

Cardiovascular Research Laboratory

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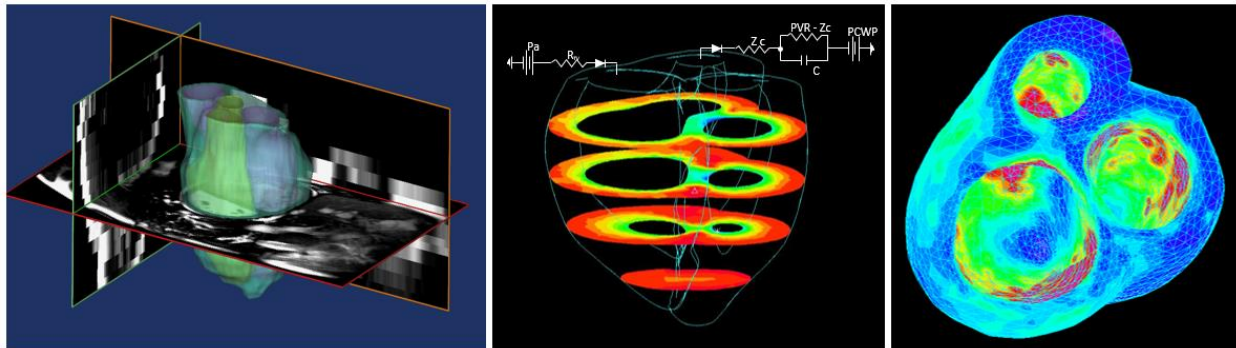
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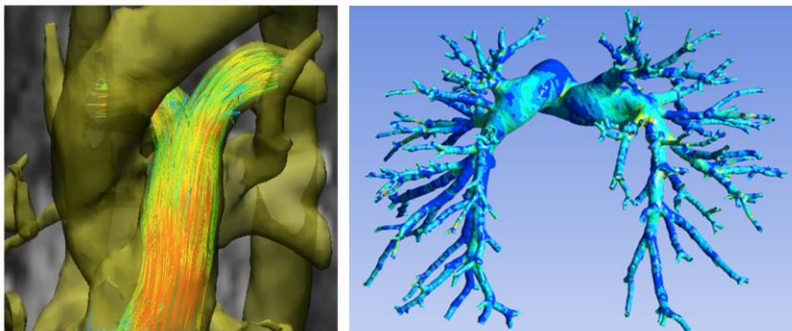
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The overall objective of the Cardiovascular Research Laboratory (CRL) is to stubbornly pursue novel methodologies to evaluate and treat adults and children with pulmonary hypertension (PH). PH is a disease of the pulmonary circulatory system, which ultimately leads to heart failure through biomechanical and biochemical mechanisms. Combining advanced magnetic resonance imaging (MRI) and computational modeling can identify novel approaches for evaluating patient disease progress, elucidate pathways of disease progression that could serve as therapeutic targets, and offer a patient-specific computational model to predict therapeutic efficacy. The picture below shows an example of a patient heart being reconstructed from MRI and used to develop a computational model:



This model can reveal mechanical stress acting on the heart and allow us to test what treatment scenarios would improve heart function.

MRI imaging can also be used to visualize the way blood flows in the heart and lungs of PH patients. When comparing PH patients with healthy subjects, we observe visible vortices that can be used to measure the extent of pulmonary vascular dysfunction and explain why some patients experience more aggressive disease. The figure below shows velocity streamlines of flow in the pulmonary artery measured using MRI (left), along with a computational model to explain what's causing the observed vortices (right).



Finally, an exciting new development in pulmonary hypertension and many cancers is the discovery of molecules that exist in blood and tissue, called micro-RNAs. In our laboratory, we employ machine learning algorithms to identify how circulating biochemical markers

can be used to phenotype a specific patient. By measuring the presence of certain markers from a simple blood test, we eventually hope to accurately diagnose the disease, estimate the severity of the disease, and identify therapeutic options that are most likely to work for the patient being evaluated.