Modélisation et Simulation Multi Echelle, MSME UMR 8208

Post-doctoral position in experimental bone biomechanics and acoustics

Multimodal characterization of the bone-implant interface

Keywords: Biomechanics, bone, implant, interface, acoustics, nanoindentation, characterization, quantitative ultrasound.

Implants are often employed in orthopaedic and dental surgeries. However, risks of failure, which are difficult to anticipate, are still experienced and may have dramatic consequences. Failures are due to degraded bone remodeling at the bone-implant interface, a multiscale phenomenon of an interdisciplinary nature which remains poorly understood. The objective of this study is to provide a better understanding of the biomechanical properties of the bone-implant interface. To do so, we aim at studying the evolution of the biomechanical properties of bone tissue around an implant during the remodeling process.
To do so, a dedicated implant model will be used, which allows to work under standard conditions. The aim of this work will be to extract multiscale quantitative information on the bone-implant interface. A multimodality approach will be considered involving:

- *Ultrasonic experiments*. The aim is to investigate the potentiality of quantitative ultrasound techniques to characterize the properties of newly formed bone tissue.
- *Experimental approaches of adhesive contact micromechanics.* This task aims at measuring the effective adhesion energy of the bone-implant interface.
- *Nanoindentation measurements*. The aim is to determine the biomechanical properties of newly formed bone tissue.
- *Histological and biological analysis.* The aims of this task are i) to assess the biological nature of newly formed bone tissue and ii) to assess the bone-to-metal contact (BIC) fraction.
- *X-ray micro-computed tomography.* The objective is to measure the micro-architecture parameters of newly formed bone at the vicinity of the implant.

The results will be used to design effective loading clinical procedures of implants and to optimize implant conception, leading to the development of therapeutic and diagnostic techniques.
The candidate will have a PhD degree in mechanics, material science or acoustics. No particular knowledge in Medicine or Biology is required but the candidate is expected to be interested by multidisciplinary approaches. He/she will validate the experimental results with models developed by our group. The salary will be commensurate with the experience of the candidate.
The work will be done in the MSME laboratory in Créteil but this project involves mobility at the European level. The candidate will work within a multidisciplinary team of 15 persons (including engineers, biologists and clinicians), all studying the biomechanical properties of the bone-implant interface founded by the European Research Council (ERC Consolidator Grant 2015).

Contact:
If you are interested, send a curriculum vitae, a cover letter describing previous research experience and interests, the names and contact information of two references. Please, submit via email with "ERC BoneImplant PD2" on the subject line to Guillaume Haiat (Guillaume.haiat@univ-paris-est.fr).

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