

Submission
2016 National Research Infrastructure Roadmap Capability Issues Paper

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In developing this response to the NCRIS Roadmap and the Issues Paper we are aware that many individual institutions, researchers and governments are providing submission based on their particular research sectors and disciplines. It is anticipated most of these will be supportive of the general principles and continuing need for an adequately resourced national infrastructure strategy addressing agreed national priorities and focus. This submission has a wider perspective, highlighting a proposal being developed by an informal working group in consultation with a broad cross section of the research, policy and industry community interested in genomics – currently being developed under the working title of Genome Australia.

The submission addresses the issues raised under Theme 3 “National Research Infrastructure Policy Issues”.

Genomics is the science that aims to translate and understand the entire genetic information of an organism through sequencing and analysis of an organism’s genome. Advanced DNA sequencing, analytical technologies and programs interrogate genomic, epigenomic and gene expression profiles to address research questions and industry objectives.

Exploitation of genomic opportunities for the benefit of the Australian economy and the country’s global scientific standing requires national coordination, speed and a common purpose. It needs a dedicated national initiative to realise the enormous potential of genomics and its translational spinoffs that will generate intellectual property, healthcare, economic advances and environmental and social developments to deliver health and prosperity for Australians. The genomics revolution enables advances across all of the life and biological sciences and impacts on seemingly unrelated disciplines and industries such as IT, engineering, petrochemicals and mining and therefore is far broader than the remit of NHMRC, ARC, and rural research agencies. A broad national approach is essential to address the need for genomics and will provide the strategic framework, core infrastructure, leveraged R & D programs and other necessary resources.

To further develop this capability for Australia, the scale and coordination of genomics science will need to be increased significantly, and will require the establishment of a coordinated, national program investment in genomics science achieve these outcomes identified within the timeframe required to sustain Australia’s competitive advantage. Since genomics has a common framework across all sectors, we suggest that a dedicated entity, Genome Australia, be established to provide the capability to prosecute a national strategic agenda in genomics, as a major enabler of a modern, robust and diversified 21st century economy. Key outcomes will include major leverage from national and international research investment, acting as a magnet attracting a talented workforce, and building private sector investment from the health, biopharmaceutical, agri-food, environmental management and related industries

A Working Group is consulting on a proposal for Genome Australia, using Genome Canada as a model. In emulating the Canadian model (which has included dedicated programs in medicine,

agriculture, biodiversity etc.), Genome Australia would seek to coordinate genome science and technology in Australia and would work collaboratively with genomics capability in the region and globally. An important aspect of the Australian genomics initiative is the highly refined capacity to link genomic science with biological processes, medical advances and the agricultural and food industries.

It is proposed Genome Australia would have four areas (Attachment 1) of focus and would prioritise projects involving significant collaboration:

1. National Genome Centres;
2. Capacity Building and Education in bioinformatics, biostatistics and computational biology;
3. Ground-breaking Projects in priority agricultural genomic research areas;
4. Consideration of the economic, ethical, environmental, legal and societal (GE3LS) issues related to the development and delivery of genomics technologies.

This concept has the support of a wide cross-section of the genomic related leaders from universities, institutes, research centres, schools, facilities, CSIRO and industry; reflected in the support received from 124 signatories for the Genome Australia concept (attachment 2) as part of the submission sent to the 2015 Commonwealth House of Representatives Standing Committee on Agriculture and Industry Inquiry into Agricultural Education.

The suggested structure for Genome Australia is the federal government providing up to 50% of the funding for infrastructure platforms and strategic research and development programs, including international partnerships, with the other 50% being supplied by co-investing institutional partners, industry, state government grants and philanthropy. Genome Australia would coordinate genome science and technology in Australia and would work collaboratively with the genomic capability in the region and globally. An important aspect of the Australian genomics initiative is the highly refined capacity to link genomic science with biological processes, human medicine and the agricultural and food industries.

The current reality is that Australian research investment is sectorially fragmented but open to increased coordination and optimisation. Accessible infrastructure for genomics and bioinformatics is supported through NCRIS, EIF Super Science, CRIS and NCRIS 2 and is administered through Bioplatforms Australia. The entities currently supported include the Australian Genome Research Facility, the Ramaciotti Centre at UNSW, the Biomolecular Resource Facility at ANU and the Kinghorn Centre for Clinical Genomics at the Garvan Institute for Medical Research.

This existing funding represents a baseline investment in genomics for the future and has already built a national infrastructure network, enabled the delivery of data for large scale research projects including those in the biology of melanoma and wheat and initiated the process of delivering bioinformatics capacity through new training programs. The potential of this capability has been proven and with time, this will realise significant value in sectors of importance to Australia.

Complementary areas proposed for further enhancement include:

- The ability to develop and implement novel and innovative genomic approaches to biological questions through investment in people and tools to undertake and apply this knowledge.
- A significant increase in bioinformaticians and related experts that will enable improved experimental design and analysis to deliver solutions for a wide range of national applications.
- Major funding for genomics projects that is not readily available in the present funding system. Biplatforms Australia fund a selection of genomics data resources and NHMRC and ARC have their standard grant programs where genomics may form part of the application but this does not sufficiently address the growing opportunity for genomics use.
- Further investment in capital and operational support to deliver translation and services required for the emergent commercial sectors (eg community application of clinical genomics).

Genome Australia would be an appropriate structure to enable strong linkages to Federal departments and state governments – key departments being Department of the Environment, Department of Agriculture, Department of Employment, Department of Health, Department of Human Services (DHS), Department of Immigration and Border Protection and Department of Industry Innovation and Science. Input from the Attorney-General's Department (AG), Treasury, Department of the Prime Minister and Cabinet (PMC), Department of Education and Training, Department of Finance, Department of Foreign Affairs and Trade (DFAT) may also be of value. Strong links to major government funding agencies such as ARC and NHMRC to develop synergistic approaches to funding genome science would be important.

Other important considerations would be the creation of a board of management with strong governance, audit and risk skills and with appropriate scientific, industry and consumer representation and a major focus on international engagement. Key committees would include a Programs committee that designs, reviews and recommends programs for funding and a Science and Industry Advisory Committee responsible for evaluating emerging scientific research challenges and to define areas for future investment as well as opportunities for international collaboration.

It is important to highlight the Genome Australia concept is not seen/proposed to be an alternative to current arrangements and entities. It is intended to build on and be a natural progression driving additional integration of the current capabilities and networks to further realise the enormous potential of genomics and its translational spin offs that will eventuate. NCRIS alignment with this opportunity would greatly assist Australia's future genomic strengths, industry and community benefit as well as international competitiveness. The listing at attachment 2 highlights the extent of support for collaborative consideration across the sector.

It is suggested Genome Australia would have four areas of focus and would prioritise projects involving significant collaboration:

1. **National genome centres** ('platforms' in Genome Canada parlance) – to provide advanced equipment and bioinformatic capability, with specialist foci, that would not only provide cost-effective state-of-the-art services in genomic analysis to Australian researchers and industry but would also explore the latest technologies and ensure these innovative capabilities become rapidly available to Australian researchers. These centres would be highly networked to ensure resources, experience and expertise are shared, both with local groups at varying scale and linked into similar networks internationally. With an integrated national focus, expensive duplication would be avoided.
2. **Capacity building and education in bioinformatics, biostatistics and computational biology** – allowing appropriate experimental design, the development of new tools and promoting availability of existing tools for analysis of genome data sets, allowing Australian researchers and industry to mine their own data sets and exploit data generated elsewhere. Universities would be supported to develop training in computational methods to enlarge the pool of analytical capacity supported by *Genome Australia* and available to the research community, and simultaneously be fundamental to training a new generation graduates skilled in this area and boosting capacity and innovation for the business community more generally.
3. **Projects that use genomic approaches in:**
 - *Health & Medicine* – to improve disease prevention, diagnosis and treatment with a view towards the improvement, efficiency and sustainability of the health care system by targeting expensive therapies to gain maximum benefit and contributing Australian IP to the development of new therapies and personalised medicine.
 - *Agri-food, Fisheries & Aquaculture and Forestry* – to improve competitiveness by enhancing food production, profitability and quality, increase crop and livestock hardiness, enhance farm practices through genome/ epigenome-directed agronomy and minimise food waste during harvest, storage and transport. Genomic advances will also improve the balance between profitability and the impacts on the wider environment, help manage pests and diseases, drive the development of functional foods and promote the sustainable sourcing from our very diverse land, forest and marine ecosystems.
 - *Biosecurity – pests, weeds and diseases* – to protect our unique and valuable natural and agricultural environments from exotic pests and accurately identify pests in our own export products to minimise damage to trade. Additionally, to ensure preparedness and responsiveness to disease incursions (e.g. by quickly identifying pest genetic sources) and to support the advantages of Australia as a source of “clean, safe, ethical and sustainable” food and biodiversity resource products.
 - *Environment and biodiversity*— to complete the genetic catalogue and tree of life of Australasian biota, one of the most unique on earth; to document the distribution of genetic resources in key pre-domesticated and wild relatives to support the next wave of bio-prospecting and sustainable natural resource product development; to identify adaptive variation to support climate change adaptation strategies and to enable rapid identification and monitoring of biodiversity for enhanced environmental impact assessment, environmental remediation and waste management.

- *Other Industries* — to explore the use of genomics in industries not traditionally linked with life sciences, such as mining and to exploit the link between genomics and synthetic biology which will add tools to industry, the likes of which we have not yet experienced.
4. **Consideration of the genomics-related economic, ethical, environmental, legal and societal (GE3LS) issues** — when technology is introduced in a manner in which the implications and benefits are explained and discussed, the Australian community are early and enthusiastic adopters. *Genome Australia* will play a leadership role in working with the community and with industry to explore the ethical, legal and social challenges and opportunities of genomics research and the application of genomic-based technologies.

GENOME AUSTRALIA SIGNATORIES AS AT NOVEMBER 5th, 2015

(extract)

The level of improvement in genomics capability is now reaching the point where it can credibly lead to transformational scientific advancement and to the development of new commercial sectors such as personalised medicine and enhanced targeted crop breeding. In order to capitalise on these advances, the time is right to establish a dedicated national initiative, Genome Australia, seeking to realise the enormous potential of genomics and its translational spinoffs that will eventuate. The individuals and organisations listed below support the Genome Australia concept.

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