

Bachelor's / Master's Thesis

in collaboration with
Institute of Biomechanics

The Role of Hormonal Modulation in Musculoskeletal and Joint Modeling

Description

Musculoskeletal (MSK) modeling and multibody system (MBS) dynamics are powerful tools for understanding human movement and joint mechanics. However, current models often overlook the influence of hormonal factors, such as the **peptide hormone relaxin**, on ligament laxity, joint stability, and tissue remodeling.

Relaxin plays a significant role in sex-specific and life-stage-specific scenarios, including pregnancy, elite athletics, and hormonal therapies. Its effects on collagen turnover, tissue stiffness, and joint mechanics (e.g., in the knee and elbow) can impact injury risk, rehabilitation outcomes, and performance. For example, elevated relaxin levels are associated with increased ligament laxity, which may predispose individuals to injuries like ACL tears or joint instability.

This thesis project offers opportunities for both **Bachelor's** and **Master's** students to explore the integration of hormonal effects into MSK models. The goal is to develop or adapt computational frameworks that account for hormone-dependent tissue properties, improving the accuracy of joint stability predictions and therapeutic interventions.

Tasks

- Literature review
- Adapting/Develop/Refine an existing MSK model
- Simulate and analyze case scenarios, e.g., joint range of motion under varying relaxin levels

Requirements

- Interest in biomechanics, musculoskeletal modeling, or computational mechanics.
- Basic programming skills (e.g., Python, MATLAB, or similar).
- Willingness to collaborate in an interdisciplinary environment.

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