

## Heart Failure

The Division has a distinguished record in heart failure research, especially in the areas of diastology, myocardial imaging, cardiac resynchronisation therapy (CRT) and contractility modulation. Current efforts are focused on cardiogeriatric research, advanced heart failure, end-of-life care, and heart failure service models.

**Theme 1:** Recently launched projects include a study on Undiagnosed heart Failure in frail Older (UFO) individuals and the Shatin Advanced Heart Failure Registry (SAHFIRE). UFO is elucidating the scale of heart failure in frail and pre-frail elderly in the community through formal frailty assessment, functional capacity testing and cardiac screening. It is designed to take advantage of omics technologies and biosignatures to define heart failure subphenotypes. Findings from UFO may lead to new diagnostic and therapeutic approaches. We are also involved in a multidisciplinary effort to maximise the range of mechanical circulatory support and end-of-life care pathways for patients with advanced heart failure. This ongoing research has been presented at international meetings, including the European Society of Cardiology Congress, among others.

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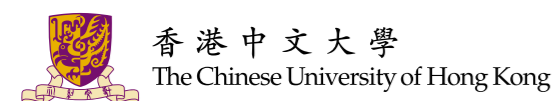
**Theme 2:** Our team is exploring the optimal integration of multidisciplinary care to improve self-management in patients with heart failure. A Multidisciplinary Heart Failure Clinic was set up in 2017, with the aim of reducing heart failure re-hospitalisation and mortality. We have also participated in many multi-centre clinical trials for new heart failure drugs and therapies.

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## Heart Valve Disease

The cardiac imaging team and the heart valve surgical team are conducting research on a new pathogenic mechanism and treatment strategy for mitral valve disease. Our team has discovered that mitral annulus disjunction occurs in 42% of patients with mitral valve prolapse undergoing transesophageal echocardiography. This represents an intrinsic annular abnormality that leads to paradoxical annular enlargement and flattening during systole. The extent of annular disjunction is related positively to the degree of mitral regurgitation. Such dynamic abnormalities of the annulus may be related to decoupling of the annular and ventricular functions. A paper on this research was published in *JACC: Cardiovascular Imaging* in 2017 and was selected as the Image of the Month on the cover of the December issue of this journal, highlighting the significance of the work.

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## Interventional Electrophysiology and Device Therapy

Interventional Electrophysiology is a fast-growing field and one of the recent research interests of our team is searching for a safer and more efficient technology to deliver lesions via different energy sources during catheter ablation. Apart from tachyarrhythmia management, we are involved in researching direct His bundle pacing for heart failure, a leadless pacemaker for bradycardia, and the use of a non-invasive 3-dimensional global electrocardiac mapping system.

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## Interventional Cardiology

In the rapidly-evolving field of interventional cardiology, our team is at the forefront of advanced interventional techniques and procedures. For example, we were the first in the region to perform left atrial appendage occlusion, renal artery sympathetic denervation and optical coherence tomography (OCT). Our group has also led an investigator-initiated multinational randomised controlled study, which was supported by Hong Kong Research Grants Council, to evaluate a novel intra-coronary drug delivery system. We also conduct regular workshops at our centre, featuring live case demonstrations and lectures on advanced techniques, complications and challenges in interventional cardiology.

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## Peripheral Vascular Disease and Endovascular Interventions

We currently perform the highest volume of complex endovascular procedures for critical limb ischemia and thromboembolic diseases in Hong Kong. Our Combined Vascular Medicine & Intervention Program, which is held in collaboration with vascular surgery, orthopaedic surgery, endocrinology and podiatry, is supported by multiple grants from the S.K. Yee Medical Foundation for providing limb saving endovascular therapy. We are also interested in the development of novel endovascular devices and alternative therapies. We have performed large animal pre-clinical and subsequent first-in-man trials for a novel nitinol woven-self expanding stent. In addition, we recently completed an investigator initiated randomised placebo-controlled trial funded by the Food and Health Bureau of the HKSAR Government to investigate the use of traditional Chinese medicine (Danshen and Gegen) in the treatment of intermittent claudication.

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## Cardiology

The Division of Cardiology aspires to become a world leader in cardiovascular medicine through a continuous commitment to excellence in patient care, medical education and scientific research. Our Division is engaged in a broad spectrum of research programmes, ranging from basic bench science and translational investigation to clinical trials, biomedical engineering, epidemiological studies and health economics. Our mission is to understand the underlying causes of cardiovascular diseases, develop new treatments and improve quality outcomes. Our efforts have earned us an international reputation in several areas of cardiovascular medicine, particularly in heart failure, echocardiography and cardiac resynchronisation therapy.

# DEPARTMENT OF MEDICINE AND THERAPEUTICS CARDIOLOGY



“ We are proud of our past, but have our sights set on the future. We are dedicated to meeting the challenges of providing innovative and compassionate care to our patients. ”

**Joseph Yat Sun CHAN**  
Head of Division

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## Cardiovascular Advancement, Research and Education

With the generous support of the Lui Che Woo Institute of Innovative Medicine (LCW IIM), we established the Cardiovascular Advancement, Research and Education (CARE) research initiative in 2012. The aim of CARE is to advance cardiovascular education, research and patient care through the synergetic efforts of both clinical and research scientists. These scientists are performing pioneering studies in molecular and genetic/epigenetic mechanisms and translational research related to chronic cardiovascular diseases. With the interdisciplinary strengths and expertise brought together under this initiative, we believe we will be able to identify new mechanisms and develop novel therapies for cardiovascular diseases.

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## Atrial Fibrillation

Atrial fibrillation (AF) along with the associated risk of stroke in our ageing population is an issue of growing concern. Our group is engaged in large-scale population screening using handheld Electrocardiography (ECG) and contact-free devices with automatic diagnostics. We are also interested in cost-effective strategies of AF detection and stroke prevention. To date, we have found AF grossly underdiagnosed and undertreated as the awareness and knowledge of AF is low in Hong Kong. Our work is funded by the Hong Kong Research Grants Council and published in *Circulation* and *Clinical Cardiology*. Recognition for our work includes the best abstract award in AF at the European Society of Cardiology Congress 2017 as well as coverage of our AF facial detection project in *American Heart Association News* and *MIT News*.

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## Clinical Outcome and Epidemiological Studies

Our group is interested in the epidemiology, clinical practice, health economics and long-term outcomes of cardiovascular diseases and interventions. Among the projects that we have undertaken, we initiated the Asia Pacific Evaluation of Cardiovascular Therapies (ASPECT) collaboration. Involving more than 70,000 patients from over 30 hospitals across Hong Kong, Singapore, Malaysia and Australia, this study benchmarked the clinical practices and outcomes of cardiac interventions and enabled us to develop a risk adjustment model for patients undergoing cardiac procedures across the Asia Pacific region. Our collaboration is funded by Hong Kong Research Grants Council, with the initial results published in the *International Journal of Cardiology* and *Value in Health*.

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## Ambulatory Haemodynamic Monitoring and Telehealth Systems

With mobile technology becoming more widely accepted in healthcare delivery, we are working closely with our Biomedical Engineering Department as well as local and overseas institutions and industries to develop unobtrusive, flexible sensing and wearable devices for health informatics. Our work is funded by the Hong Kong Innovation and Technology Commission (ITC) for the development and validation of a wearable cuffless multi-parameter haemodynamic monitor. The results of this work have been published in the *Annals of Biomedical Engineering* and *IEEE Transactions on Biomedical Engineering*.

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## Basic and Translational Science

The Division is engaged in research carried out under several translational themes, including inflammation, myocardial fibrosis, cardiomyopathy, heart failure and cardiorenal interactions. Research groups in the Division are using animal models, human clinical specimens and primary cell culture systems as well as omics technologies to investigate new signalling mechanisms and pathways. These include making use of non-coding RNA in these processes, in addition to biomarkers and biosignatures associated with the pathologies. Funding support has come from the Hong Kong Research Grants Council and the Health and Medical Research Fund of the Food and Health Bureau of the HKSAR.

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## Cardiovascular 3D Printing and Structural Heart Intervention

Minimally invasive, catheter-based structural heart intervention is increasingly used in treating structural heart diseases, such as heart valve diseases, atrial fibrillation, adult congenital heart defects, and aortic diseases. Imaging plays an important role in guiding these procedures. Our team has also pioneered the use of 3D printing for personalised planning of structural heart interventions and cardiac surgery. Supported by an Innovation and Technology Seed Project Fund (ITF), we developed the first 3D-printed pressure sensor-enhanced circulatory platform for simulated training and patient-specific procedural planning for left atrial appendage occlusion and aortic intervention. The results of our work have been published in high-impact journals such as *JACC: Cardiovascular Interventions* and *Circulation: Cardiovascular Interventions*.

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## Echocardiography and Cardiac Imaging

Our Echocardiography Laboratory continues to be at the forefront of cardiac imaging research. Since 2016, the echo lab of the CUHK/Prince of Wales Hospital has been designated by the Hospital Authority as the training centre for 1-year structural echo training for nursing sonographers at all public hospitals in Hong Kong. Among the courses we offer is the annual 3D Echo Hands-on Course organised by CUHK, which attracts over 70 attendees locally and from other Asian countries. In addition, we have been conducting the Fabry Cardiomyopathy Screening Program since 2017 to define the prevalence of undiagnosed Fabry disease among Chinese patients with left ventricular hypertrophy. Supported by the Health and Medical Research Fund and in collaboration with the Division of Rheumatology, we also completed a study on subclinical cardiovascular dysfunction in patients with connective tissue and systemic inflammatory disease using a novel technique called exercise speckle tracking echocardiography.

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## Pulmonary Hypertension and Right Heart Failure

The Division collaborates with the Division of Rheumatology on pulmonary hypertension in patients with autoimmune disorders, such as systemic lupus erythematosus and mixed connective tissue diseases. Ongoing research studies include longitudinal analysis of echocardiographic data with patient outcomes, treatment response, and patients' quality of life. On the interventional front, the Division is conducting clinical research and applying cutting-edge devices to treat patients with acute thromboembolism in the pulmonary circulation.

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