**Multiscale modeling of cardiac growth (5U01HL119578-03)**

Sheikh Shavik Mohammad1; Julius Guccione2; Joakim Sundnes3; Samuel T. Wall3; Ghassan Kassab4; Daniel Burkhoff5; Lik Chuan, Lee1

1Department of Mechanical Engineering, Michigan State University, East Lansing, MI, U.S.A

2University of California San Francisco, San Francisco, CA, USA

3Simula Research Laboratory, Oslo, Norway

4California Institute of Medical Innovations, San Diego, CA, USA

5Columbia University, New York, NY, USA

Here, we describe the development of a multiscale computational cardiac modeling framework that bridges the physics occurring at different spatial and temporal scales. Specifically, the framework connects sub-cellular description of the coupling between electrophysiology and cross-bridge cycling to organ-level description of the coupling between different compartments of the circulatory system. Also connecting events occurring at different temporal scales, the framework describes how a short-term deviation from the homeostatic condition leads to long-term changes in ventricular shape and function. We demonstrate that the framework predictions are consistent with well-established physiology and observations, including (1) a linear end-systolic pressure-volume relationship and a linear MVO­2-PVA relationship both produced under varying preload and afterload, as well as (2) a long-term rightward shifting of the pressure-volume loop during cardiac growth and remodeling. Applications using this framework will also be presented.