Job title | Postdoctoral Researcher in Signal Processing
---|---
Division | Medical Sciences Division
Department | Nuffield Department of Clinical Neurosciences (NDCN)
Location | John Radcliffe Hospital, Headington, Oxford, OX3 9DU
Grade and salary | Grade 7: £ 31,604-£42,418 p.a.
Hours | Full-Time (37.5 hours)
Contract type | Fixed term for 2 years (subject to milestones completion at 9 months)
Reporting to | Dr Katie Warnaby
Vacancy reference | 132457
Additional information | The project is to develop slow wave activity saturation (SWAS) as a marker of depth of anaesthesia. The post is available from January 2018.

The role
Reporting to Principal Investigator (PI), Dr Katie Warnaby. You will work closely with the PI and the established project team to develop a depth of anaesthesia monitor. The new monitor harnesses an individualised biomarker called slow wave activity saturation (SWAS) that will ensure perception loss for each individual patient during anaesthesia. You will optimise an existing Bayesian prediction model and develop a prototype anaesthesia monitoring system. The system will allow identification of SWAS in real-time using recordings of electrical brain activity under anaesthesia. In collaboration with the project team, you will help optimise the prototype system for surgical anaesthesia in a small patient study in Oxford. As part of a one-month long trip, you will also assist with the implementation of the prototype system in a larger feasibility study based in New Zealand. This final study is designed to confirm the clinical effectiveness of the SWAS biomarker by demonstrating improved patient outcomes after surgery. The project is based at the new Wellcome Centre for Integrative Neuroimaging (WIN) in Oxford. It is funded by the Medical Research Council (MRC) Development Pathway Funding Scheme, subject to completion of pre-defined project milestones.
Responsibilities

- Manage own academic research and administrative activities. This involves small scale project management to co-ordinate multiple aspects of work to meet deadlines
- Adapt existing and develop new scientific techniques and experimental protocols
- Test hypotheses and analyse scientific data from a variety of sources, reviewing and refining working hypotheses as appropriate
- Contribute ideas for new research projects
- Develop ideas for generating research income, and present detailed research proposals to senior researchers
- Collaborate in the preparation of scientific reports and journal articles and occasionally present papers and posters
- Act as a source of information and advice to other members of the group
- Represent the research group at external meetings/seminars, either with other members of the group or alone
- Carry out collaborative projects with colleagues in partner institutions and research groups
- Assist with creation and teaching of electroencephalography (EEG) and anaesthesia workshops

Selection criteria

Essential

- Hold a PhD/DPhil degree in engineering, computing science or other relevant subject, together with relevant experience
- Possess sufficient specialist knowledge to work within established research programmes
- Ability to develop and apply signal processing methods to real-time data
- Ability to manage own academic research and associated activities
• Ability to contribute ideas for new research projects and research income generation

• Excellent communication skills, including the ability to write for publication, present research proposals and results, and represent the research group at meetings

This job includes the following hazards or safety-critical activities which will require successful pre-employment health screening through our Occupational Health Service before the successful candidate will be allowed to start work:

• Work in clinical areas with direct contact with patients

• Travel outside of Europe or North America on University Business

Desirable

• Experience of independently managing a discrete area of a research project

• Experience of EEG data analysis and artefact rejection techniques

• Experience of modelling burst suppression and pharmacokinetic/pharmacodynamic effects in anaesthesia

• Experience of real-time software-hardware interfacing, graphic user interfaces and prototype systems and brain-computer interfaces

Research Background Information

Project: Developing slow-wave activity saturation as a marker of depth of anaesthesia
Anaesthetists still have no robust way of knowing when an individual experiencing general anaesthesia stops perceiving the outside world. Consequently, many anaesthetists increase the population-based anaesthetic dose to provide a safety margin that ensures the patient is unaware during surgery. Despite this, some patients still experience intraoperative awareness, which can have distressing long-term psychological consequences. Potentially more importantly, there is an increasingly recognised risk of adverse short and long-term post-operative outcomes associated with over-anaesthesia, particularly in elderly, young and vulnerable patients.

Current monitors used to assess depth of anaesthesia generate indexes of consciousness derived from non-specific and population-based EEG measures of brain activity. They have limited neurobiological supporting evidence and questionable efficacy. There is a need for an individualised brain-based depth of
We propose a depth of anaesthesia monitor using our individualised measure of perception loss called slow-wave activity saturation (SWAS). Our experimental and clinical observations show that the brain’s electrical activity saturates at slow wave frequencies (0.5-1.5Hz) with increasing anaesthetic dose. Our simultaneously acquired fMRI data indicate that this electrophysiological endpoint is a key transition when an individual brain becomes unresponsive to external events under general anaesthesia. Subsequently, we have shown that SWAS occurs during surgical anaesthesia for different hypnotic agents and in the presence of anaesthetic co-induction agents, such as opioids and muscle relaxants.

We have recently developed a real-time Bayesian prediction model (BPM) that will allow titration of surgical anaesthesia to SWAS, thus achieving perception loss within that individual. It dynamically tracks changes in the individual’s brain’s electrical activity as a function of drug concentration, and has several free parameters that may be dynamically updated across time and with varying anaesthetic dose. Constraints on these parameters will be applied initially (e.g. to specify the expected SWAS level dependent on age, etc.) and through time (e.g. to allow for expected interactions between hypnotic and opioid levels). The model will also be applied to multiple frequencies to allow interactions between frequencies (e.g. slow waves and alpha frequencies).

This three-year project is funded by the Medical Research Council, subject to completion of project deliverables at each phase. The project’s primary objective is the development of a prototype system and demonstration of its feasibility of use in a busy operating theatre. The project will be achieved in three project phases, with this advertised post extending from the project start until six months into Phase 3. We will first optimise the SWAS-BPM (Phases 1 and 2) and apply the prototype system to titrate surgical anaesthesia to SWAS in 20 patients using a standardised propofol-fentanyl anaesthetic induction (Phase 2). We will confirm clinical feasibility by applying an optimised system in a second study of 200 patients in New Zealand (Phase 3). For both patient studies, we need to develop a prototype system with an intuitive graphic output and reliable interfacing with the EEG hardware.

Success of the study will be assessed primarily on lack of conscious response in the patients using a modified version of the isolated forearm test (IFT). As secondary outcomes, we will compare the patients’ autonomic/somatic stability and quality of post-operative recovery with control incidences. This study will enable a larger late-stage clinical trial of a SWAS-based depth of anaesthesia monitor with a commercial partner.

The already established SWAS research team consists of Katie Warnaby, Jamie Sleigh, Lara Prisco, Saad Jbabdi, Myles Allen and Irene Tracey. Dr Katie Warnaby, the PI and project manager, leads the anaesthesia neuroimaging programme at the Wellcome Centre for Integrative Neuroimaging and Nuffield Department of Clinical Neurosciences. Professor Jamie Sleigh and Dr Lara Prisco are both practicing consultant anaesthetists. Professor Sleigh is a world leader in anaesthetic mechanisms and depth of anaesthesia monitoring. His team at the Waikato Hospital in New Zealand have extensive experience in performing
successful large-scale clinical EEG trials using various depth of anaesthesia monitors. Myles Allen is the developer of the SWAS-Bayesian Prediction Model and is a Professor of Physics at the University of Oxford. Associate Professor Saad Jbabdi is a senior member of the FMRIB Centre’s Analysis Group. Professor Irene Tracey is Head of the internationally-leading Nuffield Department of Clinical Neuroscience at the University of Oxford.

For further information, please contact Dr Katie Warnaby (katie.warnay@ndcn.ox.ac.uk) by email.

About the University of Oxford

Welcome to the University of Oxford. We aim to lead the world in research and education for the benefit of society both in the UK and globally. Oxford’s researchers engage with academic, commercial and cultural partners across the world to stimulate high-quality research and enable innovation through a broad range of social, policy and economic impacts.

We believe our strengths lie both in empowering individuals and teams to address fundamental questions of global significance, and in providing all of our staff with a welcoming and inclusive workplace that supports everyone to develop and do their best work. Recognising that diversity is a great strength, and vital for innovation and creativity, we aspire to build a truly diverse community which values and respects every individual’s unique contribution.

While we have long traditions of scholarship, we are also forward-looking, creative and cutting-edge. Oxford is one of Europe’s most entrepreneurial universities. Income from external research contracts in 2014/15 exceeded £522.9m and ranked first in the UK for university spin-outs, with more than 130 spin-off companies created to date. We are also recognised as leaders in support for social enterprise.

Join us and you will find a unique, democratic and international community, a great range of staff benefits and access to a vibrant array of cultural activities in the beautiful city of Oxford.

For more information please visit www.ox.ac.uk/about/organisation

Medical Sciences Division

The Medical Sciences Division is an internationally recognized centre of excellence for biomedical and clinical research and teaching, and the largest academic division in the University of Oxford. World-leading programmes, housed in state-of-the-art facilities, cover the full range of scientific endeavour from the molecule to the population. With our NHS partners we also foster the highest possible standards in patient care.

For more information please visit: www.medsci.ox.ac.uk
The Wellcome Centre for Integrative Neuroimaging

Established in 2017, the Wellcome Centre for Integrative Neuroimaging (WIN) is a multi-disciplinary neuroimaging research facility which encompasses the Oxford Centre for Functional MRI of the Brain (FMRIB), Oxford Centre for Human Brain Activity (OHBA, Department of Psychiatry) and imaging facilities within the Department of Experimental Psychology. It focuses on the use of Magnetic Resonance Imaging (MRI) for neuroscience research, along with related technologies such as Transcranial Magnetic Stimulation, transcranial Direct Current Stimulation, MEG and EEG.

WIN aims to bridge the gap between laboratory neuroscience and human health, by exploiting the capacity of neuroimaging to provide measurements that are sensitive to cellular phenomena and that can also be acquired in living humans. This is achieved by focussing on five themes: Cross-Species Neuroimaging, Cross-Scale Relationships, Population Data Mining, Open Neuroimaging and Clinical Markers. For a list of publications outlining the work of the WIN, please see: https://www.win.ox.ac.uk

The Nuffield Department of Clinical Neurosciences

The Nuffield Department of Clinical Neurosciences (NDCN), led by Prof Irene Tracey, has over 350 staff and 100 postgraduate students. NDCN has an established research and teaching portfolio with a national and international reputation for excellence.

NDCN is based in high quality research and clinical facilities in the West Wing of the John Radcliffe Hospital, alongside the Department’s world-class Oxford Centre for Functional MRI of the Brain (FMRIB), the Weatherall Institute of Molecular Medicine (which houses 3 of our research groups) and provides the ideal facilities to translate research from bench to bedside. In keeping with the award of NIHR Comprehensive Biomedical Research Centre status, to a partnership between Oxford University and the Oxford Radcliffe Hospitals NHS Trust, we have developed a highly integrated and interdisciplinary environment in which research, teaching, clinical training and clinical care interact. This enables us to establish new approaches to the understanding, diagnosis and treatment of brain diseases. To this end the Department fosters collaborations worldwide and warmly welcomes visiting scientists, clinical fellows and students. The Department comprises five sections:

For more information visit: www.ndcn.ox.ac.uk

Nuffield Division of Anaesthesia

NDA is led by Associate Professor Andrew Farmery. The NDA is committed to the development and maintenance of internationally competitive research programmes in pain and consciousness; respiration and hypoxia; adult and neuro-intensive care; simulation and human factors training.

For more information visit www.nda.ox.ac.uk

Division of Clinical Neurology

DCN is led by Professor Kevin Talbot. DCN is committed to the development of research programs that improve understanding of the nervous system in health and disease.

For more information visit www.dcn.ox.ac.uk
Centre for Functional Magnetic Resonance Imaging of the Brain
FMRIB is led by Professor Heidi Johansen-Berg. FMRIB is an internally recognised human neuroimaging centre housing both 3T and 7T scanners. The Centre has strong programmes of research in MR physics, image analysis and the applications of neuroscience in health and disease.
For more information visit www.fmrib.ox.ac.uk

Nuffield Laboratory of Ophthalmology
NLO is led by Professor Russell Foster, who leads the Sleep & Circadian Neuroscience Institute. NLO pursues scientific and clinical research into a range of areas related to vision, the eye and circadian neuroscience.
For more information visit www.nlo.ox.ac.uk

Centre for the Prevention of Stroke & Dementia
CPHD is led by Professor Peter Rothwell. The centre carries out research that increases understanding of the causes of cerebrovascular disease. Its aims are to improve prevention of stroke and dementia by earlier diagnosis, more reliable prognostication, and more effective use of existing preventive treatments in routine clinical practice.
For more information visit https://www.ndcn.ox.ac.uk/divisions/cpsd

Working at NDCN
NDCN actively promotes a healthy work life balance amongst employees through a number of family friendly policies. See http://www.admin.ox.ac.uk/personnel/staffinfo/benefits/ for further information.

The University of Oxford is a member of the Athena SWAN Charter and holds an institutional Bronze Athena SWAN award. The Department of Clinical Neurosciences holds a departmental Silver Athena award in recognition of its efforts to introduce organisational and cultural practices that promote gender equality and create a better working environment for both men and women.

How to apply
Before submitting an application, you may find it helpful to read the ‘Tips on applying for a job at the University of Oxford’ document, at www.ox.ac.uk/about/jobs/supportandtechnical/.

If you would like to apply, click on the Apply Now button on the ‘Job Details’ page and follow the on-screen instructions to register as a new user or log-in if you have applied previously. Please provide details of two referees and indicate whether we can contact them now.

You will also be asked to upload a CV and a supporting statement. The supporting statement should explain how you meet the selection criteria for the post using examples of your skills and experience. This
may include experience gained in employment, education, or during career breaks (such as time out to care for dependants).

Your application will be judged solely on the basis of how you demonstrate that you meet the selection criteria stated in the job description.

Please upload all documents as PDF files with your name and the document type in the filename

All applications must be received by **midday** on the closing date stated in the online advertisement.

**Information for priority candidates**

A priority candidate is a University employee who is seeking redeployment because they have been advised that they are at risk of redundancy, or on grounds of ill-health/disability. Priority candidates are issued with a redeployment letter by their employing departments.

If you are a priority candidate, please ensure that you attach your redeployment letter to your application (or email it to the contact address on the advert if the application form used for the vacancy does not allow attachments)

Should you experience any difficulties using the online application system, please email recruitment.support@admin.ox.ac.uk. Further help and support is available from www.ox.ac.uk/about_the_university/jobs/support/. To return to the online application at any stage, please go to: www.recruit.ox.ac.uk.

Please note that you will be notified of the progress of your application by automatic emails from our e-recruitment system. Please check your spam/junk mail regularly to ensure that you receive all emails.

**Important information for candidates**

**Pre-employment screening**

Please note that the appointment of the successful candidate will be subject to standard pre-employment screening, as applicable to the post. This will include right-to-work, proof of identity and references. We advise all applicants to read the candidate notes on the University’s pre-employment screening procedures, found at:

www.ox.ac.uk/about/jobs/preemploymentscreening/.
The University’s policy on retirement

The University operates an Employer Justified Retirement Age (EJRA) for all academic posts and some academic-related posts. From 1 October 2017, the University has adopted an EJRA of 30 September before the 69th birthday for all academic and academic-related staff in posts at grade 8 and above. The justification for this is explained at: www.admin.ox.ac.uk/personnel/end/retirement/acrelretire8+.

For existing employees, any employment beyond the retirement age is subject to approval through the procedures: www.admin.ox.ac.uk/personnel/end/retirement/acrelretire8+.

From 1 October 2017, there is no normal or fixed age at which staff in posts at grades 1–7 have to retire. Staff at these grades may elect to retire in accordance with the rules of the applicable pension scheme, as may be amended from time to time.

Equality of Opportunity

Entry into employment with the University and progression within employment will be determined only by personal merit and the application of criteria which are related to the duties of each particular post and the relevant salary structure. In all cases, ability to perform the job will be the primary consideration. No applicant or member of staff shall be discriminated against because of age, disability, gender reassignment, marriage or civil partnership, pregnancy or maternity, race, religion or belief, sex, or sexual orientation.

Benefits of working at the University

Training and Development
A range of training and development opportunities are available at the University. Further details can be found at www.ox.ac.uk/staff/working_at_oxford/training_development/index.html.

For research staff only: Support for Research Staff
There is a particularly wide range of support for career development for research staff. Please visit: www.ox.ac.uk/research/support-researchers to find out more.

Pensions
The University offers generous occupational pension schemes for eligible staff members. Further details can be found at www.admin.ox.ac.uk/finance/epp/pensions/pensionspolicy/.

Information for international staff (or those relocating from another part of the UK)
A wealth of information is available on the University’s International Staff website for staff who are relocating to Oxford from abroad, at www.admin.ox.ac.uk/personnel/staffinfo/international/.
The University of Oxford Newcomers' Club
The Newcomers' Club is aimed at helping partners of newly-arrived visiting scholars, graduate students and academic members of the University to settle in and to meet people in Oxford.

Transport schemes
The University offers a range of travel schemes and public transport travel discounts to staff. Full details are available at www.admin.ox.ac.uk/estates/ourservices/travel/.

University Club and University Sports Facilities
The University Club provides social, sporting and hospitality facilities. It incorporates a Club bar, a cafe and sporting facilities, including a gym. See www.club.ox.ac.uk for all further details.

University staff can use the University Sports Centre at discounted rates, and have the chance to join sports clubs. Please visit www.sport.ox.ac.uk/oxford-university-sports-facilities.

Childcare and Childcare Vouchers
The University offers quality childcare provision services at affordable prices to its employees. For full details about the services offered, please visit www.admin.ox.ac.uk/childcare/. NB: Due to the high demand for the University's nursery places there is a long waiting list.

The University also offers nursery fee payment schemes to eligible staff as an opportunity to save tax and national insurance on childcare costs. Please visit www.admin.ox.ac.uk/childcare.

Disabled staff
The University is committed to supporting members of staff with a disability or long-term health condition and has a dedicated Staff Disability Advisor. Please visit www.admin.ox.ac.uk/eop/disab/staff for further details.

BUPA - Eduhealth
Bupa Eduhealth Essentials private medical insurance offers special rates for University of Oxford staff and their families www.eduhealth.co.uk/mini-site/.

All other benefits
For other benefits, such as free entry to colleges, the Botanic Gardens and staff discounts offered by third party companies, please see www.admin.ox.ac.uk/personnel/staffinfo/benefits/.