TECHNIQUES & APPLICATIONS

Biofilms: you do the maths!

Mathematical modelling can be used to predict the effectiveness of different treatments for biofilms, and the latest in a series of models was presented by Joao Xavier and colleagues in a recent issue of *Microbiology*.

The matrix of extracellular polymeric substances (EPSs) that embeds the bacterial cells in a biofilm is primarily responsible for biofilm surface attachment. One as-yet relatively unexplored method of biofilm removal involves promoting their detachment from surfaces. In this paper, Xavier *et al*. present a mathematical feasibility study that uses mathematical modelling to assess the prospects for biofilm-control strategies that are based on promoting detachment by compromising the integrity of the EPS matrix.

A three-dimensional representation of the biofilm was created using a technique known as individual-based modelling, and the effects of different treatment scenarios with detachment-promoting agents (DPAs) were then analysed to determine which characteristics of the DPA were important in achieving detachment. Only a few of the simulations produced a clean surface, with many simulations showing that a thin layer of the biofilm was extremely difficult to remove, and it is the removal of this last fraction that constitutes most of the overall removal time.

This work is the latest in a series of mathematical approaches to the problems that biofilms pose, and it highlights the utility of theoretical studies. The challenge now is for the modellers and microbiologists to get together and translate these mathematical results into practical applications.

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ORIGINAL RESEARCH PAPER Xavier, J. B. *et al*. Biofilm-control strategies based on enzymic disruption of the extracellular polymeric substance matrix — a modelling study. *Microbiology* **151**, 3817–3832 (2005)
FURTHER READING Xavier, J. B., Picioreanu, C. & van Loosdrecht, M. C. M. A framework for multidimensional modelling of activity and structure of multispecies biofilms. *Environ. Microbiol.* **7**, 1085–1103 (2005) | Hall-Stoodley, L., Costerton, J. W. & Stoodley, P. Bacterial biofilms: from the natural environment to infectious diseases. *Nature Rev. Microbiol.* **2**, 95–108 (2004)