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COMPUTATIONAL MODELS OF SOFT TISSUE GROWTH AND REMODELING

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JOAKIM SUNDNES[*] AND SAMUEL T. WALL[†]

[*] Simula Research Laboratory and Department of Informatics, University of Oslo
Kristian Augusts gate 23, 0164 Oslo, Norway
sundnes@simula.no

[†] Simula Research Laboratory, Kristian Augusts gate 23, 0164 Oslo, Norway
samwall@simula.no

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ABSTRACT

Biological tissues throughout the body are dynamic and respond to mechanical stimuli by adapting their anatomy and physiology. This process of growth and remodeling is essential for tissues to change and meet the body's shifting needs, such as a muscles growing stronger in response to exercise. However, growth and remodeling can also be pathological, and are central components of severe global health problems such as cancer and cardiovascular disease. Computational models are increasingly being used to understand the biomechanics and mechanobiology that govern the function and development of soft tissues. These models often incorporate growth laws that predict how a tissue will grow and remodel in response to altered mechanical stimuli. Despite recent progress, many important questions remain unresolved. For example, what are the primary mechanical stimuli that drive growth and remodeling, how are these drivers sensed and processed at the cellular level, and how can computational models effectively bridge the vast time scales involved, from a single mechanical cycle to several months of tissue change?

In this minisymposium we aim to bring together scientists from various branches of soft tissue biomechanics and mechanobiology, to address fundamental challenges in computational modeling of growth and remodeling. Relevant topics include (but are not limited to):

- Biophysically based models of growth and remodeling processes on sub-cellular and tissue scale
- Multiscale computational models of growth and remodeling, that address the fundamental challenge of disparate spatial and temporal scales in the process.
- Studies of growth and remodeling in specific progressive diseases
- Agent-based models for cell proliferation and migration
- Multiphysics and multiscale models for mechanics and mechanobiology
- Numerical methods and algorithms for multiscale and multiphysics models
- Applications of biomechanics models in cardiovascular medical and surgical treatments
- Computational tools, specialized software, and databases for cardiovascular biomechanics and mechanobiology