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BONE AND CARTILAGE MECHANOBIOLOGY: EXPERIMENTAL AND COMPUTATIONAL ASSESSMENT ACROSS THE SCALES

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ABSTRACT

There has been an increasing interest in the computational modeling of various aspects of bone and cartilage biology including the mechanobiology of structural adaptation as well as the cellular and biochemical underpinnings of tissue remodeling. In vivo experimentation with bone and cartilage tissue is very expensive and a deeper understanding of basic tissue biology is indispensable to improve treatment methods for disorders such as osteoporosis, osteoarthritis and the bone metastases of various cancer types. Bone and cartilage are multiscale in nature and tissue integrity needs to be maintained by homeostatic feedback processes regulated by cells such as osteocytes, osteoblasts, osteoclasts, and chondrocytes. These processes act across large length and time scales, which are difficult to identify based on experiments alone. Developing multiscale computational approaches together with new experimental data obtained applying latest imaging technologies allow to integrate and then interrogate these feedback processes.

This mini-symposium brings together bioengineers, biologists and mathematicians whose common goal is the advancement of current understanding of bone and cartilage tissues behavior and function. We are looking for new innovative assessment strategies including multiscale computational modeling and high resolution imaging technologies. Topics will range from musculoskeletal models describing bone-muscle interactions during daily activities such as walking or running, to joint mechanics, to micromechanical models for estimation of tissue mechanical properties, to tissue remodeling and adaptation models, to cellular models describing the complex cell interactions taking into account biochemical and biomechanical regulatory factors.