Enzymatic and non-enzymatic cross-links in collagen and their influence on local mechanical properties

Open PhD student position for 4 years at the Ludwig Boltzmann Institute of Osteology

Starting from March 2022

We are looking for a highly motivated PhD student for an interdisciplinary research project studying the influence of cross-links in collagen on the local mechanical behavior. Collagen—the main building block of the organic matrix in bone—gains part of its mechanical stability by the enzymatic addition of bonds that cross-link different collagen molecules mostly in the telo-peptide regions close to their ends. In diabetes additional non-enzymatic cross-links, so called advanced glycation end-products (AGEs), may form at any location of the molecule that leads to a deterioration of the mechanical performance. The proposed research project aims at relating the local cross-link characteristics (number and type) to the local mechanical performance of collagenous structures. The local cross-link content will be measured with Raman and FTIR microspectroscopy, the corresponding mechanical performance will be assessed using scanning acoustic microscopy (SAM). The complexity of the system investigated will be gradually increased: starting from non-mineralized, well aligned rat tail collagen, over rat bone to human bone. This project demands a high interest and skills in sample preparation as well as in experimentation. Furthermore, data analysis and processing using computational methods is required. Consequently, some programming experience is recommended (Matlab, python, java or similar). In particular, your work will consist in

• Bone sample preparation for spectroscopic and SAM measurements (cutting, polishing, embedding)
• Assessment of cross-link density and type via Raman and FTIR measurements
• Measurement of local mechanical properties via SAM
• Correlation of cross-link characteristics (number and type) with mechanical properties
• Presentation of the results at (inter)national conferences
• Preparation of manuscripts for publication in scientific journals

Who we are

The Ludwig Boltzmann Institute of Osteology (LBIO) is a non-university research institute that is dedicated to the elucidation of the mechanisms underlying the basic function of bone, and musculoskeletal diseases, leading to the discovery and development of effective strategies for diagnosis, prevention, and treatment. To achieve this goal the LBIO unites a multidisciplinary team consisting of clinicians, physicists, biologists, chemists and epidemiologists. The institute has two laboratories both located in hospitals in Vienna: one at the Hanusch Hospital, the other at the AUVA Trauma Centre Meidling (which will be the place of employment for the current position).

Your qualifications

• Academic degree (MSc. or equivalent) in physics, biology, (biomedical) engineering or similar
• Attendance of one or two semester courses in spectroscopy
• A strong interest in experimental work as well as in numerical data analysis is necessary (basic knowledge of programming in languages like matlab, python, java or similar is recommended)
• Excellent communication and teamwork skills, as well as the ability to work independently

We offer

• Participation in a cutting edge research institution hosting a large variety of modern analysis tools: electron microscopy, light microscopy, histomorphometry, Raman and FT-IR spectroscopy as well as a cell biology facility
• A vibrant research team
• International collaborations
• 4-year contract
• Competitive salary: 2237.60 € (14× per year), 30 hours/week

Interested? Please, send your application including a CV via email to
markus.hartmann@osteologie.lbg.ac.at