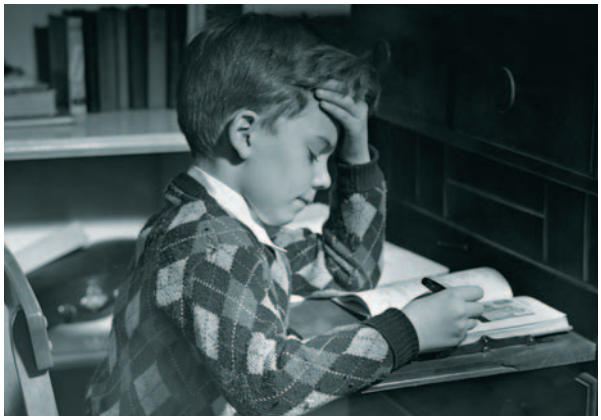

TECHNIQUES & APPLICATIONS

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.

Sheilagh Molloy

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)

VIROLOGY

Promoting silence

Herpesviruses are characterized by their ability to establish latent infections from which the virus can reactivate and cause recurrent disease. The transition from productive (lytic) to latent infection in herpes simplex virus (HSV) is associated with marked shutdown of the herpesvirus genome — during lytic infection more than 80 gene products are expressed, whereas during latent infection only the latency-associated transcript gene (*LAT*) is highly expressed. Now, David Knipe and colleagues argue that *LAT* represses HSV gene expression by promoting the assembly of heterochromatin on viral lytic-gene promoters.

The authors used chromatin immunoprecipitation assays to study the assembly of chromatin on HSV lytic genes during infection of murine trigeminal ganglia. Initially, during lytic infection, low levels of histone H3 were associated with viral DNA, which is consistent with findings that the viral genome is relatively nucleosome-free during productive infection. But as latent infection was established, the genome became increasingly chromatinized. Consistently, during latent infection, lytic-gene promoters showed a higher level of association with heterochromatin (marked by histone H3 methylated at lysine 9) compared with euchromatin (marked by histone H3 methylated at lysine 4). Using *LAT*$^-$ HSV, Wang *et al.* showed that expression of *LAT* significantly increased the amount of heterochromatin and decreased the amount of euchromatin associated with most lytic-gene promoters. This suggests that *LAT* facilitates shutdown of the HSV genome by promoting the assembly of inaccessible chromatin on viral DNA.

ANTI-INFECTIVES

Effective protection

Two recent *Nature* papers report promising results on the use of microbicides to prevent sexually transmitted infections.

In a paper published online on November 23, Judy Lieberman and her colleagues from Harvard Medical School describe how they used RNA interference to develop a microbicide that disrupts both infection and replication of herpes simplex virus 2 (HSV-2) in mice. Small interfering RNAs (siRNAs) that target two viral genes, *UL27* and *UL29*, which encode envelope glycoprotein B and a DNA-binding protein, respectively, suppressed viral replication *in vitro* in NIH3T3 and Vero cells. Vaginal instillation of these siRNAs was found to protect mice from vaginal challenge with a lethal dose of HSV-2. This protective effect occurred whether the siRNAs were administered before or after infection and, although under certain circumstances siRNAs can induce the interferon pathway and trigger inflammation, in this study treatment of mice with the siRNAs did not induce an inflammatory response.