Bachelor and Master theses at the Institute of Biomechanics

Presented by: Manuel P. Kainz
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Website: https://www.biomech.tugraz.at/

Scan for more topics and the latest updates!

March 12, 2024

Bachelor and Master projects with Med Uni Graz

- **Topic 1**
  - Influence of aging on mechanical properties of the pelvic floor and support system of the uterus
- **Responsibilities and tasks**
  - Performing and evaluating mechanical experiments and microstructure analysis

- **Topic 2**
  - Quasi-static and dynamic mechanical fatigue testing of human bone-implant-systems and soft tissues to improve clinical interventions
- **Responsibilities and tasks**
  - Planning, performing and analyzing mechanical experiments

- **Topic 3**
  - Workflow for standardized testing of human (ultra) soft tissues
- **Responsibilities and tasks**
  - Optimization of control system parameters for different tissues and experimental validation

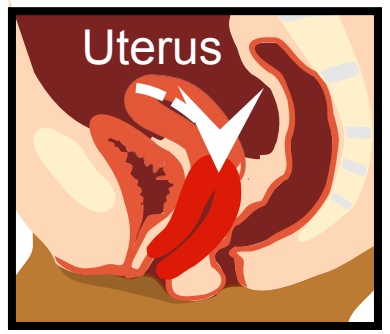


Figure 1: During uterine prolapse, the uterus descends from its original position. Image curtesy: Andreas Bauer

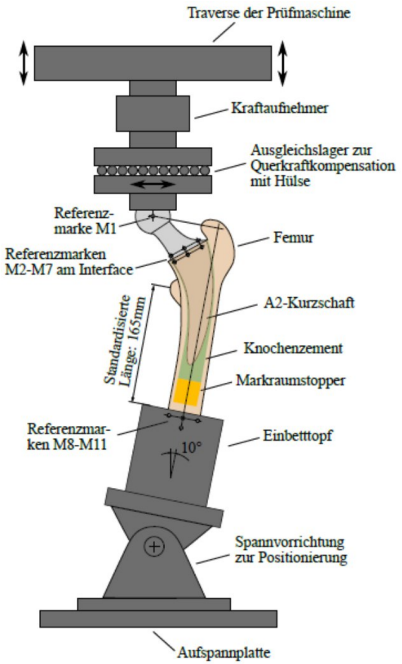


Figure 2: Fatigue tests of hip endoprostheses

Bachelor project/Master project

- **Topic 1**
  - ‘Mechanical characterization of rabbit’s myocardium under shear and compression/tension test’
- **Requirements**
  - Hands-on lab experience
- **Responsibilities and tasks**
  - Testing of the myocardium tissue and related data analysis

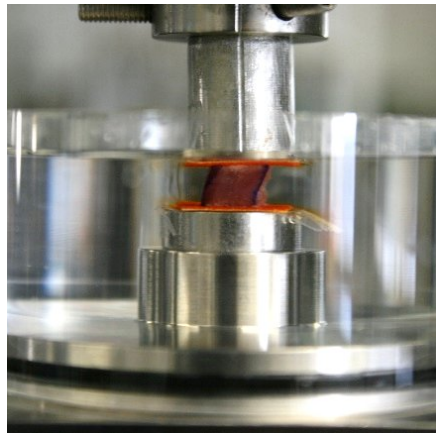


Figure for topic 1: Representative image of the experimental set-up used to test myocardium under shear

- **Topic 2**
  - ‘Analysis of biaxial mechanical data related to influence of hyperhomocysteinemia in atherosclerosis development’
- **Requirements**
  - Good programming skills
- **Responsibilities and tasks**
  - Definition of a code structure for analysis of experimental data

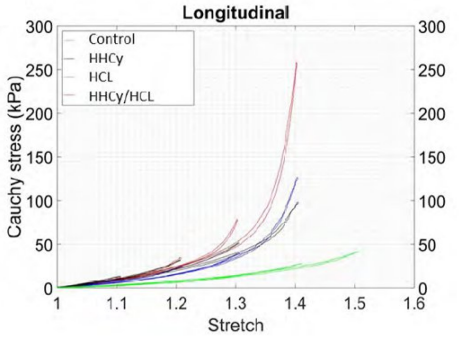


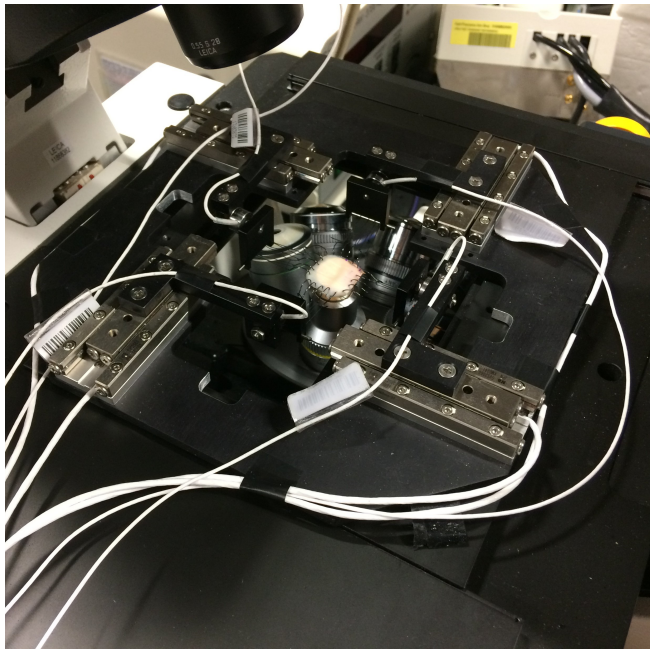
Figure for topic 2: Changes in tissue mechanical response as a function of hyperhomocysteinemia presence

Bachelor project

- **Topic**
  - Reverse engineering – specification, documentation, and user manual of already existing biaxial extension device

- **Requirements**
  - Basic knowledge of sensors and actuators design
  - Basic knowledge of LabView software

- **Responsibilities and tasks**
  - Specification of already existing device for biaxial extension tests
  - Documentation of the hardware and software used
  - Preparation of a user manual



Device for biaxial extension tests (Pukaluk et al., 2022)

Bachelor project/Master project

- **Topic 1**
  - ‘Modeling the insertion of microneedles in human skin’
- **Responsibilities and tasks**
  - Develop a FE model of skin microneedle insertion
  - Knowledge of computational mechanics and FE method

- **Topic 2**
  - ‘Modeling the fracture mechanics of polymeric scaffolds’
- **Responsibilities and tasks**
  - Developing a FE model of crack propagation

- **Topic 3**
  - ‘The intricacies of simple shear in soft tissues’
- **Responsibilities and tasks**
  - Theoretical analysis of simple shear in nonlinear elasticity

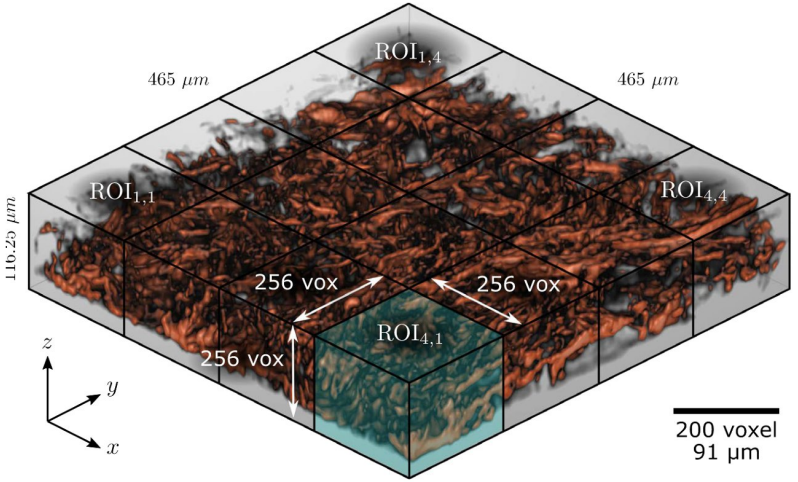


Figure for topic 1: second harmonic generation tomography of collagen fibers in the human skin. Taken from:
Alberini, …, Terzano et al., 2024, Sci.Rep.

Master project

- **Topic**
  - Perfusion experiments on brain tissue and biomimetic hydrogels

- **Requirements**
  - Hands-on lab experience with soft materials
  - Technical experience in CAD design
  - Experience with design/fabrication of 3D prints

- **Responsibilities and tasks**
  - Independent preparation of biological tissues brain tissue-mimicking hydrogels
  - Support during technical development and advancement of the experimental setup

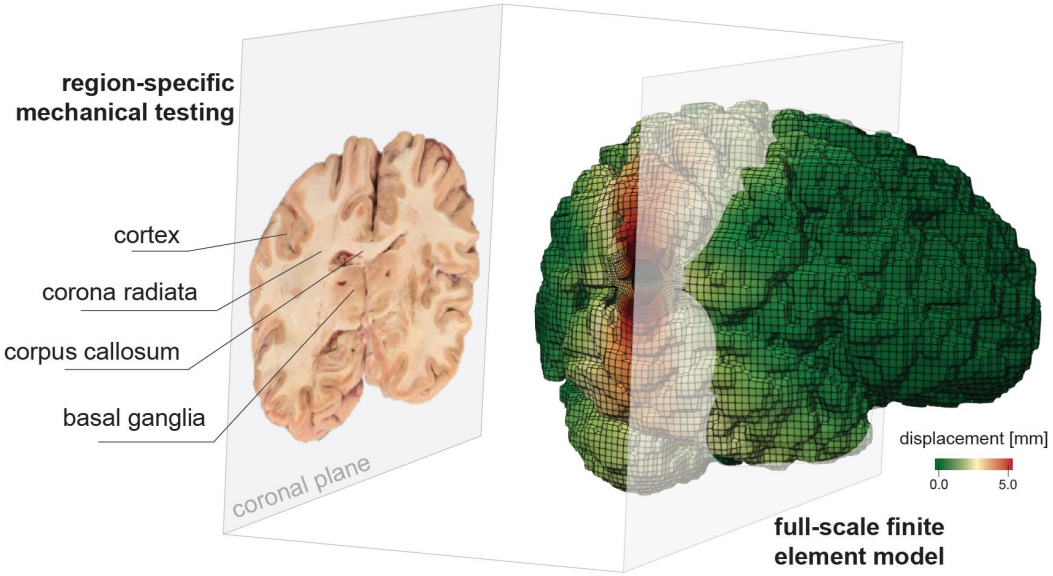


Figure: Human brain slice and full-scale computational model

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