J. Krishnan
Imperial College London
e-mail: krishnan@icex.imperial.ac.uk
Aiman Alam-Nazki
Imperial College London

Modelling and elucidating design principles underlying attractive and repulsive gradient sensing

Many cells, both prokaryote and eukaryote exhibit the feature of chemotaxis, the directed motion in response to gradients of chemicals. Furthermore, many of these cells exhibit both attractive and repulsive gradient sensing to either the same or different chemicals. In this talk, I will discuss two aspects of this problem.

The first is the mechanistic modelling of a network postulated to describe chemorepulsion in the model system Dictyostelium. The signalling network is complex since it is strongly non-linear incorporating a combination of feedforward and feedback loops with spatial signalling. A systematic mechanistic modelling of this work describes whether and under which condition the network can exhibit the desired behaviour and makes clearcut predictions of the important features in this regard, resulting in very non-trivial conclusions.

The second aspect which I will discuss is how the cell signalling networks may be organized to give rise to both attractive and repulsive gradient sensing in a given cell, and how the resulting behaviour depends on the qualitative aspects of signal transduction (eg. adaptation, spontaneous polarization). Here a framework using qualitatively simplified models will be used to distill transparent insights. The relevance to individual systems will also be discussed.