

Department of Applied Mathematics Seminar

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Topic

Agent-based modelling of (1) corneal epithelial cell regulation and (2) interclonal cooperativity in cancer evolution

Date| Time

4 November 2025 (Tuesday) | 10:30 am – 11:30 am (HK Time)

Venue

TU717

Abstract:

We develop a Voronoi cell-based model of epithelial cell dynamics and apply it to two phenomena: (1) the regulation of the cornea, and (2) potential pathways for the evolution of cancer. In the first model, we consider the cornea, which is a stratified epithelium consisting of several layers, each only one cell thick. Maintaining this structure is essential for high-quality vision. Furthermore, the cornea regenerates itself from a ring of stem cells at the bottom layer. Despite its importance, little is known about what regulates this process and how it adjusts to cell loss due to shearing, or rubbing, and wound healing. We seek to shed light into corneal cell regulation using a Voronoi cell-based model, linking local interactions between cells to the emergent dynamics of the stratified epithelium. In the second model, we use our Voronoi model to consider the development of cancer. A common paradigm for cancer evolution is that cells acquire a series of mutations producing increasingly malignant clones that outcompete other populations in a process known as lineal evolution. However, recent experiments observe that many tumours remain polyclonal, conflicting with the idea of one dominant clone. We propose an alternative paradigm of interclonal cooperativity in which individually nonmalignant clones, cooperate to produce a collectively malignant cancer population.

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