



A brain imaging database of rare and endangered Australian mammals

A conceptual demonstration of a national imaging data collection of Australia's unique fauna

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The project in a nutshell

Rationale: Establishing a national imaging data collection of specimens of Australia's unique fauna

- Millions of physical animal tissue specimens are held in national bio-sample collections
- Modern volumetric imaging facilities (MRI, CT, etc.) capture many of their morphometric and functional features
- A widely accessible archive for these datasets generates an invaluable permanent resource for research and education

Short term goal: Transform a pre-existing collection of brain image volumes into a national data resource

- Locally stored MRI and CT image volumes from several neuroevolutionary projects.
- Resourced and acquired in collaboration with various bio-sample collections (Museums and Conservation societies)

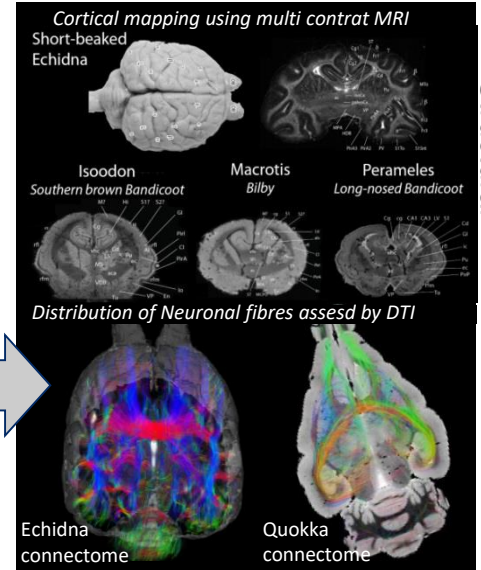
Long-term goal: A national platform for general animal tissue specimens

- Consistent storage of data from various sources and different imaging modalities.
- General metadata descriptors for images from preserved collection specimens

Physical specimen collections



(Brain) tissue specimens



Key issues

when establishing a FAIR database of animal tissue images for collection specimens

- A broad stakeholder community (incl. Museums and conservation societies) has a clear need for a platform to archive and share volumetric image data from animal tissue specimens in their bio-sample collections

- In Aus no dedicated flexible platform or framework for this purpose exists

- Key requirements on the way to a national specimen imaging platform:

1. Consistent and flexible metadata framework

- with standardized but extensible metadata types providing clear tags to allow for flexible searches under various aspects and machine interoperability
- including definitions of a wide range of image and non-image related information on multiple levels.
- accommodating the wide range of imaging modalities and data formats used for collection digitization and image storage

2. A database platform/infrastructure implementing the metadata framework to make the image data 'FAIR'

- All existing platforms tend to have a very rigid data model, restricting flexibility in data storage and data-mining
- A platform with a data model dedicated to specimen imaging is needed with image specific search and visualization capabilities

Metadata requirements for data-mining

Imaging related Info

- Instruments/modalities
- Acquisition Information
- Image/data quality
- Image Processing/provenance
- Numerical results from image assessments
- Annotations (anatomy, etc.)



Image formats

- 2D, 3D, 4D
- Volumes: Dicom, nifti...
- Planar [fotos]: tif, jpg...
- Surfaces: vtk, stl, pty...



Specimen related Info

- Past and present locations
- History and condition
- Sample preparations



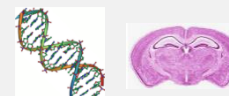
Animal related info

- Taxonomy
- Demographics
- Specimen sampling/collection
- Living environment



Other information from related DBs:

- Genetic
- Biodiversity
- Histology

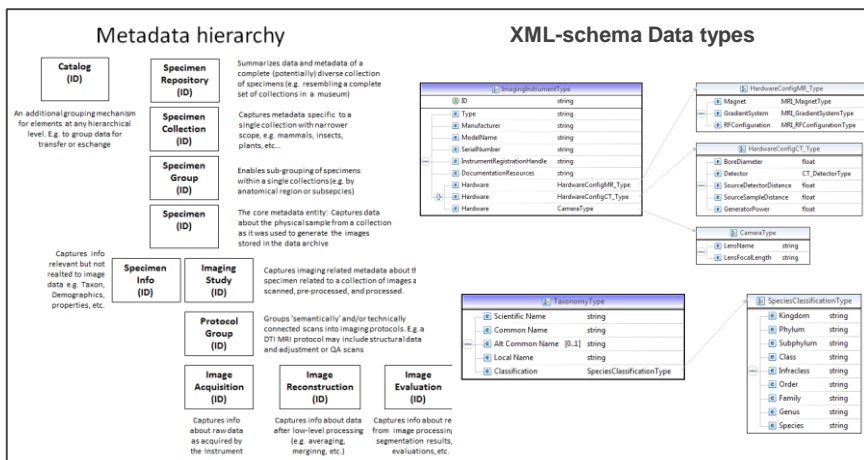


Lessons learned

First steps towards a national specimen image repository

Goal 1: General metadata descriptors for images from preserved collection specimens

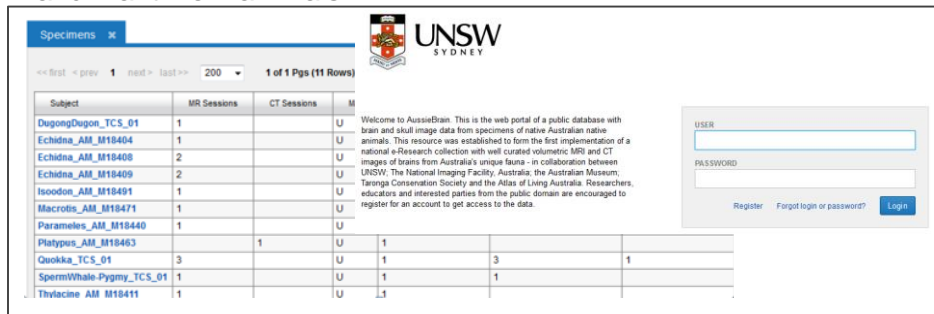
- Specification of a dedicated XML schema for metadata structures for general images of specimen from museum collections
- Definition of a metadata hierarchy and XML datatypes for generic imaging instruments, acquisitions and evaluations and dedicated specifications for for MRI and CT instruments/acquisitions.



- **Conclusion and future work:** The metadata definition provides general and extensible descriptors for animal specimen images from collections. A national metadata standard should be established among the various stakeholders – best achieved in a national working group.

Goal 2: A demonstrator national brain imaging database for preserved collection specimens

- Design of an XNAT based public image repository of brain and skull specimens from museum collections
 - Implementation of modifications to accommodate collection data
 - Platform extension with purpose built metadata types
 - Metadata collation and upload of pre-exisiton research datasets
- Database is publicly accessible via secure web access under URL <https://aussiebrain.unsw.edu.au/>. Users can register on the website.
- Currently holds 50+ brain datasets from marsupials, monotremes and maritime mammals.



Specimens

Subject	MRI Sessions	CT Sessions	M
DugongDugon_TC5_01	1		U
Echidna_AM_M18404	1		U
Echidna_AM_M18408	2		U
Echidna_AM_M18409	2		U
Isoodon_AM_M18491	1		U
Macrotis_AM_M18471	1		U
Perameles_AM_M18440	1		U
Platylops_AM_M18463		1	U
Quokka_TC5_01	3		U
SpermWhale-Pygmy_TC5_01		1	U
Thylacine_AM_M18411	1		U

Welcome to AussieBrain. This is the web portal of a public database with brain and skull image data from specimens of native Australian native animals. This resource was established to form the first implementation of a national Research collection with well curated volumetric MRI and CT images of brains from Australia's unique fauna - in collaboration between UNSW, The National Imaging Facility, Australia; the Australian Museum, Taronga Conservation Society and the Atlas of Living Australia. Researchers, educators and interested parties from the public domain are encouraged to register for an account to get access to the data.

Register Forgot login or password? Login

- **Conclusion and future work:** XNAT archive vastly improves FAIRness of our brain imaging data, allowing for data-mining and international research collaboration. However, the XNAT data model is restricted, which limits the platform's adaptability for specific needs for imaging data from collections.

Acknowledgements

We'd like to express our thanks to the following national institutions and people for their contributions to the project:



- Facilitation of imaging instrumentation
- Consultations in NIF 'Animal Plants and Material Imaging' (APM) theme group
- Technical expertise in image acquisition, archiving and curation
- Specific thanks to all NIF node fellows who were involved in the collation of data and metadata for the project



- Resourcing of brain and skull specimens
- Consultations about museum requirements in image curation
- Collation of metadata and consultaion about linking museum and imaging databases
- Specific thanks to Dr C.Slatyer, Dr S.Ingleby for contiuing support of the project



- Resourcing of brain specimens and image acquisition
- Advice about the needs of the research community
- Database implementation
- Specific thanks to Prof K.Ashwell, Dr Y.Gurowich, P.Cherupalli who were crucial in driving this project forward



- Resourcing and preparation of specimens
- Advice and consultation about needs of a national image archive
- Characterization of physical samples
- Specific thanks to Dr Lydia Tong for contiuing support of the project, specific advice and sample preparation



- Funding within the 'Transformative Data collections' scheme
- Specific thanks to Dr Mingfang Wu for helpful advice about data FAIRness



- Advice and consultation about needs of national animal data archives and about linking biodiversity information
- Specific thanks to Hamish Holewa for contiuing supporting the project and advice concerning metadata requirements