





## AUSTRALIAN GENOMICS

Celebrating a 10 year journey











#### AUSTRALIAN GENOMICS: CELEBRATING A 10 YEAR JOURNEY



OREWORD

Australian Genomics launched in 2016 with an NHMRC grant of \$25 million. 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.

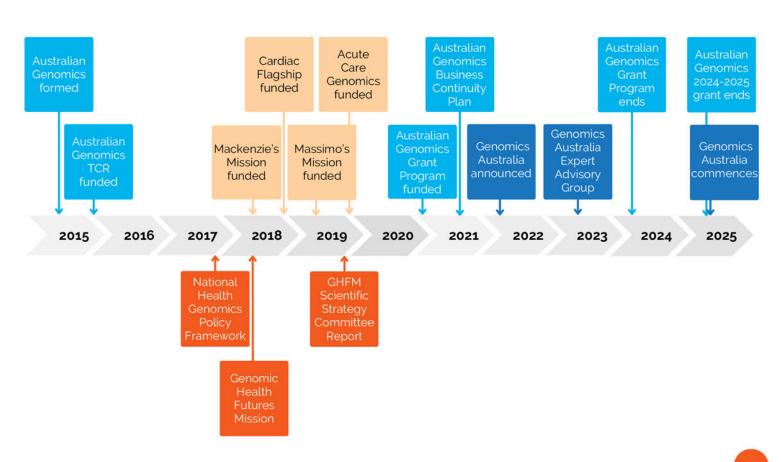
#### **Professor Kathryn North AC**

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.





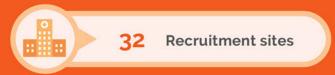
# THE FIRST FIVE YEARS











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.

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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 million Screening Program, the \$6 Cardiovascular Genetics Disorders Program, the \$5 million Acute Care Genomics Program and the \$3 million Leukodystrophy Research Program.





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 Partners**

Australian Research Data Commons Australian Biocommons BioPlatforms Australia Breast Cancer Network of Australia Centre for Genetics Education

Genetic Alliance Human Genetics Society of Australasia InGeNA Mito Foundation

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

European Genome-Phenome Archive GEM Japan Genomics England H3Africa-Bionet Oxford University

#### **Global Partners**

Global Alliance for Genomics and Health

#### **Northern Territory**

#### Western Australia

Harry Perkins Institute of Medical Research PathWest Laboratory Medicine PathWest QEII Medical Centre

Perth Children's Hospital Telethon Kids Institute

South Australia

#### Queensland

#### **New South Wales**

Australian Institute of Health Innovation, Macquarie University

Centre for Genetics Education

Children's Medical Research Institute of Medical Research

Garvan Institute of Medical Research Hunter Genetics - Genetics of Learning Disability Service
Macquarie University
NSW Health Pathopoly
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**

#### Victoria

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 Deakin University Monash University
Genetic Support Network of Victoria Murdoch Children's Research Institute
Gen V Peter MacCallum Cancer Centre Melbourne Genomics Health Alliance Royal Children's Hospital Melbourne
Melbourne Health The University of Melbourne
Monash Health 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).





#### 'So thankful' for test that let Mairead beat odds

#### EXCLUSIVE

Maddle Throites remembers staring at the wall as a genetic coansellor shared the results of a check wab she and her hosbood, Claram McAuley, had done two months earlier and had thought little about

as a moment or powersu proseence, the Geekong couple were told they carried the same rare gote mutation that meant any child they conceived had a one-in four chance of having a deady neurodegenerative disorder.

"We would have been completely blindsided," Threalter said. "Neither of us has any family history of genet

The Thwaltes were one of 9000 couples acreened for 1000 genes Inded to over 700 rare childhood-onset diseases by the Mackansis' Mission project- an unprecedented to scale study exploring the fessible by of a satisfancial, volume for the project of the project o

program.

The study published yesterday in the New England Americal 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

Yet 80 per cent of the affects couples were carriers for penet conditions that would not have bee picked up by the Modicare-funds genetic carrier test introduced i November 2023 that screens for spinal muscular atrophy GMA cystic Showia and fragle X.

federal government to establish a free expanded carrier screening program. Eachael Casella, whose daughter

Machanete - the inspiration for Machanete's Mission - died of SM/ at seven months old, said every couple should have access, regardless of their resuns, location, cultural back ground or their doctor's views.

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Claran McAuley and Maddle Thwaites with their two-year-old daughter Mairead. Photo Joe Arm

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who were not yet pregnant et oudergo a free IVF cycle, I am just so their enthry so known as preine hation genetic testing) and use crived Maire tradicted methyon to have due. The Threaltes were senong drives home m offer learning that they were feer for a floorder that alled

had finished primary school.

"This was more heartache and grief than we were willing to risk," Maddle said. "Now that we have our doughter, I am just so thankful that we get to be parenta," she said, having conceived Mairend, now agod two, from their first IVF embryo transite. "It

drives notice just how auxiv we are. Couples could otherwise choose to conceive without IVF and undergo prevastal testing or test their child after hirth. They could also choose to use choose aggs, sperm or embryos, adopt or choose not to have child

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



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







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.





Trio whole exome/ genome sequencing



Time to report



>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.







### 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.

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- 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 GENONICS' 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 other participation in international entities, such as the World Economic Forum.































# DATA CELEBRATING A 10 YEA NFRASTRUCTURE

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.

#### Consent Gene curation Variant interpretation Genomic data policy Online interactive tool to Progressing a National PanelApp Australia Shariant support Clinical Consent Online platform for gene Approach to Genomic National platform for and a Dynamic Consent sharing evidence about Information and virtual panel Platform (CTRL) curation clinically curated variants Management

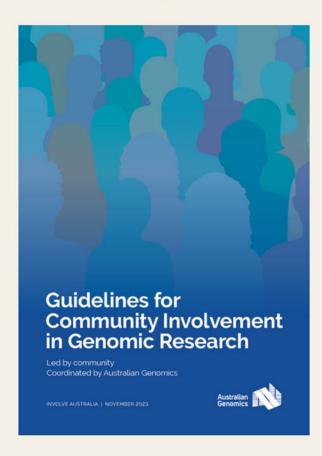
I have had the immense privilege of contributing to the transformative space of genomic data. From its inception, Australian Genomics advocated for and supported responsible genomic data sharing – not shying away from the many challenges (technical, ethical, legal, social) to work towards solutions,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

MARIE-JO BRION
Data Manager





## COMMUNITY NOLVEMENT



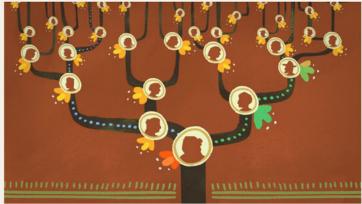
Since its inception Australian Genomics has recognised the critical role of community members, patient support and advocacy groups whose involvement underpins the success of many AG projects.

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 sometimescomplex 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



### **Faster help for kids**

#### New genetic testing times drastically cut





#### Survey to assess students' grasp of genomics

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#### Genetic screening now reality



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

Four years ago, Rachael and Jonny Caselia'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

#### **AUSTRALIAN GENOMICS: CELEBRATING A 10 YEAR JOURNEY**

#### THE .. AGE

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





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 gove 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."

#### Rapid tests give hope

OR 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 Heraid Sun, an Australian-first program will offer hope in fast-tracking accurate diagnosis.

Critically ill children will be given ascess 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.



## MPACT



Australian Genomics

THE FIRST FIVE YEARS



RESEARCH HIGHLIGHTS Our story is your story too Australian Genomics Australian Genomics is a national collaboration supporting the translation of genomic research into clinical practice **Tools & resources** We offer a range of tools, resources, publi and datasets for genomic researchers.

**NATIONAL APPROACH** TO GENOMIC **INFORMATION** 



MANAGEMENT (NAGIM)

IMPLEMENTATION RECOMMENDATIONS OVERVIEW







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.

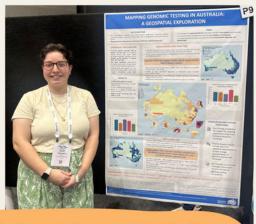
#### John Christodoulou



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





















Through researce collaboration and involvement, Australia enabled a real charage in aligned to

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**

















