Annual Report

Financial Year 2022–23

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Chairman's message

I am pleased to present AGRF's annual report for the year ended 30 June 2023.

AGRF is proud to be at the forefront of the genomics field's advancements. Our commitment to providing cutting-edge technologies and services has resulted in AGRF being the first in the Oceania region to offer Illumina NovaSeq™ X Plus and PacBio Revio® services. These innovative technologies have enabled us to accelerate research and generate genomic data with unprecedented speed and accuracy, allowing us to provide better genomic insights to our clients.

At AGRF, we remain committed to supporting research in primary industries such as agriculture and environmental science. We have partnered with leading research institutions to advance our understanding of the genetic basis of crop and animal health, soil and water quality, and environmental resilience. Our genotyping, high-throughput sequencing, and long-read technologies have allowed us to identify traits crucial for productivity, disease resistance, and adaptation to changing environmental conditions.

We continue to partner with clinical genomic clients with a team of experts in genomics and bioinformatics, experienced in working with clinical samples and analysing large-scale genomic data. Under ISO15189, we have expanded our services to support researchers and clinicians in obtaining clinically actionable insights to aid in diagnosing, treating, and preventing diseases. We have completed the validation of the Illumina TruSight™ Oncology 500 panel and continue to work with our clients to translate genomic insights into improved patient outcomes.

At AGRF, we believe that genomics has the power to transform primary industries and clinical genomics while driving innovation and contributing to valuable research in emerging fields such as single cell and spatial genomics. We are committed to continuing our work in these areas and to collaborating with our partners to achieve shared goals for a healthier, more sustainable planet.

I would like to express my gratitude to our clients, AGRF leadership team, and employees for their continued support and dedication to advancing genomic science. Together, we are making great strides in our understanding of genomics, and I am confident that our best days are still ahead.

Professor Simon Foote
Chairman AGRF

A message from our Chief Executive Officer

This has been a year of tremendous growth and expansion for our organisation. I am proud to report that we have made significant progress towards achieving our vision of advancing genomic science and promoting a healthier, more sustainable world.

A highlight this year was our continued investment in state-of-the-art technologies including the Illumina NovaSeq X Plus and the PacBio Revio systems. These cutting-edge technologies have enabled us to generate large amounts of genomic data with unprecedented speed and accuracy. Our expanded capabilities mean we have been able to support a wider range of research projects, from basic research in genomics to clinical applications in precision medicine, primary industry projects and beyond.

Our commitment to collaboration and partnership has also been a key driver of our success this year. We have forged new partnerships with leading research institutions and industry partners across our region, and we have expanded our global network of clients and collaborators. By working together with our partners, we leverage our collective expertise and resources to achieve shared goals and drive innovation in genomics research and development.

Of course, none of this would be possible without the dedication and hard work of our talented team and leaders. I would like to take this opportunity to thank you for your commitment to excellence, your unwavering focus on our values of integrity, collaboration, knowledge and accountability, and your tireless efforts to progressing the field of genomics and promote a healthier world.

I acknowledge the ongoing support of our friends at Bioplatforms Australia who along with funding from NCRIS, contribute to the outstanding capabilities provided by AGRF which helps to strongly position us in the global genomics ecosystem.

As we look to the future, we are confident that we are well-positioned to continue our growth and expansion in the years to come. We remain committed to our mission of advancing genomic science, and we will continue to push the boundaries of what is possible in genomics research and development. Together, we will continue to make a positive impact on the world, and I am excited to see what the future holds for AGRF.

Joe Baini
Chief Executive Officer

A message from our Chief Scientific Officer

It has been an exciting year at AGRF. As Chief Scientific Officer, I am proud to be part of a team that continues to make significant contributions to the field of genomics, both within Australia and beyond.

At AGRF, we believe in the power of collaboration. We continue to expand our partnerships, working with a wide variety of organisations and research groups. This collaborative approach has been instrumental in fostering innovation and driving progress in the scientific community, as well as ensuring the services we deliver at AGRF are led by research and industry needs.

This year we expanded our Science and Technology Team through a Research Collaboration Agreement with the University of Adelaide. We appointed a post-doctoral scientist to AGRF who is seconded to the South Australian immunoGENomics Cancer Institute (SAiGENCI). Working in the Single Cell and Spatial Omics Laboratory under the leadership of Associate Professor Luciano Martelotto, a world leader in single cell and spatial biology, this collaboration puts AGRF at the forefront of new application development on a range of spatial biology platforms. It is one example of how we are positioning ourselves to deliver world-class collaborations and services in new areas of genomics. Through initiatives such as these, we continue to actively contribute to the development of novel techniques and approaches alongside our research partners.

Demonstrating our dedication to remaining at the forefront of new technology, this year we implementd the Illumina NovaSeq X Plus at our Melbourne laboratory and the PacBio Revio at our Brisbane facility. This expands our fleet of state-of-the-art sequencing infrastructure. Putting these new platforms into operation marks a significant milestone for AGRF. We take great pride in being the first in Australia to introduce both of these new technologies. These sequencing platforms have lower running costs and higher capacity than their predecessors, offering our clients and collaborators greater genomic insights and enhancing the potential for greater impact on the Australian community.

AGRF has co-authored 10 peer-reviewed publications during this financial year, and our work has been cited in 389 publications and 17 patent applications. These accomplishments reflect our commitment to excellence and our dedication to pushing the boundaries of scientific knowledge.

As we grow, we continue to strategically invest in our collaborations. We have committed $1.1M in cash contributions to our partnerships and collaborations over the next six years. Throughout this financial year, we have partnered on six new successful grants, bringing our total number of grant partnerships to 17, with a further 12 applications pending. Grants supported by AGRF contribute close to $250M to Australian researchers. These grants provide exciting opportunities to make a lasting impact in their respective research domains.

Looking ahead to the next 25 years of AGRF, we remain committed to advancing scientific knowledge, promoting innovation, and delivering positive change in the scientific community.

Dr Cath Moore
Chief Scientific Officer

Our governance

Our Board

Prof. Simon Foote
Chairman

- *BMedSci, MBBS, PhD, DSc, FFSc (RCPA), FAA, FAHMS, FTSE*
- *Member of the Finance, Audit & HR Committee*

Professor Foote is an Emeritus Professor at The John Curtin School of Medical Research at The Australian National University. He has been Director of The John Curtin School, Dean of the School of Medicine at Macquarie University, Director of the Menzies Research Institute at the University of Tasmania and Divisional Head at the Walter and Eliza Hall Institute, Melbourne. Professor Foote was elected to the Australian Academy of Science in 2016 and was a founding member of the Australian Academy of Health and Medical Sciences (AAHMS) after being elected to the Academy in 2014 and is also a Council Member of the AAHMS. He was elected as a Fellow of the Australian Academy of Technological Sciences and Engineering (ATSE) in 2009, and he was a postdoctoral fellow at the Whitehead Institute at the Massachusetts Institute of Technology.

Prof. Nick Samaras
Deputy Chairman

- *BSc (Hons), PhD, MBA, FAIM, FAICD, FWCLP*
- *Member of the Finance, Audit & HR Committee*

Professor Samaras has worked in senior positions of several global life sciences companies for over 30 years. Professor Samaras has served on the boards of several Australian-based technology companies and is currently the Chairman of Genetic Signatures Ltd. He is also an Enterprise Professor at the University of Melbourne and Professor (Practice) at Monash University. He has extensive experience in the global life sciences market and advises the AGRF Board on current technological advances, market trends and industry engagement.

Anneke du Toit
Partner, Deloitte Touche Tohmatsu

Anneke is an experienced audit partner with over 20 years' experience across South Africa, the UK and Australia. Her expertise is in corporate auditing, particularly in health and biotechnology. She serves as the Victorian Market Leader for Deloitte Private and is a member of the National Deloitte Private Executive.

Prof. Benjamin Kile
BSc (Hons), LLB (Mon), PhD, FAHMS

Professor Benjamin Kile, is an internationally recognised molecular biologist and the Executive Director of the Garvan Institute of Medical Research. He serves as an independent director and liaison to the medical research sector, with a research focus on blood cell regulation and targeted cancer therapies.

Prof. Ingrid Winship AO
MBChB, MD (Human Genetics), FRACP, FACD, FAICD

Ingrid Winship is a clinician scientist and is the Inaugural Chair of Adult Clinical Genetics at the University of Melbourne and The Royal Melbourne Hospital. Professor Winship was appointed Officer of the Order of Australia in 2020 for distinguished service to medicine and her career has combined clinical practice, biomedical research and the translation of research into practice and policy.

Prof. Brandon Wainwright AM
BSc (Hons), PhD

Professor Brandon Wainwright is a Co-Director of the Children's Brain Cancer Centre, with expertise in discovering pathways for diseases, particularly medulloblastoma in children. His ground-breaking work in molecular genetics led to the identification of the genetic "hedgehog" pathway that causes most human cancers.

AGRF would like to thank and acknowledge the contributions of Professor Gabrielle Beltz and Dr John Bell who retired from the Board prior to this publication.

Our Executive Team

Joe Baini
Chief Executive Officer

Cath Moore PhD
Chief Scientific Officer

Jim Nanos
Chief Operating Officer

Karen Jenkins
Head of People & Culture

Matthew Tinning
Head of Laboratory Operations

Jessica Poy
Chief Commercial Officer

Our vision, mission and values

Our *Vision*

To help make the world a better and more sustainable place through the use of genomics.

Our *Mission*

AGRF's purpose is to partner with the genomics community to make profound improvements to people's lives by delivering a world-class, innovative, and integrated capability.

Our *Values*

Integrity

We strive to do the right thing by engaging with our community using respectful, ethical and honest actions and communication.

Collaboration

We build inclusive teams and valued relationships in pursuit of shared company goals creating a meaningful impact for the community.

Knowledge

We embrace challenges with curiosity and initiative to provide our clients with access to cutting-edge genomic and analytical technologies.

Accountability

We take ownership and can be trusted for our role in delivering quality outcomes with reliability and consistency.

Highlights 2022–23

We continued to work across a wide range of biological fields including environmental research, agriculture research, aquaculture, human health, and plant research.

Interesting AGRF projects, include:

- PacBio Pangenome and transcriptome covering 10 ecotypes of Australian *Senecio* (daisy) as a model system for understanding evolutionary and ecological processes.
- Particpating in the BPA Plant Pathogen Initiative, focusing on short read sequencing of various plant pathogens, with the aim of enhancing biosecurity surveilliance and advancing palnt protection research.
- Whole genome sequencing of important food crops such as pineapple, kiwifruit, citrus and Australasian native rice, to enable genetically directed selection and breeding of desirable traits.
- In collaboration with Monash University, we used 10x Genomics Single Cell Multiome ATAC + Gene Expression assay to understand the transcriptomic and epigenomic dynamics of prostate cancer at single-cell resolution.
- Working with The Children's Hospital at Westmead, we used Honeycomb Bio HIVE Single Cell RNA-seq technology to study neutrophil biology in paediatric patients with autoimmune encephalitis.

Key *Stats*

We processed more than

465,000

samples

Publications

AGRF has co-authored

10 peer reviewed publications

and been cited in a further

389

Genotyping

22,765

samples across 465 projects, for the Illumina SNP and Methylation services.

Long-read Sequencing

We've sequenced

50 new genomes

15 strains/ cultivars

of existing genomes

Next-Generation Sequencing

Over

1,658 whole genomes

sequenced from different species, including over

886 human genomes

Nuts for knowledge: Can walnuts be the answer for stressed university students?

AGRF's genomic data is helping researchers explore the connections between gut health, gut microbiota and brain health, particularly in relation to stress and depression.

Consuming walnuts during stressful periods had a positive impact on self-reported mental health and wellbeing.

Being a student can be quite stressful, especially during the university years which coincide with a critical transition into early adulthood. According to a recent Australian study, students are more susceptible to experiencing psychological distress and are at greater risk for changes to their mental health.

At the University of South Australia (UniSA), researchers have been exploring the connections between gut health, gut microbiota and brain health, particularly in relation to stress and depression.

Professor Larisa Bobrovskaya leads the neuroscience research group at UniSA and is joined by PhD student Mauritz Herselman who has been actively involved in this research. Bobrovskaya explains, "We were interested in investigating whether daily walnut consumption could have a positive impact on the mental health and gut microbiome of university students, as they are a group particularly vulnerable to the impacts of academic stress, especially during exam periods."

To unravel the intricate relationship between the gut and the brain, the research team conducted a randomised clinical trial with university students. Participants were divided into two groups: a control group and a treatment group that was asked to consume a serving of walnuts daily for the duration of the study. The focus was on examining the effects of walnuts on mental health and general wellbeing through this dietary intervention.

Analysing the gut microbiota is a complex business due to the huge number of bacterial species. This is when AGRF's invaluable expertise came into play, taking a critical role in assisting with the analysis of these samples. By employing Next Generation Sequencing (NGS) microbial profiling techniques, the researchers were able to gain insights into the overall diversity of gut flora in the participants, as well as specific changes in the subgroups of gut bacteria.

"Our partnership with AGRF has been incredibly valuable, particularly when it comes to analysing the gut microbiota," says Mauritz. "We have benefited greatly from the high quality and timely data and would recommend them to others." He praised the value of the partnership with AGRF, which provided expertise and access to cutting-edge technology to enable the research.

The team's findings revealed that consuming walnuts during stressful periods had a positive impact on self-reported mental health and wellbeing. Mauritz explains that academic stress can have a negative impact on mental health in the longer term. "However, in this study, we've seen that walnut consumption helped mitigate some of these effects and, in some cases, the analysis suggested that they may have a protective effect on the gut microbiota."

This research has opened exciting avenues for further exploration, with the team eager to delve deeper into the role of the gut microbiota and diets in stress-related mental health disturbances. They also aim to expand the research scope to get a better understanding of the potential impact of walnuts in neurodegenerative disorders like Parkinson's disease.

The progress made by the UniSA research group in collaboration with AGRF highlights the importance of studying the gut-brain connection and its potential implications for mental health. By continuing to uncover the beneficial effects of dietary interventions such as walnut consumption, they aim to contribute to the wellbeing of students and individuals affected by neurological disorders.

"Our partnership with AGRF has been incredibly valuable, particularly when it comes to analysing the gut microbiota."

1. Browne, V, et al, 'The mental health of Australian university students', *JANZSA,* 50, October 2017.

Wayne Ward: Celebrating 25 years

Wayne Ward

National Procurement & Facilities Manager

Joined AGRF in 1998

Wayne Ward, a veteran of AGRF, gravitated naturally towards the world of science due to his analytical mind and methodical mentality. He began his journey with us in 1998 when AGRF was just a small lab based at the Walter and Eliza Hall Institute (WEHI) in Melbourne.

Wayne fondly remembers his early days as a genetic analyst in genotyping. “I started out learning how to score microsatellites digitally, which was quite different to the autoradiography methods of the time,” he says.

He quickly became an indispensable member of the AGRF team, earning the affectionate name of “Mr Fixit” for his ability to keep things operating smoothly in the lab and filling in gaps by taking on more facilities management and safety duties for the organisation as it evolved. Wayne’s dedication and personal mantra of “you get out what you put in” led him to transition from analysis to laboratory management, eventually taking on the role of Melbourne Laboratory Manager in 2003.

Driven by a desire to expand his horizons, Wayne pursued a Master of Biotechnology and Business at RMIT. His talents eventually propelled him to the position of National Laboratory Manager, overseeing operations on a larger scale.

Wayne fondly recalls the milestone moments when AGRF expanded and new laboratory sites were introduced, delivering clients improved local access to our genomic services. He played a crucial role in designing and building our Perth and Sydney sites. His colleague, Dave Chandler, vividly remembers Wayne’s arrival in Perth with the ABI 3730 sequencing machines for our Sanger service back in 2010. “It almost seemed like Wayne carried those instruments on his back,” recalls Dave.

Wayne smoothly managed the relocation of the Melbourne facility to the state-of-the-art Victorian Comprehensive Cancer Centre (VCCC) facility where our laboratory and executive/commercial office now thrive.

During a recent celebration of Wayne’s 25 years at AGRF, it was evident how highly his colleagues regard him. They admire his unwavering dedication, stability and generosity. “He is a problem solver who always finds a way,” remarks his friend and colleague, Desley Pitcher.

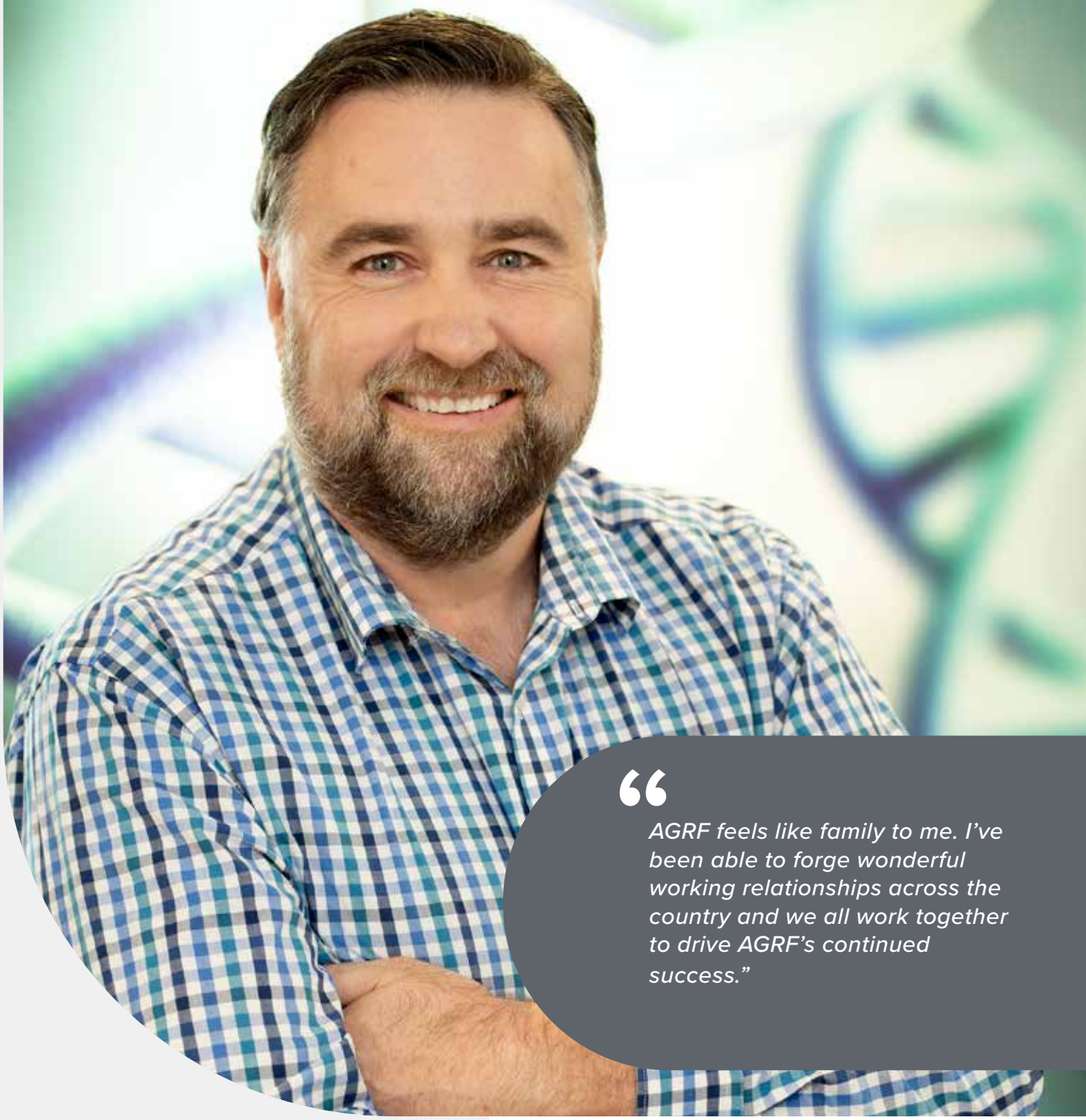
Wayne continues to keep the wheels turning and the gears oiled in his current role as National Procurement and Facilities Manager–from changing light bulbs and ensuring equipment is functioning properly to managing budgets and prioritising safety compliance. These tasks are vital for our organisation’s success. “The variety of the role keeps me on my toes,” says Wayne.

Wayne sees AGRF as his client, striving to provide his colleagues with what they need to perform their own important roles and deliver the high quality service our clients expect.

Wayne’s career longevity can be attributed to a combination of career development opportunities and never forgetting his science. He loves being part of an ever-evolving field of genomics and embraces the acquisition of cutting-edge technology. However, above all else, it’s the people he works with that make his time with AGRF worthwhile. “AGRF feels like family to me,” he says. “I’ve been able to forge wonderful working relationships across the country and we all work together to drive AGRF’s continued success.”

Throughout his long tenure, Wayne has seen many changes from both technical and goal-oriented perspectives and he embraces the future ahead. “The future is bold, and I am excited for our continued growth,” he says.

Congratulations on your 25-year anniversary, Wayne! We’re looking forward to another 25 years together.



“AGRF feels like family to me. I’ve been able to forge wonderful working relationships across the country and we all work together to drive AGRF’s continued success.”

Pictured: Wayne Ward

Melanie O’Keefe: An invaluable contribution

Melanie O’Keefe

Quality Manager

Joined AGRF in 1998

> “There is nothing static about science. It’s always on the move, offering new things to learn and to contribute.”

Meet Mel, one of our incredible AGRF team members who has been with us for an impressive 25 years! We are so proud to recognise her remarkable dedication and service to our company. Mel's insatiable curiosity and persistent questioning led her down the path of studying science. Even from a young age, her teachers noticed her relentless pursuit of knowledge and her knack for asking insightful questions.

Thinking back to what motivated her to pursue a career in science, Mel says, "There is nothing static about science. It's always on the move, offering new things to learn and to contribute." Mel joined AGRF in 1998, fresh out of university with an honours degree in genetics and psychology. Back then, AGRF was just starting out and the DNA lab only had a handful of people. It was here that Mel began her journey as a lab assistant and gradually took on greater responsibilities, eventually becoming the head of the sequencing lab.

Reflecting on her early days, Mel recalls, "We used to rely on slab-based sequencing and genotyping. It feels like a lifetime ago when we had to pour polyacrylamide gels into 0.4mm thick plates. Thankfully, those gel-making days are over!"

Throughout her time at AGRF, Mel has witnessed incredible changes. "We've grown from a tiny lab at WEHI to where we are now at the Victorian Comprehensive Cancer Centre, right in the heart of Melbourne's bustling biomedical precinct."

Mel still shudders when remembering the old days of manually spotting pins on a glass slide for microarrays. She even proudly shows off two antique brass microarray plates tucked away in one of her desk drawers.

After many years of being in the lab, Mel became eager for new opportunities. She decided to pursue a master's in biotechnology and business, allowing her to explore her interests in regulation, biopharmaceuticals and law. This shift enabled her to transition from microarrays to her current role as Quality Manager.

An early highlight of Mel's career transition was simplifying access to our sequencing services. She developed an online system and automated data delivery for clients, revolutionising the way we operate. As AGRF grew, Mel played an integral role in establishing our Sydney laboratory which has become an outstanding service today. She also spearheaded the NATA accreditation of the Melbourne laboratory which she successfully implemented across our Sydney, Adelaide and Brisbane sites.

"What really matters are the robust processes and systems behind the scenes. Whether it is our staff, our clients, or the technology partners we work with, you can trust that everything is traceable and well validated," says Mel.

As we enter an era of precision medicine and biomedical research, the significance of Mel's dedication to ensuring the quality and reliability of our data cannot be overstated. Our data plays a pivotal role in shaping critical decisions ranging from life-changing drug treatments and therapies to informing innovative agricultural breeding programs. With such far-reaching implications, Mel's dedication ensures that the information we provide is trustworthy and impactful.

Mel's involvement in the flagship work of whole exome sequencing and her collaboration with Melbourne Genomics Health Alliance have been invaluable contributions. Throughout her 25 years with us, Mel has seen a remarkable increase in the level of sequencing and significant technological advances across a spectrum of research areas. "Twenty years ago, we were using the 377s for the Tamar Wallaby Genome Project and loading them three times a day. Now we are doing a whole genome in two days," says Mel.

Thanks to rapid changes in technology, we've added the new Illumina NovaSeq X and the PacBio Revio systems to our sequencing systems line-up. It's this continual exposure to the latest and greatest genomic technology that constantly expands Mel's knowledge and expertise.

What Mel treasures most about AGRF is it's people and the amazing camaraderie and the connections that flow between all the labs across Australia. She feels like she is part of an incredible team where we're all working together and achieving something significant. With her infectious enthusiasm and passion for science, we can't wait to see what the next 25 years hold for Mel and AGRF.

ZERO: A hopeful future for children with cancer

Through the analysis of hundreds of childhood cancers each year, ZERO will add significantly to science's understanding of cancer in children, ultimately benefiting all children diagnosed with cancer in the future.

In Australia, more than 1,000 children and adolescents are diagnosed with cancer every year. While the overall survival rate for childhood cancer is now over 80%, for some types of cancer the rate is much lower. Every week, three young lives are lost to cancer – more than to any other disease.

In 2021, AGRF joined a unique collaboration aiming to improve these statistics, becoming a key partner in the Zero Childhood Cancer Program (ZERO), Australia's first national precision medicine program for children with cancer. Led by the Children's Cancer Institute and Kids Cancer Centre at Sydney Children's Hospital, and involving every childrens' hospital in Australia, ZERO is based on the recognition that every child's cancer is unique. To have the best chance of successfully treating each child, we need to know as much as possible about each child's cancer.

That is where AGRF comes in. ZERO harnesses AGRF's extensive multi-omics sequencing data – including whole genome sequencing, RNA sequencing and methylation analysis – to analyse the genetics of each child's cancer. This in-depth genomic analysis is a powerful tool, potentially leading to a whole new understanding of a child's cancer that can inform their diagnosis, prognosis and treatment.

One child who has directly benefited from this approach is Thomas. Born in Melbourne, Thomas was two-and-a-half years old when symptoms of persistent lethargy and vomiting led his parents to take him to hospital. After an initial diagnosis of gastritis, Thomas had an MRI done at Monash Children's Hospital, where his parents, John and Abby, found out that Thomas had multiple tumours growing in his brain and on his spinal cord.

After surgery to remove as much of the cancer as possible, Thomas developed complications, including fluid on the brain and loss of sight in his left eye. Frustratingly, as years passed by, a precise diagnosis proved elusive, meaning there was no clear path forward in terms of treatment. Then John and Abby found out about the Zero Childhood Cancer Program.

A sample from Thomas' tumour was sent for genomic analysis, which revealed a genetic mutation believed to be driving the growth of the cancer. The ZERO team was able to identify a targeted therapy for that genetic mutation – a drug known as Afatinib. After two months of treatment, Thomas' brain scan showed a noticeable improvement. He was no longer in debilitating pain and began to regain his energy and his health.

Today, Thomas is 11 years old. While the damage to his eyesight is permanent, he is otherwise healthy and happy, and his brain scan results remain stable. John and Abby say they consider themselves very fortunate and are extremely grateful to the entire ZERO team. "The work that these people are doing – it actually changes people's lives," says Abby.

Initially only for children with rare, relapsed and high-risk cancers – those with less than 30% chance of survival – ZERO is now being expanded, and by the end of this year will be open to all children with cancer in Australia. Through the analysis of hundreds of childhood cancers each year, ZERO will add significantly to science's understanding of cancer in children, ultimately benefiting all children diagnosed with cancer in the future.

> *"The work that these people are doing – it actually changes people's lives."*

This in-depth genomic analysis is a powerful tool, potentially leading to a whole new understanding of a child's cancer that can inform their diagnosis, prognosis and treatment.

Pictured: Thomas
Image credit: Children's Cancer Institute

Pictured: Dr Vanessa Tyrell from the ZERO Childhood Cancer Program
Image credit: Children's Cancer Institute

The future is fungi: Transforming agriculture and climate change

This holds huge potential for mitigating greenhouse gases on a global scale but also promotes a healthier food system and regeneration of soil.

> “Our aim is to utilise microorganisms, especially fungi, to capture carbon from the atmosphere and return it to the soil.”

This inspiring Australian success story originates in New South Wales, where Loam Bio began its mission to address climate change.

Through years of dedicated research and farm trials, its novel approach leverages microorganisms in grain production systems, delivering increased soil carbon benefits to growers and the environment.

At the forefront of Loam Bio's Science and Innovation department is Abed Chaudhury. Leading a team of microbiologists and soil researchers, Abed focuses on understanding the intricate interactions within microbial populations and deciding on the right cohort of species to reduce greenhouse gas contribution. Abed and his team delve into the microbial diversity of soil, a complex ecosystem comprising millions of microorganisms. Through advanced genomic techniques, they are uncovering new frontiers of scientifc understanding of these microbial communities and their interrelationships.

Abed explains the team's vision: "Our aim is to utilise microorganisms, especially fungi, to capture carbon from the atmosphere and return it to the soil."

Connecting with AGRF very early on, Abed has been engaging Next Generation Sequencing microbial profiling techniques and metagenomics to sequence fungi in Australia to understand the functions and behaviour of these organisms. "We use the short read data alongside powerful bioinformatics to give us a deep understanding of the subject matter and make sense of it all," he says. Abed values the "efficient and proactive" interaction with AGRF and explains that it has been the straightforward engagement and high quality genomic sequencing from AGRF that has made progress possible.

The microbial products being researched by Loam Bio centre on the soil sequestration of carbon in soil. Seed coating involves applying external materials to the natural seed coat to modify the physical properties for specific purposes.[1] A farmer treats their crop seeds with a microbial inoculum prior to sowing and, through a beneficial relationship between plant and fungus, the plant is able to draw in atmospheric carbon and store it in a very stable form under the soil. This holds huge potential for mitigating greenhouse gases on a global scale but also promotes a healthier food system and regeneration of soil. Mick Wettenhall, Co-founder of Loam Bio, emphasises the significance of reliably influencing this process to realise the full gains in the industry.[2]

In the animal-agriculture sector, Abed has discovered that fungi possess mechanisms facilitating reduced methane emissions from ruminant livestock by inhibiting methane-producing bacteria. This opens the door for transforming the sector by targeting and controlling this metric reliably.

Loam Bio is adding great value to our planet's needs and is dedicating its efforts towards developing technologies that reduce greenhouse gases, transforming an environmental challenge into an opportunity for farmers and the broader community. With an expanding presence in the US and Canada, Loam Bio is committed to fostering healthier food systems and regenerating soils on a global scale to create a better and more sustainable world.

The straightforward engagement and high-quality genomic sequencing from AGRF has made progress possible.

1. Penrini, S, 'Seed coating: Science or marketing spin?', *Trends in Plant Science*, (2017): 106–116.
2. Loam Bio Home, accessed 2 June 2023, https://www.loambio.com/

Lesley Gray: A journey of meaningful impact

Lesley Gray

Data Strategy Manager

Joined AGRF in 2017

Lesley Gray grew up in the Goulburn Valley of Victoria, where science and community intertwine to support local agriculture. After moving to Melbourne, her love for quantitative genomics saw her complete her PhD in dairy genomics at the Department of Primary Industries (now known as DEECA - Department of Energy, Environment and Climate Action). Keen to continue exploring new frontiers, she delved into medical and bacterial genomics at the University of Melbourne as a post-doctoral researcher.

In 2017, driven by a desire to expand her expertise, Lesley joined AGRF. Joining us as a Senior Bioinformatician, Lesley quickly became indispensable. As her passion for science and her dedication to her work continued to shine through, Lesley moved into the role of Data Strategy Manager.

Lesley plays a pivotal role in ensuring that data generated by AGRF is valuable, accessible and presented in a format that aids in delivering genomic insights. She has witnessed the evolution of bioinformatics from a specialised field available to only well-funded laboratories into a vital component of medical and life science research. She notes, “My role at AGRF is crucial in keeping pace with the industry and taking leadership in the ever-growing data influx.”

Lesley’s career has been defined by her connections with people and a deep commitment to addressing real-life challenges. She fondly recalls the collaborative project involving the Telethon Kids Institute and Menzies School of Health Research in Western Australia. “We worked closely with Indigenous leaders and advocacy groups to understand how colonisation had impacted their health, perceptions of genomics and how that affects their community each day,” says Lesley.

Lesley’s current collaborations span various fields, engaging with people ranging from hospital staff and bioinformatics experts to clinicians. The collective aim is to provide meaningful data for routine diagnostics, and ultimately improve people’s lives.

Lesley’s passion for genetics was ignited during a classroom lesson and since then, her love for the field has only grown stronger. Being at the forefront of the industry and working with cutting-edge technologies fills her with excitement and purpose. She takes pride in being part of a community of like-minded individuals who share her commitment to improving lives through genomics research.

“I love the diverse exposure to different genomics applications and being connected with the genomics community,” says Lesley. “Every day, I am proud of what we do.”

> *“My role at AGRF is crucial in keeping pace with the industry and being prepared for the ever-growing data influx.”*

“I love the diverse exposure to different genomics applications and being connected with the genomics community. I am proud of what we do.”

A parasitic puzzle: Exploring the genomic secrets of Australian ticks

Researchers have been working with AGRF, employing cutting-edge techniques to understand native ticks and open the door to public health initiatives for Australian conditions.

> “A major component of our research is to understand the causes of tick-borne illness in Australia and the implications for human and animal health.”

Image credit: Murdoch University

In the field of genomics, researchers like Dr Amanda Duarte Barbosa are driven by an insatiable curiosity to unravel the mysteries held within the DNA of various organisms. A Senior Lecturer and Researcher at the Vector and Waterborne Pathogens Research Group, Murdoch University, WA, Amanda specialises in the molecular epidemiology of vector-borne pathogens that affect the animal-human-ecosystem interface, and it's the enigmatic tick that has captured her attention.

With a keen interest in disease transmission dynamics and its impact on the health of people and animals, Amanda embarked on a journey to explore the genetic diversity of microbes in Australian ticks and their native mammalian hosts.

For many years, Amanda and her team have focused on identifying and characterising the microbiome of these ticks as a primary objective. "It's been a huge knowledge gap and in the past 10 years, our team has discovered a plethora of novel microorganisms in Australian ticks," says Amanda. As the research progressed, it opened a new avenue of inquiry leading her to investigate whether these bacteria could be associated with tick-borne illness.

To gain deeper insights into the impact of microbes in ticks, the researchers have been working with AGRF and employing the latest techniques for microbial profiling, including Next Generation Sequencing and Long-read genomic analysis. "We're interested to learn if the microbes are associated with chronic illness that many people have developed after getting bitten by a tick," she says. "A major component of our research is to understand the causes of tick-borne illness in Australia and the implications for human and animal health. Working with AGRF has enabled us to achieve excellent and reliable results based on high quality sequencing data to support our research."

With a structured approach, the team has recruited a national cohort of blood samples, skin biopsies and ticks removed from patients. With careful dedication, Amanda and her team have begun to unravel the genomic secrets held within ticks to investigate associations between microorganisms transmitted to patients during a tick bite and the development of acute and chronic disease symptoms such as skin rashes, fever, headaches, fatigue and neurological symptoms.[1]

Exploring the connection between tick pathogens, humans and the environment carries significant implications for human and animal health. By creating new avenues of knowledge Amanda's investigations will contribute towards a deeper understanding of our native population of ticks and open the door for public health initiatives for Australian conditions.

> *"AGRF has enabled us to achieve excellent and reliable results based on high quality sequencing data to support our research."*

1. Barbosa, A D, et al, 'The troublesome tick research protocol: Developing a comprehensive, multidiscipline research plan for investigating human-tick associated disease in Australia', *Pathogens*, 11, 2022.

Dr Cath Moore: Striving to make a positive change

Cath Moore

Chief Scientific Officer

Joined AGRF in 2020

Cath Moore has always had a natural curiosity that led her to pursue the sciences, in part due to her parents' scientific backgrounds. She spent her PhD developing molecular markers to assess whether palm trees would yield oil without the need to burn down rainforests. "I absolutely loved doing my PhD," Cath says. "Imagine being able to save thousands of hectares of rainforest by planting only a quarter of the number of trees that would be required to return the same amount of oil".

Cath gained valuable understanding into how science could be applied through her work with the oil palm breeders and her work in Sumatra. "This gave me incredible insight into the practical applicatons of science, and I loved that," she says. After her PhD, Cath moved to Australia from the UK to do post doctoral research in academia, but ultimately found that her passion lay in applying her scientific training to help researchers progress their work.

Following her post-doc, Cath worked at QIAGEN for 17 years in various roles, culminating as the ANZ genomics market development manager. She had the opportunity to meet a diverse range of people using molecular genetics and genomics in their research, which she found truly fascinating. Cath discovered that she could apply her scientific background to help researchers find impactful solutions to improve people's lives. "That was important to me because along the way I have always been motivated to use science to have a positive impact on society and people's wellbeing." says Cath.

Cath sought opportunities to apply her scientific and technological expertise, provide solutions to advance research and healthcare, remain solutions focused regardless of technology, and join an organisation that shared her values. This led to her current role as Chief Scientific Officer at AGRF.

In her current position, Cath leads the Science & Technology group, which assesses emerging technologies and applications, evaluates them, and develops standard operating procedures to transfer them to the Operations Team as new services. The team collaborates widely with the research community, health and industry, to understand the emerging needs of people using genomics and to ensure that AGRF is ready to meet new challenges and continue to offer cutting-edge technologies.

"We work at many levels with technology suppliers to understand what they have coming next and what it can do, including gaining early access to new technologies and tools," says Cath. "We do all this to ensure that AGRF is prepared to take on new challenges, fostering growth and progress, both now and into the future."

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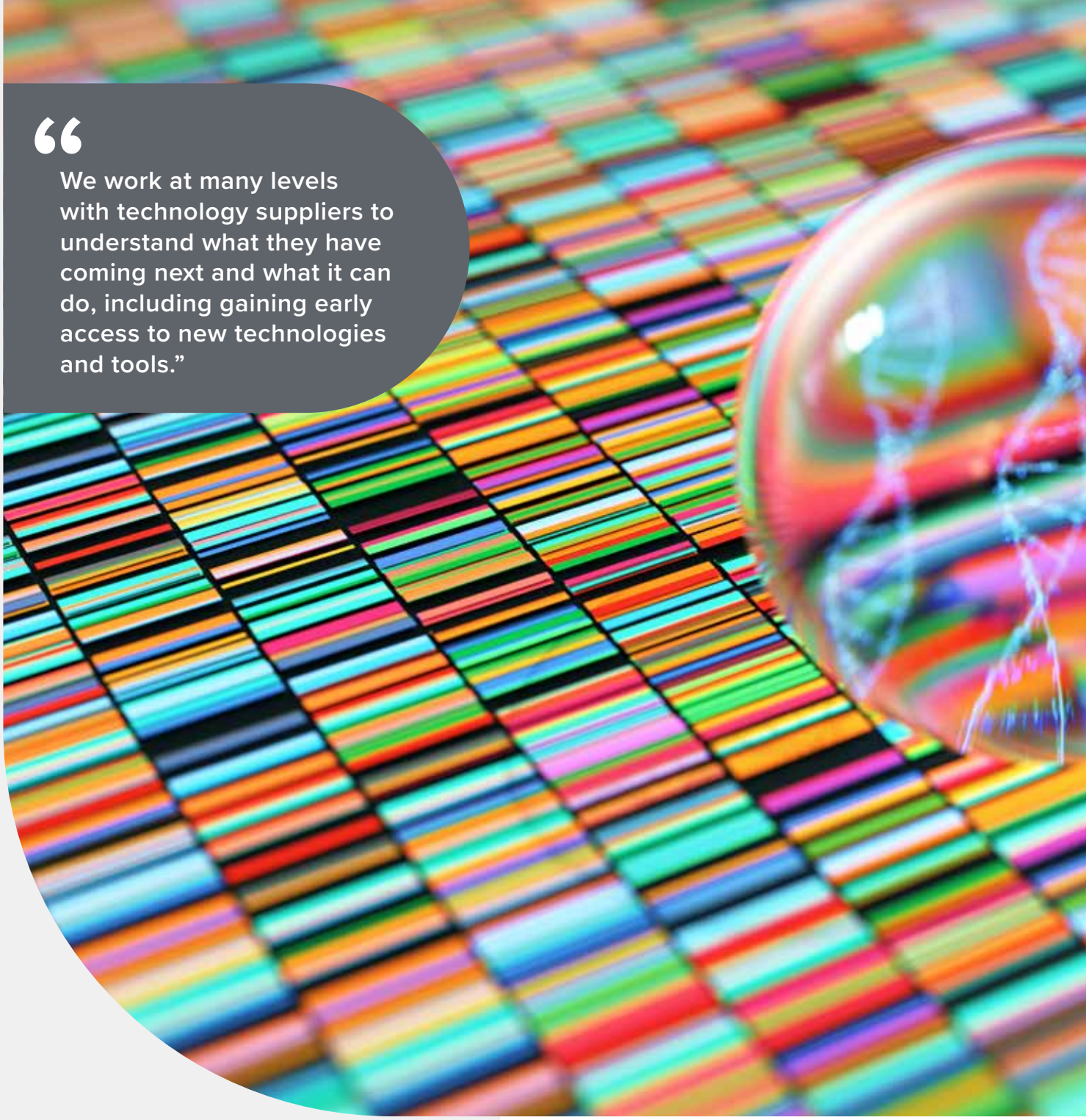

> We work at many levels with technology suppliers to understand what they have coming next and what it can do, including gaining early access to new technologies and tools.”

Pictured: Dr Cath Moore

Cracking the code: Uncovering the impact of early life environment on human health

> Epigenetics is the layer of information that surrounds DNA. It influences which genes in an individual's genome can be switched on or off."

> They take the time to understand my research needs and make available technical and other staff to assist me."

Epigenetics is an exciting and rapidly expanding field in biology that has garnered interest in its applications to human health. It offers a promising approach to our understanding of how environmental factors can impact gene expression and contribute to the risk of chronic conditions.[1]

Jeff Craig, Professor of Epigenetics and Cell Biology at Deakin University – Waurn Ponds, Victoria, and his team are applying genomic techniques to investigate epigenetic and cell biology to develop practical applications in health and disease. "Our research goal is to help mitigate the effects of early life environment on the risk of chronic neurological conditions such as cerebral palsy," explains Jeff.

To achieve this goal, they have developed a sample cohort from twins, known as the Peri/postnatal Epigenetic Twin Study (PETS), funded by the NHMRC. This study, initiated at the Murdoch Children's Research Institute with Professor Richard Saffery, focuses on cardiometabolic function, cognition and brain structure and function of identical and fraternal twins, within a set of time periods ranging from pre-birth to 11 years old. These time periods provide a unique longitudinal snapshot to help answer whether early life environments have a persistent association with the epigenetic state.

The team has been working with AGRF to perform genome-wide methylation screening using the Infinium MethylationEPIC array on more than 1,000 samples. Jeff highlights that advances in genetic techniques have significantly enhanced the accuracy of genome annotation, resulting in more meaningful datasets. "We've specifically used the Infinium arrays due to their ease of use, affordability and the availability of extensive comparative data," says Jeff.

Working with AGRF has proven invaluable to Jeff in fulfilling his research requirements. He commends the excellent communication and prompt responsiveness, noting, "They take the time to understand my research needs and make available technical and other staff to assist me."

Through twin studies, Jeff's team is using epigenetics to understand the contribution of genetics and environment to an individual's genes. "Epigenetics is the layer of information that surrounds DNA," explains Jeff. "It influences which genes in an individual's genome can be switched on or off." Factors such as trauma, aging, stress, and illness have been shown to have epigenetic effects. Taking cerebral palsy as the example, one of the team's hypotheses was that genes related to hypoxia, inflammation and thrombosis are associated with the condition. By comparing the DNA methylation profiles of twins with and without cerebral palsy, the researchers aimed to identify the differences in the genome and understand the underlying mechanisms.

One of the main findings of the investigations indicated an association of inflammatory pathways. "Once we understand the mechanisms and interactions of these pathways, there is potential to develop avenues for diagnosis, treatment and therapy," says Jeff. The clinical goal is to develop susceptibility models/scores for various conditions to be able to intervene for better long-term patient outcomes where early intervention may prevent or reduce the effects of disease or provide better early management strategies.

In the future, the team hopes to follow up with the twin birth cohort as they age and measure the same patients at additional time periods as they progress through to adulthood. "We want to see how their epigenomes change over time," says Jeff. To ensure the research is relevant, the team also plans to undertake community consultation on the important aspects to consider for children going into their teenage years and then adulthood – so the research ultimately helps those who need it the most.

"Once we understand the mechanisms and interactions of these pathways, there is potential to develop avenues for diagnosis, treatment and therapy."

1. Lynch, F, et al, 'Public knowledge and epigenetics and concepts', *Journal of Developmental Origins of Health and Disease*, 2021.

Reflecting on 25 years of genomic technologies

We amped up our sequencing capabilities by adding the latest in Next Generation Sequencing platforms to our line-up.

You might be forgiven for thinking “The X” simply refers to the title of a sci-fi movie but here at AGRF, “The X” is our affectionate name for the NovaSeq X Plus sequencing platform. Earlier this year, we amped up our sequencing capabilities by adding the latest in Next Generation Sequencing platforms to our line-up. Just a month later, we proudly unveiled the newest addition to our long-read sequencing family – the PacBio Revio. We are proud early adopters of genomic sequencing technology and provide our clients access to the latest equipment to advance their research and realise their goals.

But let’s take a moment to appreciate how far the AGRF team have come. Over the past 25 years, our dedicated staff have witnessed a whirlwind of changes. Back in 1997, our Melbourne and Brisbane laboratories were established as part of the Commonwealth Government’s Major National Research Facility (MNRF) Program. Initially, we began with Sanger and Genotyping services, focusing on projects involving heart and inflammatory bowel diseases as well as diabetes.[1] Even during our early days, we proudly positioned ourselves as leaders in genomic technology, running Sanger sequencing with the Applied Biosystems (ABI) 373 – the very first automated sequencer in Australia. Sanger Sequencing was the dominant research tool at the time and played a pivotal role, such as the completion of high-quality reference sequencing of the human genome a part of the Human Genome Project.[2]

In 2000, both our Melbourne and Brisbane laboratories acquired large CRS robotic systems designed to automate their processes from start to finish. Picture a robotic arm, elegantly feeding a liquid handler, plate sealer and washers – it was a sight to behold and garnered cheers from our team who had otherwise spent their time manually handling this process. This advancement in technology allowed us to prepare and load PCR plates overnight, giving us the capacity of 48x 384 plates per day. It was at this time that whole genome sequencing was available, enabling the exploration of bacteria, animal, and human genomes. The early 2000s saw a significant shift in sequencing practices at AGRF. We upgraded from the ABI 373 to the 377, then to the 3730 and finally the 3730.[3]

As the research community began looking for more economical and faster approaches to sequencing, two key studies based around pyrosequencing and ePCR set the scene for the era of Next Generation Sequencing. These two revolutionary technologies completely changed the game with high throughput sequencing of whole transcriptomes, better known as RNA-seq. This breakthrough was essential for understanding the development and disease.[4] This ability to unlock a new layer of insights through Next Generation Sequencing has had an immense and far-reaching impact.

Around this time, we welcomed a series of Illumina Next Generation Sequencing systems to our range. Beginning with the HiSeq in 2010, we then upgraded to the HiSeq 2500, followed by the MiSeq and NextSeq. And let’s not forget the NovaSeq 6000, which joined the line-up in 2017. These systems brought scalability and high throughput capability, allowing us to sequence samples faster than before and improve costs for our clients.[5]

The emergence of single molecule sequencing technology (SMRT-seq) by PacBio and nanopore sequencing by Oxford Nanopore Technologies (ONT) brought a wave of excitement.[6] These ground-breaking developments allowed the sequencing of long continual stretches of DNA or RNA, enabling us to decode raw signals and assemble genomes de novo. We welcomed the first PacBio Sequel and began long-read sequencing with the first genome assembly completed in 2016.

Single cell genomic approaches were essential to gain insights into developmental processes, functions and the initiation and progression of disease.[7] Recognising this, we introduced the 10x Chromium system in 2016, allowing researchers to explore new layers of knowledge.

Fast forward to 2023 and the technology we have today is best in class and offers some of the most impactful tools used in biomedical research, agriculture, and environmental industries. With a continuing expansion in the range of genomic applications, we’re thrilled to be at the forefront of this incredible journey. Most of all, we are excited to partner with some of the most remarkable researchers and scientists in the country and beyond, pushing the boundaries of what is possible and contributing to their next ground-breaking discovery.

We are proud early adopters of genomic sequencing technology, and provide our clients access to the latest equipment to advance their research.

Pictured: Dr Christopher Noune

The technology we have today is best in class and offers some of the most influential tools used in biomedical research, agriculture, and environmental industries.

1. Pitcher, D, 2018, 'Celebrating Wayne's 20 years at AGRF', AGRF flyer.
2. Koch, et al, 2021, Foreword, *Nature Milestones. Genomic Sequencing*, www.nature.com/collections/genomic-sequencing-milestones.
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4. Brandt, M, 2021, 'Transcriptomes – A new layer of complexity', *Nature Milestones. Genomic Sequencing,* www.nature.com/collections/genomic-sequencing-milestones.
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Funding partners

BIOPLATFORMS AUSTRALIA

NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

We provide researchers with state-of-the-art genomic platforms and novel techniques to support high impact scientific publications and preliminary data for research grant applications.

Bioplatforms Australia (BPA) is a non-profit organisation that is supported by the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS). BPA provides access to state-of-the-art 'omics technologies through nationally distributed organisations such as AGRF. Through BPA, we are able to leverage NCRIS funding to facilitate innovative and translational research for a wide range of academic and commercial users, across many science disciplines.

We work closely with BPA as a funding partner on their Framework Initiative projects, which are large national projects of research, that span many different institutes, universities, government organisations, museums, and conservation and wildlife groups. These projects are of great cultural, economic and national security importance as they provide a genomics resource for many native species, some of which are on threatened species lists, and to monitor the environment for biosecurity purposes.

AGRF is an integral partner to BPA's Framework Initiatives by providing a wide range of innovative genomics platforms to ensure these projects are successfully completed. In addition, our National Next Generation Sequencing Manager, Dr Chris Noune, our Bioinformatics Manager, Dr Kenneth Chan, and Brisbane site and Platform Manager, Dr David Hawkes, serve on BPA's Framework Initiative Steering Committees, which further strengthens our partnership.

AGRF has collaborated with BPA on four major Framework Initiatives over recent years:

- Genomics for Australian Plants
- Oz Mammals Genomics
- Threatened Species Initiative
- Australian Microbiomes

Other notable BPA projects AGRF has worked on include:

- Stem Cells
- Australian Research Data Commons Cross-NCRIS OzBarley
- Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Future Science Platforms

We have recently embarked on major initiatives including:

- Australian Functional Fungi
- Plant Pathogen Omics
- Reptiles and Amphibians.

As a leader in the Australian genomic community, AGRF collaborates with a wide variety of organisations across Australia. This includes partnerships with our host institutes and the wider research community. These partnerships and connections allow us to uphold our mission and to be a key enabler of genomic research in Australia.

As such, we are constantly engaging with our partners on innovative projects that explore and evaluate new-to-market technologies. For these projects, we use novel techniques and platforms, distinct from our regular services, and evaluate the feasibility of offering these services to the wider research community. This ensures Australian researchers have access to the best genomics technologies to keep them at the forefront of scientific research.

Our expert Innovation and Development team work on exploratory DNA and RNA extraction methods, novel short and long-read sequencing applications, and various innovative and commercially viable genotyping solutions. These projects encompass a wide range of biological fields, including environmental research, agriculture and aquaculture research, human health and plant research.

Some notable examples of our Innovation and Development projects include:

- MAS-seq sequencing on the PacBio Revio
- HIVE single-cell sequencing
- Direct DNA methylation analysis on the Nanopore platform
- 10X Chromium single cell gene expression flex (fixed RNA)
- Dovetail Omni-C sequencing for 3D genomic interactions

Our Innovation and Development team includes experts who provide researchers with state-of-the-art genomic platforms and novel techniques to support high-impact scientific publications and preliminary data for research grant applications.

We are proud to work together with some of the most brilliant scientists, dedicating their careers to answering fundamental biological questions and of our role in enabling them to remain world leaders in their fields of research.

Acknowledgment of Country
AGRF acknowledges the Aboriginal and Torres Strait Islander people as the Traditional Owners of the land on which we work and live, and we pay our respects to Elders past and present.

We respect and recognise their continuing connection to Country and land, water and community.

AGRF is a not-for-profit organisation, committed to quality and innovation.
We actively seek to partner and share our knowledge and expertise in genomics. Through our national network, AGRF provides access to innovative and leading technologies, enabling genomics in the biomedical, agricultural and environmental sectors. From single gene analysis to whole genome sequencing, AGRF provides a full range of genomic capabilities and services with complementary bioinformatics across the entire biological spectrum, to academia, healthcare and commercial industries.

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