PhD Studentship

At University College London working with ESRF, and part of the Centre for Doctoral Training in Intelligent, Integrated Imaging In Healthcare (i4health)

STUDENTSHIP TITLE: Macro-to-molecular correlative X-ray imaging of strain during spinal joint loading; PRIMARY SUPERVISORS: *Prof. Peter D Lee, Federico Bosi and Himadri S Gupta (QMUL)*

Project Background

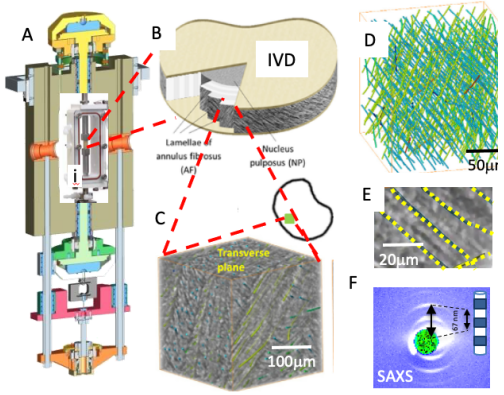
Fibrillar composites are ubiquitous in biological structural organs, with their mechanobiology critical for physiological function, and their multiscale structural/ mechanical changes in disease or injury often critical to loss of function. Treatment for these conditions imposes a huge healthcare burden. The bioengineering challenge is to determine the correlated 3D deformation and structural changes at the molecular-, fibrillar-, and cell-matrix length-scales under physiological load in intact tissue, and how these alter in ageing, injury and disease. Phase-contrast tomography (pCT) and small-angle X-ray scattering (SAXS) powerful tools for supramolecular changes and fibre-array architecture, whose integration would enable a step-change in understanding such multiscale biophysical dynamics.

This is a joint project between University College London (UCL) and Queen Mary University of London (QMUL), funded by Engineering and Physical Sciences Research Council (EPSRC), in collaboration with ESRF (www.esrf.eu), Diamond Light Source (www.diamond.ac.uk), University of Manchester and Oregon State University (USA). It aims to develop a path-breaking new X-ray bioengineering imaging modality (Tomo-SAXS) combining synchrotron phase-contrast tomography (micro) and X-ray scattering (nano) imaging in the same platform to visualize biophysical structural dynamics from the molecular to the macroscale in hydrated collagenous tissues concurrently.

Your role will be to apply tomography combined with digital volume correlation (DVC) image analysis methods to understand the mechanisms of injury in the IVD, starting with idealised synthetic collagen mimics and progressing to deformation of whole-joint animal models. Deep Learning and other AI techniques may be used to couple modalities. Computational modelling of the experimental data may be included depending on the student's interests. Your project will be aligned with the groups developments in novel tomographic and Deep Learning imaging techniques, and you will be working with groups at the UCL main campus (see https://mecheng.ucl.ac.uk/hip-ct/), QMUL, Harwell Campus (https://www.rc-harwell.ac.uk) and ESRF (www.esrf.eu). Most of the group sit at Harwell Campus; you could be based at UCL Bloomsbury, but will need to spend a significant amount of time at Harwell and ESRF when developing and performing experiments.

Person Specification:

Applicants should ideally have a first class undergraduate degree (or equivalent) in Physical Sciences (Computer Science, Engineering, Mathematics and Physics) with a preferred route through any core Engineering discipline (e.g. Bioengineering/Biomedical Engineering, Mechanical Engineering, Chemical, Electrical Engineering, etc.). All applicants must be able to demonstrate strong mathematical skills and ideally have experience in modelling Applicants should have an interest in bioengineering combined with medical imaging as this is core to our projects. Excellent organisational, interpersonal and communication skills, along with a stated interest in interdisciplinary research, are essential.



In situ dynamic multi-modal imaging from the macro to molecular-level during loading of spinal joints. Deep learning techniques are required to couple modalities.

Closing Date and Start Date:

Applications considered on a rolling basis until position is filled. Latest start date available Sept 2021.

Value of award:

Full home student tuition fees and stipend of ca. £17,000 per annum (for up to 3 years, with possible 4th year if required.)

Eligibility:

The position is open to students on Home Fees and applicants whose first language is not English are usually required to provide evidence of proficiency in English by UCL. Please do not enqire about this studentship if you are ineligible. Please refer to the following website for eligibility criteria: https://www.ucl.ac.uk/prospective-students/graduate/research-degrees/mechanical-engineering-mphil-phd

Application Process:

Please send an expression of interest and current CV to Prof peter.lee@ucl.ac.uk.
Further details at ***http://bit.ly/TomoSAXS_PhD1***