



Oxford Health BRC PhD Scholarships in Brain Technologies at the University of Oxford

We are pleased to invite UK applications for a doctoral degree within the Oxford Health Biomedical Research Centre, in the Department of Psychiatry and Nuffield Department of Clinical Neurosciences of the University of Oxford. The doctoral degree will start in October 2024.

The focus of the research will be on developing methods to support brain technologies in healthcare. Two potential projects are offered:

1. Project 1 - Dr. Ludovica Griffanti

This project will deliver new software tools for assessing brain health. This requires innovative methods for accurate and quantitative assessment of brain scans from an individual patient. This technology could be used, for example, to predict whether someone with memory decline is likely to go on to develop dementia.

Millions of hospital brain scans are performed globally each year. At the moment, these scans are interpreted by eye. But even the most expert clinician may not be able to detect subtle changes in this way. In the research setting, we build powerful algorithms that analyse information objectively, compare scans across individuals or over time (<https://pubmed.ncbi.nlm.nih.gov/21979382/>). However, these tools are mostly designed to analyse homogeneous data from groups of participants in research studies rather than to inform decision making about individual patients based on variable clinical data. This PhD project focuses on the steps needed to deploy such brain-health markers to support individual patient decision making in clinical practice: develop methods to obtain comparable measures from scans acquired with different hardware; model population variation in the measures and derive population norms against which to compare individual patients; mine population datasets (like the UK Biobank - <https://pubmed.ncbi.nlm.nih.gov/27643430/>) to identify subgroups within and across diagnostic categories. Ultimately, the tools developed could be used, for example, to predict based on a brain scan whether an individual with memory problems is likely to go on to develop dementia. Students will need good mathematical, engineering and computing skills, and through the project will acquire a strong set of skills in the areas of image processing, big data analysis, normative modelling, AI and machine/deep learning.

2. Project 2 - Prof. Mark Woolrich

This project will develop new technologies for inferring brain activity in real world settings. These technologies could be used, for example, to detect changes in brain activity during sleep, that could predict development of neurodegenerative disease.

We use cutting-edge laboratory methods, such as magnetoencephalography (MEG) and high-density electroencephalography (EEG). We combine these data with state-of-the-art artificial intelligence and deep learning techniques to learn how the brain's dynamics are organized into spatio-temporal patterns of fluctuating brain networks (<https://pubmed.ncbi.nlm.nih.gov/36041643/>). This approach allows us to detect early signs of

brain network dysfunction in diseases such as dementia before symptoms show. This project is focussed on adapting these approaches to become low-cost and scalable methods that can be used in the home. The proposed PhD project will focus on developing new methods for portable, low-density EEG that could be used in real world settings, e.g. at home. This technology could be used, for example, to detect early signs of neurodegeneration in high-risk individuals based on changes in brain activity during sleep, or as part of a closed-loop system delivering brain-activity-cued brain stimulation. This project requires the development and use of artificial intelligence (AI), machine learning and deep learning techniques. Students will need good mathematical, engineering and computing skills, and through the project will acquire a strong set of skills in the areas of image and signal processing, Bayesian inference, AI and machine/deep learning.

The scholarship funds a tax-free stipend of not less than £18,622 per year for 3 years; this amount may increase each year but will definitely not decrease, university tuition and college fees at home rates, plus support for research expenses, conference attendance, and consumables. This is supported by a grant from National Institute for Health Research Oxford Health Biomedical Research Centre. The BRC aims to bring together researchers from across the fields of health and science to improve the translation of research findings into clinical practice. The Brain Technologies theme specifically focuses on using innovative technologies to improve understanding, diagnosis, and treatment of brain disorders. This includes research into neuroimaging, neurostimulation, neuropharmacology, and cognitive neuroscience.

Both projects would be a collaboration between the OHBA (<http://www.ohba.ox.ac.uk>) and FMRIB (<http://www.fmrib.ox.ac.uk>), both of which are part of the Wellcome centre for Integrative Neuroscience (WIN - <https://www.win.ox.ac.uk>).

Applicants should have at least an upper second-class honours degree in a relevant subject area and previous research experience. Education to Master's degree level is highly desirable. Fees will cover home rates only (not overseas rates).

Potential applicants are **asked to contact the above-named supervisors as a first step** to discuss their application. **You will require supervisor support in order to submit a full application.**

If you have supervisor support to submit an application then you will need to apply for both the DPhil in Psychiatry and this studentship via the main University online graduate application form, and pay an application fee of £75. The application form, all supporting materials required for the programme (including references) and payment must be submitted by the appropriate studentship deadline. To access the application form and application guide please visit our website at www.graduate.ox.ac.uk/apply

Deadline for submission of applications: 12.00 midday (UK time) on Friday 1st December 2023
Studentship Code: 24PSYCH02WEB