

Bacterial Swarming and Antibiotic Tolerance

Abstract: Many bacteria swim individually in liquid, but migrate as a dense consortium on the surface of a semi-solid substrate by a process known as 'swarming'. Flagella propel the bacteria during both swimming and swarming. A special property of swarming bacteria is their ability to withstand exposure to a variety of antibiotics at concentrations that are lethal for bacteria swimming in liquid. This phenomenon is called 'adaptive resistance', because it is maintained only during the swarming state and dissipates once the bacteria are transferred to liquid i.e. the resistance is non-genetic. Cell density is an important factor in this resistance. It was reported (Butler et al., 2010) that during swarming over an antibiotic surface, a substantial population of dead cells accumulate on agar, indicating a possible contribution of these cells to the observed resistance. I will describe our progress in understanding this phenomenon using genetics, biochemistry and microscopy. Overall, we find that two signaling pathways are involved in bacterial survival under conditions of antibiotic exposure. The first is the known chemotaxis signaling pathway, and the second pathway is new.