MATHEMATICAL MODELLING TO UNDERSTAND MICROBIAL BEHAVIOUR AND ADVANCE NOVEL TREATMENTS FOR BACTERIAL INFECTIONS

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The ability of bacteria to become resistant to previously successful antibiotic treatments is an urgent and increasing worldwide problem. Solutions can be sought via a number of methods including, for example, identifying novel antibiotics, re-engineering existing antibiotics or developing alternative treatment methods. The nonlinear interactions involved in infection and treatment render it difficult to predict the success of any of these methods without the use of computational tools in addition to more traditional experimental work. We use mathematical modelling to aid in the development of anti-virulence treatments which, unlike conventional antibiotics that directly target a bacterium's survival, may instead attenuate bacteria and prevent them from being able to cause infection or evade antibiotics. Many of these approaches, however, are only partially successful when tested in infection models. Our group are studying a variety of potential targets, including preventing bacteria from binding to host cells, inhibiting the formation of persister cells (these can tolerate the presence of antibiotics) and blocking efflux pump action (a key mechanism of antimicrobial resistance). I will present results that illustrate how mathematical modelling can suggest ways in which to improve the efficacy of these approaches.