LONDON'S GLOBAL UNIVERSITY

Job Description

Research Fellow in Synchrotron Imaging of Bio-Mechanics

Grade: 7

This post is funded for two years in the first instance.

Department: UCL Mechanical Engineering

Location: European Synchrotron (ESRF), Grenoble, France

Reports to

Prof. Peter D. Lee and Dr. Joseph Brunet

About the Project

Would you like to help generate the world's highest resolution imaging of ex vivo human bio-mechanics? A new Research Fellow position is available to join the UCL team at the European Synchrotron (ESRF) doing just this. Your post will focus on developing methods of stepped dynamic imaging to better understand the bio-mechanics of organs like the spine, lung, and heart. You will be based at ESRF (Grenoble, France) to develop and apply Hierarchical Phase-Contrast Tomography (HiP-CT, see mecheng.ucl.ac.uk/HiP-CT), generating 4D scans with near cellular (micron) resolution.

HiP-CT offers the chance to capture dynamic processes within organs through quasi-dynamic imaging across the length scales, enabling direct insights into biological mechanisms such as the expansion and contraction of blood vessels or the effect of osteoarthritis (OA) on both soft and hard tissues in joints.

As part of this role, you will develop methods to use stepped dynamic imaging to measure the properties of tissue *in situ*. For example, you will provide new insights into how anatomical and structural characteristics of heart muscle and vasculature affect the success of treatment such as angioplasty or percutaneous valve deployment. The HiP-CT results will be used to inform multiscale computational models with unprecedented resolution.

The overall project is led by Peter Lee and Claire Walsh in the UCL Mechanical Engineering Department and Paul Tafforeau at ESRF (www.esrf.eu), together with an international set of collaborators. The overall HiP-CT project involves about twenty Postdocs and PhD students. Mechanical Engineering has a strong track record in healthcare engineering through the Institute of Healthcare Engineering (www.ucl.ac.uk/healthcare-engineering/).

About the Location: ESRF, Grenoble, France

ESRF is the world's first 4th generation high-energy synchrotron, producing the world's brightest X-rays. It is a centre of excellence for fundamental and innovation-driven research in condensed and living matter science. Located in Grenoble, France, the ESRF owes its success to the international cooperation of 22 partner nations. It is a unique place to work, combining interdisciplinary science with a lovely location.

About the Collaborators

The project is an international interdisciplinary collaboration between scientists and mathematicians at UCL, ESRF and clinicians in Germany, the UK and France, together with many other collaborators.

You will be working directly with Peter D Lee, Joseph Brunet, Ryo Torii, Rebecca Shipley, and Claire Walsh and colleagues in Mechanical Engineering on the imaging, rig design and modelling. You will also work with clinicians and anatomical specialists, including Dr Joe Jacob in CABI on the lungs, Prof. Andrew Cook in the UCL Institute of Cardiovascular Science on the heart, and Prof. Andy Pitsillides at the Royal Veterinary College on OA.

In addition to your core project, you will also be part of a Hub helping groups worldwide learn and apply the HiP-CT technique to a range of biomedical applications, including neurology (with the Harvard/MIT Martinos Centre), lung disease (with UCLH and Antwerp) and prostate cancer (with Aachen and Mainz). You will help continue to develop the Human-Organ-Atlas.esrf.eu .

Context

Funded by the Chan Zuckerberg Initiative, you will be part of an International Collaboration to continue developing and applying Hierarchical Phase-Contrast Tomography

(HiP-CT). Your project will focus on applying HiP-CT to image and quantify our organs and joints to improve our understanding of biomechanics.

Main purpose of the job

This is an exciting opportunity to work in a team developing multi-disciplinary, cutting-edge technologies. The person taking this role will be based at the ESRF with regular visits to UCL. You will focus on developing methods to measure the bio-mechanical and flow properties *in situ* (but *ex vivo*). Additionally, you will apply image reconstruction algorithms, digital volume correlation, and image correlation to other modalities to help develop models of blood and air flow, and tissue mechanics.

The post will require a motivated researcher who is prepared to work with biological samples and develop test rigs. You will be computationally adept, helping automate reconstruction, ML analysis of 4D volumes, and segmenting the images for use in image-based modelling. The role will require close co-working with researchers from a range of backgrounds and disciplines, in a collaborative team. You will be responsible for supporting beamtimes and coordinating samples/results on joint projects.

Duties and responsibilities

- To develop and perform in situ experiments with HiP-CT on large biological samples, including musculoskeletal and pulmonary applications.
- To perform bio-mechanical characterisation by coupling the experimental and modelling results.
- To apply (and develop) imaging analysis techniques, especially digital volume correlation, to interpret quasi-dynamic biological system behaviour.
- To help develop new sample preparation and HiP-CT techniques for dynamic experiments.
- To help operate the Human Organ Atlas Hub (HOAHub), working with groups worldwide, performing HiP-CT scans, analysis, and training others in these aspects.
- To liaise and collaborate with biologists, clinicians, and other imagers to analyse and interpret the results.
- To disseminate the results in appropriate peer-reviewed journals, meetings, workshops, and conferences.
- To contribute to engagement activities.
- To help supervise MSc and PhD students.
- To contribute to the overall activities of the research team and Department as required.

Person Specification

Criteria	Essential or Desirable	Assessment method (Application/Interview)
Qualifications, experience and knowledge		
• PhD in a relevant discipline (e.g. bio-mechanical or other engineering, computational biology, biophysics)	Essential	Application
• Experience in bio-mechanical characterisation and an understanding of bio-mechanics	Essential	Application, Interview
• Experience in performing imaging experiments, ideally in situ	Essential	Application, Interview
• Experience in imaging, ideally synchrotron tomography experiments with biological systems	Essential	Application, Interview
• Experience in large data handling	Desirable	Application, Interview
Skills and abilities		
• Ability to understand and interpret experimental data from 3D imaging, ideally biomedical	Essential	Application, Interview
• Skilled at understanding and modifying coding scripts in a team environment (e.g. Matlab and Python in GitHub)	Essential	Application, Interview
• Ability to perform, understand and interpret statistical analysis techniques	Essential	Application, Interview
• Effective written and verbal communication skills, which can be adapted to a range of audiences, including the public and media	Essential	Application, Interview
• Skilled at handling and preparing biological samples	Desirable	Application, Interview
Personal attributes		
• Willingness to work collaboratively, within a team	Essential	Interview
• Commitment to high-quality, interdisciplinary research	Essential	Application, Interview
• Commitment to UCL's policy of equal opportunity and the ability to work harmoniously with colleagues and students of all cultures and backgrounds	Essential	Interview