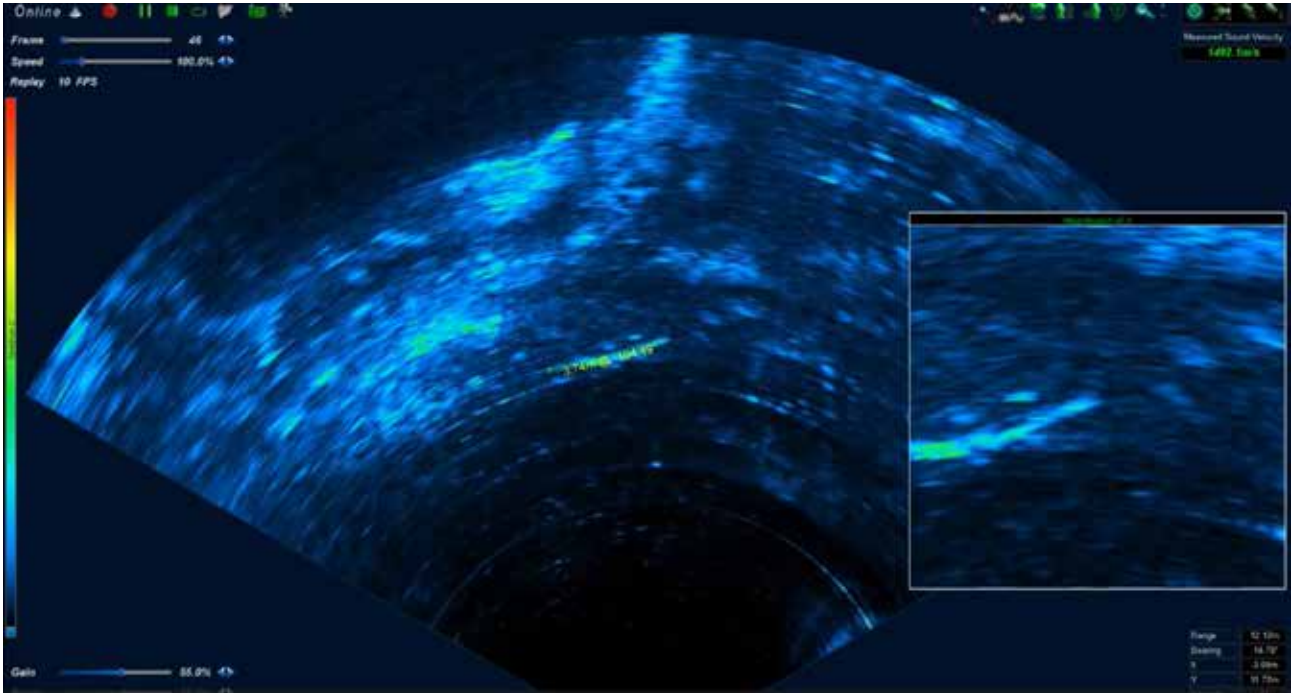


Figure 15: Multi-Beam Sonar for The Detection of The Estuarine Crocodile

The Department of Environment and Science is undertaking pioneering research that uses multi beam sonar technology along with image recognition software to detect estuarine crocodiles.

The effectiveness of the multi beam sonar technology is being tested in a region of the North Kennedy River in the Rinyirru National Park. The multi beam sonar projects around 1,200 beams underwater, significantly more than sonars found on boats. To help verification as the crocodiles move through the water, they are also tracked and monitored using acoustic tags. If the technology can successfully detect crocodiles, it could be expanded and used as an alert system around popular recreational areas and swimming holes.

Sonar technology is only one tool that the Department of Environment and Science is exploring to detect crocodiles. Another one that is being investigated is how to detect the presence of crocodiles in waterways simply by testing for the presence or absence of their DNA.



## The Australian Research Council Centre of Excellence for the Digital Child



Figure 16: Centre of Excellence for the Digital Child

This world first research centre is dedicated to creating positive digital childhoods for Australian children. Led by Queensland University of Technology, the Centre brings together experts from across Australia to investigate children's digital experiences.

Children are growing, learning, and connecting with digital technology that's rapidly evolving and families are asking: How can technology help my child learn? How do I know good digital engagement from bad? How much technology is safe for my child? How do I keep my child safe online? The Centre will address these questions through three research programs which will examine the balance of health risks of digital technologies and access to knowledge and social interactions; how to harness digital technologies to optimise learning and access to knowledge; and how to balance access to social and knowledge connections in the digital world against risks and children's rights.

A central part of the work of the centre will be a study exploring children's engagement with digital technologies. This four-year study will involve more than 3000 families from across Australia, including children as young as six months, and will provide a big picture of digital technology use in early childhood.

The Department of Education is a partner in this landmark centre, and has committed \$700,000 of in-kind support. The Centre's objectives align with Queensland Government's objectives to Educate for the Future, and the Department of Education's vision of Equity and Excellence to give Queensland children the best start.

## Spinal Cord Therapy Research



Figure 17: Professor St John and his team

In 2020 the Queensland Government, through the Motor Accident Insurance Commission, provided \$5.7 million to boost research into a cell-based therapy for chronic spinal cord injury led by Griffith University researcher Professor James St John, head of the Clem Jones Centre for Neurobiology and Stem Cell Research.

The ground-breaking spinal injury project which began in 2017, is focussed on developing easily available, affordable, treatment for patients with spinal injury. Any advancements that can be made to improve the treatment and rehabilitation for people with spinal cord injuries will reduce the health and long-term care costs as well as give people back their independence and improve their quality of life.

Professor St John and his team have found success using an experimental treatment which takes specialised cells from the nose (called olfactory ensheathing cells) and transplanting them into the spinal cord. This led to the development of a novel therapy known as a nerve bridge. The nerve bridge is made up of pure high-quality olfactory ensheathing cells that can be placed into injured spinal cords to build a bridge across the gap and stimulates the regeneration of damaged nerve cells and restores function. The therapy has been successfully tested in animals and will now move to a phase I clinical trial in humans.



## Local Research to Transform the Treatment of COVID-19

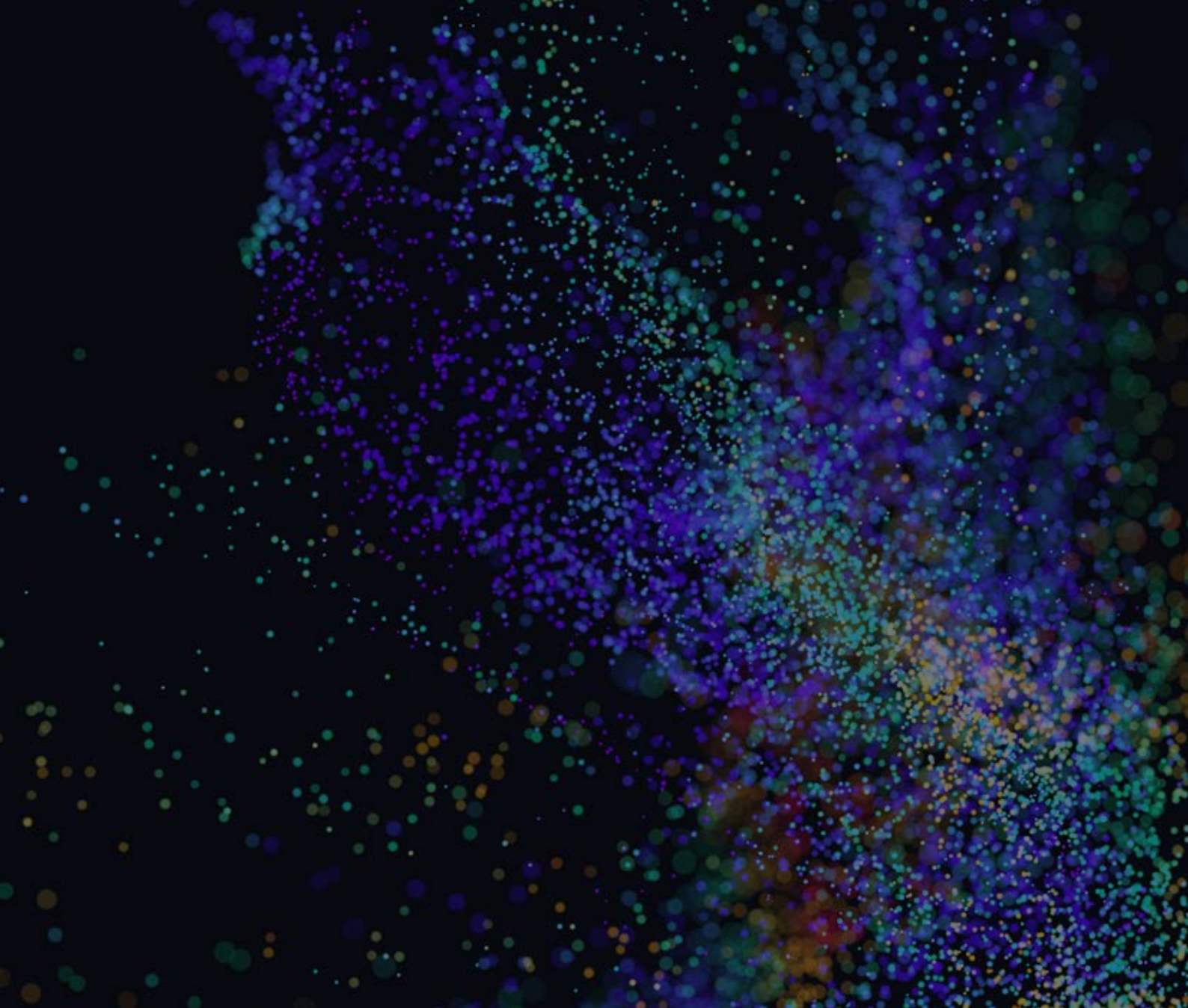


*Figure 18: Professor Sudha Rao*

Professor Sudha Rao who leads QIMR Berghofer's Gene Regulation and Translational Medicine Laboratory has developed a new drug that could transform the treatment of COVID-19 as part of the Queensland Government's \$5 million funding injection to support local research to investigate new COVID-19 treatments.

A major study led by Professor Sudha Rao, showed that a new drug called NACE2i stopped the COVID virus from replicating and protected against re-infection. Professor Rao believes the drug could be used to boost the effectiveness of existing vaccines providing long-lasting protection against any variant that tries to enter the cells.

Another important finding made by Professor Rao's research team was that NACE2i may also help in the treatment of long COVID which affects between 10-20% of people who have COVID-19. Having uncovered the pathway that the COVID virus uses to produce the persistent inflammation associated with long COVID, they found that NACE2i prevented this inflammation, and even repaired damaged lung tissues in pre-clinical models. These exciting findings make NACE2i a promising drug both for the prevention and treatment of long COVID.



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