# Research

Molecular and Vascular Medicine

The crux of many diseases lies in the blood vessels. We are finding means to restore blood vessel health before adverse outcomes of diseases occur, with the goal of working towards preventive medicine. Main thrusts of our research include:

<u>Personalised Vascular Models</u>

Our lab invents methods to convert human stem cells to blood vessel cells, resembling those found in the heart and brain arteries. We also develop blood outgrowth endothelial cells directly from patients with vascular complications. These cellular models recapitulate the phenotypic and molecular changes associated with vascular pathology, opening the door to drug screening and regenerative medicine.
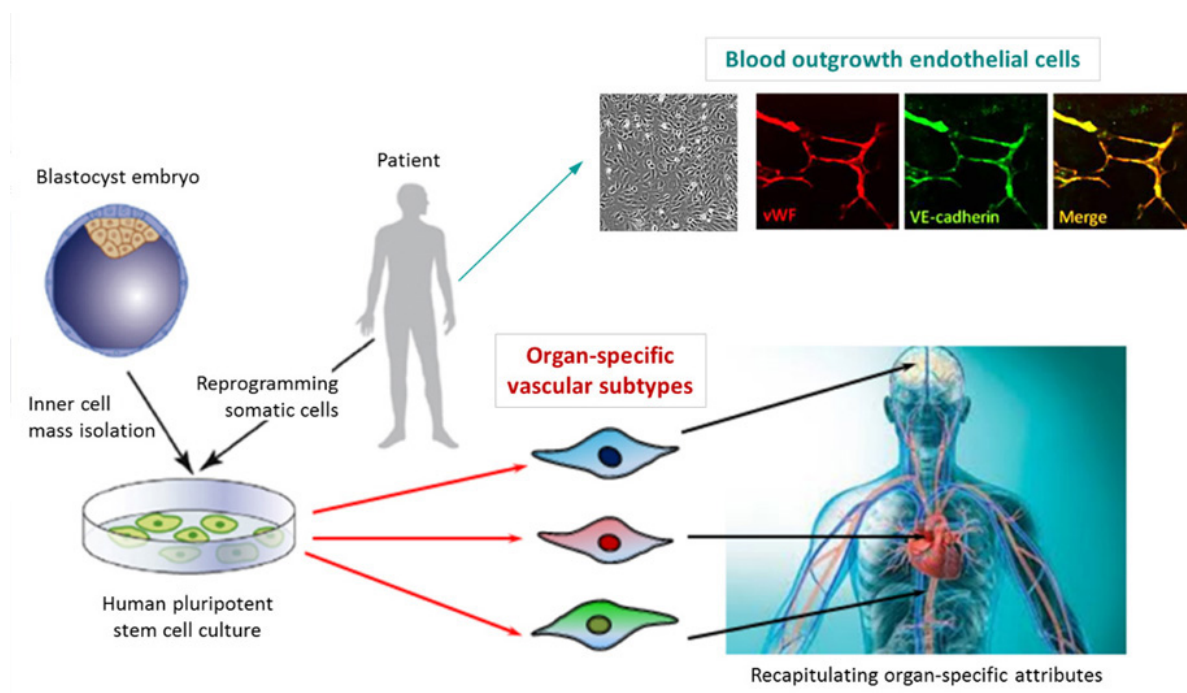
<u>Genetic Basis of Vascular Ageing</u>

Blood vessels in various organs behave differently despite similar genetic and systemic conditions. This may explain why diseases like cerebral amyloid angiopathy and CADASIL uniquely affect the vasculatures of the brain. We aim to understand how certain genetic disorders preferentially inflict vascular beds of specific organs. By employing genome editing tools and cell-based phenotypic assays, we hope to explore pathogenic mechanisms which pave the way for developing vascular-targeted therapies.

Vascular Disease Biomarkers

There remain significant knowledge gaps in the functional interpretation of clinical biomarkers in whether they are causal or a consequence in the disease process. Leveraging on our collaborations with clinicians, we elucidate biomarkers relating to key vascular processes such as blood vessel instability and inflammation. Deep-dive elucidation of such molecular signatures will enable us to unravel implicated pathways, and achieve better diagnostics for early intervention.

Human Stem Cell-Based Platform

Our lab has invented techniques to grow vascular cells from human pluripotent stem cells, resembling those found in brain arteries. By employing genome editing tools and phenotypic assays, we could recapitulate the molecular and cellular changes in cerebrovascular disease. Knowledge of pathogenic mechanisms will pave the way to developing vascular-targeted strategies for neurological disorders.

For highly-motivated individuals who are interested in PhD or other research positions in our lab, please send your detailed CV to ccheung@imcb.a-star.edu.sg.