



BHF 4-Year Multidisciplinary PhD Programme – Theme and Structure

This multidisciplinary DTP 'Pathways to Cardiovascular Health through novel Imaging and AI' will train a new generation of researchers proficient across the disciplines of cardiovascular biology, imaging technologies, and computer sciences to develop innovative solutions for cardiovascular health and disease.

The programme comprises three interwoven research themes:

1. Imaging Across the Scales (molecules to man) – Development and application of multiscale imaging modalities to study molecular, cellular and whole tissue dynamics, cardiovascular inflammation, and electrophysiological function, utilising optical (microscopy, photoacoustics), ultrasound, X-ray phase contrast, and MRI techniques.

2. Al and Data Science in Cardiovascular Research – Leveraging machine learning and big data analytics to improve cardiovascular disease modelling, patient stratification, risk prediction, and enhance image capture and analysis.

3. Models, Systems and Engineering – Mathematical and numerical models of hemodynamics, disease processes, artificial valves, smart structures and imaging systems to deepen understanding and facilitate design.

This interdisciplinary programme will ensure students receive a broad training that integrates cardiovascular science, engineering, imaging technologies, data science and computational modelling. Each project will be jointly developed and supervised by University of Birmingham (UoB) and University College London (UCL) faculty members. All students will have physical access to both institutions, ensuring strong interdisciplinary, cross-institutional collaboration. The supervisory team will be interdisciplinary, thus each student will have one supervisor from a biological discipline (e.g., cardiovascular physiology, vascular biology, immunology) and another from a technological discipline (e.g., imaging physics, AI, data science). We have in excess of 100 PIs signed up to the proposed programme. We will not only train a new generation of multidisciplinary scientists but foster novel collaborative projects amongst PIs.

First year students will enter a programme of structured training that combines fundamentals in cardiovascular disease at UoB and applied AI and imaging at UCL. We will deliver bespoke specialist workshops including: 1. Intellectual property, enterprise and commercialisation/industry, 2. Presentation skills, paper review, journal club and writing skills, 3. Using generative AI in research, and 4. EDI, PPI and ethical issues in research. Introduction to hands-on research tools and interdisciplinary collaboration across UoB and UCL will provide students with wide exposure to biological and technological environments before they commit to their PhD project.

Years 2-4 will focus on research specialisation, with joint supervision and further targeted training from both institutions. This will incorporate an annual symposium, shared training, and joint mentorship, fostering deeper integration and encouraging new collaborative research projects between groups at the two universities.

Students will have access to state-of-the-art facilities, including Birmingham's Centre of Membrane Proteins and Receptors (COMPARE), Intravital imaging suites, cardiac optical mapping facilities and UCL's Centre for Advanced Biomedical Imaging (CABI), Hawkes Institute (Centre for Medical Image Computing), Collaborative Healthcare Innovation through Mathematics, EngineeRing and AI (CHIMERA), and the Multiscale Cardiovascular Engineering Group. Students will gain expertise in biomedical research, imaging, computational science, and translational applications. Graduates will be highly competitive for careers in academia, industry, and healthcare, strengthening the UK's cardiovascular research ecosystem and paving the way for future discoveries.