

Summer Research Program 2011/2012***Fingers of death: simulations of the advancing edge of a rampaging bacterial swarm*****Supervisor: Dr. Prabhakar Ranganathan****Email: prabhakar.ranganathan@monash.edu****Phone: 9905 3480****Department: Mechanical & Aerospace Eng.**

Objective

Many serious infections are initiated by motile bacterial cells quickly spreading on surfaces of exposed tissues or of biomedical implants. These first steps of bacterial colonization are now known to be quite complex, and involve considerable cooperation between individual cells. In fact, a dense colony of advancing cells appears very much like a fluid, and it has been suggested that bacteria have evolved mechanisms to take advantage of fluid mechanics to spread rapidly on surfaces. Here, we are interested in predicting structures at the edges of advancing colonies that resemble finger-like patterns formed when a less viscous fluid is pumped into a thin film of a more viscous fluid.

Description

The cell colony is modelled as a self-propelled fluid suspension of particles. A set of equations describing the motion of the line interface between the colony and the ambient fluid has been derived. These have been discretized using a simple finite-difference approach, and a preliminary simulation code has been developed in Fortran 95/2000. This code will be developed and tested further. Predictions will be compared with results available from literature and with experimental data.

Prerequisites: good background in engineering mathematics (at undergraduate level); demonstrable programming skills

Desirable, but not essential: experience with Fortran 90+