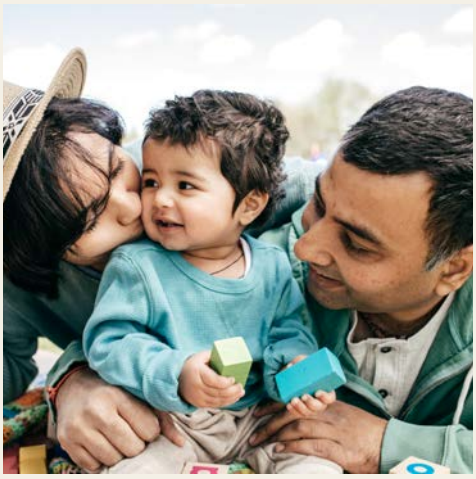
Australian Genomics

AUSTRALIAN GENOMICS

Celebrating a 10 year journey



FOREWORD

Australian Genomics launched in 2016 with an initial NHMRC grant of $25 million over five years. Looking back, I am still struck by how an investment of $5 million a year could achieve so much.

While it was small by international standards, that investment gave us the opportunity to develop a cohesive national approach to the evaluation and implementation of genomic technologies. As a result, Australia is now recognised globally as a country with leading expertise in genomic medicine.

Australian Genomics was able to leverage investments in genomics from federal and state governments, philanthropy and industry. It provided a core team of expertise to enable hundreds of research projects around the country, and the generation of evidence to support health technology assessment and the funding of genomics in healthcare in a timely and equitable way.

Most importantly, over the past 10 years, Australian Genomics has created a collaborative clinical and research community that will champion genomic medicine for decades to come.

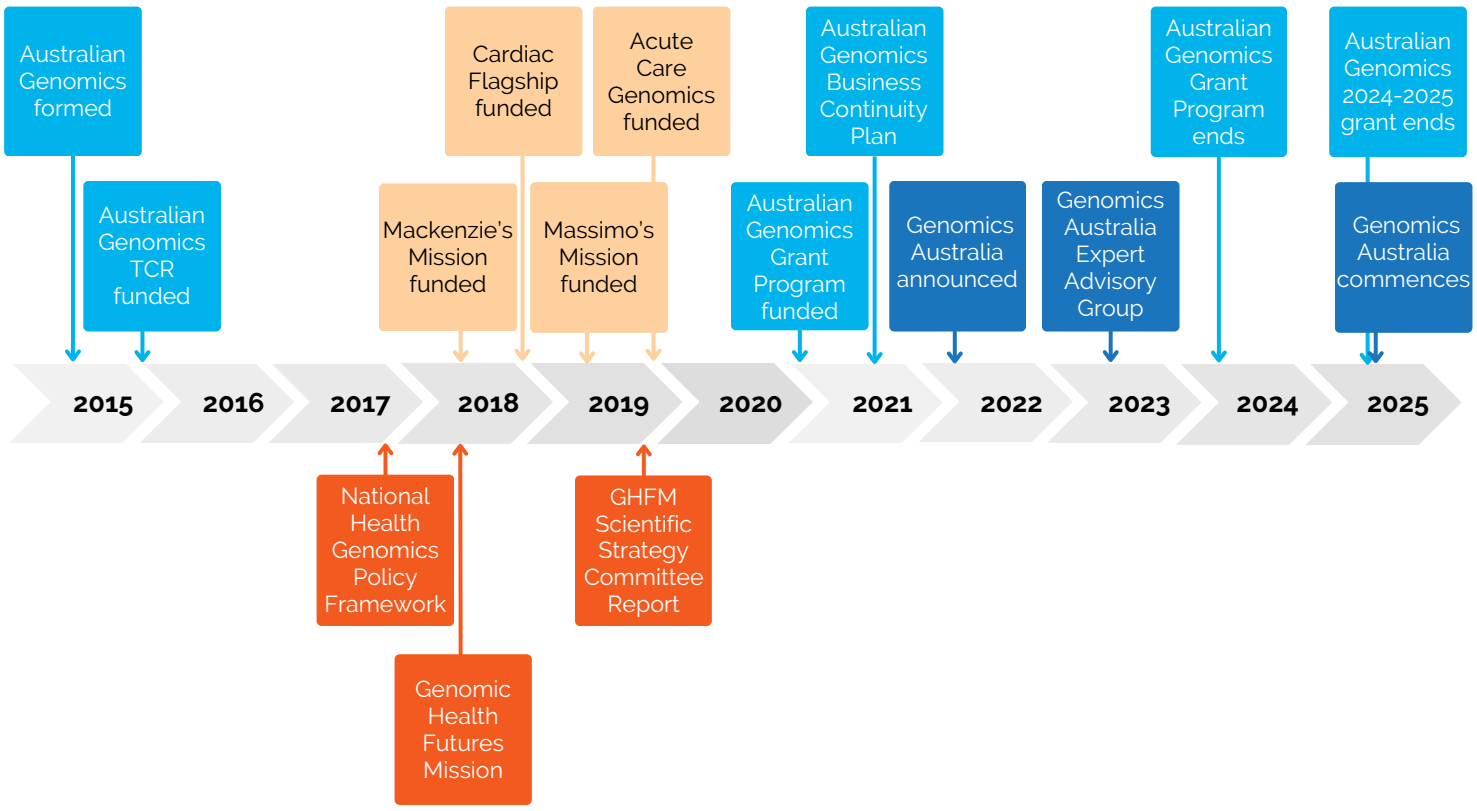
Professor Kathryn North AC

Lead, Australian Genomics
Director, Murdoch Children's Research Institute

EVOLUTION OF A NATIONAL GENOMICS PROGRAM

It began as a small network with a big agenda.

It began as a small network with a big agenda. The Australian Genomics Health Alliance, as it was known back then, began in 2015 and was launched in 2016 with a five-year, $25 million National Health and Medical Research grant. It grew quickly to form a national footprint with 32 clinical sites, 103 organisational partners, and 450 investigators and collaborators. After several grant rounds, Australian Genomics ends on 30 June 2025. Its legacy forms the foundations of a new entity, Genomics Australia, with ongoing funding.



THE FIRST FIVE YEARS

5,200 Patients recruited / genomic testing

21 Cancer & Rare Disease studies

100% Results returned

32 Recruitment sites

115 Ethics & site submissions per year

In 2015 diagnostic genomics across Australia was poorly coordinated and highly variable across states and territories, resulting in inequitable access to services and cost inefficiencies.

In 2016 the National Health and Medical Research Council issued a Targeted Call for Research, Preparing Australia for Genomics Medicine. And with a $25 million NHMRC grant over five years the Australian Genomics Health Alliance was launched.

In response to the fragmentation in genomics, Australian Genomics formed a national diagnostic and research community to build disease-focused networks, evaluate the use of genomics in specific clinical contexts and, where appropriate, develop approaches to inform their sustainable implementation into clinical practice. It drew on the expertise of its members to develop resources and conduct projects of significant value to the genomics community.

This collaborative national network included hospitals, clinical and laboratory genetic services, research institutes, consumer organisations, and professional bodies, all instrumental in advancing the use of genomic testing in the diagnosis and management of rare diseases and cancers.

Using a federated model, Australian Genomics established a network of 32 clinical sites for recruiting research participants across 19 flagship studies. During that period, 5273 individuals with rare diseases and cancers and 2399 relatives underwent genomic testing. The average diagnostic rate in the rare disease flagships was 33 per cent, ranging from 17 to 54 per cent. In the cancer flagships, 48 per cent of findings were clinically actionable.

Four program areas ran in parallel to the research flagships building the evidence to inform policy and practice for a nationally consistent approach to using genomic testing in mainstream healthcare. That infrastructure includes many tools and resources now being exploited by a national and international network of researchers, clinicians, and healthcare services.

They include platforms and resources to promote consistent interpretations of genomic data, clinical, research and dynamic consent, and the increasingly complex and critical area of data storage and sharing. These integrated national data resources are crucial in supporting a "virtuous cycle" between clinical and research genomic delivery, a major legacy of Australian Genomics.

The adoption of a federated model proved successful, particularly in negotiating a national approach across jurisdictions in a nation where responsibility for health is shared between the states, territories and commonwealth governments. The model has been cited as an international exemplar.

Major projects administered by Australian Genomics and supported by its infrastructure in those first five years included the $20 million Australian Reproductive Genetic Carrier Screening Program, the $6 million Cardiovascular Genetics Disorders Program, the $5 million Acute Care Genomics Program and the $3 million Leukodystrophy Research Program.

A NATIONAL DIAGNOSTIC & RESEARCH NETWORK

450 Collaborators & Investigators
103 Organisational partners

117 Jobs created
55 PhD / Masters research students trained

10 Advisory Boards

6 Communities of practice
925 Members

A national diagnostic and research community enabled Australian Genomics to build disease-focused networks and evaluate the use of genomics in specific clinical contexts.

These networks included hospitals, state genetic services, laboratories, other research institutions and patient advocacy groups. Australian Genomics drew on the expertise of these members to develop resources and conduct projects of significant value to the genomic community. These included: standardised best practice approaches to clinical and research consent; guidelines for mainstreaming genomic pathology reports; mechanisms for sharing and resolving discordance in clinical variant classification and disease specific gene lists; improved community awareness and consumer support of genomics; the establishment of a national functional genomics network for resolution of variants of unknown significance; and evaluation of the unmet needs for genomic testing.

National diagnostic and research network

National Partners
Australian Research Data Commons
Australian Biocommons
BioPlatforms Australia
Breast Cancer Network of Australia
Centre for Genetics Education
Childhood Dementia Initiative
CSIRO
Genetic Alliance
Human Genetics Society of Australasia
InGeNA
Mito Foundation
National Computational Infrastructure
Omico
The Poche Centre for Indigenous Health at the University of Sydney
Rare Cancers Australia
Rare Voices Australia
Syndromes Without a Name Australia
The Royal College of Pathologists Australasia
Zero Childhood Cancer

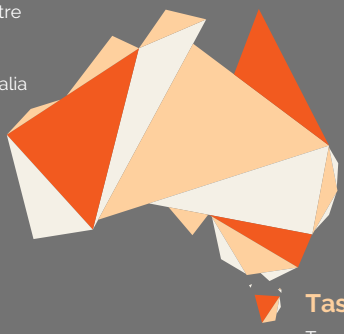
International Partners
Broad Institute
Canadian Institute for Health Research
ELIXIR
European Genome-Phenome Archive
GEM Japan
Genomics England
H3Africa-Bionet
Oxford University

Global Partners
Global Alliance for Genomics and Health
World Economic Forum

Northern Territory
Royal Darwin Hospital

Western Australia
Genetic Services of Western Australia
Harry Perkins Institute of Medical Research
PathWest Laboratory Medicine
PathWest QEII Medical Centre
Perth Children's Hospital
Telethon Kids Institute
University of Western Australia

South Australia
Central Adelaide Local Health Network – SA Pathology
Royal Adelaide Hospital
South Australian Health and Medical Research Institute
The University of Adelaide
University of South Australia
Women's and Children's Hospital Adelaide



Queensland
Brisbane Diamantina Health Partners
Genetic Health Queensland
Institute for Molecular Bioscience
Pathology Queensland
Queensland Children's Hospital
Queensland University of Technology IHBI
QIMR Berghofer Medical Research Institute
The University of Queensland
Townsville Hospital and Health Service

New South Wales
Australian Institute of Health Innovation, Macquarie University
Centre for Genetics Education
Children's Medical Research Institute
Garvan Institute of Medical Research
Hunter Genetics – Genetics of Learning Disability Service
Macquarie University
NSW Health Pathology
Royal North Shore Hospital
St Vincent's Hospital
Sydney Children's Hospital Network
The University of Sydney
Victor Chang Cardiac Research Institute
UNSW Sydney

Tasmania
Tasmanian Clinical Genetic Services
University of Tasmania

Australian Capital Territory
Australian National University

Victoria
Deakin University
Genetic Support Network of Victoria
Gen V
Melbourne Genomics Health Alliance
Melbourne Health
Monash Health
Monash University
Murdoch Children's Research Institute
Peter MacCallum Cancer Centre
Royal Children's Hospital Melbourne
The University of Melbourne
Walter and Eliza Hall Institute of Medical Research

MACKENZIE'S MISSION

Mackenzie's Mission was a $20 million study into government-funded reproductive genetic carrier screening for Australian couples seeking to have children.

It had the largest number of genes tested for reproductive carrier screening of any study in the world and involved 1000 healthcare professionals, researchers, diagnostic laboratory staff and others spread across all states and territories.

The study, administered by Australian Genomics, tested 9107 couples to see if they had an increased chance of having children with one or more of about 750 severe childhood-onset genetic conditions. One in 50 couples tested were found to be in that category.

The three project leads were Professor Edwin Kirk (NSW Health Pathology, University of NSW), Professor Martin Delatycki (Victoria Clinical Genetic Services, Murdoch Children's Research Institute) and Emeritus Professor Nigel Laing AO (Harry Perkins Institute of Medical Research, The University of Western Australia and PathWest Laboratory Medicine).

L-R: Martin Delatycki, Edwin Kirk, Rachael, Joshua, Johnny & Izaac Casella, Nigel Laing.

‘So thankful’ for test that let Mairead beat odds

EXCLUSIVE
Kate Aubusson

Maddie Thwaites remembers staring at the wall as a genetic counsellor shared the results of a cheek swab she and her husband, Ciaran McAuley, had done two months earlier and had thought little about since.

In a moment of powerful prescience, the Geelong couple were told they carried the same rare gene mutation that meant any child they conceived had a one-in-four chance of having a deadly neurodegenerative disorder.

“We would have been completely blindsided,” Thwaites said. “Neither of us has any family history of genetic disorders.”

The Thwaites were one of 9107 couples screened for 1300 genes linked to over 750 rare childhood-onset diseases by the Mackenzie’s Mission project – an unprecedented-in-scale study exploring the feasibility of a nationwide, voluntary genetic reproductive carrier screening program.

The study published yesterday in the *New England Journal of Medicine* found 1.9 per cent (almost one in 50 couples) were at high risk of having children with one or more of these conditions.

Yet 80 per cent of the affected couples were carriers for genetic conditions that would not have been picked up by the Medicare-funded genetic carrier test introduced in November 2023 that screens for spinal muscular atrophy (SMA), cystic fibrosis and fragile X.

The finding bolsters calls for the federal government to establish a free expanded carrier screening program.

Rachael Casella, whose daughter Mackenzie – the inspiration for Mackenzie’s Mission – died of SMA at seven months old, said every couple should have access, regardless of their means, location, cultural background or their doctor’s views.

“I want to jump up and down and shout: ‘Do you understand how important this is, and the impact this could have on families?’” Casella said.

Project co-lead Professor Martin Delatycki at the Murdoch Children’s Research Institute said Australia could be a world leader, envisioning an expanded genetic reproductive carrier screening initiative akin to the National Bowel Cancer Screening Program.

“By not offering a bigger gene panel, we know that children will be born with these conditions and that many, but by no means all, couples would want to take steps to avoid that,” Delatycki said.

The federal government-funded study, co-ordinated by Australian Genomics, provided affected couples with counselling sessions with genetic counsellors, clinical geneticists, and other medical specialists who explained their results, enabling couples to ask questions and make informed decisions.

About 83 per cent of affected couples who were not yet pregnant chose to undergo a free IVF cycle, test their embryos (known as preimplantation genetic testing) and use only unaffected embryos to have children. The Thwaites were among them after learning that they were carriers for a disorder that killed most affected children before they had finished primary school.

“This was more heartache and grief than we were willing to risk,” Maddie said.

“Now that we have our daughter, I am just so thankful that we get to be parents,” she said, having conceived Mairead, now aged two, from their first IVF embryo transfer. “It drives home just how lucky we are.”

Couples could otherwise choose to conceive without IVF and undergo prenatal testing or test their child after birth. They could also choose to use donor eggs, sperm or embryos, adopt or choose not to have children.

Ciaran McAuley and Maddie Thwaites with their two-year-old daughter Mairead. Photo: Joe Armao

Mackenzie’s Mission was named after Rachael and Jonathan Casella’s daughter, Mackenzie, who died of spinal muscular atrophy in 2017 when she was seven months old. The Casella’s have run a vigorous campaign calling for free reproductive genetic carrier screening for all prospective parents who wish to have it.

At first, I struggled to understand what Australian Genomics was – despite attending multiple talks. Then Mackenzie’s Mission happened, and it all became clear. AG was the scaffolding on which we built Mackenzie’s Mission (and on which many other projects were built). Without it, we’d never have been able to get the job done.

PROFESSOR EDWIN KIRK
NSW Health Pathology

MACKENZIE’S MISSION
REPRODUCTIVE GENETIC CARRIER SCREENING

Co-leading Mackenzie’s Mission since 2018 has been an extraordinary realisation of something I have wanted to do for >30 years. The New England Journal of Medicine publication last November, and the reaction to it, suggests Mackenzie’s Mission succeeded. Implementing Mackenzie’s Mission as a national screening program early in the new Genomics Australia era would help so many couples. It must happen.

EMERITUS PROFESSOR NIGEL LAING AO
The University of Western Australia

ACUTE CARE GENOMICS

The Acute Care Genomics study pioneered a national approach to delivering ultra-rapid genomic testing for babies and children admitted to intensive care with suspected genetic conditions, coupled with a comprehensive economic, implementation and psychosocial evaluation.

Established in 2018, the study set out to build a network of hospitals, diagnostic laboratories, and multi-disciplinary teams of medical and genomic specialists to deliver timely and accurate answers for families with babies and children in intensive care.

Over four years, the program provided genomic testing to 450 families with critically ill infants and children. The average time to result was three days, with a diagnostic yield of over 50 per cent.

The study findings were published in more than 50 manuscripts, including JAMA and Nature Medicine, and led to the discovery of over 10 gene-disease discoveries.

Professor Zornitza Stark and Associate Professor Sebastian Lunke of the Victorian Clinical Genetics Services led the study.

450 infants & children

Trio whole exome/ genome sequencing

Time to report <3 days

>50% diagnostic yield

"...there is so much angst waiting for results and this is compounded by caring for a very sick child. Having the test come back quickly lifted an incredible weight and stress from our shoulders."

Left: Project Leads Professor Zornitza Stark & A/Professor seb Lunke.

Below: Evie Wagner.

In 2019, then seven-year-old Evie Wagner, became critically ill with a life-threatening liver condition. From the intensive care unit at The Royal Children's Hospital, Evie was referred to Australian Genomics' Acute Care study for ultra-rapid genome sequencing. The results showed she had a rare recessive genetic condition called Wilson's disease.

The rapid diagnosis set Evie on an extraordinary journey that has seen her circle back to the family's dairy farm in Western Victoria where once more she leads a happy, healthy life.

It has been such a privilege to be part of the Australian Genomics community over the past 8 years! I am hugely proud of what we have achieved in building world-class evidence for the implementation of genomics into healthcare and creating national resources but most of all I will cherish the collaborative relationships I have built with so many amazing people from all around Australia.

PROFESSOR ZORNITZA STARK
Victorian Clinical Genetics Services

In 2021 Australian Genomics entered its second phase.

It successfully transitioned from conducting and evaluating human cohort studies to leveraging its research capabilities and its National Coordination Network. During this period, it delivered comprehensive plans and resources across many areas of activity including data infrastructure, community involvement in research, clinical consent, workforce education, and partnerships with Indigenous communities. Some 220 unique research initiatives received Australian Genomics support in more than 1800 different activities. It continued its original mission to inform evidence-based policy and practice. And as other nations advanced their genomic healthcare efforts, Australian Genomics expanded its international partnerships and collaborations.

THE SECOND PHASE OF AUSTRALIAN GENOMICS

- Research resources
- CTRL dynamic consent
- Coordination
- Translation
- National collaborative networks

- Digital platforms
- Shariant
- PanelApp Australia
- NAGIM
- Clinical data capture
- International standards

- Patient partnership
- Involve Australia
- International collaboration
- SING Australia
- Co-design with Indigenous & CALD communities
- Genomics in schools

- National test directory
- Quality Assurance
- Clinical consent
- Improving accessibility of genomic health
- Workforce education
- Traineeships

- Implementation science
- Bioethics
- Health economics
- HTA consultations
- Landscape analyses

AUSTRALIAN GENOMICS' INTERNATIONAL PARTNERS

Australian Genomics has established a reputation as a leader and key collaborator in global genomics efforts. It built this reputation through many partnerships and collaborations across research, data, governance and in international memberships and agreements.

As a Driver project of the Global Alliance for Genomics and Health, Australian Genomics plays an important role in helping to set global standards and policies for expanding genomic data use. Its other international achievements include establishing a Memorandum of Understanding with Genome Canada, membership of the World Health Organisation's Technical Advisory Group on Genomics, and participation in other key international entities, such as the World Economic Forum.


Australian Genomics
Australian Genomics
Summit 2023
Sunday 16 July 2023 | Melbourne Convention & Exhibition Centre


Australian Genomics Seminar Series
DNA dialogue
Be at the genomics conversation (B-ATGC)


Australian Genomics
2023


Co-production means doing research together.
People with disability are included in the research process.
Co-production can help solve wicked challenges in health care.

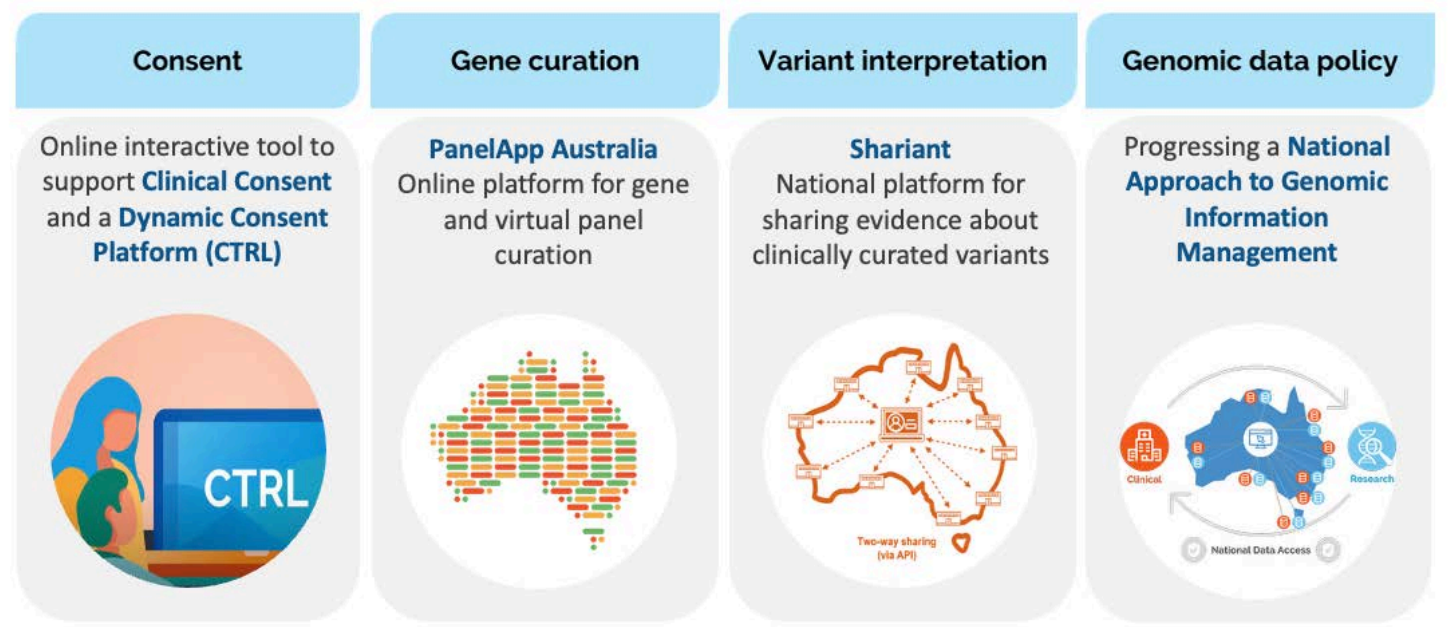

mito FOUNDATION


CREATING THE FOURTH CHAPTER OF HUMAN GENOMICS
Australian Genomics
12pm - 1pm
Tuesday 2 July 2024
Dr Eric Green
Director, National Human Genome Research Institute, National Institutes of Health (US)

DATA INFRASTRUCTURE

Australian Genomics invested significantly in building genomic data infrastructure informed by clinical and diagnostic sector needs. It is evidence based and leverages international standards and collaborations.

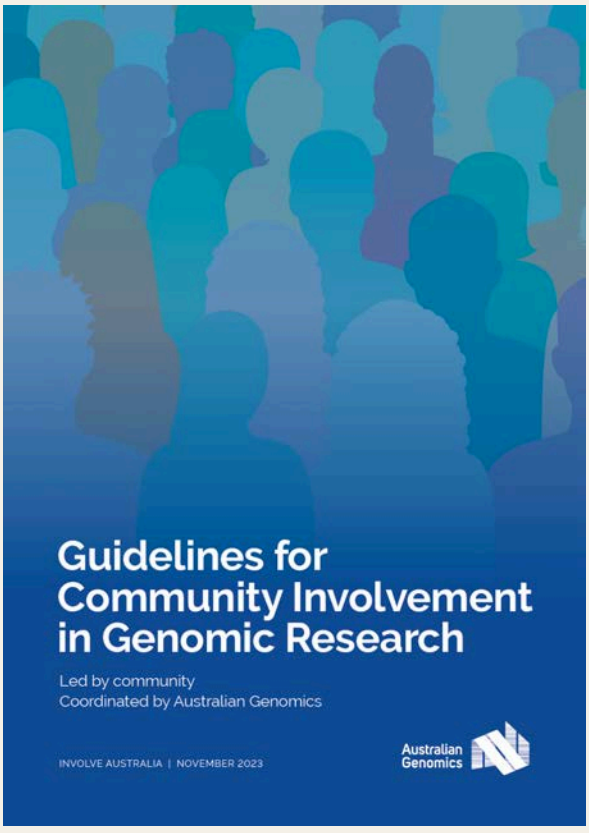
Some of these tools have been designed to support participant autonomy and inform patients undergoing clinical genomic testing. Others improve the efficiency and quality of diagnostic genomic practice and progress prototypes and recommendations to inform a national approach to managing genomic information in Australia.



I have had the immense privilege of contributing to the transformative space of genomic data. From its inception, Australian Genomics advocated for and supported responsible genomic data sharing - not shying away from the many challenges (technical, ethical, legal, social) to work towards solutions, knowing there is huge impact from achieving ethical health data sharing for improving patient care.

MARIE-JO BRION
Data Manager

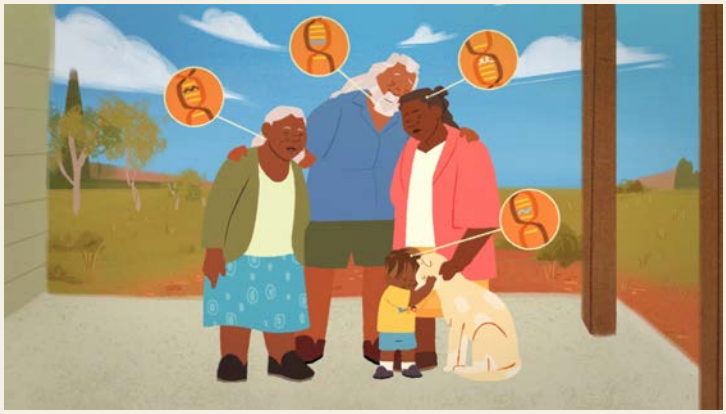
COMMUNITY INVOLVEMENT



Since its inception Australian Genomics has recognised the critical role of community members, patient support and advocacy groups whose involvement underpins the success of many AG projects.

Among the tools and resources developed by Australian Genomics to advance this relationship are patient consent materials, a public-facing website for genomic testing, guidelines for community involvement in genomic research, recommendations for health and medical funders and institution to better support community involvement and a remuneration policy for community members.

Ensuring and enabling Indigenous peoples' control and sense of ownership over genomic research and healthcare is a key factor in community involvement. In partnership with communities the National Centre for Indigenous Genomics (NCIG) rolled out a suite of resources to help people seeking to understand genetic conditions, genetic testing and genomics research, and to navigate the sometimes-complex pathways to these.



> Through an enduring, inclusive and positive partnership, the Australian Genomics teams amplified our incredibly important work nationally and internationally. With the policy team we were able to develop joint submissions that not only advocated for the needs of Aboriginal and Torres Strait Islander peoples but articulated existing barriers many face in accessing genetic and genomic health services and research.

LOUISE LYONS
Senior Manager, Strategy and Policy, Indigenous Genomics

IN THE NEWS

AUSTRALIAN GENOMICS: CELEBRATING A 10 YEAR JOURNEY

HERALDSUN.COM.AU SATURDAY, NOVEMBER 3, 2018

Faster help for kids

New genetic testing times drastically cut

BRIGID O'CONNELL

CRITICALLY ill children now have access to faster genetic testing with the potential to diagnose, change treatment and even their prognosis in as little as three days.

The Australian-first program aims to slash the years it can take to find a diagnosis, end trial-and-error treatments, and stop parents from passing on the disease to siblings.

Standard genetic testing, aiming to pinpoint the source of disease among 22,000 genes, takes three to six months — far too long for a severely ill child. More than 50 children — some as young as a few days old — have had the rapid testing this year.

Professor John Christodoulou, co-lead of Australia Genomics said they had diagnosed half of all cases in under five days. It can take as little as three days.

"Genomic sequencing is the most disruptive technology in health care in 10 years," he said. "It gets these kids off the diagnostic treadmill, so they no longer need invasive investigations."

Blood samples are sent to the laboratory based at Murdoch Children's Research Institute. Laboratory head of the Acute Care Genomics program Dr Sebastian Lunke said a team of geneticists are on-call around the clock to process the data and analyse the results as fast as possible.

"Ten years ago patients waited a decade for data. Now we do it in three days," he said.

A diagnosis of the rare genetic epilepsy Dravet syndrome, while in Monash Children's Hospital intensive care unit in June, has allowed Joshua Stirling, 16 months, to avoid medications making his seizures worse.

Melissa Vandewater said her son's diagnosis had linked them to other affected families and given them clues as to what Joshua's future would hold. "The diagnosis has helped us know more about his triggers and we've now got rescue medications at home to try to prevent him going to hospital," Ms Vandewater said.

Melissa Stirling, with Joshua, who has been diagnosed with a rare type of epilepsy. Picture: ALEX COPPEL

brigid.oconnell@news.com.au
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THE AGE

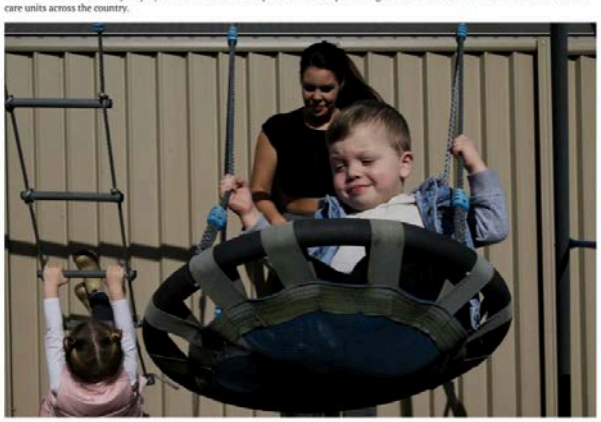
Exclusive National Victoria Healthcare

Why is my child sick? The ultra-rapid genetic tests fast-tracking diagnosis and treatment

Henrietta Cook
June 11, 2023 – 7.30pm

Critically ill children are now receiving free, rapid genetic testing in Victoria, reducing months-long waits for a diagnosis to days and fast-tracking access to life-saving treatment.

The advance follows a two-year project in which researchers provided ultra-rapid testing to 290 children with rare conditions in intensive care units across the country.



Cody Bailey with son River Weatherby and daughter Cali Weatherby at home. River suffers from a rare genetic disorder, Gaucher disease, but early diagnosis allowed early treatment. NICK MCVEAR

While analysing a child's genetic make-up previously took an average of five or six months, the high-speed testing had an average turnaround time of 2.9 days.

After the Australian Genomics study ended last year, the Victorian and West Australian governments took on funding the tests for hospitalised children, at a cost of about $10,000 a child.

"There's a lot of relief in having an answer," said the study's lead investigator, Professor Zornitza Stark.

"We would like to see this funded nationally so that there's equitable access across Australia."

More than half the children involved in the federal government-funded study received a diagnosis after providing a blood sample, results published in the latest *Nature Medicine* journal show.

A speedy diagnosis allows children to avoid a barrage of invasive tests and leave hospital earlier than they would otherwise. It might allow some families to determine how they spend their remaining time with a terminally ill child, or to connect with others with the same condition.

Medical student Guy Helman with a researcher in a gene sequencing laboratory at the Murdoch Institute in Melbourne AARON FRANCIS

Survey to assess students' grasp of genomics

SIAN POWELL

Medical students in Australia and New Zealand will be asked to fill in a five-minute online survey to determine the extent of their genomics medicine understanding and their level of comfort with the fast-paced subject.

Conducted by the Australian Genomics group, a National Health and Medical Research Council-funded network working on the development of genomic medicine in Australia, the survey is an attempt to take a snapshot of the genomics knowledge of roughly 12,000 medical students and, more specifically, the genomics understanding of about 4000 final-year medical students in the two countries.

"This is a high-paced field," said Andrew Mallett, from the University of Queensland's medical faculty and the survey's principal investigator. "It's changing rapidly as genomics is integrating into the healthcare sector."

Accelerating scientific advances in the field meant the genomics revolution was directly or indirectly influencing many areas of medicine, including oncology, infectious diseases, neurology, haematology and rare diseases, he explained, and it was important for genomics education to keep pace with the continually developing subject matter, and important to understand how much the current crop of medical students had learned about genomics at university and elsewhere.

"Rather than focusing on the individual medical schools' curricula, we felt that focusing on the actual product of the curricula — the medical students themselves — would be a functional way of actually ascertaining how well-placed is the workforce we're currently training for genomic medicine," Dr Mallett said.

Massive infrastructure underpinned genomics medicine across Australia, he added, and developments were continually emerging across a broad array of specialised areas within the discipline.

"Amazing stuff is happening and it's finally getting to a point where real patients and clinicians can actually benefit in all kinds of interesting ways," he said.

Guy Helman, a medical student at the University of Queensland and the survey's lead investigator, said the survey questions assessed a range of genomics education elements including the students' genomics knowledge and understanding their "comfort level" with the subject, the nature of the students' genomics medicine experience on clinical rotations, and which parts of the process of ordering genomic testing they had witnessed.

As well as rapidly becoming essential to many medical specialties, and fast expanding in research fields, genomics medicine is becoming a routine part of general health services.

"Whole health systems in the US are using exome or genome sequencing as part of routine clinical care," Mr Helman said. "That's something that's going to be happening here in Australia as well."

A recent genomics education study in the US found that although students had high interest in the field, and "perceived (the) importance of genomics and personalised medicine to their future practice", current programs were not preparing them well for using genomics, he added.

Overall, only 6 per cent of medical students surveyed for the study agreed with the statement "My medical education has adequately prepared me to practice personalised medicine", and 7 per cent agreed with "I know whom to ask questions regarding genomic testing".

The Australian Genomics survey is at www.mcri.edu.au/research/projects/genomics-and-medical-education-gene-survey.

Rapid tests give hope

FOR anxious parents, the worry and wait to clearly identify a child's illness is excruciating.

For critically unwell infants and children, accurate diagnosis gives hope of optimum treatment and care.

As revealed in today's *Herald Sun*, an Australian-first program will offer hope in fast-tracking accurate diagnosis.

Critically ill children will be given access to rapid genetic testing that aims to identify early diagnosis to provide better targeting of treatment and improve health outcomes.

The genetic testing can be conducted in as little as three days.

For some stricken children, it can otherwise take years for a diagnosis to be made, if ever. The situation can result in months or years of trial-and-error treatments.

The rapid genetic assessments will give greater insight into disease sources by analysing tens of thousands of genes. So far in 2018, more than 50 children and infants with suspected genetic conditions in intensive care units across Australia have undergone the rapid tests, which previously have taken three to six months to complete. Australia Genomics, a collaboration of 80 hospitals and research institutes, were able to diagnose half of all cases in under five days.

The revolution in genetic testing will equate to better treatment and provide crucial answers for critically ill kids and their parents.

Anna and Chris Pratt, with son Freddie, are among the first to be tested and, below, Mackenzie Casella's parents Jonathan and Rachael. Photo: Dean Sewell

Genetic screening now reality

Kate Aubusson
Health editor

A handful of Sydney couples are among the first of thousands to use free genetic testing for more than 700 severe and deadly diseases they could potentially pass onto their children.

The pilot phase of Mackenzie's Mission is under way. The landmark trial could pave the way for population-wide preconception carrier screening.

The research team of geneticists, genetic counsellors, clinicians and lab scientists have begun guiding 20 to 40 couples through the process – a test run for the full-scale trial.

The project will ultimately recruit roughly 10,000 couples considering having a baby or in early pregnancy.

The would-be parents will be

Boggs said the trial aimed to give would-be parents the information they needed to make informed decisions about family planning and full reproductive choice.

"We see so many families and what they go through when they have children with severe genetic disease. It is incredibly traumatic," Ms Boggs said.

"Some children don't survive for very long. Others are severely affected by their conditions."

Commercial companies offer carrier testing for a handful of genetic conditions, usually costing between $300 and $600.

Principal investigator and clinical co-lead UNSW professor Edwin Kirk said the goal was to prove wide-scale carrier screening could be a success and ultimately be able to offer it free.

"I don't think I fully appreciated how really complex something like this is and the numbers of decisions we would need to make to work out how best to do it," Professor Kirk said of the project overseen by the Australian Genomics Health Alliance.

"We are looking at the psychosocial, economic, ethical issues of screening, involving genetic screening – a comprehensive look at every aspect to find any problems and work out how to address them," he said.

"We aren't carriers for what happened to Freddie but having been through this experience, we wanted to make sure we covered our bases this time around," Mrs Pratt said.

"Freddie is amazing. He's a little chiller, and we are really lucky to have him, despite all the things we have to deal with.

"Information is power," she said. "That is how we approach things with Freddie day-to-day, and having this genetic testing means we can be prepared.

"Regardless of the results we will be able to arm ourselves with the research to make informed decisions for our next child."

Couples are provided with educational material and talk through the process, the limitations and potential ramifications with a genetic counsellor.

If they choose to go ahead, they

"I've still got a beautiful husband, family and daughter – even though she's not here"

Four years ago, Rachael and Jonny Casella's baby daughter Mackenzie passed away, and the couple launched a crusade to make reproductive genetic carrier testing free and readily available in Australia. Now, as they prepare for the birth of their second child, they open up to *Body+Soul* and reveal how Mackenzie's legacy is about to become a reality

PHOTOGRAPHY DAMIAN BENNETT
STYLING GEMMA KEIL
STORY SASKIA TILLERS

RACHAEL WEARS
JONNY WEARS

At 35 weeks pregnant, Rachael Casella is the embodiment of a glowing mother-to-be. Yet beneath her radiant exterior, Rachael is grappling with a complicated cocktail of emotions. "I am so scared," she tells *Body+Soul*. "But at the same time it's exciting to feel him move and think, 'Do we really get to keep him?'"

While a sense of trepidation about what happens once you leave the hospital with a new baby is a source of anxiety for most new mothers, Rachael's fear stems

from an entirely different place. Having lost her daughter Mackenzie at just seven months and 11 days old from the genetic condition spinal muscular atrophy (SMA), Rachael, 37, and her husband Jonny, 41, are understandably terrified. And while this baby boy doesn't have SMA, she confesses it's "hard not to wonder if the rug is going to be pulled out again. We represent everyone's worst nightmare."

Jonny met Rachael at an Australian Federal Police safety training course in 2013. He recalls an indescribable pull to her. "My gut said, 'There's your future. What are you gonna do about it?'" Marriage and a miscarriage followed before Mackenzie was born in 2017. Their daughter was a picture of health and happiness, but their joy was short-lived. When, at 10 weeks old, Mackenzie was diagnosed with SMA – a terminal genetic condition that progressively destroys nerve cells in the brain stem and spinal cord that control muscle activity such as walking, breathing and swallowing – Rachael felt utterly "blindsided".

"We were told there was nothing we could do except take her home and love her," Rachael recalls. "She had a beautiful life with us once we were able to get out of bed. I don't think we processed what was happening, but we could clearly see that we had this little girl who needed us, and we needed to just let her live."

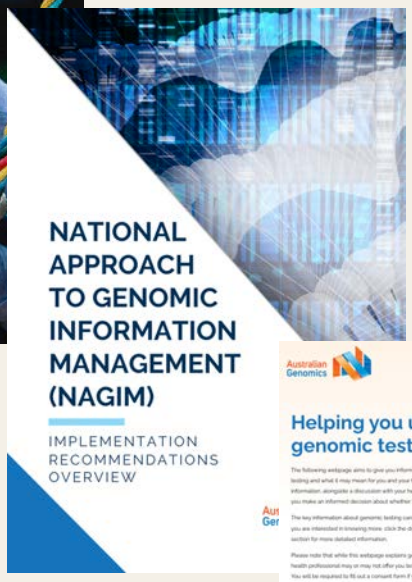
For seven months, Rachael and Jonny soaked up every minute as a family, until one morning, Mackenzie turned blue. "I screamed for my mum and Jonny, and called the ambulance while we tried to get her breathing," she says. "I still get flashbacks when I hear sirens." After five days in hospital, Mackenzie passed away on October 22, 2017.

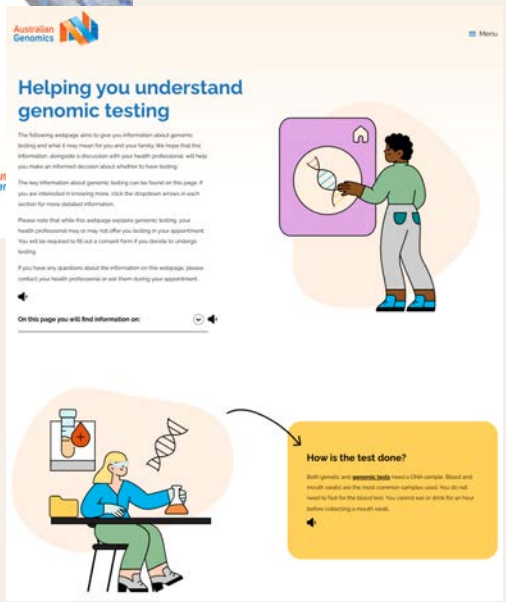
Rachael and Jonny were consumed by grief. "We couldn't comprehend how we were supposed to keep going, how the world kept turning." But gradually, it morphed into something else – anger. Unbeknown to Jonny and Rachael, they were both carriers of SMA, meaning that while the condition didn't affect them, there was a one-in-four chance their children could get it. They discovered that while SMA, as well as hundreds of other life-threatening genetic conditions, can be tested easily with a saliva swab, they'd never been offered it because they didn't have any family history – even though four out of five children born with a genetic condition don't either. Then there's the cost of the test – which can be up to $1000 – an additional expense many prospective parents can't afford.

"Anger can be a powerful driver,"

Rachael says. "And we w angry, because we'd ask test possible to have a h For a long time, I wonder But that changed to "Wh is estimated all people a about five faulty recessiv of which are severe or le passed on to their childr one in 20 children are bo genetic condition or birth range from those you ca those that are terminally means a small number. " we testing?" Rachael as we as a society talking a A woman on a mission, wrote 275 letters to fede – determined for her dau not to be in vain. Her suc Less than four months a achael and Jonny ith minister G r, when han y 2018, the $500 millio e rolled out

OUR IMPACT





The Science Within Us

A digital learning resource exploring our genetic identity

REFLECTIONS

Here we are at the end of Australian Genomics.

I'm deeply grateful for the opportunities, experiences and relationships that have been built through Australian Genomics. Despite the hard work, I've loved working with you all on this, and am so proud of all we have achieved, the skilled team we've built, and the incredible community we've developed.

I am feeling enthusiastic that Genomics Australia will build upon our collective efforts of the last decade, and it feels like the right time for national health genomics efforts to move from research into Government.

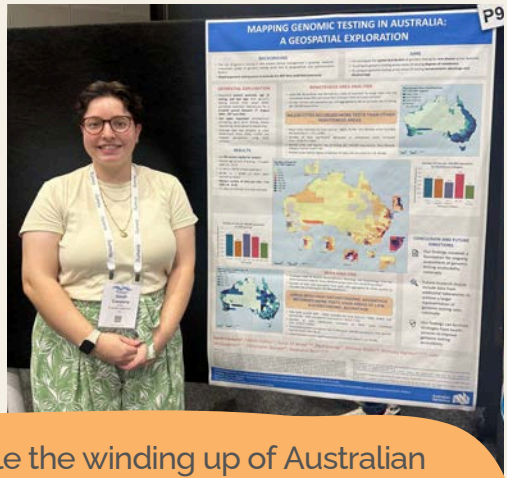
Thank you,
Tiffany Boughtwood

We set out to demonstrate that it was possible to bring genomic medicine into the Australian healthcare system, and we certainly delivered on our four major objectives: demonstrating patient benefit and cost effectiveness of the technologies in the rare disease and cancer arenas, understanding what is needed to bring genomic medicine into our health system, and building Australia's translational research genomics capacity.

John Christodoulou

While it's bittersweet to see the Australian Genomics chapter come to an end, I look back with so much pride in everything we've achieved together. We've truly helped change the face of genomics in this country, and I think we can all be really proud of that.

Kirsten Boggs



While the winding up of Australian Genomics is a milestone, it has been but a beginning with ever improving infrastructures (national databases for example) and emerging technologies such as AI, long read sequencing, spatial and multiomic technologies still to be brought systematically to the clinical interface.

Hamish Scott

AUSTRALIAN GENOMICS: CELEBRATING A 10 YEAR JOURNEY

It's hard to summarise or pick out individual key achievements as highlights, because for me, it all comes back to developing the genomics network in Australia – it's the partnerships with organisations and relationships with individuals that have driven progress. Without the commitment and motivation of the people who've engaged in our work, we wouldn't have reached where we are today.

Matilda Haas

Through research, national collaboration and community involvement, Australian Genomics has enabled a real and sustained change in clinical practice for the benefit of thousands of families experiencing genetic conditions.

Ilias Goranitis

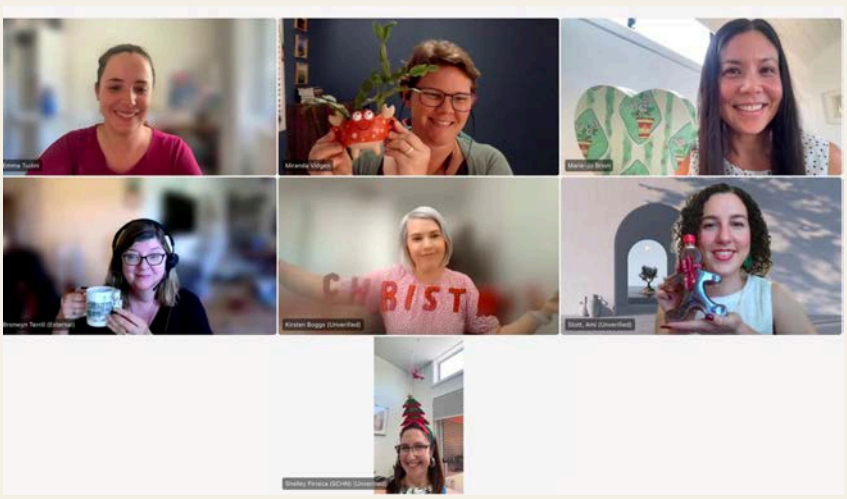
Australian Genomics has been such a catalyst for progress in genomic research, translation and implementation in Australia. Being part of this over the past few years is something that many of my colleagues and I will remember fondly and cherish. In the area of kidney health, the lofty and aspirational goals we had only a few short years ago have now been achieved.

Andrew J. Mallett

When Australian Genomics began as the Australian Genomics Health Alliance in 2016, genomic cancer medicine was in its early infancy. The work that was conducted by those of us working at the coalface of genomic cancer medicine has laid the foundations for mainstreaming genomics into the diagnosis, treatment and risk management of cancer patients.

David Thomas


Australian Genomics
National Conference, 2017



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