



PhD Scholarship in Biomechanics

“Understanding a Cause of Partial Blindness: Numerical Modelling of Chiasmal Compression”

UNSW@ADFA, Canberra, Australia

This thesis project aims to develop the numerical modelling techniques required to investigate the role of mechanical crushing of the optic chiasm in regards to Bitemporal Hemianopia (BH), which occurs when an individual loses sight from the inner visual zones of each eye. It is well recognized that this debilitating condition is associated with the compression of the optic chiasm induced by the adjacent growth of pituitary tumours, and other abnormalities. To date there has been no agreement on the mechanism for the resulting selective damage to the visual system. One promising theory nominates mechanical crushing of the crossing optic nerve fibres in the optic chiasm as the likely candidate, but this has yet to be conclusively demonstrated and requires detailed investigation.

The student will numerically model the deformation and stress fields in the optic chiasm using engineering Finite Element Modelling (FEM) techniques. Initial simulations have shown the utility of this approach to the problem, but were very simplistic in terms of geometry, material properties and loading cases. The PhD student will greatly extend this work in a number of required areas including the importation and generation of realistic model geometries from medical scans. The student will also investigate the use of new multi-scaling techniques in the FEM to simultaneously investigate the effects of the compression both on the chiasm as a whole and on the optic nerve fibres within it, which are orders of magnitude smaller. The student will improve the fidelity of the materials models used in the FEM simulations and examine a range of potential loading scenarios that can occur in the clinical pathology of Bitemporal Hemianopia.

Establishment of the casual mechanism of BH and the development of numerical modelling tools will help both diagnosis and treatment of the condition. This project will involve collaboration with ANU, Canberra Hospital and Queens University, Belfast. Applicants should possess a good honours degree in Engineering or Science preferably with some FEM experience. A medical or bioscience background will also be considered.

The successful applicant will be awarded a UNSW@ADFA Research Training scholarship with an annual tax-free stipend of \$21,627. This scholarship is for a period of 3 years and is subject to satisfactory progress reviews. Applicants would be expected to be available to commence their studies in Session 2, 2009.

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