

# IBRAIN GROUP RESOURCES & SERVICES

The integrative Brain Research using AI and Neuroimaging (iBRAIN) group can facilitate access to, and use of imaging, storage and analytical infrastructure for all types of human and preclinical neuroscience applications.

## INTRODUCTION

In April 2018, Monash University created the Department of Neuroscience, a world-class academic department, part of the Central Clinical School and co-located at the Alfred Hospital. Later that year, internationally renowned neuroradiologist, Professor Meng Law, was recruited to jointly lead the imaging research group at Monash and take up the appointment as Director of Radiology and Nuclear Medicine at the Alfred Hospital. He leads a research group of more than 25 staff and students across both institutions with strong capabilities in all techniques for brain imaging, image analysis, database management, informatics, computational mathematics/engineering & medical imaging.

The iBRAIN group can facilitate access to, and use of imaging, storage and analytical infrastructure for all types of human and pre-clinical neuroscience applications. Through our close connections with the Alfred Hospital's Departments of Neurology/Neurosurgery and Monash's Department of Neuroscience, we have access to pre-clinical models and clinical populations across a wide range of neurological and neurodegenerative diseases. All services are available under collaboration or fee for service arrangements.

## ACCESS TO IMAGING INFRASTRUCTURE

We have expertise in the acquisition and analysis of numerous types of neuroimaging data and can also facilitate access to a number of human and preclinical imaging systems in Melbourne through Monash or Victorian Biomedical Imaging Capability partners, including:

### Human imaging

- Human 1.5/3/7Tesla MRI (through Alfred Hospital, Baker Institute (dedicated Prisma research 3T), Monash Biomedical Imaging or The University of Melbourne Brain Imaging Unit)
- Human PET/CT (Alfred Hospital or University of Melbourne)



Professor Meng Law, Director (sitting) and Dr Ben Sinclair, Post-Doctoral researcher of the iBRAIN group, part of the Department of Neuroscience, Central Clinical School at Monash University.

- Human PET/MRI (Monash Biomedical Imaging)

### Preclinical imaging

- Preclinical 9.4T MRI (Dept of Neuroscience or Monash Biomedical Imaging)
- Preclinical PET/CT (Dept of Neuroscience or Monash Biomedical Imaging)
- Preclinical Magnetic Particle Imaging (Dept of Neuroscience)

## PROTOCOL DESIGN AND OPTIMISATION

iBRAIN can provide assistance with protocol setup and optimisation for preclinical (murine models) and clinical (human) neuroscience applications including:

### Magnetic Resonance Imaging\*

- Structural morphometric and quantitative relaxometry

- Vascular and perivascular imaging – including contrast/dynamic contrast imaging, ASL (PASL and PCASL), SWI, TOF

- Diffusion MRI - Diffusion Tensor Imaging and multi-shell models

- Functional MRI – acquisition protocols and task design

- Quantitative Susceptibility Mapping (QSM), MRS, Glu-CEST

- Sodium MRI – total sodium quantification, relaxometry and TQF imaging

### Positron Emission Tomography\*

- 18F-FDG (glucose metabolism)
- 18F-FEMPA (neuroinflammation; TSPO receptor)
- 18F-FBB or 18F-Flut (amyloid)
- 18F-PI2620 (tau)
- 18F-FP-CIT (dopamine, DAT)

## WE MAKE YOUR IMAGING DATA NEEDS POSSIBLE

- <sup>64</sup>Cu-ATSM (oxidative stress / hypoxic injury)
- New tracers of your choice - our team have extensive experience in preclinical and clinical early stage development and trialling of nuclear medicine procedures, and strong links with academic and industry radiopharmaceutical partners to bring online additional neuro-tracers.

We also have strong links with MRI developers at Siemens, GE, Phillips, Canon and international sites to facilitate the application of non-standard or cutting-edge techniques.

## ACCESS TO RESEARCH GRADE CLINICAL DATA

We can identify cohorts of the Alfred patients for your investigator-initiated research and commercial clinical trials using the Alfred developed and validated REASON Cohort Discovery Tool. REASON allows us to concurrently search the Alfred electronic medical records, Radiology Information System, PACs medical image repository and other hospital databases to rapidly extract cohort clinical data.

## DATA TRANSFER, STORAGE AND CURATION

iBRAIN provides in-house data storage and curation using the open-source XNAT system within the Alfred Hospital firewall making it possible to store identifiable research imaging data (see figure). Example neuroscience applications include the storage of routine clinical MRI scans for the Alfred Multiple Sclerosis and Neuroimmunology service line. Scans are stored and managed in XNAT and can be deidentified and onsent to research analysis infrastructure or commercial/academic partners. We also have VPN connectivity with Monash XNAT for transfer, storage and analysis of deidentified data on the Monash MASSIVE M3 HPC cluster for neuroimage analysis or machine learning analysis.

## DATA ANALYSIS

iBRAIN houses a dedicated analysis server optimised for training deep learning algorithms equipped with 4 Quadro 8000 RTX GPUs with 48GB of VRAM each, as well as 20 CPU cores and 256GB of RAM. The server hosts a full deep learning stack with up-to-date CUDA drivers and dockerised deployments of different deep learning frameworks for easy analysis. Easy access can be granted on the Alfred intranet or via VPN using JupyterHub, so users can train and develop deep learning models from their browser without any local installation required. This dedicated analysis server hosts the iBRAIN XNAT application and is directly connected to XNAT storage for quick retrieval and analysis of clinical data hosted within XNAT.

We can also facilitate access to Monash University's MASSIVE infrastructure. Details regarding the compute, storage and analysis capabilities of MASSIVE can be found at the website ([www.massive.org.au](http://www.massive.org.au)). MASSIVE is a high performance computing facility dedicated to data analysis, and is particularly suited to neuroimaging and machine learning type analysis. MASSIVE includes numerous neuroimaging software packages that are kept up to date, as well as the Australian mirror of the Human Connectome Project data.

Key features of the MASSIVE M3 HPC include:

- 7,000 CPU-cores and 300 NVIDIA GPU co-processors
- Two 3PB fast parallel file systems (6PB total space)
- A specialised machine learning capability - 11 NVIDIA DGX1-V servers
- Remote desktop access for visualisation & analysis

- Integration with Monash and Alfred XNAT instances, and
- Specialised support for researchers new to big data analysis problems.

The iBRAIN group can provide assistance with analysis or training of students/staff to perform neuroimaging analyses including:

- Morphometric analysis – including brain and regional volumetric analyses (FSL, Freesurfer, SPM, “BrainAge”)
- Automated brain lesion mapping
- Tissue quantification – including T1/T2/T2\*/QSM/myelin mapping
- Diffusion MRI analyses – including DTI, CSD, DSI, NODDI – voxel/fixel based analysis – diffusion tractography and structural connectivity
- fMRI analysis – including task and resting-state fMRI ASL analysis
- Quantitative and Semi-quantitative PET analysis.

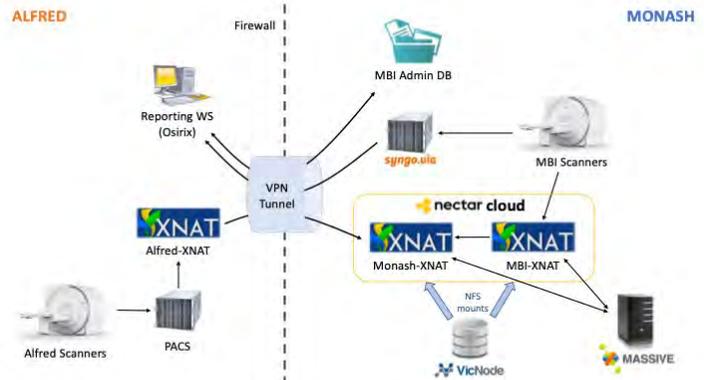
We can also assist with optimising these analysis protocols for longitudinal datasets.

## OPERATIONAL TEAM

- Professor Meng Law - Director
- Dr Scott Kolbe - Deputy Director
- Monash University iBRAIN group (*Leaders - A/Professor David Wright, Dr Ian Harding, Dr Bianca Jupp*)
- Alfred Hospital RRU Radiology Research Unit (*Dr Helen Kavnoudias, Mr Adil Zia, Dr Robin Lee, Dr Jarrel Seah*)

Visit our website for more information:

- [monash.edu/medicine/ccs/neuroscience/research/law-group](http://monash.edu/medicine/ccs/neuroscience/research/law-group)
- [alfredhealth.org.au/services/radiology-at-alfred-health/](http://alfredhealth.org.au/services/radiology-at-alfred-health/)



The iBRAIN secured connection from the Alfred XNAT through a VPN to Monash University & Monash Biomedical Imaging (MBI) XNATs, with direct access to Monash eResearch Centre platforms, MASSIVE and Monash SERP safe haven (Image from Dr Tom Close, Imaging Information Officer & Professor Gary Egan, Director, MBI).

## Contact Us

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