

Hanna Isaksson

“Multiscale imaging of the mechanical behavior of soft musculoskeletal tissues ”

Musculoskeletal soft tissues have unique hierarchical structure and composition that together entail their mechanical function and response to load. They are generally composed of collagen rich fibrous matrix, that together with the extracellular matrix and water makes up the tissue. The hierarchical structure of the tissues is optimized for their unique function. To understand musculoskeletal disorders and diseases, one must understand structure, composition, and functional relationships.

This presentation will give an overview of our strive towards developing synchrotron-based multiscale approaches to visualize and study soft tissues during simultaneous load, using tomographic imaging, small angle scattering and/or spectroscopic methods. It will focus on the articular cartilage and meniscus in the knee, as well as the Achilles tendon and provide examples of the application of these methods. The experiments are tailored to deliver important data for image correlation approaches, computational model development and validation. Recent findings of the importance of integrating direct in situ imaging data into computational models for articular cartilage and tendon mechanics will be presented. To summarize, it will emphasize the importance of further combined development of dedicated experiment and computational approaches, as it will be key to expanding our understanding of mechanobiological, biomechanical or biological processes in a range of musculoskeletal tissues, both in health and disease.



Hanna Isaksson is a Professor in Biomechanics at the Department of Biomedical Engineering, Lund University, Sweden. She obtained her PhD in Biomedical Engineering from Eindhoven University of Technology, the Netherlands, in 2007 in a collaborative project with the AO Research institute in Davos, Switzerland. She then spent three years as a post-doctoral researcher at the Biophysics of Bone and Cartilage research group, University of Eastern Finland, Kuopio, Finland (2008-2010), before joining the Division of Solid Mechanics at Lund University in 2011 as an Assistant Professor. Since 2014, she is leading the biomechanics research at Department of Biomedical Engineering, Lund University. Prof Isaksson's expertise is in musculoskeletal tissue mechanics, using methods from material science and solid mechanics to address research questions of relevance to orthopedics. The multidisciplinary research focuses on understanding how tissue structure, composition and mechanical function are related in health and disease, utilizing both complex experimental tissue characterization methods and advanced computational modelling. The team addresses questions related to bone and osteoporosis, knee joint tissues and osteoarthritis and, tendon tissue and tendinopathies and ruptures. She has an extensive track-record of securing research funding, including e.g. a Wallenberg Academic Fellowship and an ERC consolidator grant, and in 2024 she obtained the Erna Ebeling award from the Swedish Society for Medical Technology, for her translational osteoporosis research. She is engaged both in the national and international research community, currently as a member of the World Council of Biomechanics, and national research policy making, currently as a member of the Scientific Council for Natural and Engineering Sciences at the Swedish Research Council.