MASTER THESIS PROJECT IN SOFT MATTER PHYSICS
Study of the bone quality in critical size bone defects by birefringence imaging.

Bone has a highly hierarchical ordered structure, in which the distribution of collagen fibrils and hydroxyapatite platelets define the basic physical properties in the macro-scale. Fractures with a critical size are associated with high rates of non-union, which are a serious issue in trauma and orthopaedic surgery. A proposal to address these issues are bone grafts which mimic the natural bone and enhance bone regeneration. Previously, small angle X-ray scattering (SAXS) in 2D and 3D was used to study the alignment and degree of orientation of mineralized collagen fibrils.

We offer a Master Thesis project based on a complementary study of the bone quality using birefringence imaging on bone slices. The goal of the project is to study the orientation of the collagen fibres in the original and newly formed bone in the femur gap by the use of a state of the art birefringence microscope. The results will be part of a larger collaboration between Chalmers, ETH Zürich and Universitätsspital Zürich (Switzerland) were several techniques are being used to study the healing process and effectivity of those previously described PLGA-CaP grafts for future treatment.

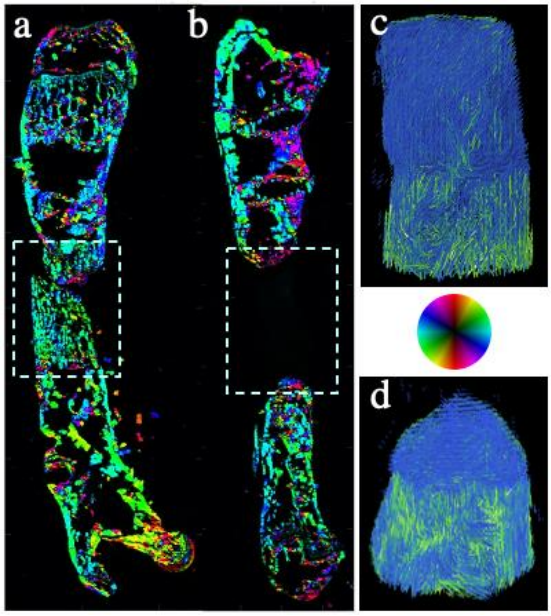

Figure: scanning SAXS maps and 3D reconstruction of the orientation of the mineral platelets in aligned (a, d) and random (b, c) scaffolds in mice femur.

The project can be adapted to the student's interest including a literature study, birefringence imaging experiments and data analysis, with the possibility of developing automated image analysis tools. The project will be embedded in the Liebi research group in the Division of Materials Physics. For questions regarding the project, contact Adrian Rodriguez (adrian.rodriguez@chalmers.se) or Marianne Liebi (marianne.liebi@chalmers.se).