

PhD Studentship

Department of Mechanical Engineering
University College London

UCL-EPSC DTP-CASE PhD Studentship expression of interest

TITLE: Computational and experimental design of new microfluidic devices for isolating circulating tumour cells:

Description: Outstanding applications are invited to submit their expression of interest to join the Department of Mechanical Engineering at UCL as part of an EPSRC Doctoral Training Programme CASE (DTP-CASE) PhD studentship. The PhD project is being jointly supervised by Professor Emad Moeendarbary from the Department of Mechanical Engineering ([University College London](https://www.ucl.ac.uk), UCL) and Dr Cesar Cortes-Quiroz from [ANGLE plc](https://www.angleplc.com) (British multinational medical device company).

Project Brief: Cancer Research UK's statistics suggest that men have a 45% likelihood of suffering from cancer during their life, while women are only slightly lower at 41%. All forms of cancer are characterized by excessive proliferation of cells in the form of solid tumours, which often shed cancer cells into the patient's blood stream to other secondary locations (metastasis cascade). These cells, known as Circulating Tumour Cells (CTCs), are very rare (a single cell in one billion blood cells) and difficult to isolate. However, they are highly valuable cells due to their defining features. They contain information on the type of disease for cancer diagnosis, which can help on deciding targeted drug therapies and treatment monitoring, while their presence and quantity are indicative of patient prognosis.

For CTC isolation, size-/deformability-based cell separation (enrichment) technologies are distinguished because their operating methods are label-free, fast and simple. Enriched CTCs remain unmodified and viable for downstream analyses.

The aim of this project will be to develop a numerical simulation platform for the design and analysis of the flow patterns of whole blood and biological reagents during the operation of microfluidic devices used for CTCs isolation from patient blood samples. Insights of flow characteristics will be determined and design modifications proposed to improve the capacities and efficiency of the system. Traditional mechanical components of lab equipment systems such as reservoirs, flow generators, valves, tubing, sensors and actuators will be investigated on their efficacy to carry the biological fluids without compromising the performance of the system. A CAD tool will be used to model 2-D and 3-D geometries of a proposed medical device and a CFD tool will explore the fluid flow characteristics in different system components. Aspects of cellular biomechanics and behaviour during blood transport can be included to determine their impact on the performance of critical capturing microdevices of the system. The final outcome of the work will be an improved system configuration and composition as well as its optimum operating conditions. Experimental validations will be coordinated with a leading biotechnology company in new liquid biopsy technology.

Environment, Research and Training: The project is mainly based at UCL (Bloomsbury Campus located in the heart of Central London) which is one of the world's top multidisciplinary universities, with an international reputation for the quality of its research and teaching. The candidate will benefit from state-of-the-art mechanical engineering research trainings, high performance computing, experimental laboratories and combined supervision by world leading engineers and scientists in the fields of microfluidics, cellular biology, biomechanics, mathematical and computational modelling. As part of this project you will be collaborating with the industrial partner.

Value of award: The candidate will be enrolled in a 4-year PhD program covering fees and stipend. You will receive a stipend of (£17,000 pa), fees, and a research training support grant (£1200 pa), including funds for attending national/international conferences to present your work.

Eligibility

(see <https://www.ucl.ac.uk/prospective-students/graduate/apply-graduate-study/what-you-need>)

- Applicants are preferred to have a first class undergraduate and master's degrees (or equivalent) in Mechanical Engineering, Physics, Mathematics or a related discipline.
- **The position is only open to UK or EU citizens with at least 3 years residency in UK.**
- Excellent organizational, interpersonal and communication skills, along with a stated interest in interdisciplinary research, are essential.

- Experience in computer programming and strong knowledge in solid mechanics and/ or fluid mechanics and/or microfluidics would be essential.
- Fluency and clarity in spoken English as well as good written English in accordance with UCL English requirements (TOEFL>92 or IELTS>6.5).

Application Process

Eligible applicants should contact Professor Emad Moeendarbary (e.moeendarbary@ucl.ac.uk) enclosing a cover letter (including the names and contact details of two referees), one-page research statement and two pages CV. The shortlisted candidates will be notified for an interview and will be put forward for funding application.