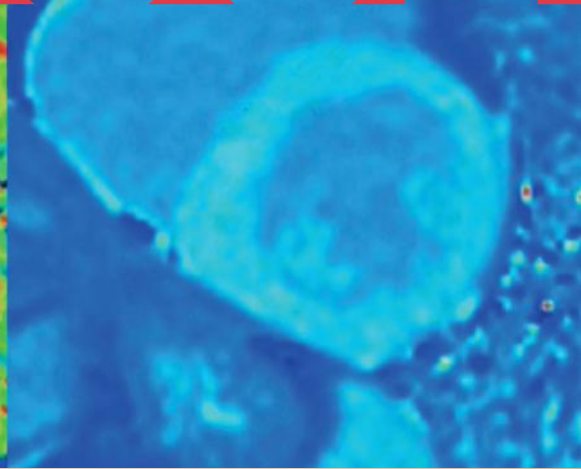
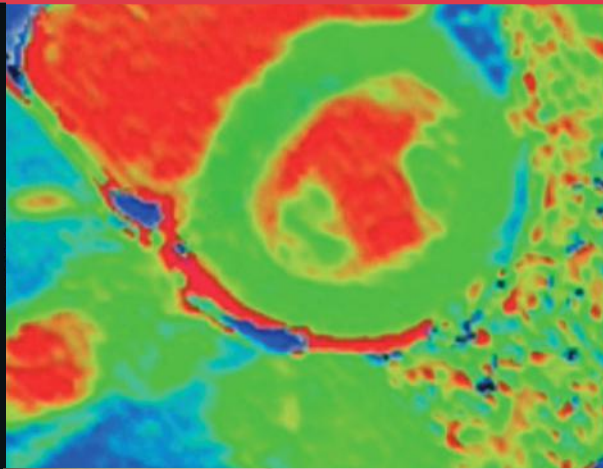
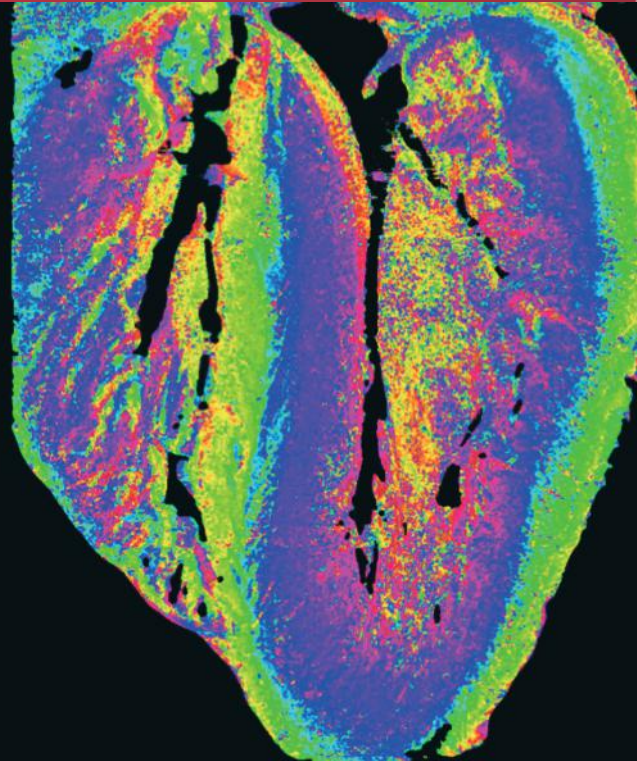
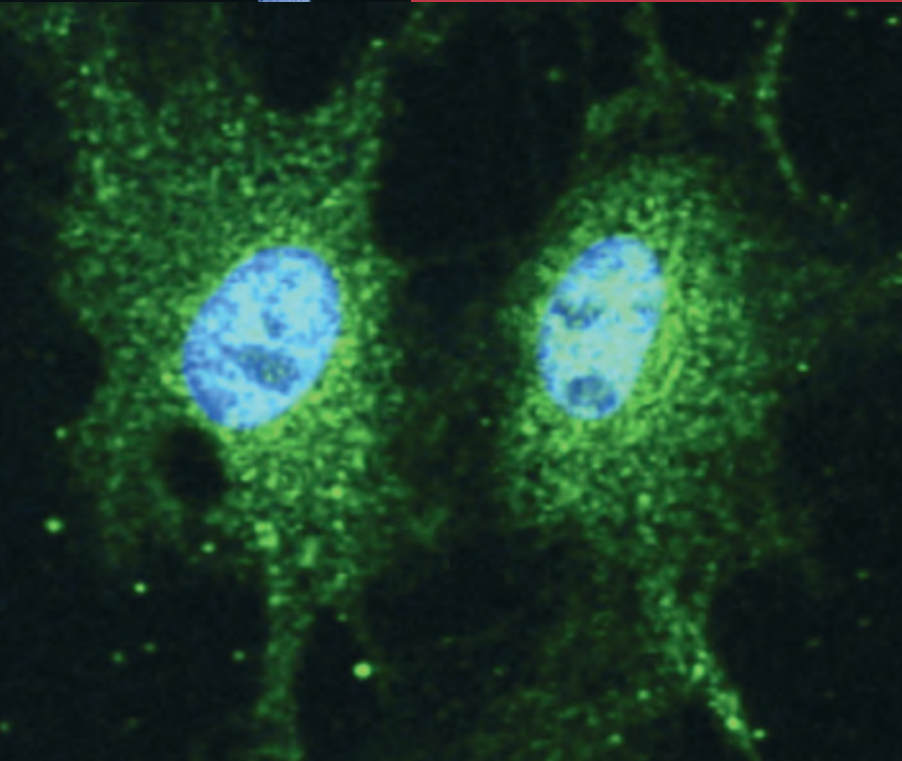




# UCL

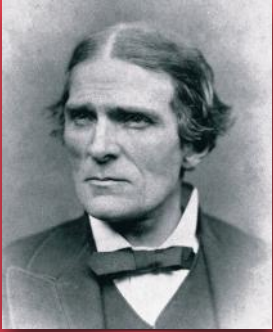


**UCL Institute of  
Cardiovascular Science**



# A CENTURY OF INNOVATION

UCL RESEARCHERS HAVE BEEN LEADERS IN THE STUDY AND TREATMENT OF CARDIOVASCULAR DISEASE FOR MORE THAN A CENTURY.



**JOHN BURDON-SANDERSON FRS (1828-1905)**

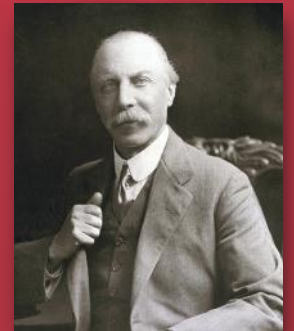
*UCL JODRELL PROFESSOR OF PHYSIOLOGY*

LED THE DEVELOPMENT OF PHYSIOLOGY AS A SCIENCE IN BRITAIN

**EDWARD SHARPEY-SCHAFER FRS (1830-1935)**

*UCL JODRELL PROFESSOR OF PHYSIOLOGY*

DISCOVERED ADRENALINE AND COINED THE TERMS 'ENDOCRINE' AND 'INSULIN'



**SYDNEY RINGER FRS (1836-1910)**

*UCL PROFESSOR OF MEDICINE*

SHOWED CALCIUM IS NEEDED FOR HEART CONTRACTION AND DEVELOPED A PHYSIOLOGICAL SOLUTION.

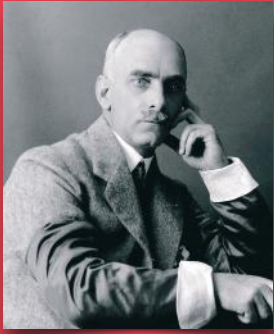
**ERNEST STARLING FRS (1866-1927)**

*UCL JODRELL PROFESSOR OF PHYSIOLOGY*

DISCOVERED THE FRANK-STARLING LAW OF THE HEART AND THE STARLINGS FORCES IN CAPILLARIES







**THOMAS LEWIS FRS (1881-1945)**

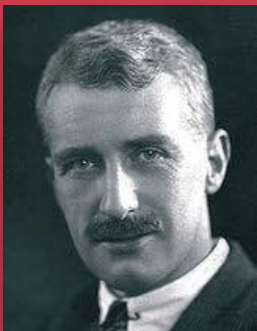
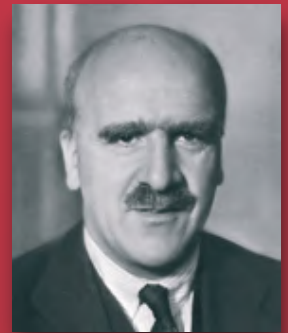
**CARDIOLOGIST, UCL HOSPITAL**

INTRODUCED JUGULAR VENOUS PRESSURE MEASUREMENT AND  
ELECTROCARDIOGRAPHY INTO CLINICAL PRACTICE

**JBS HALDANE FRS (1892-1964)**

*UCL PROFESSOR OF GENETICS*

WORKED ON THE PROPERTIES OF BLOOD AND DEVELOPED  
THE SCIENCE OF POPULATION GENETICS



**AV HILL FRS (1886-1977)**

*UCL JODRELL PROFESSOR OF PHYSIOLOGY*

DESCRIBED OXYGEN BINDING TO HAEMOGLOBIN AND RECEIVED  
A NOBEL PRIZE FOR WORK ON MUSCLE

NEARLY A CENTURY AFTER UCL WAS FORMED, ICS SCIENTISTS AND CLINICIANS  
CONTINUE TO LEAD THE WORLD IN CARDIOVASCULAR RESEARCH, INNOVATION AND  
EDUCATION.

## OUR INSTITUTE

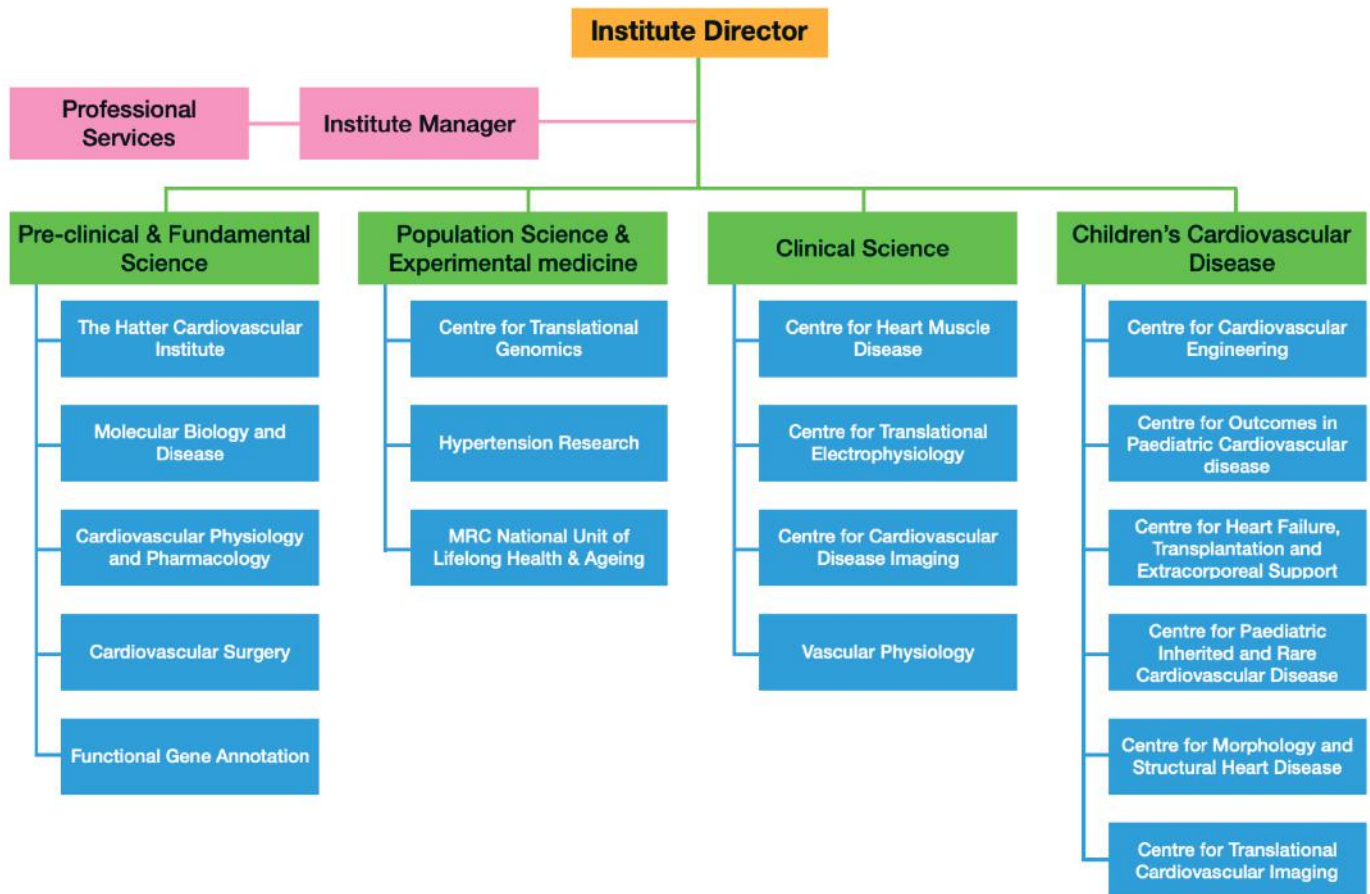
In 2011, the UCL Institute of Cardiovascular Science (ICS) was created to be a World-class hub of cardiovascular research, partnering with other UCL departments and clinical centres at UCLH, Royal Free, Great Ormond Street and Barts and the Royal London.

The institute is currently spread across 11 university and hospital locations throughout north London (see image below). The institute has 110 staff, including 24 principal investigators, and 60 research fellows (mainly funded by UKRI and BHF). In addition, another 100 honorary staff make vital contributions to research, education, and training.



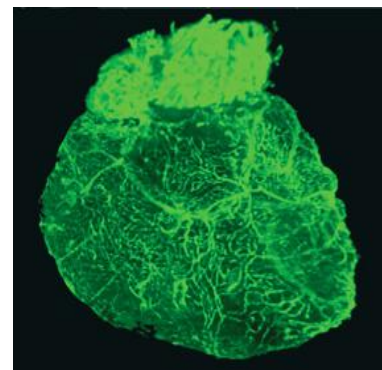
Map of the location of or principal investigators including both UCL buildings and partner hospital sites

ICS is grouped into four research departments, each of which administers a diverse range of research groups/centres and principal investigators:



## PRECLINICAL AND FUNDAMENTAL SCIENCE

The goal of the Research Department for Pre-clinical and Fundamental Science is to understand biological processes that control the development and functions of the vasculature and the heart and to translate this knowledge into treatments for human cardiovascular diseases. Key programmes of research include annotation of genes relevant to human cardiovascular disease, transcription factors controlling heart development and their role in diseases such as key signalling pathways required for new blood vessel growth (angiogenesis), the development of genetically modified biological heart valves for improved durability, strategies for protection against ischaemia and reperfusion injury in the heart, and the development of novel therapeutic approaches for treating coronary artery disease and pulmonary arterial hypertension.





## POPULATION SCIENCE AND EXPERIMENTAL MEDICINE

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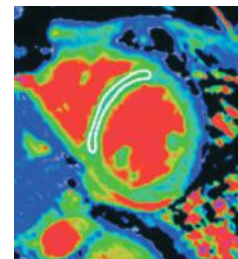


The Research Department of Population Science and Experimental Medicine comprises clinicians and scientists with expertise in various aspects of cardiometabolic disease and aging. It includes the MRC Unit for Lifelong Health and Ageing at UCL, which hosts several longitudinal studies, including the National Survey of Health and Development (the 1946 Birth Cohort), and leads the COVID-19 National Core Study on Longitudinal Health and Wellbeing. Activities in the department range from discovery science, through detailed cardiometabolic phenotyping to influencing policy. Research on-going in the department includes the investigation of genetic variation influencing risk of disease, causal mechanisms responsible for cardiometabolic disease and drug target validation using genetic approaches, characterization of cardiometabolic phenotypes in the population and their relationship to exposures over the life course, the identification of biological and social factors affecting lifelong health, aging and chronic disease risk, and research in hypertension and cardiovascular diseases, with particular expertise in early and later phase clinical trials.

## CLINICAL SCIENCE

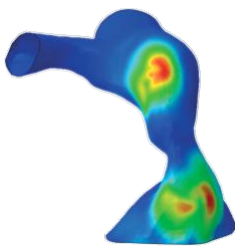
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The Research Department of Clinical Science is dedicated to the promotion of clinical excellence and World-class translational research and education. The department comprises clinical and basic researchers based at UCL but linked to some of the UK's leading organisations in healthcare delivery and cardiovascular research including St. Bartholomew's Hospital and The Royal Free Hospital. The Department is organised into several centres including Heart Muscle Disease, Translational Electrophysiology and Cardiovascular Imaging. The Department has a broad portfolio of research aligned to the UCL Biomedical Research Centre strategic themes of cardiovascular 'omics' and informatics, biomarker discovery for precision medicine and advanced phenotyping. The overarching goal of the Department is to act as a catalyst for collaborative research with direct impact on human health.



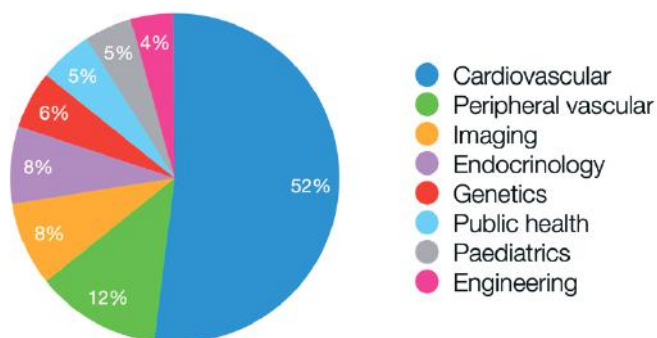
## CHILDREN'S CARDIOVASCULAR DISEASE

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The Research Department of Children's Cardiovascular Disease is one of the largest paediatric cardiovascular research groups in the World. Its mission is to improve the lives of children with heart disease through patient centred research with demonstrable clinical outcomes. The department comprises clinical, computer science and engineering researchers based at UCL and linked to Great Ormond Street hospital, which is the largest clinical paediatric cardiology programme in the country. The main areas of clinical research in the department are the use of big data for precision, predictive & personalised medicine (using clinical data, genomics, metabolomics, radiomics and outcomes); paediatric cardiac transplantation; inherited cardiovascular disease and pulmonary hypertension in children; patient communication; and cardiac surgery and morphology. While our main engineering focuses are development of advanced imaging techniques; Improved visualization for clinical practice including virtual reality; and computational modelling of devices.

## OUR RESEARCH



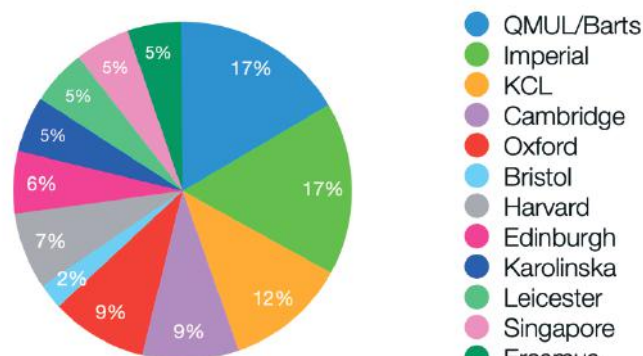
Percentage of Publications

## OUR RESEARCH IS HIGHLY DIVERSE

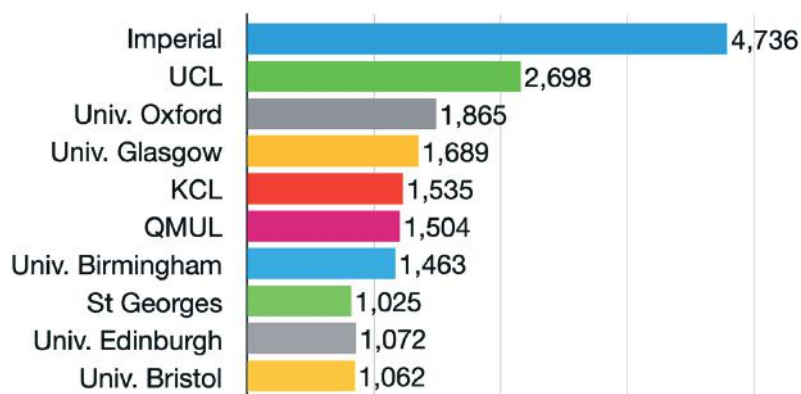
While most of our research is cardiovascular in nature, principal investigators at ICS also perform research in a wide range of other impactful areas.

## OUR RESEARCH IS HIGHLY COLLABORATIVE

UCL research is recognized as being collaborative with 89 % of studies involving non-UCL research partners. ICS research is also collaborative both nationally and internationally.



Percentage of Collaborations

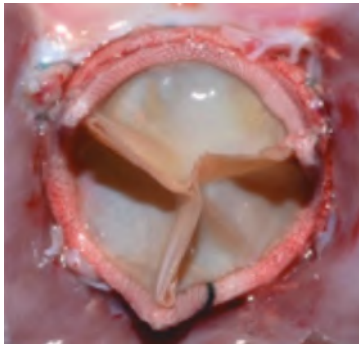


Number of papers 2017-2022

## OUR RESEARCH IS NATIONALLY COMPETITIVE

UCL ranks 2<sup>nd</sup> in terms of research output in the cardiovascular domain. Internationally, UCL ranks 17<sup>th</sup> and is one of only 2 UK institutions in the global top 20.

## EXAMPLES OF TRANSLATION



Prof Christopher McGregor and colleagues developed a new type of artificial heart valve based on pericardial material from genetically modified pigs (Gal free). The absence of the Gal antigen results in significantly improved durability (withstanding 200 million cycles of in vitro durability with no observable damage), with first in man studies imminent. This research has the potential to revolutionise the surgical treatment of valve disease and accelerate efforts in cardiac xenotransplantation.

Prof Alun Hughes and Prof Nish Chaturvedi have led a team investigating Long Covid using sophisticated phenotyping tools. The team have provided policymakers and NICE with information on Long Covid burden of disease, risk factors, definition and long-term outcomes via original research and a SAGE report. The results led to an enhanced NHS service specification and have played an important role in the NICE evidence assessment and living guidelines.



Dr Richard Issitt has found a way of using immunoadsorption columns during paediatric cardiac transplantation to remove mismatched antibodies that can lead to transplant rejection. By filtering out specific antibodies, the child's blood doesn't need to be completely removed and replaced. This consequently halves the amount of donated blood required during the transplant, allowing larger, older children to have an 'incompatible' transplant – making them more likely to be matched with a suitable heart.

Prof Pier Lambiase and colleagues studied outcomes of the EFFORTLESS registry of patients with subcutaneous implantable cardioverter-defibrillators. In this diverse S-ICD registry population, spontaneous shock efficacy was consistently high over 5 years. Very few patients underwent S-ICD replacement with a transvenous device for pacing indications. Importantly, treated, and self-terminating arrhythmic episodes predict future shock events, which should encourage more personalized device optimization in the future.





## EDUCATION

A strong educational programme is essential to the success of the Institute. Our programme allows us to inspire and educate the next generation of cardiovascular researchers and healthcare professionals, and ensures the success of our central mission, to reduce cardiovascular disease. Furthermore, as one of the premier cardiovascular research hubs in the world we believe it is our obligation to translate our research excellence into teaching excellence.



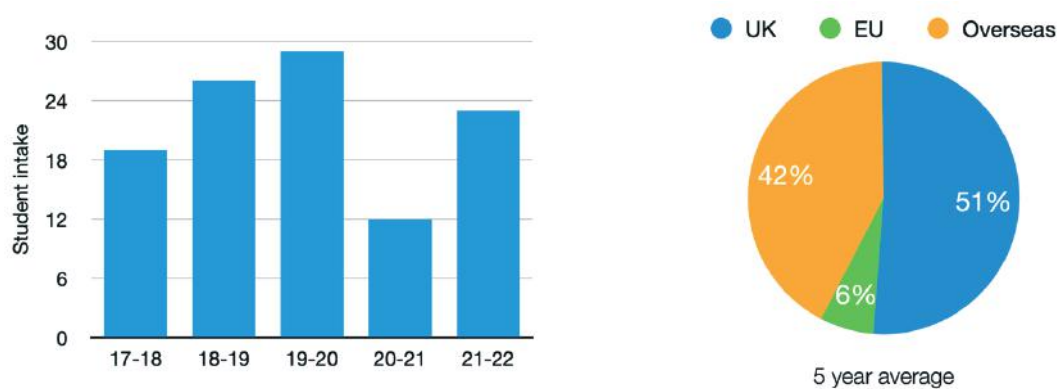
*Students partaking in a VR cardiac anatomy teaching session*

## POST-GRADUATE RESEARCH STUDENTS

Doctoral students are the lifeblood of research, and a PhD from UCL remains a highly sought after degree. Since its inception ICS has had a major focus developing strong post-graduate programmes with a mix of basic science, engineering, and clinical PhDs. We have two 4-year PhD programmes (funded by the BHF and MRC) focussed on interdisciplinary cardiovascular science and data science. In addition, a significant proportion of PhDs are funded through individual grants many of which are clinical research fellowships.

## MSC IN CARDIOVASCULAR SCIENCE

The MSc programme, taught by cardiovascular scientists and clinicians, offers the opportunity to learn about topical areas in cardiovascular science, preparing students for further research or a career in industry, or healthcare. The MSc is highly popular with a wide range of applicants from both scientific and clinical backgrounds, with increasing student intake between 2017 and 2020.



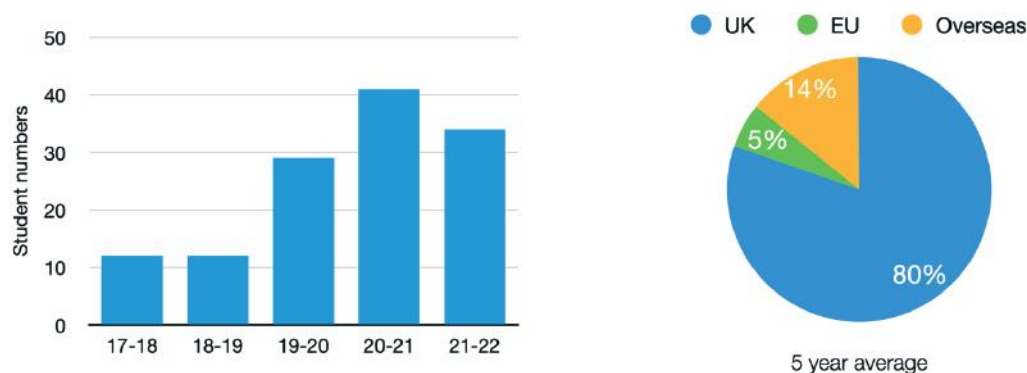
The MSc is a 180-credit course taught over 2 terms. In term 1, students take three compulsory modules (total 60 credits) and in term 2, two to four optional modules (total 60 credits). In term 3, students commence their independent research project (60 credits). Currently, the most popular modules are cardiovascular science and disease, and congenital heart disease.

### MSC IN INTEGRATED BIOMEDICAL, SOCIAL AND DATA SCIENCE

This MSc is planned to start in 2023 and is a collaboration across several research domains. Modules will include - Fundamentals of Population Science, Frontiers in Measurement, Data Science and Statistics, Multidisciplinary Perspectives on health Inequalities and Applied Data Science. This new MSc aligns closely with other post-graduate educational outputs at UCL and leverages the faculty's considerable international reputation in population health science.

### INTEGRATED BSc IN CARDIOVASCULAR SCIENCE

The integrated BSc (iBSc) in Cardiovascular Science provides undergraduate medical students with a rigorous foundation in cardiovascular science and its application in clinical and healthcare settings. The iBSc was launched in 2016 and is highly popular with UCL medical students, seeing a significant increase in numbers over the last five years. In fact, the iBSc regularly accepts >10% of the whole 3<sup>rd</sup> year cohort at UCL medical school. As it is one of only four iBSc in cardiovascular science in the UK, it also attracts large numbers of students from outside UCL. There are a significant number of overseas students (enrolled in MBBS programme) who choose to do the iBSc.



## EQUALITY, DIVERSITY, AND INCLUSION

Equality, Diversity and Inclusion run deeply through ICS and UCL. As an Institute, we recognise that our strength lies in our staff and student populations, and we are strongly committed to promoting a culture of collective responsibility that supports our staff and students in all departments. To achieve this, we have identified and implemented measures to ensure equality, diversity and inclusion of all staff and students irrespective of gender and sexual orientation, race or ethnicity, religion, and cultural belief, disability, or caring responsibilities. This was recognised by the renewal in 2017 of the Silver Athena SWAN award for ICS.



ICS researchers are involved in outreach activities focussed on underrepresented communities, with the aim of improving health education and inspiring young people to pursue a career in science and medicine.

This includes the EDI committee championing gender equality by raising awareness of issues affecting heart and cardiovascular health in women. This program was launched at the first International Women's Day event: 'Hidden in Plain Sight – Heart Disease in Women'.



*Panel members: Prof Vishwanie Mahadeo, Dr Charlotte Manisty and Dr Gaby Captur*



# OUR MISSION

IN THE UK THERE ARE AROUND 7.6 MILLION PEOPLE LIVING WITH HEART AND CIRCULATORY DISEASES, MORE THAN TWICE THE NUMBER OF PEOPLE WITH CANCER AND ALZHEIMER'S DISEASE COMBINED. DESPITE SEVERAL DECADES OF PROGRESS IN CARDIOVASCULAR MEDICINE AND PUBLIC HEALTH INITIATIVES, CARDIOVASCULAR DISEASE (CVD) REMAINS THE MOST COMMON CAUSE OF DEATH IN DEVELOPED NATIONS AND IS BECOMING INCREASINGLY IMPORTANT IN DEVELOPING NATIONS. MOREOVER, RECENT TRENDS REVEAL A SLOWDOWN IN THE RATE OF DECLINE IN DEATH RATES FROM CVD PARTICULARLY IN YOUNGER AGE GROUPS. IF THIS CONTINUES, THERE IS LIKELY TO BE AN EXCESS MORTALITY FROM CVD OVER AND ABOVE WHAT WOULD BE EXPECTED FROM A GROWING AND AGEING POPULATION.

OUR MISSION IS TO REDUCE THE IMPACT OF CARDIOVASCULAR DISEASE THROUGHOUT THE LIFE COURSE BY CONDUCTING INNOVATIVE RESEARCH FOR THE PREVENTION AND TREATMENT OF DISEASES OF THE HEART AND CIRCULATION, WORLD-CLASS TEACHING AND TRAINING IN CARDIOVASCULAR SCIENCES AND FORWARD-THINKING POLICY DEVELOPMENT AND ADVOCACY.

# OUR FUTURE



For decades, translational research and public health policies have impacted favourably on the burden of cardiovascular disease, but heart failure, sudden cardiac death and stroke remain the largest cause of years lost due to disability and early death in all regions of the World. Persistence of this health burden has been attributed to a false optimism that cardiovascular disease is no longer a public health issue, but other contributory factors include diagnostic imprecision, gene-environment interaction, ageing, co-morbidity and societal inequities.

While the UK remains competitive as a global research hub, supported by generous research networks and global partnerships, it will need to become even more effective in translating science into clinical solutions and products in the post-Brexit/post-Covid era.

The UCL Institute of Cardiovascular Science is host to a vibrant and successful community of basic and clinical scientists dedicated to the better understanding of fundamental mechanisms of cardiovascular disease and their diagnosis, prevention and treatment throughout the life course. Our strategy for the next five years is to focus on scientific programmes that drive therapeutic innovation and position UCL and its partners as global leaders in cardiovascular research and education.

In his Harveian Oration on Clinical Science at the Royal College of physicians, London in 1933, Sir Thomas Lewis said of William Harvey:

*'He established for us a tradition, a tradition that Clinical Science shall not be confined narrowly or by artificial boundaries, but shall be free to search how and where it will: a tradition which will not countenance attempts to separate the study of health from that of disease or the study of animals from that of man, or work at the bedside from that of laboratories.'*

This collaborative approach to the study of the cardiovascular system in health and disease is and will remain the founding principle for cardiovascular research at UCL.

**Professor Perry Elliott MBBS; MD; FRCP; FESC; FACC**  
**Director | UCL Institute of Cardiovascular Science**