

EUROMECH Colloquium 594

“Bone remodeling: multiscale mechanical models and multiphysical aspects”

15-19 May, 2018, Nancy, France

Chairperson: Jean-François Ganghoffer

Co-Chairperson: Michal Nowak

A bone has the ability to adapt its external shape and internal structure to variations in its mechanical environment. The adaptive response of bones to changes in load history is called bone remodeling since the pioneering work of Wolff (1892): adaptation of bone to functional demands such as mechanical loadings may result in bone loss in situations of reduced loading, and bone mass increase in situations when functional mechanical loadings exceed a certain magnitude. Despite the many studies devoted to the mechanisms controlling the process of bone formation and renewal, a clear understanding of the underlying mechanisms across the scales and the role of mechanical loading is still not available.

Bone is multiscale in nature and the tissue integrity is maintained across large length and time scales by complex multiscale multiphysical homeostatic processes regulated by specialized cells. Since these are difficult to identify based purely on experiments, it is important to develop multiscale computational approaches in combination with the acquisition of new experimental data obtained by efficient imaging techniques to integrate and investigate these processes. Optimization theories envisage bone as a mechanical structure undergoing an evolutionary adaptation, and will be one important topic of the Colloquium. Application of the computational models to predict the impact of medical treatments and implants in a patient-specific based approach is another important topic covered by the Colloquium.

The Colloquium was split into five sessions:

Session 1: Model of bone remodeling and computation of bone properties: multi – scale aspects

Session 2: Model of bone adaptation: topological and anisotropic approaches

Session 3: Tissue engineering: characterization of substitutes and simulation of bone healing

Session 4: Bone damage induced by diseases, bone fracture and fracture repair: clinical aspects

Session 5: Interaction between bone and implants

The objective of the Colloquium was to bring together researchers amongst the computational and experimental mechanics and biomechanics community to exchange the latest achievements as well as recent research work in the field of bone mechanical research. The Colloquium did provide state-of-the-art information in the domain of bone mechanics, focusing on bone remodeling and bone adaptation as a core topic.

The participants appreciated especially the one session format of the Colloquium which together with the informal atmosphere allowed extensive discussions and exchanges amongst participants.

We thank EUROMECH for his financial and scientific support which made the Meeting possible.