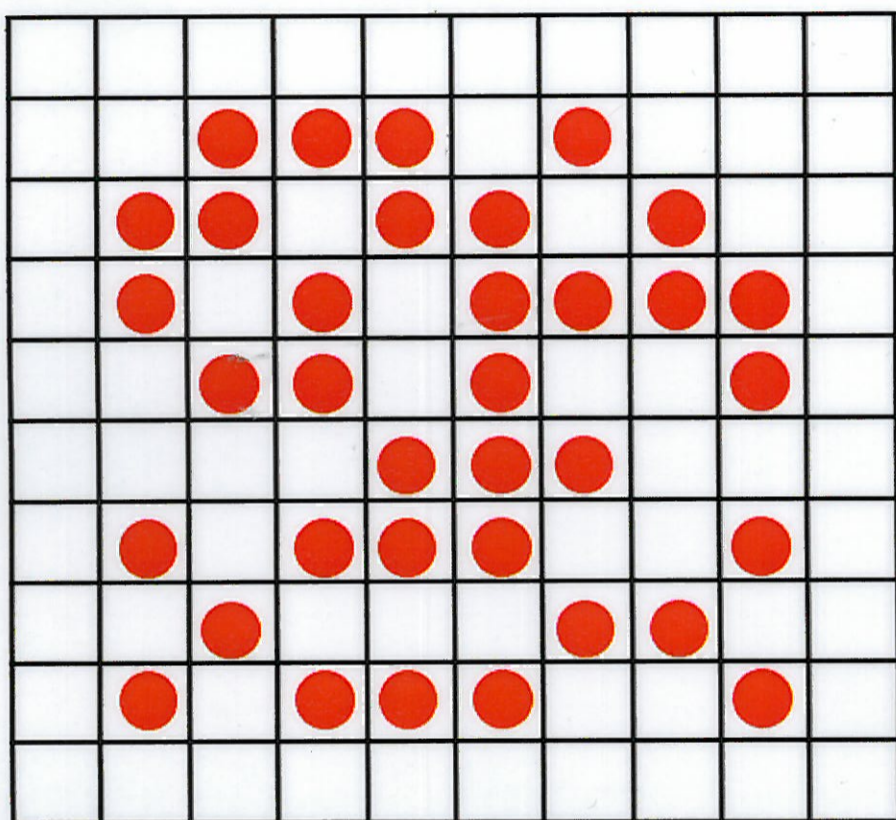


# SIMULATING CELL MOTION

Cell motility and proliferation mechanisms play an important role in understanding the propagation of cells, and hence the evolution of many biological systems.

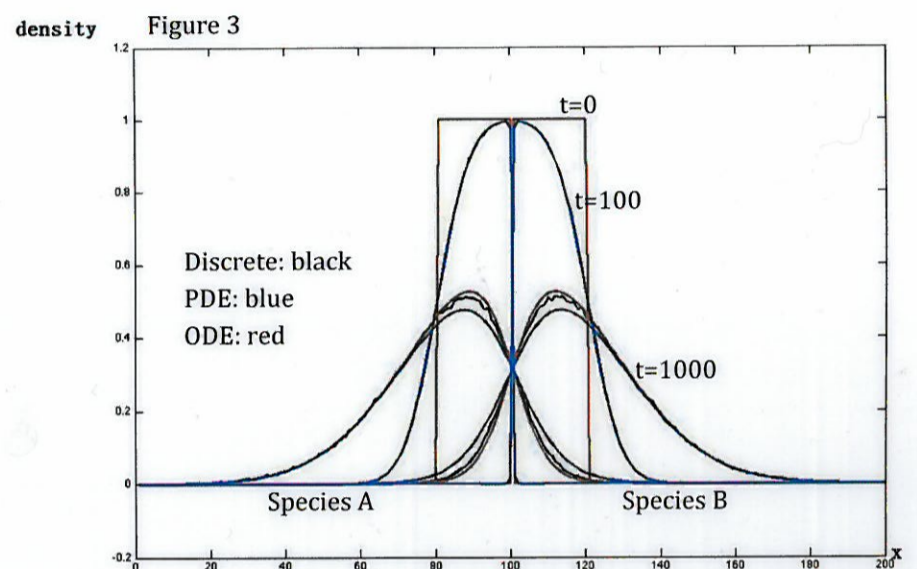
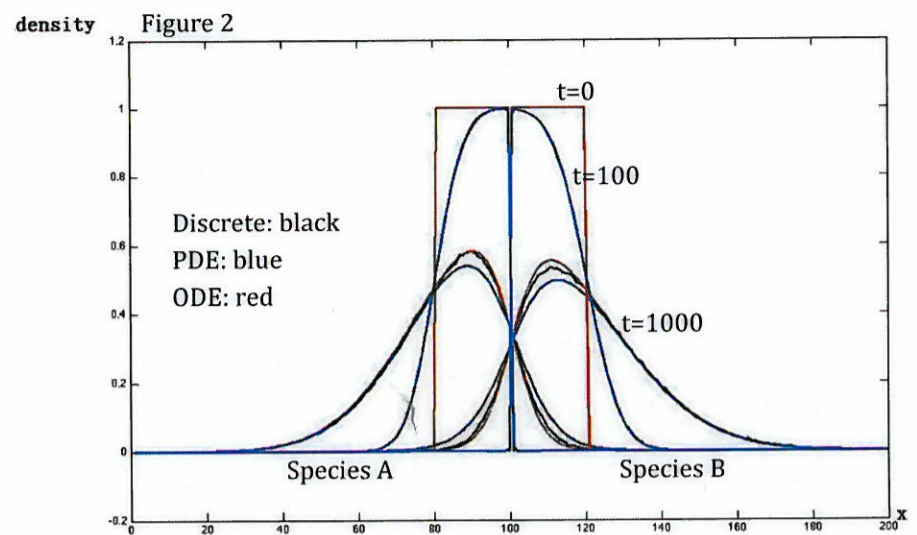
My project involves simulating the motion of cells on a two-dimensional square lattice with focuses on the behavior of both individual cells (using discrete simulation) and the entire population (using continuum systems). The set-up is shown below, where the red dots represent single cells.



We often assume that occupancies of adjacent sites are independent, however this may not be sufficiently accurate. In my project, I compared the precision of motility models - a PDE model and a system of ODE's. The first was based on the independence assumption, and the second one incorporated adjacent-site correlation effect but assumed independence between the occupancies of non-adjacent sites. Comparison was done by matching the densities from continuum models to discrete density profiles. The models were constructed for the motility mechanism of two different species of cells.

Simulation was performed for cell species with motility rates of 0.75 and 1 (fig. 2), and 1 and 1 (fig. 3). The states of the system at times 0, 100 and 1000 are shown.

Since the ODE model provides a better match, I concluded that correlation effect between



occupancies of adjacent sites exists and affects the propagation of cells. Correlation between non-adjacent sites exists, though much weaker, and matching would be improved if this was incorporated.

The vacation scholarship program was a truly rewarding experience as it gave me the opportunity to see the challenges that lie within independent research. You never know if you are going to get results at all, and it is usual to get stuck for a long time before making a minor breakthrough.

I also had the privilege to attend CSIRO's Big-Day-In and shared research results with other maths students from across Australia. It was fascinating to learn about a variety of the cutting-edge maths issues that currently interest researchers.

**By Joy Chen**

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