



Biophysical modelling of epithelial cell polarity – Fully funded 4-year PhD studentship available.

Start date: September 2022 (or sooner)

Application deadline: 15 February 2022

Supervisors:

Dr Rastko Sknepnek, physics and computational biology

Dr Jens Januschke, cell and developmental biology

We invite applications for a fully funded four-year EN & MN Lindsay Endowed PhD studentship in biophysical modelling of epithelial cell polarity at the University of Dundee, United Kingdom. This interdisciplinary studentship will combine biophysical modelling and advanced live imaging allowing the PhD candidate to work at the forefront of biophysics research in close collaboration with a cell biology lab. The student will be based in Dundee's School of Life Sciences, one of the UK's flagship institutions for biological research.

Project description:

Polarity is a fundamental feature of a vast number of cells that allows them to fulfil their required functions. Epithelial cells can regulate their polarity via intricate positive and negative feedback loops. This enables epithelial cells to establish a geometrical axis along with they can organise the required physiological functions and that also determines the contact sites with neighbouring cells. The integrity of epithelia relies on their ability to resist external mechanical stresses, which is possible due to these physical connections between the cells within them. More precisely, it is believed that transmission of forces between neighbouring cells is mediated by cell-cell junctions located at the top (apical) side of the cell. Coupled to these junctions is the actomyosin network – a meshwork of fibres that can actively contract and generate forces and which are under the control of polarity proteins. These systems combine to provide the engine that drives the cell movements required to form and grow tissues and organs, repair damage, etc. The fact that cells are polarised seems to play a key role for this cellular engine to properly function. Despite active research, there are many aspects of the

biophysical mechanism that control the active contraction in cells and how it couples to cell polarity that remain unknown. This is what this project will explore.

In this project, we will use a combination of image analysis and continuum modelling to explore mechanisms of active contraction in the presence of polarity. The project will involve close collaboration between biophysics theory group led by Dr Rastko Sknepnek and the cell biology group of Dr Jens Januschke.

Requirements:

Applicants are expected to hold (or be about to achieve) at least a 2:1 Honours degree in a relevant subject or demonstrably equivalent experience.

This is an interdisciplinary project aimed at a physicist or applied mathematician who is interested in applying advanced theories of physics of active matter to biological systems and keen to closely collaborate with biology groups and work on analysis of microscopy data. Strong analytical skills and ability to program in Python and/or MATLAB are essential. Familiarity with continuum mechanics and statistical physics are desirable as is background knowledge in cell biology.

Funding:

This studentship is funded by the EN & MN Lindsay Scholarship. The 4-year studentship comes with a stipend of £16k per annum plus generous research funds of £5,000 per annum and covers tuition fees at the home rate.