

## PhD Studentship

### Harmonisation and quantification of PET imaging for lung diseases

This project aims to develop a lung test-object deformable phantom with tissue mimicking materials to validate recently developed methods for improved quantification of diseased lung tissue with Positron Emission Tomography and Computed Tomography (PET/CT), and assess the accuracy and reproducibility of lung PET imaging in a multi-centre clinical setting.

This ultimate aim of this project is to improve the accuracy and precision of lung imaging using PET/CT, and provide standardised protocols to enable reproducible measurements between clinical centres.

This studentship is part of a close collaboration between the Institute of Nuclear Medicine at UCL, the National Physical Laboratory in the UK and GlaxoSmithKline (GSK) and builds upon an existing international 'PET in lung disease collaboration initiative' involving 16 institutions (5 industrial, 5 academic and 6 clinical partners) formed in 2016 with the aim of standardising imaging of lung disease. The PhD studentship is EPSRC Industrial CASE funded with industrial support from NPL and additional input from GSK. The funding covers an annual stipend (at least £17,280) and tuition fees at the rate for UK/EU nationals for **4 years**.

The student will be part of the UCL EPSRC Centre for Doctoral Training in Intelligent, Integrated Imaging In Healthcare (i4health).

### Project

About 10,000 people are diagnosed with a lung disease every week, with one death from the condition every 5 minutes in the UK, accounting for 20.1% of deaths in 2012. Non-invasive molecular imaging techniques such as PET/CT provide functional and structural information used to develop novel imaging biomarkers that can play an important role in diagnosing lung abnormalities and assessing disease progression and treatment response. However, accurate quantification of radiopharmaceutical uptake from lung PET/CT data is challenging due to respiratory motion and the presence of large variations in fractions of tissue, air, blood and water. Image quality is further degraded by positron range effects as well as image reconstruction and registration approaches. To address these challenges a lung test-object phantom will be developed to validate air fraction, positron range and motion correction methods.

The project will involve design using CAD software, Monte Carlo simulations, experimental measurements including movement, data analysis, contributing to international conferences and journals.

The student will be located within the Institute of Nuclear Medicine (INM) at the University College London Hospital, but will regularly visit NPL for experiments. The supervisory team will include Prof Kris Thielemans and Dr Robert Moss at UCL, and Dr Andrew Robinson at NPL with further input from Mr Fred Wilson at GSK.

### Facilities

#### *University College London (UCL)*

UCL is ranked highly in the world in World University Rankings and publications from UCL have the highest number of citations outside the US. UCL hosts one of the largest and most productive centres for biomedical

science in Europe. Staff and students enjoy a wide range of facilities including on-line access to most journals, but also sports facilities.

A wide variety of lectures and seminars take place at UCL to which PhD students can normally attend. Of particular note are the MRes lectures for the i4health Doctoral Training Programme.

#### *UCL Institute of Nuclear Medicine*

The Institute of Nuclear Medicine has a long track record in Nuclear Medicine with publications across a wide range of applications including cardiology, neuro-psychiatry and oncology, utilising state-of-the-art instrumentation including SPECT/CT and PET/CT and more recently PET/MRI. Professor Thielemans leads a research group in Medical Physics applied to Nuclear Medicine and Molecular Imaging Science within INM, with close links to the Centre for Medical Image Computing (CMIC). The group has active research in the areas of tomographic reconstruction, resolution, scatter and motion correction, tracer kinetic modelling and optimised instrument design.

#### *National Physical Laboratory*

NPL will provide access to the NMI lab (SPECT-CT-PET camera) and the Rapid Phantom Prototyping Lab (3D Printing). These unique facilities will enable the project to investigate the production of novel 3D printing materials and provide traceable PET imaging data.

#### *GlaxoSmithKline*

GSK is a global pharmaceutical company with an interest in the use of quantitative PET/CT to support the development of novel drugs for respiratory diseases and will support this project through the provision of funding and supervisory support from the perspective of an end user.

### **Requirements**

Candidates must meet the UCL graduate entry requirements which include holding at least an upper second class degree or equivalent qualifications, in a relevant subject area such as physics, biomedical engineering or applied mathematics. A Master's degree in a relevant discipline and additional research experience would be an advantage.

EPSRC has restrictions on eligibility, for instance related to residency within the UK, see <https://epsrc.ukri.org/skills/students/help/eligibility/>.

### **Application**

Informal enquiries can be addressed to Prof. Thielemans ([k.thielemans@ucl.ac.uk](mailto:k.thielemans@ucl.ac.uk)). For a formal application, please e-mail [k.thielemans@ucl.ac.uk](mailto:k.thielemans@ucl.ac.uk) a covering letter outlining your motivation for the position and two referees, your CV and evidence of courses and grades achieved. Shortlisted candidates will be required to provide transcripts of previous degrees. Please use subject header "PhD UCL-NPL-GSK".

Application closing date: 23<sup>rd</sup> of April 2019.

Expected start date: October 2019, but this can be discussed.

### **Further information**

UCL Institute of Nuclear Medicine: <https://www.ucl.ac.uk/nuclear-medicine>

i4health: <https://www.ucl.ac.uk/healthcare-engineering/training/study/epsrc-centre-doctoral-training-intelligent-integrated-imaging-healthcare-i4health>

UCL Graduate Prospectus: <http://www.ucl.ac.uk/prospective-students/graduate/>

NPL: <https://www.npl.co.uk/medical-physics>

GSK R&D: <https://www.gsk.com/en-gb/research/>