

THE UNIVERSITY



OF HONG KONG

*Institute of Mathematical Research
Department of Mathematics*

Numerical Analysis Seminar

Computational Investigation of Spatiotemporal Dynamics of a Growing Bacterial Colony

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Abstract

The growth of a bacterial colony on hard agar surface exhibits striking patterns and robust expansion kinetics, despite complex interactions among millions of cells under varying chemical gradients. To probe the spatiotemporal dynamics of such a growing colony, we develop a theory of cellular mechanical interactions and construct a hybrid three-dimensional simulation model. This model consists of an agent-based description of the growth, division, and movement of individual cells, and a set of reaction-diffusion equations for metabolic dynamics. Our large-scale simulations and analysis predict that the mechanical interactions, metabolic gradients, particularly the nutrient depletion, and cell maintenance together control the kinetics of a growing colony, in a good agreement with experiment. Our study is a first step toward detailed computational investigation of bacterial biofilms. This is joint work mainly with Mya Warren, Hui Sun, Harish Kannan, Tolga Caglar, Jia-Jia Dong, and Terence Hwa.

Date:	Sept 27, 2023 (Wednesday)
Time:	2:00pm - 3:00pm
Venue:	Room 320A, Run Run Shaw Building HKU

All are welcome