# Hanna Isaksson

## Biography

Dr. Hanna Isaksson is a professor of Biomechanics at the Department of Biomedical Engineering, Lund University, where she leads the Biomechanics team. Her expertise is in musculoskeletal tissue mechanics, using methods from material science and solid mechanics to address research questions of relevance to orthopedics. The 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.

Over the last 20 years, Hanna has authored more than 180 peer-reviewed journal articles (H-index 39, citations ~ 4,800). Her team has been pioneering the development of in situ experimental methods from the organ down to the nanoscale, required for advancing and validating computational models' ability to describe musculoskeletal tissue biomechanics and mechanobiology. Some of these outcomes aiming to significantly improve the diagnosis and treatment of orthopedic conditions were recently recognized at the IVA 100 list 2024 - Innovation through Interdisciplinary Research, as the research with the most potential to create value through commercialization, business and method development or societal impact.

She has an extensive track-record of securing research funding, including e.g. an ERC consolidator grant, and is currently the vice-head of MathKOA (an excellence center spanning three countries funded by the Novo Nordisk foundation). In 2024 she obtained the Erna Ebeling award for her translational osteoporosis research from the Swedish Society for Medical Technology. Hanna is actively involved in teaching and mentoring students, with the goals to foster and open collaborative and inclusive learning environment. She has supervised 24 PhD students (whereof 18 graduated) and 20 post-docs from diverse fields. The team members have obtained several high-recognition awards, including the best doctoral thesis by the European Society of Biomechanics and the Oscar II scholarship for the most prominent thesis at Lund University twice. Several previous team-members have secured substantial own funding and are currently academic faculty members and post-doctoral researchers in leading labs across Europe.

She is engaged both in the national and international research community, currently as a member of the World Council of Biomechanics. Moreover, she is active in national research policy making and the national funding landscape, exemplified by her previous engagement in the Swedish Young Academy and current role on the Scientific Council for Natural and Engineering Sciences at the Swedish Research Council.

# 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 the 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 expand our understanding of mechanobiological, biomechanical or biological processes in a range of musculoskeletal tissues, both in health and disease.