Transport of extracellular vesicles in synthetic biological tissues

Keywords:
Extracellular vesicles, Bioengineering of Lipid Membranes, Soft Matter, Tissue Engineering

Project Description

A PhD studentship is available at the Department of Chemical Engineering of Loughborough University to investigate the mass transport processes governing the motion of extracellular vesicles (EVs) in synthetic tissues.

Extracellular vesicles (EVs) are biological nanoparticles that are naturally released and internalised by cells. These vesicles are natural biological vectors capable of transporting cell constituents, such as DNA, RNA and proteins, between distant cells. By acting as a mediator of intercellular communication, EVs play crucial roles in many physiological and pathological processes, such as intercellular signalling, tissue development and cancer metastasis. In recent years, extensive investigations have been conducted to elucidate their functions within biological systems, but also to exploit them as powerful therapeutic tools for pathological conditions, such as neurological diseases and cancers.

The objectives of this project are i) to investigate the mechanisms governing the transport of EVs in synthetic extracellular matrices, and ii) to determine how the motion of EVs can be either hindered or enhanced within tissue environments. This research will lead to an improved understanding of how EVs can navigate across tissues, which is key to comprehend EV biological functions and improve their therapeutic potential.

The successful candidate will design and fabricate synthetic tissues, mimicking the features of extracellular matrices. He/she will use microfluidic technologies and state-of-the-art microscopy techniques (e.g., confocal microscopy, time-resolved fluorescence spectroscopy and electron microscopy) to investigate the motion of EVs in these matrices. The student will also develop/use theoretical models with the support of the research team to interpret the experimental observations and unveil the underlying mechanisms governing the transport processes.

This project will be undertaken within the Particle Microfluidics group (www.particlemicrofluidics.com).

Entry requirements:
Applicants should have, or expect to achieve, at least a 2:1 Honours degree (or equivalent) in Bioengineering, Chemical/Mechanical Engineering, Physics, Chemistry or a related subject. A relevant Master's degree and/or experience will be an advantage.

Supervisors:
Primary supervisor: Dr Guido Bolognesi
Secondary supervisor: Dr Goran Vladisavljević, Dr Owen Davies