



RESEARCH FELLOW

DEPARTMENT/UNIT	Monash e-Research Centre
FACULTY/DIVISION	Office of the Vice-Provost (Research and Research Infrastructure)
CLASSIFICATION	Level B
DESIGNATED CAMPUS OR LOCATION	Clayton campus

ORGANISATIONAL CONTEXT

Everyone needs a platform to launch a satisfying career. At Monash, we give you the space and support to take your career in all kinds of exciting new directions. You'll have access to quality research, infrastructure and learning facilities, opportunities to collaborate internationally, as well as the grants you'll need to publish your work. We're a university full of energetic and enthusiastic minds, driven to challenge what's expected, expand what we know, and learn from other inspiring, empowering thinkers. Discover more at www.monash.edu.

Monash eResearch Centre (MeRC) is a University commitment to accelerating research by applying advanced computing and information technology to important research problems. The centre partners with individual researchers, Australian research institutions and global research communities. MeRC is a leader amongst international eResearch initiatives, supporting over 2000 researchers by operating a number of projects including the MASSIVE high-performance computing facility, R@CMon - a node of the Nectar Research Cloud, petascale data storage and life-cycle infrastructure, data safe havens for global communities, and the national Characterisation Virtual Laboratory. Staff at the Monash eResearch Centre deliver impact: we help visualise how the human brain is connected, we design high performance computing systems, we write data processing workflows for one-of-a-kind Australian microscopes, and we write smart software for interrogating unique data collections. MeRC is driven by the quality and passion of our staff, and the partnership with the researchers we work with. For more information about the work we do, please visit our website: www.monash.edu/researchinfrastructure/eresearch.

Kwan's Lab: Based in the Department of Neuroscience in the Alfred campus, our "Epilepsy and Personalised Medicine" group is conducts translational research that covers a broad spectrum of areas in relation to neurological diseases such as epilepsy - ranging from basic discovery to clinical trials and implementation. One of the major research areas is the use of machine learning to guide treatment selection for epilepsy. For more information about the work we do, please visit our website: www.monash.edu/medicine/ccs/neuroscience/research/kwan-group.

Monash Medical Artificial Intelligence Lab (MMAI) has strong collaboration networks and works with healthcare providers such as the Alfred Health, the Royal Melbourne Hospital, ACEMID and Eye Research Australia to conduct high-quality medical research. We believe AI + Medical will bring better healthcare into this world. Our

mission is to deliver high-quality healthcare service through world-class research with industry partners and healthcare providers. We think delivering our research outcomes to the community is essential, and that is why we work closely with multiple medical service companies like Airdoc, Eyetelligence, NVIDIA, BUPA and Molemap to deploy the technology. For more information about the work we do, please visit our website:

www.monash.edu/mmai-group.

POSITION PURPOSE

A Level B research-only academic is expected to carry out independent and/or team research within the field of medical AI, data science/machine learning in medicine and bioinformatics. Our research goal is to identify genetic, structural, metabolic and environmental factors that affect treatment outcomes in people with epilepsy and related neurological conditions (e.g. following stroke), and promote the translation of research findings into clinical practice using personalized medicine to improve treatment outcomes for patients.

Epilepsy affects 1 in 26 people. Patients with recurrent seizures that may cause injuries or even death. Despite the development of many new medications over the last 20 years, more than 30% of patients do not have their seizure controlled. Currently it is not possible to predict which medications, either singly or in combination, will be effective for an individual patient, and no patient can trial all possible combinations within their lifetime. Under the current paradigm, the patient is sequentially trialled on different medications, doses and combinations in the hope of eventually finding an effective regime. For the patient this protracted (often years long) journey results in substantive co-morbidity, loss of productivity and greater risk of sudden death.

Instead of trial-and-error this project will test a more personalised treatment strategy. The project aims to:

- a) Develop complete anti-seizure medication (ASM) selection model prior development of drug resistant epilepsy (DRE) using novel deep learning techniques and incorporate diagnostic information using natural language processing techniques
- b) Use patient-specific induced pluripotent stem cell derived brain organoids to identify drugs that are able to modulate hyperactive neural activity
- c) Create an integrated predictive model for drug selection via artificial intelligence (AI) analysis of in vitro, clinical, and genomics data sets
- d) Validate treatment predictions in vitro and in real-world clinical care settings

The first part of this project will involve establishment of induced pluripotent stem cell lines from drug-resistant epilepsy patient blood samples and identify anti-seizure medications (ASMs) and drug combinations that suppress hyperactive neural activity in brain organoids derived from these cell lines. The second part of the project will involve integration of novel artificial intelligence approaches to further enhance the accuracy of these personalized drug efficacy profiles by incorporating single cell gene expression data sets, clinical information, and patient genomics data.

Reporting Line: The position reports to Associate Professor Zongyuan Ge

Supervisory Responsibilities: Not applicable

Financial Delegation: Not applicable

Budgetary Responsibilities: Not applicable

KEY RESPONSIBILITIES

Specific duties required of a Level B research-only academic may include:

1. The conduct of research under limited supervision either as a member of a team or, where appropriate, independently and the production or contribution to the production of conference and seminar papers and publications from that research

2. Involvement in professional activities including, subject to availability of funds, attendance at conferences and seminars in the field of expertise
3. Limited administrative functions primarily connected with the area of research of the academic
4. Development of a limited amount of research-related material for teaching or other purposes with appropriate guidance from other staff
5. Occasional contributions to teaching in relation to their research project(s)
6. Experimental design and operation of advanced laboratory and technical equipment or conduct of advanced research procedures
7. Attendance at meetings associated with research or the work of the organisational unit to which the research is connected and/or at departmental, school and/or faculty meetings and/or membership of a limited number of committees
8. Advice within the field of the staff member's research to postgraduate students
9. Other duties as directed from time to time

KEY SELECTION CRITERIA

Education/Qualifications

1. The appointee will have:
 - A doctoral qualification in the relevant discipline or a closely related field or equivalent qualifications or research experience.

Knowledge and Skills

2. Strong track-record in machine learning, medical imaging processing or bioinformatics (e.g. MICCAI/NeurIPS/ICML/Bioinformatics/Briefings in Bioinformatics)
3. Knowledge in EHR/EMR and genomics
4. Excellent programming skills (in C++ and Matlab/Python) are required
5. Strong foundation in data science, artificial intelligence, machine learning, NLP, especially deep learning (using e.g. Keras, PyTorch)
6. Demonstrated analytical and manuscript preparation skills
7. Ability to solve complex problems by using discretion, innovation and the exercise diagnostic skills and/or expertise
8. Well-developed planning and organisational skills, with the ability to prioritise multiple tasks and set and meet deadlines
9. Excellent written communication and verbal communication skills with proven ability to produce clear, succinct reports and documents
10. A demonstrated awareness of the principles of confidentiality, privacy and information handling
11. A demonstrated capacity to work in a collegiate manner with other staff in the workplace
12. Demonstrated computer literacy and proficiency in the production of high level work using software such as Microsoft Office applications and specified University software programs, with the capability and willingness to learn new packages as appropriate

OTHER JOB-RELATED INFORMATION

- Travel to other campuses of the University may be required
- There may be a requirement to work additional hours from time to time
- There may be peak periods of work during which taking of leave may be restricted

GOVERNANCE

Monash University expects staff to appropriately balance risk and reward in a manner that is sustainable to its long-term future, contribute to a culture of honesty and integrity, and provide an environment that is safe, secure and inclusive. Ensure you are aware of and adhere to University policies relevant to the duties undertaken and the values of the University. This is a standard which the University sees as the benchmark for all of its activities in Australia and internationally.