

Bridging the sex gap in traumatic brain injury biomechanics: Multiscale sex specific finite element modelling of TBI

1x Fully-Funded PhD Position:



An exciting fully-funded 4 year PhD position is available in the School of Mechanical & Materials Engineering at University College Dublin, Dublin, Ireland.

Stipend:

€25,000 tax-free stipend per annum, plus PhD registration fees (EU & Non-EU).

Project Description:

The worldwide incidence of traumatic brain injuries (TBI) is on the rise and is most prevalent in people younger than 25 and older than 75 years. TBIs lie on a continuum from transient symptoms to fatal haemorrhages with mild TBI (mTBI) being the most common type of TBI. It is estimated that 42 million people sustain a mTBI or "concussion" worldwide each year. Current brain models used to simulate TBI and design preventative, diagnostic, prognostic, and therapeutic technologies have mostly been developed using adult male data. Therefore, due to the significant morphological differences between male and female brains, the lack of female specific brain models and data may be having a detrimental effect on the advancement of these technologies. Moreover, this may adversely affect progress on reducing the economic, societal, and clinical burdens of TBI.

This PhD project is part of a larger European Research Council funded project and aims to determine the role of sex specific biomechanics in the initiation and progression of TBI by developing new state-of-the-art multiscale sex specific finite element models of the human brain. This project will involve medical image analysis to extract the brain and surrounding structures, finite element mesh development, incorporating vasculature and micro-scale models, and simulating real world case studies of TBI. This is a unique challenge in TBI biomechanics with the potential to have life-saving impacts by providing overdue and novel tools to understand the differences of TBI biomechanics in men and women. The outputs of this PhD project has the potential to significantly impact our understanding of TBI. The potential gain from this project cannot be overstated, particularly in their ambition to address the inequality in research on women's health.

Principal Duties and Responsibilities:

The candidates will be required to:

- Work full time on their PhD project at University College Dublin.
- Engage in teaching assistance, e.g., delivering lab demonstrations to undergraduate students.
- Take part in training and development.
- Contribute to public engagement and outreach activities.

Selection Criteria:

Mandatory:

- Masters degree or Primary degree (First or Upper Second Class Honours) in ***Mechanical Engineering, Biomedical Engineering***.
- Excellent finite element modelling skills (ABAQUS, ANSYS, FEBio).
- Excellent coding skills in Python or Matlab.
- Excellent English communication skills.
- Excellent report writing skills.
- Experience with data analysis and visualization.
- Attention to detail and organisational skills.
- Ability to manage a complex workload and tight deadlines.
- Be self-motivated to work independently and as part of a team of researchers.
- Willingness to work closely with other collaborators.
- Willingness to learn new skills e.g., machine learning, coding languages, conduct experiments.
- Awareness of equality, diversity and inclusion.

Desirable:

- Experience working with computational modelling of the brain or other soft tissues.
- Experience with fitting models to data.
- Experience in mechanics of materials / constitutive modelling.
- Experience with machine learning / large datasets.
- Excellent research skills.

How to apply:

Please send the following in PDF format to david.macmanus1@ucd.ie

- Cover letter detailing why you are interested in pursuing a PhD on this topic and how your experience to date makes you the ideal candidate (max. 2 pages).
- Your CV.
- Academic transcripts or a copy of your degree certificate.
- Contact details (email) for two academic referees. **Reference letters are not required at this stage.**

Closing date for applications:

The position will remain open until filled.

Start date:

January - May 2026.

Informal Enquiries:

Please email any informal enquiries to Assoc Prof David MacManus: david.macmanus1@ucd.ie

Supplementary Information:

- The University: www.ucd.ie
- UCD School of Mechanical & Materials Engineering: <https://www.ucd.ie/mecheng/>
- Equality, diversity, and inclusion: <https://www.ucd.ie/equality/>