

PhD Scholarship: A computational platform for understanding bone structure optimisation

We are offering a PhD scholarship at Queensland University of Technology (QUT), Australia for the development of “A computational platform for understanding bone structure optimisation”. This scholarship is supported through an Australian Research Council Discovery Project (ARC DP) grant. The project is a collaboration between Queensland University of Technology (QUT), the University of Saskatchewan (USASK), Canada, and the University of Paris Est Creteil (UPEC), France. The research group at UPEC is the Biomechanics unit of the Multiscale modeling and simulation lab (Modélisation et Simulation Multi Echelle, MSME UMR 8208 CNRS).

We seek to better understand how cortical bone is affected by osteoporosis and drug treatments. The successful PhD candidate will develop state-of-the-art computational models of bone remodeling to predict changes in cortical porosity and bone matrix properties due to osteoporosis and other treatment regimens. The in-silico results will be validated by experimental data provided by Prof David Cooper (USASK).

Project areas include:

- Development of continuous, i.e. based on partial differential equations, models of bone remodeling to investigate the behaviour of basic multicellular units (BMUs) in cortical bone;
- Development of discrete, i.e. cellular automata based, models of BMU behaviour in cortical bone;
- Development of multiscale 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 enrol in the QUT-UPEC joint PhD program under supervision by Professor Peter Pivonka (QUT) and Professor Vittorio Sansalone (UPEC). Professor David Cooper 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 interact 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 physics, mechanical engineering, computer science, biomedical engineering, or a related discipline; eligibility for admission to the PhD program at Queensland University of Technology; Excellent knowledge of programming (MATLAB, Python, etc.); partial differential equations, discrete (agent-based) modeling, excellent communication skills (written and verbal) in English, including meeting the QUT English language requirements (no exceptions can be made).

Desirable criteria: 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. Applications will be accepted until the scholarship is awarded, but applications will be assessed starting June 25th, 2023.