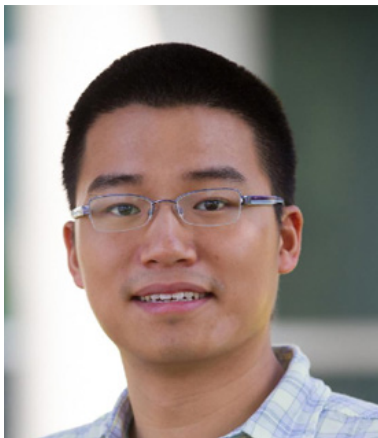


CARNEGIE MELLON UNIVERSITY

BME 2025 FALL SEMINAR SERIES



Patient-specific Modeling and Treatment for Cardiovascular Disease



PRESENTED BY

Zhenglun "Alan" Wei, Ph.D.

Assistant Professor

Department of Biomedical
Engineering

Worcester Polytechnic Institute

SCHEDULE

Doherty Hall (DH) 2315

Thursday

November 6, 2025

(9:30-10:30 AM)

Cardiovascular disease remains the leading cause of death worldwide. In children, congenital heart defects (CHDs) are the most common cause of infant mortality, affecting approximately 1% of live births in the United States. Fluid mechanics plays a critical role in the development, progression, and treatment of CHDs. Over the past decade, patient-specific modeling - both computational and experimental - has provided increasingly detailed insights into cardiovascular fluid mechanics in health and disease, driving paradigm shifts in clinical practice.

Today's talk will focus on one branch of my research program: single-ventricle abnormalities, among the most severe forms of CHDs. These defects arise when one of the two pumping chambers of the heart (ventricles) fails to develop or function properly, often requiring emergency intervention. While current treatments can achieve favorable short-term outcomes, patients frequently face significant long-term complications, including reduced exercise capacity, liver disease, and diminished quality of life.

My work aims to advance patient-specific cardiovascular modeling to (1) identify fluid mechanical factors associated with long-term complications, (2) evaluate the effectiveness of medical devices for this patient population, and (3) enable "virtual surgery" to optimize surgical strategies for single-ventricle patients.