

**eResearch: Faster, Better, and Brighter
Research at Institutional, National and Global
Scales - An Australian Perspective**

**Prof Paul Bonnington
Pro-Vice-Chancellor (Research Infrastructure)
(Prev: Director of eResearch, Monash
University)**



**THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA**

Acknowledgement of Country

The University of Queensland (UQ) acknowledges the Traditional Owners and their custodianship of the lands on which we meet.

We pay our respects to their Ancestors and their descendants, who continue cultural and spiritual connections to Country.

We recognise their valuable contributions to Australian and global society.



My Background

Combinatorics, Computational Mathematics and AI

- *most recently: AI applications to Medical Imaging, and scientific instrumentation*

University of Auckland (15 Years)

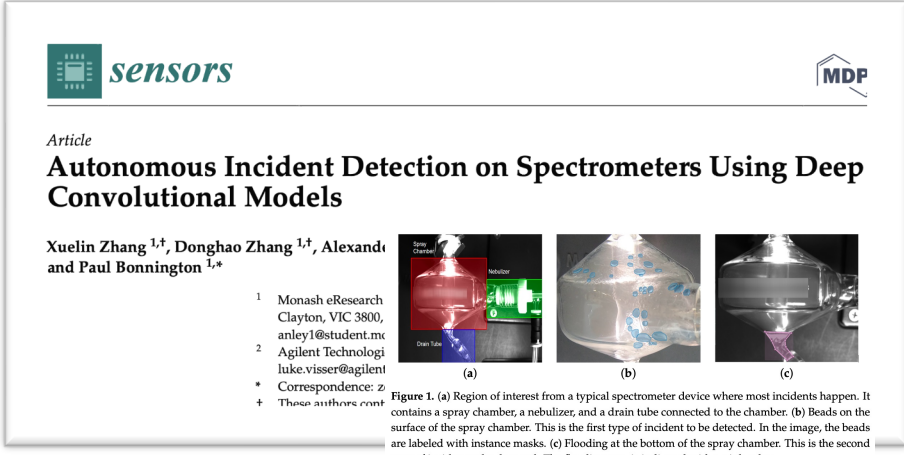
- *Led the establishment of NZ's first eResearch Programme (BeSTGRID -> NESI)*


Monash University (15 Years)

- *Director of eResearch (2008: Established as partnership between ITS, Library, DVC-R)*
- *Involved in National Collaborative Research Infrastructure Strategy (NCRIS) since 2008*
 - *Chaired the establishment of the **Australian National Data Service** which became part of **ARDC***
 - *Board of **ACCESS-NRI***
 - *Led Digital Research aspects of **Auscope**, **Microscopy Australia**, **National Imaging Facility**, **Synchrotron/ANSTO***

University of Queensland (Globally Top 50 University)

- *Pro-Vice-Chancellor (Research Infrastructure)*
- *Board of **Microscopy Australia**, **National Imaging Facility**, **Terrestrial Ecosystem Research Network**, and **Advisory Committee for Phenomics Australia***
- *Board of **Queensland Cyber Infrastructure Foundation***



sensors 

Article
Autonomous Incident Detection on Spectrometers Using Deep Convolutional Models

Xuelin Zhang^{1,†}, Donghao Zhang^{1,†}, Alexander and Paul Bonnington^{1,*}

¹ Monash eResearch Clayton, VIC 3800, anley1@student.mq.edu.au
² Agilent Technology luke.visser@agilent.com
* Correspondence: zbonnington@monash.edu
† These authors contributed equally to this work.

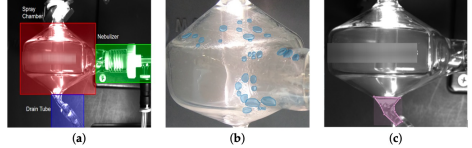
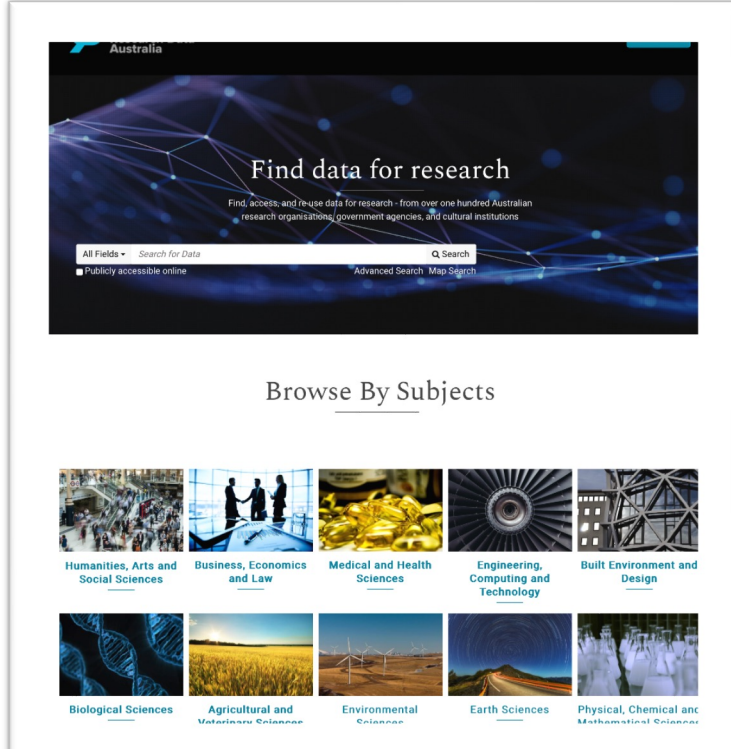


Figure 1. (a) Region of interest from a typical spectrometer device where most incidents happen. It contains a spray chamber, a nebulizer, and a drain tube connected to the chamber. (b) Beads on the surface of the spray chamber. This is the first type of incident to be detected. In the image, the beads are labeled with instance masks. (c) Flooding at the bottom of the spray chamber. This is the second type of incident to be detected. The flooding area is indicated with a pink color.













Australia

Find data for research

Find, access, and re-use data for research - from over one hundred Australian research organisations, government agencies, and cultural institutions

All Fields Search for Data Q Search
Publicly accessible online Advanced Search Map Search

Browse By Subjects

 Humanities, Arts and Social Sciences	 Business, Economics and Law	 Medical and Health Sciences	 Engineering, Computing and Technology	 Built Environment and Design
 Biological Sciences	 Agricultural and Veterinary Sciences	 Environmental Sciences	 Earth Sciences	 Physical, Chemical and Mathematical Sciences

A data-driven research example....



CREATE CHANGE



THE UNIVERSITY OF
SYDNEY



MONASH
University



Mission Statement

Mission

Transform melanoma early detection using total body surveillance to enhance individual lesion management

Research aims

Diagnostic Intelligence
Improve early detection and risk stratification using total body images integrated with history, clinical phenotype and genotype.

Health Service Evaluation
Total body imaging will reduce unnecessary biopsies by better 'hit' rate, improving cost for patients and the healthcare system.

Informatics
Integrate total body imaging into a telehealth network and EMR through implementation of image standards.

Critical infrastructure



ACRF funded telemedicine network of 15 total body imaging research nodes

Outcomes

- World's largest, most comprehensive skin imaging database.
- Reliable solutions for melanoma early detection.
- Facilitate development of artificial intelligence for risk stratification, prognostic and diagnostic support.

- Research-validated ACRF infrastructure underpinning a national targeted screening program
- Establishment of a national teledermatology network for remote care provision



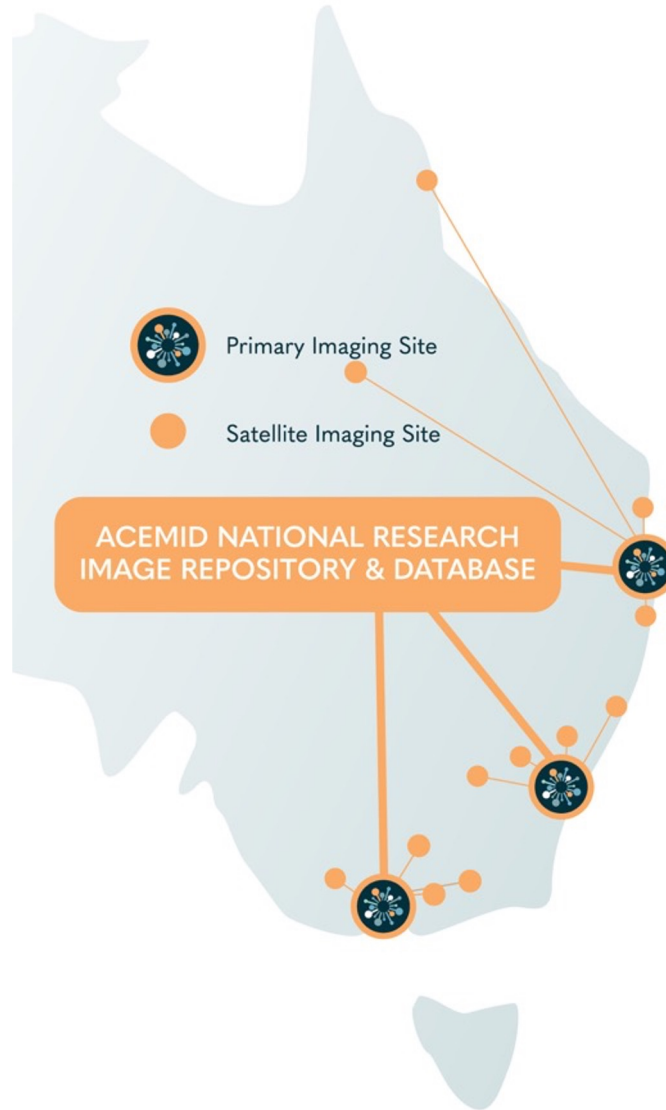
Building the Research Repository

QUEENSLAND



Sunshine Coast
Hospital and Health Service
Exceptional people. Exceptional healthcare.

VICTORIA



NEW SOUTH WALES



ADDITIONAL PARTNERS



ACEMID AUSTRALIAN CENTRE OF EXCELLENCE IN
Melanoma Imaging & Diagnosis

AUSTRALIAN
CANCER
RESEARCH
FOUNDATION

Monash eResearch Centre

Monash eResearch Programme* is the University-wide transformational programme to digitise research. The Centre uplifts the sophistication and success of Monash researchers by helping them digitise their research to make it Faster, Better, and Different.

Faster

Instrument data processing, **high performance computing**, digital research pipelines.

Better

Findable, Accessible, Interoperable, **Reusable (FAIR) research data**, data management, “Lego blocks” of reusable advanced digital techniques and technologies, automation for more secure and reproducible research.

Different

The application and translation of new research techniques and disruptive technologies such as sensors, AI, drones, data linkage, global-connected data sources and tools.

IN PRACTICE

Monash eResearch Centre

Runs Infrastructure: High Performance Computing, Data Storage, Cloud Computing

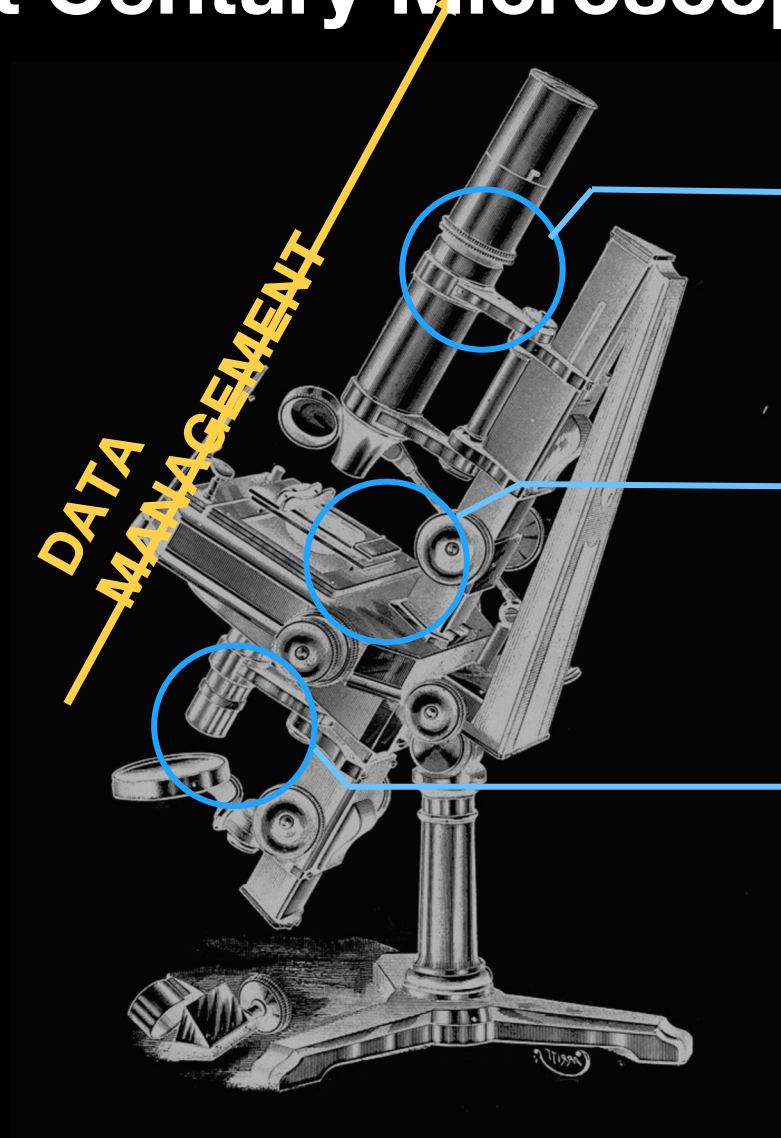
Runs and participates in national projects: *Large-scale* collaborations to digitise research and help researchers become more productive

Expertise and Training: Expertise in applying digital tools, techniques and infrastructure to advance research.



**A central theme for
eResearch - building
microscopes for 21st
Century discovery**

The 21st Century Microscopy Analogy



INSIGHT
Lens

Visualisation techniques and advanced analytics

ANALYSIS
Filters

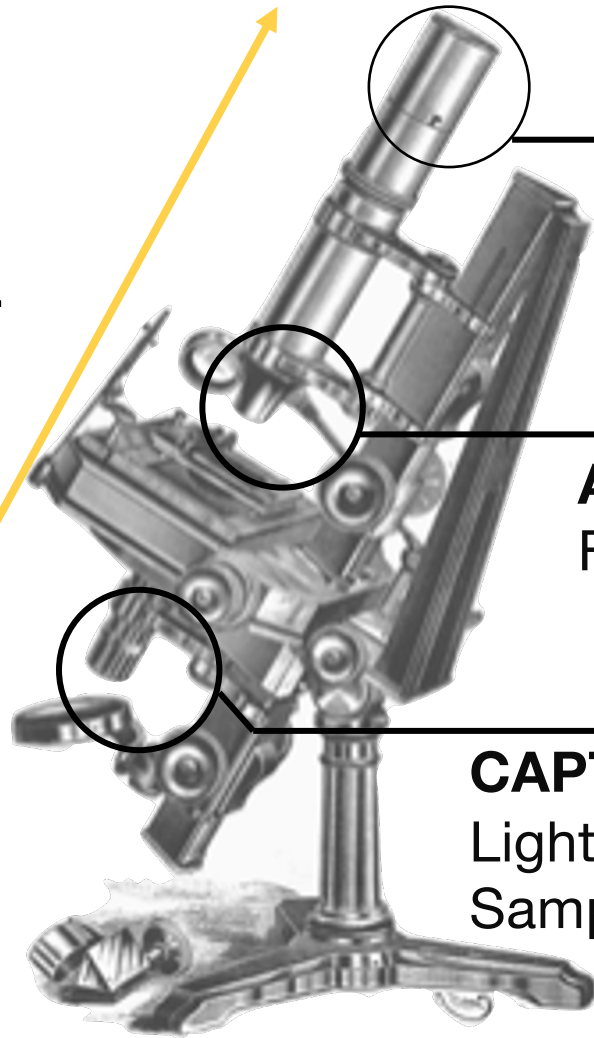
High performance computing and cloud Workbenches

CAPTURE
Light Source
Samples

The Instruments

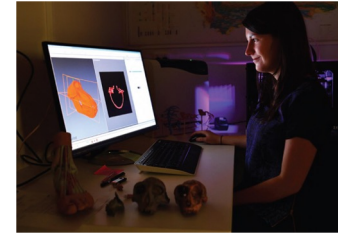
Monash eResearch Building 21st Century Microscopes

“Seamless Orchestration” with advanced digital technologies for realtime interaction with all layers



INSIGHT
Lens

SCREEN: DIGITAL VIRTUAL LABORATORIES INCL REMOTE DESKTOPS and VISUALISATION



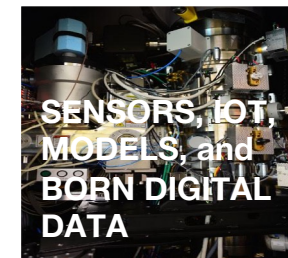
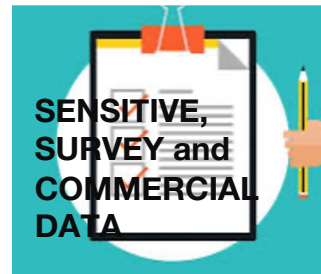
ANALYSIS
Filters

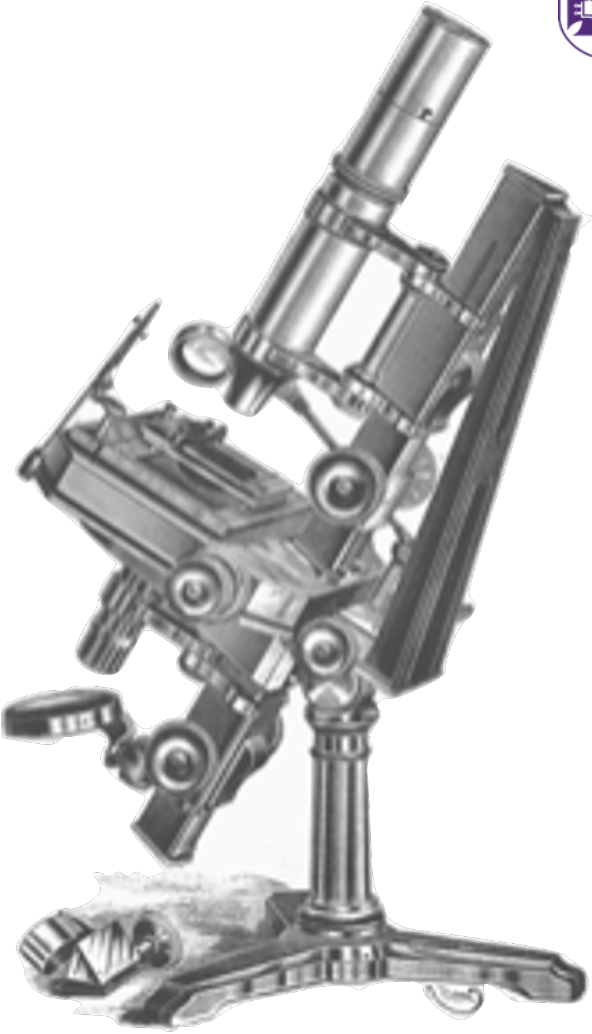
RESEARCH CLOUD and HPC



CAPTURE

Light Source, Samples, **SCIENTIFIC INSTRUMENTS**





Show the bookmarks in this folder



ACEMID


AUSTRALIAN CENTRE OF EXCELLENCE IN
Melanoma Imaging & Diagnosis

Interconnected set of Secure Digital Research capabilities

Improved security and privacy throughout the lifecycle of the research data

Data Collection


Secure text analysis
Extract data from unstructured text


Secure Hosting of Research applications
Host applications that handles sensitive data


Clinical Instruments
generating sensitive research data





Data Storage


Secure Research Data Storage
Store petabyte scale sensitive research data



Imaging Research Data Management
Including Medical Imaging De-identified Images

Data Analysis


Secure Analysis Enclave Platforms
Data custodians analyse data & create extracts for sharing with other researchers

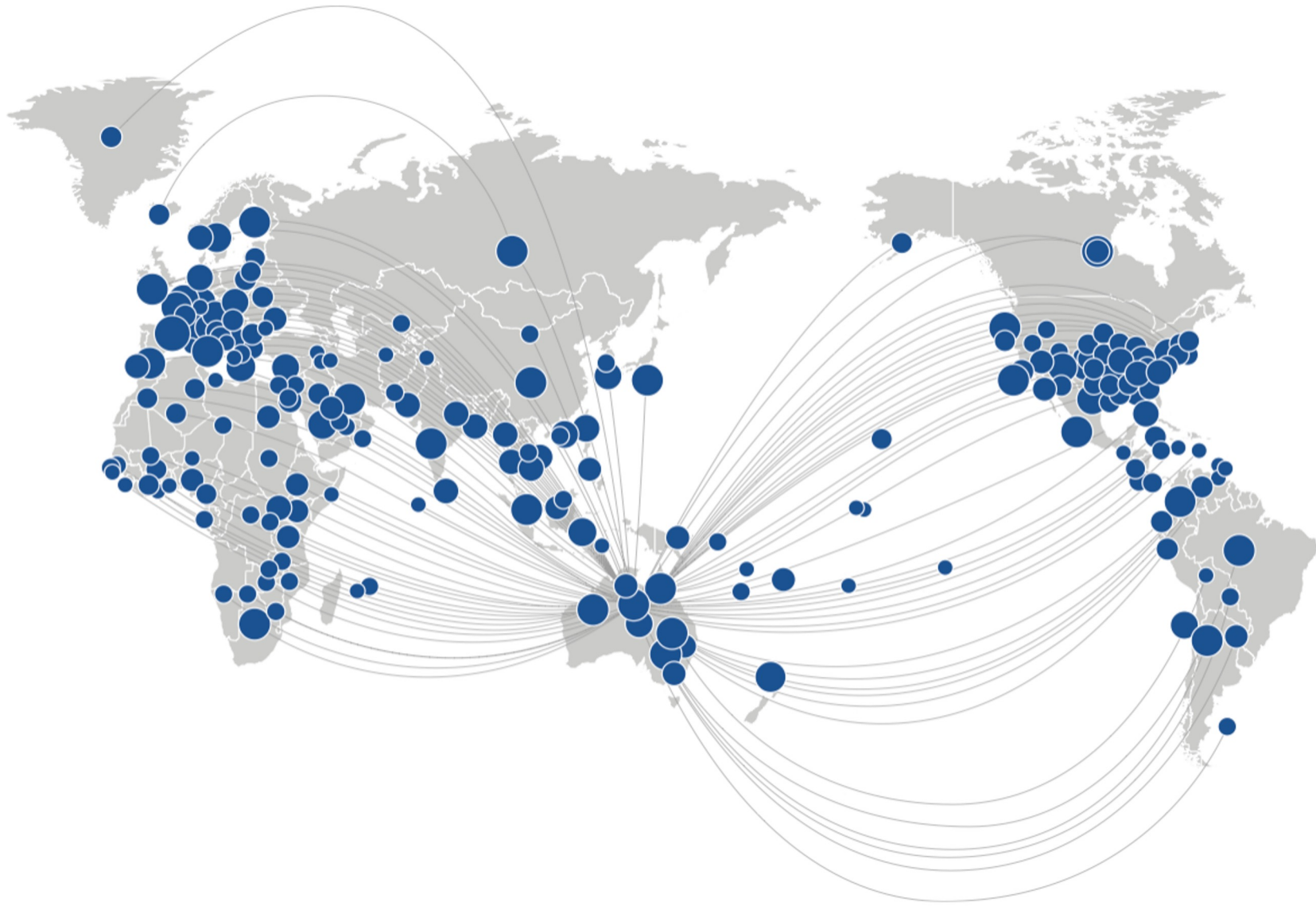

Secure HPC
For large scale image, genomic and big data for AI and ML

Data Sharing


Secure Data Custodian Platforms
Share and analyse secure data across organisations through the governed environment

Research is something that happens *between* organisations (and it is a “*team sport*”). It is not contained within the enterprise boundaries





Research Infrastructure is about People and Partnerships

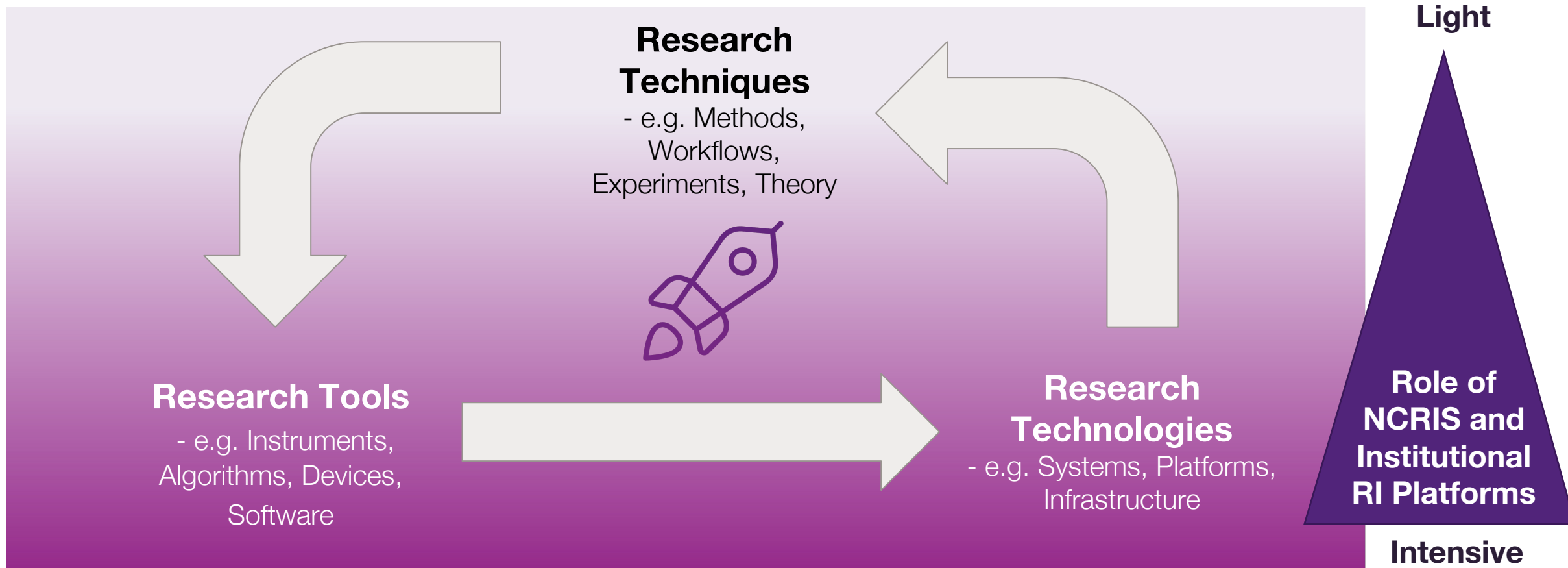


Research Infrastructure is about Co-Design



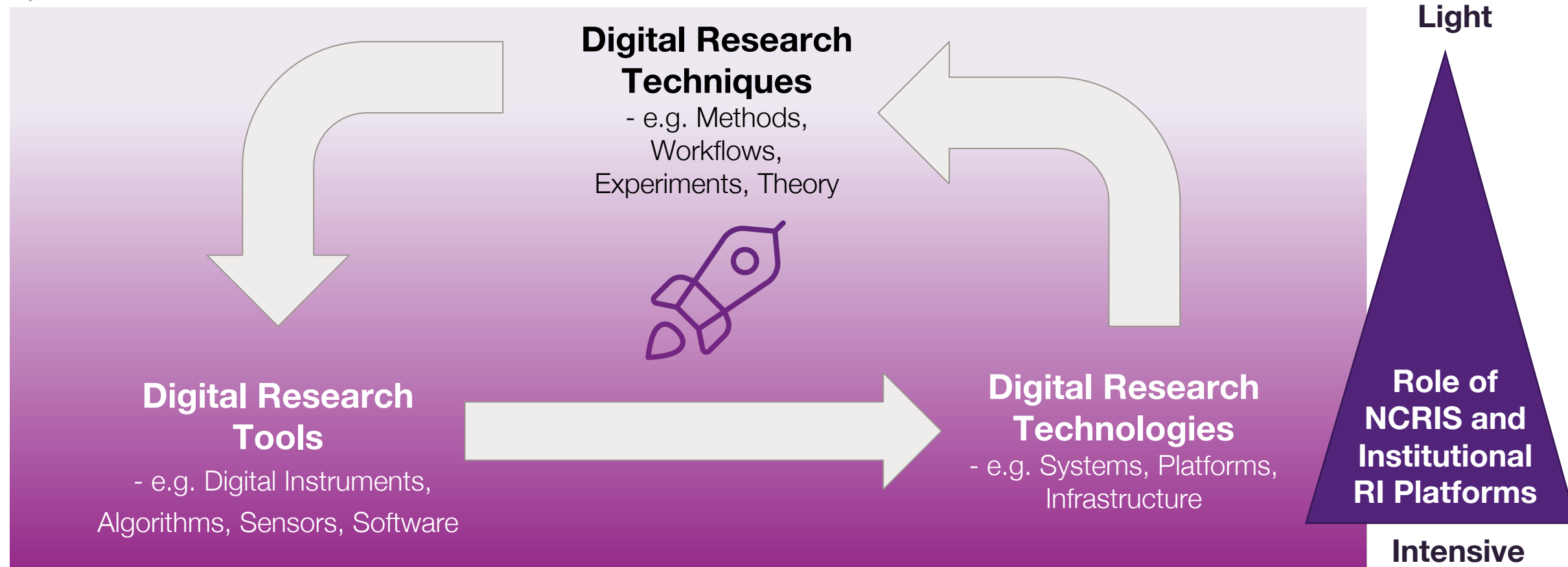
Co-Design of Research Infrastructure

Research Infrastructure Governance and Co-design. Research **Techniques**, **Tools** and **Technologies** are increasingly interlinked and interrelated in their selection, design, deployment, use and operation.



Co-Design of DIGITAL Research Infrastructure

Digital Research Infrastructure Governance and Co-design. Research **Techniques**, **Tools** and **Technologies** are increasingly interlinked and interrelated in their selection, design, deployment, use and operation.

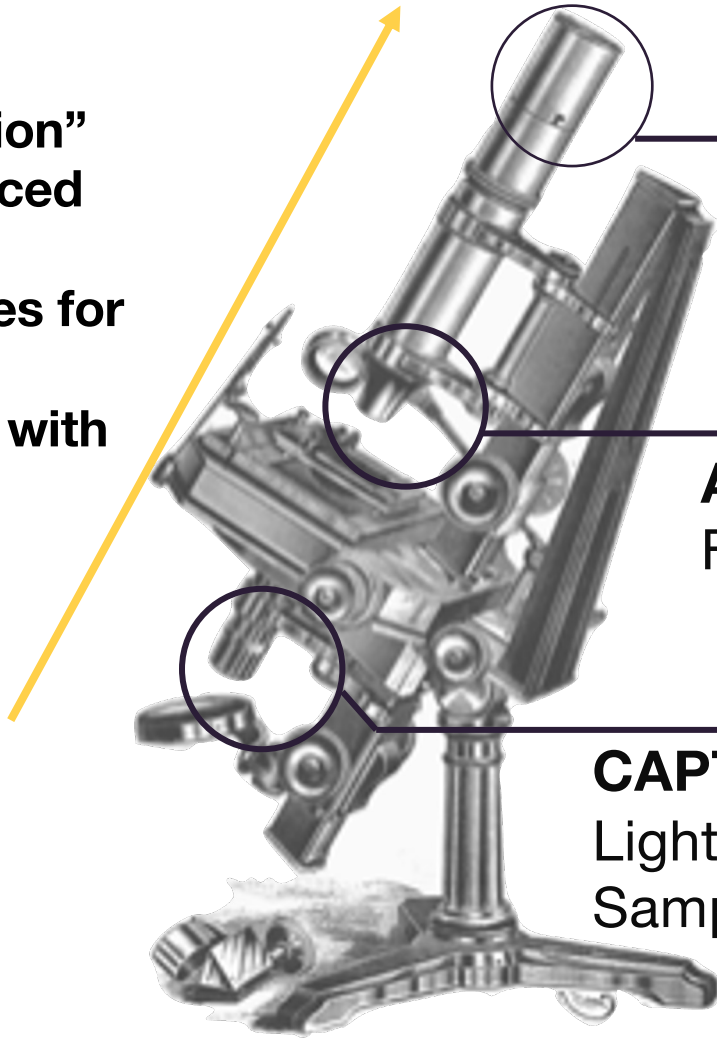


Research Infrastructure is about Collaboration and Connection



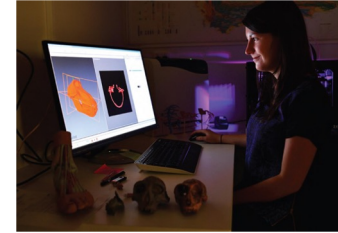
Building 21st Century Microscopes

“Seamless
Orchestration”
with advanced
digital
technologies for
real-time
interaction with
all layers



INSIGHT
Lens

SCREEN: DIGITAL
VIRTUAL
LABORATORIES
INCL REMOTE
DESKTOPS and
VISUALISATION



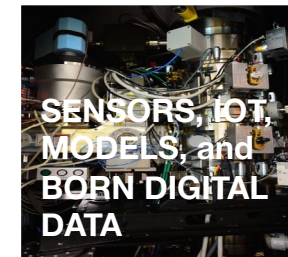
ANALYSIS
Filters

RESEARCH
CLOUD and
HPC



CAPTURE

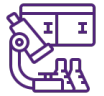
Light Source, **SCIENTIFIC
INSTRUMENTS**
Samples



National Collaborative Research Infrastructure Strategy (NCRIS)



The **only** Federal Government funding into **collaborative research infrastructure**



Provides researchers **access** to cutting edge **infrastructure** facilities, **equipment** and **resources**



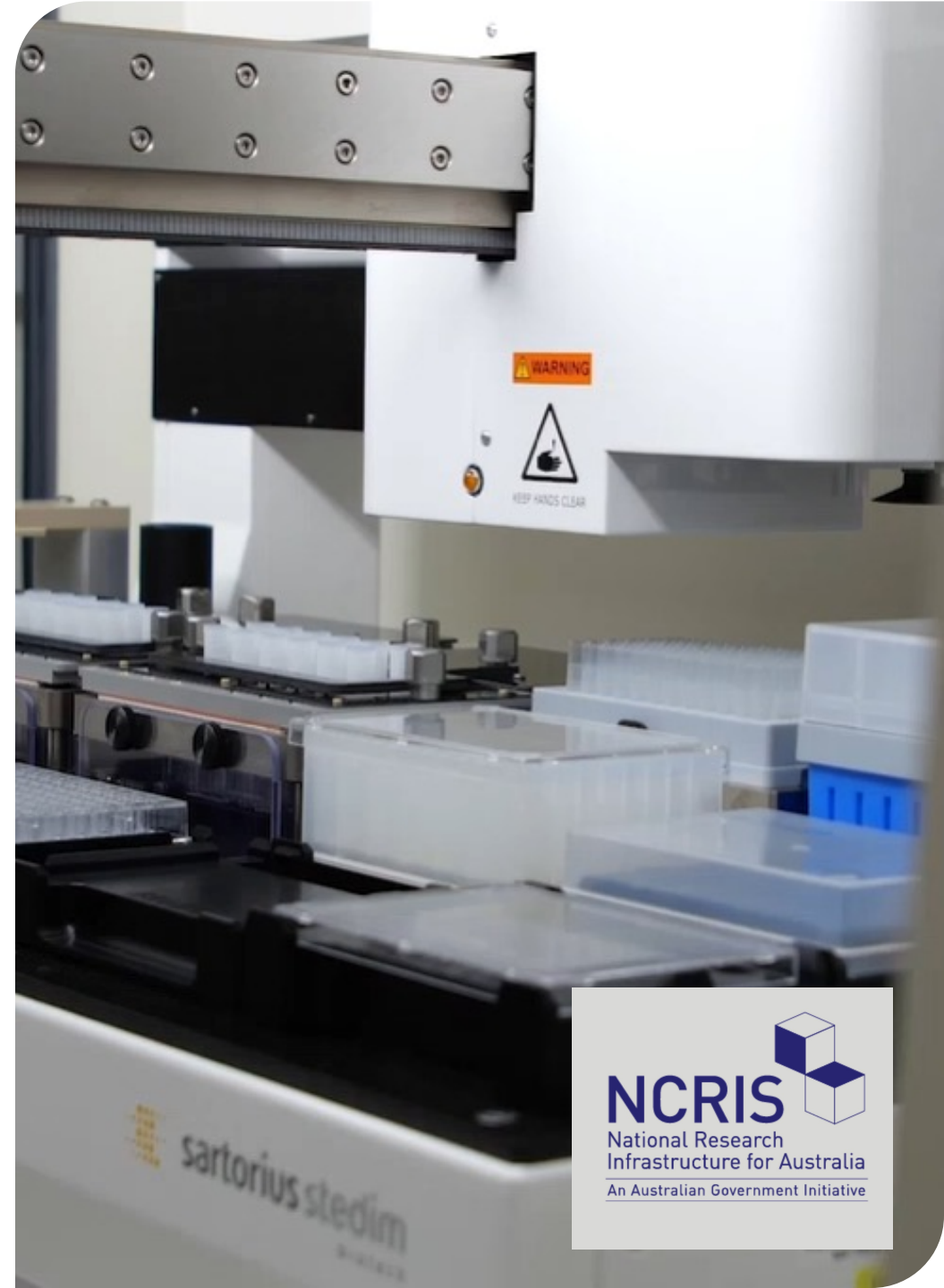
Enables **partnerships** between the **research** sector, **industry**, and **government** to bring **economic**, **environmental**, **health** and **social benefits** for Australia



Key contributor to the **attraction** of **research talent** and **industry partners** to Australia

























Co-investing enables states to **influence** and shape NCRIS capabilities to meet **State priorities**



NATIONAL RESEARCH INFRASTRUCTURE IN AUSTRALIA*



 <p>Australian Centre for Neutron Scattering Uses neutrons from the OPAL reactor to examine the structure and dynamics of materials in order to understand their properties and design new materials for real-life applications.</p> <p>Centre for Accelerator Science Has ion beam analysis and accelerator mass spectrometry tools for use in many domains, including earth and environment, materials and life sciences.</p> <p>National Deuteration Facility Offers molecular deuteration using both in vivo biodeuteration and chemical deuteration techniques.</p> <p>Australian Synchrotron Provides real-life benefits using x-ray and infra-red light to advance work in health, food, environment, biotechnology, nanotechnology, energy, resources, advanced materials and cultural heritage</p> <p><small>* Previously NCRIS supported</small></p>	 <p>Integrated Marine Observing System</p> <p>Integrated Marine Observing System Operates a range of marine observation equipment throughout Australia and makes all data generated accessible to the marine and climate science community.</p>	 <p>terrestrial Ecosystem Research Network</p> <p>Terrestrial Ecosystem Research Network A network of diverse and extensive technologies that measure and monitor ecosystem attributes over time and from continental scale to individual field sites.</p>	 <p>AuScope</p> <p>AuScope is Australia's provider of research infrastructure via the Downward Looking Telescope to the Earth and Geospatial Science community. Our tools, data, services and analytics enable scientists to understand Earth's evolution through time, and explore how it may support growing human demands.</p>		
 <p>Australian National Fabrication Facility Provides expertise and access to micro and nanofabrication tools and materials to analyse metals, semiconductors, ceramics and polymers.</p>	 <p>Astronomy Australia Ltd. Facilitates access to national and international astronomy infrastructure for Australian -based researchers, including telescopes, high performance computing and virtual observatories.</p>	 <p>Heavy Ion Accelerators Provides a world-class facility for ion-beam research which has applications in disciplines such as advanced materials, quantum and nuclear science and sustainable energy and resource use.</p>	 <p>CSIRO Marine National Facility Provides a dedicated ocean research capability for Australia, accessible to Australian researchers and their international collaborators, and makes all data collected freely accessible to all.</p>		
 <p>BioPlatforms Australia Provides access to technologies to analyse biomolecules, from genes to genomes, proteins and the metabolome.</p>	 <p>European Molecular Biology Laboratory Australia Links Australian researchers with international leaders in molecular biology.</p>	 <p>Atlas of Living Australia A collaborative, open digital platform that harmonises Australia's biodiversity data making it accessible and reusable for research and decision-making.</p>	 <p>Australian Plant Phenomics Facility Provides access to plant phenomics technologies, tools and expertise supporting scientists to develop improved crops, healthier food, more sustainable agricultural practices, and new and improved biopharmaceuticals.</p>		
 <p>Microscopy Australia Providing access to sophisticated microscopes and associated expertise in strategic locations to deliver high-impact research.</p>	 <p>National Imaging Facility Provides access to expertise and imaging instruments for diverse research disciplines.</p>	 <p>Australian Centre for Disease Preparedness Provides testing services to support the health and medical sciences and management of Australian biosecurity.</p> <p><small>* Previously Australian Animal Health Laboratory</small></p>	 <p>Phenomics Australia Provides pre-clinical model systems to accelerate the discovery of gene function and therapeutic development to improve health.</p> <p><small>** Previously Australian Phenomics Network</small></p>		
 <p>Population Health Research Network Enables the safe and secure sharing and analysis of population health data to improve wellbeing and enhance the effectiveness and efficiency of health services.</p>	 <p>National Computational Infrastructure and Pawsey Supercomputing Centre Provide research access to Australia's high-performance supercomputing and data services.</p>	 <p>Australian Research Data Commons Provides data assets, platforms and infrastructures that keep Australian researchers competitive, facilitate innovation, foster collaboration and enhance research translation.</p>	 <p>Therapeutic Innovation Australia Provides expertise and services to support better health through the translation of therapeutic discoveries into clinical applications.</p>	 <p>Australian Urban Research Infrastructure Network Provides access to datasets and analytical tools to support development of Australia's communities, towns and cities.</p>	

* NCRIS-supported National Research Infrastructure.



NCRIS across Queensland





Australian Research Data Commons





Australian Research Data Commons

OUR PURPOSE

To provide Australian researchers with competitive advantage through data.

OUR MISSION

To accelerate research and innovation by driving excellence in the creation, analysis and retention of high-quality data assets.

Share



ARDC Research Data Australia

Find, access, reuse and attribute data from Australian research organisations.

Explore >



ARDC Nectar Research Cloud

Your national research cloud – start your 6-month trial today.

Explore >



ARDC Virtual Desktop Service

Accelerate your research with quick and easy access to extra computational capabilities in the cloud.

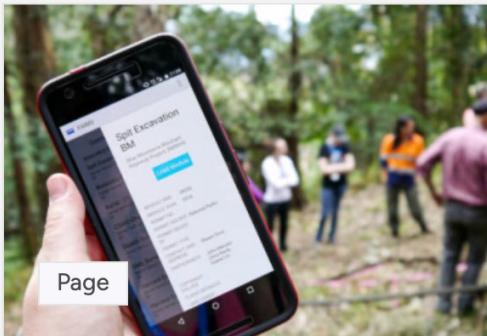
Explore >



ARDC Jupyter Notebook Service

It's easier than ever to work with Jupyter Notebooks with this national service for researchers.

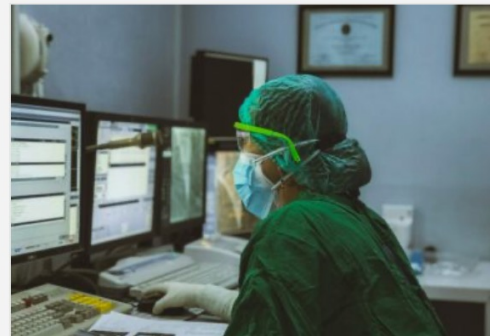
Explore >



Page

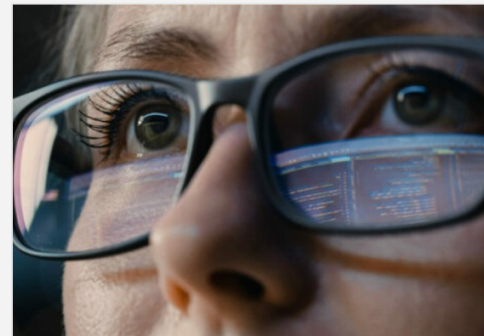
Research Platforms

We list over 25 research platforms supported by the ARDC ready to use for your...



Digital Services Hosted On Nectar

Explore and access digital services hosted on Australia's national research cloud.



ARDC Research Vocabularies Australia

Share and combine your data with confidence using Research Vocabularies Australia.



Advisory Services

Supporting your data and digital research challenges.

Find Datasets

Maximise your research impact with quality datasets and collections.



Find Datasets

We're working with research organisations across Australia and across research disciplines to make their datasets and data collections findable, accessible, interoperable and reusable (FAIR) to all researchers.

Research Data Australia is an online portal for finding research data and associated projects, researchers and data services. Browse data by subject or theme.

Many of our ARDC-supported research platforms also include open datasets.

Explore open datasets – there's something for every discipline.



Australian Research Data Commons

Find data for research

Find, access, and re-use data for research - from over one hundred Australian research organisations, government agencies, and cultural institutions

All Fields ▾

Search for Data

Q Search

Publicly accessible online

Advanced Search Map Search

Demonstration



Australian Research Data Commons

Research in the age of Data Privacy

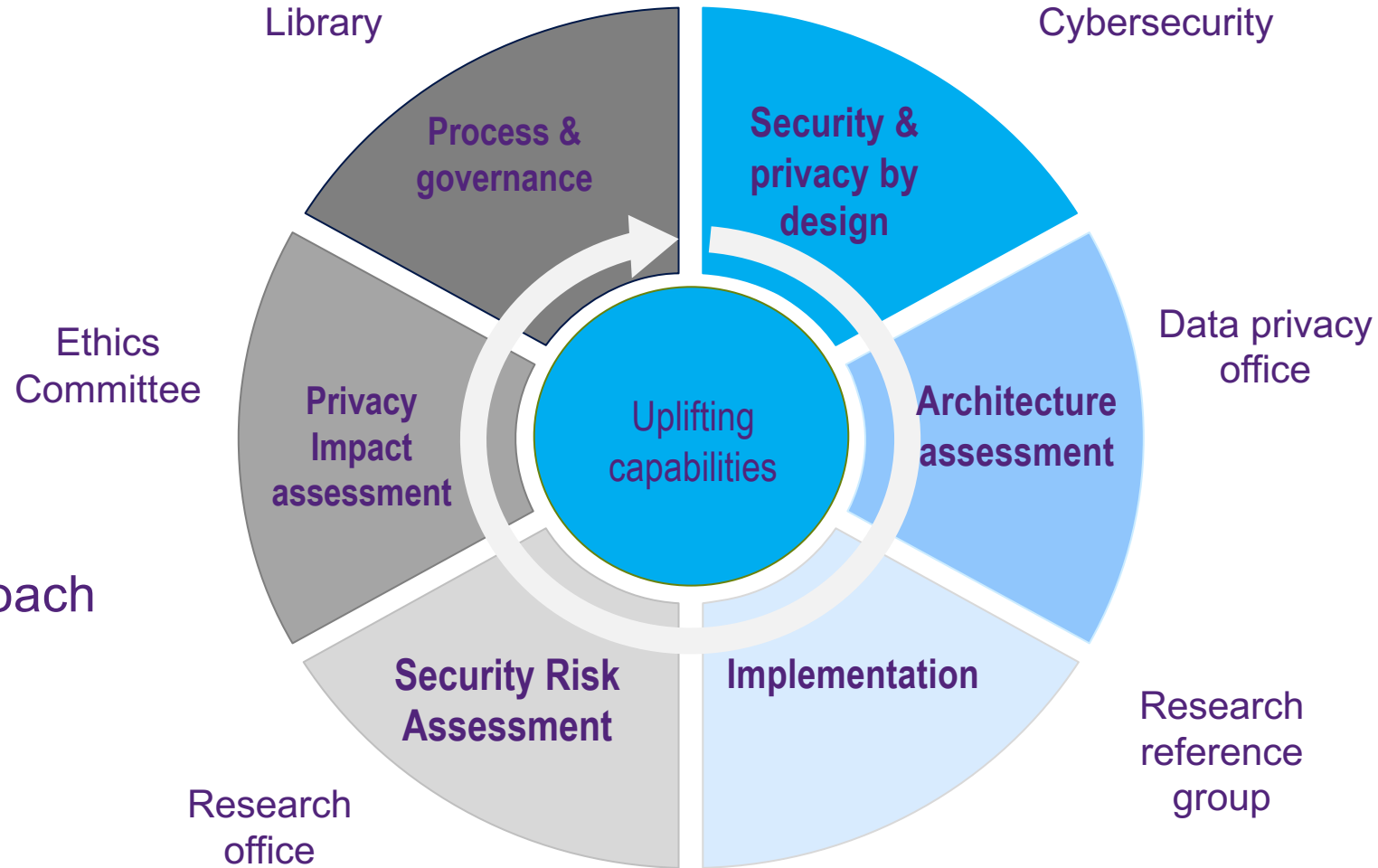
NCRIS Capabilities are increasing handling *Human Data*



Uplifting Digital Research Infrastructure for Sensitive Data

Principles:

- Bring data & tools together
- Technology + Process + Governance interplay
- Risk management based approach
- Research-led governance



Final Advice for Organisations

Digital research technology must be digitally connected to the rest of the World's digital research

decisions and control span organisations

Research is the journey of the unknown

It must follow then

So is the design of digital technology used by research

iterative and perpetual co-design where researchers contribute and lead

Digital research technology spans ownership and responsibility

workflow and data lifecycles straddles pillars of the organisation