PhD Scholarship: Integrating Four-Dimensional Synchrotron Imaging and Computational Modeling

We are offering a PhD scholarship at Queensland University of Technology (QUT), Australia for the development of "A novel platform for investigating osteoporosis treatment: integrating 4D synchrotron imaging and computational modeling". The project is a collaboration between Queensland University of Technology (QUT, Australia), University of Saskatchewan (USASK, Canada) and University of Paris Est (UPEC, France). We seek to better understand how cortical bone is affected by osteoporosis and drug treatments. Longitudinal experimental data in a rabbit model of osteoporosis will be collected by Prof David Cooper (USASK) at the Canadian Synchrotron. The successful PhD candidate will use machine learning algorithms to assess morphological changes in cortical bone and to track bone remodeling units over time using co-registration techniques based on provided synchrotron imaging data. Additionally, the candidate will develop a computational model to predict changes in cortical porosity and effects on bone matrix properties due to osteoporosis and other treatment regimens developing state-of-the-art bone adaptation algorithms.

Project areas include:

- Development of machine learning (ML) and artificial intelligence (AI) based algorithms to analyse cortical bone morphological parameters from synchrotron microcomputed (microCT) tomography data;
- Development of automatised co-registration algorithms to track resorption cavities in cortical bone based on 4D synchrotron imaging data;
- Development of computational models of bone remodeling and adaptation that are able to predict changes in cortical porosity and bone tissue mineral density distribution;

The PhD student will be enrolled in the QUT-UPEC joint PhD program under supervision by Professor Peter Pivonka (QUT) and Professor Vittorio Sansalone (MSME, UPEC). Professor David Cooper (USASK) will be an external supervisor. The student will spend a minimum of 2 years at QUT and a minimum of 1 year at UPEC. The student will collaborate with other students from the collaborating institutions.

The stipend offered for this 3-year scholarship (with possible extension for 6 months if required) will be at the APA rate of $28,870 p.a. Both Australian and international applicants are welcome to apply. However, this scholarship does not cover university tuition fees for international students, and international students may need to apply for a tuition fee scholarship at QUT, if successful in winning the scholarship.

Essential criteria: An undergraduate degree with first or second class division 1 Honours in medical physics, biomechanics, mechanical engineering biomedical engineering, or a related discipline; eligibility for admission to the PhD program at Queensland University of Technology; Good knowledge of computed tomography (CT) imaging, image- segmentation and analysis and excellent programming skills (MATLAB, Python, etc.); excellent communication skills (written and verbal) in English, including meeting the QUT English language requirements (no exceptions can be made).

Desirable criteria: Experience in machine learning algorithms; basic understanding of bone biomechanics and computational modeling.

Enquiries: Professor Peter Pivonka (peter.pivonka@qut.edu.au), Professor Vittorio Sansalone (vittorio.sansalone@u-pec.fr).

Closing date: Please send your application including motivation letter, with your curriculum vitae to Professor Pivonka and Professor Vittorio Sansalone. Applications will be accepted until the scholarship is awarded, but applications will be assessed early October, 2022.