PhD studentship

Growth and remodelling of bone tissue: poromechanical behaviour, microstructure and biochemical coupling.

At Laboratory of Osteo-Articular Biomechanics and Biomaterials, UMR CNRS 7052
Laboratory of Mechanics and Physics
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Deadline Monday, June 30, 2008

Eligibility Students with a proper degree or expecting to obtain it by December 2008 are eligible.

Salary 20 000 EUR/year plus benefits; extra money available on condition.

Application Interested applicants should send their CV by e–mail. Applications will be accepted also after the deadline, until the position is filled.

Keywords Biomechanics; Bone; Adaptation, Growth & remodelling; Poromechanics; Microstructure; Coupled multi–physics phenomena; Modelling & simulation.

Education and skills required The candidate is expected to have a solid background in continuum mechanics (both solid and fluid mechanics). Previous knowledge of numerical methods (FEM, FDM, etc.) and scientific programming tools (C++, MatLab, etc.) is required. A keen interest for biomechanics and life sciences, as well as a penchant for multidisciplinary research are important assets.

Description This PhD project focuses on the adaptation (growth and remodelling) of the bone tissue and its microstructure. Both mechanical and biochemical stimuli shall be considered to understand and predict mesoscopic bone properties, addressing in particular its poromechanical response. The general aim is to develop a biomechanical theory where bone is modelled as a porous medium whose microstructure adapts to the (mechanical and chemical) environment. The mesoscale properties of the evolving microstructure shall be obtained by means of suitable homogenization procedures. This will eventually lead to an effective macroscopic characterization of the poromechanical response of bone tissue. Of necessity, this research shall be multidisciplinary, since the coupling between mechanics, biology and chemistry will be its main theme. While doing most of his/her work in mechanics, the student will be asked to study also topics from biology and chemistry, under the guidance and in collaboration with experts in these disciplines. The biomechanical model shall be implemented in a computational code. Results from numerical simulations shall be eventually compared with experimental outcomes, in order to validate the model. This research work should provide us with a better understanding of adaptivity of bone tissue. Ultimately, it could lead to improvements on the existing therapeutic protocols and clinical practices.