

### P3 – AFM Imaging Reveals Antimicrobial Action of Sushi Peptides on Gram Negative Bacteria

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Septic shock resulting from gram negative bacterial (GNB) infection remains an unresolved clinical threat that may lead to major organ failure and death. Innovative antimicrobial peptides and proteins are designed for combating bacterial infection and inhibiting septic shock. However, the poor understanding of the antimicrobial mechanisms of these peptides and proteins obstructs the progress of designing effective drug candidates. In this study, the antibacterial effect of Sushi peptide, S3, against GNB was investigated using atomic force microscopy (AFM). Both *Escherichia coli* and *Pseudomonas aeruginosa* were incubated with different concentrations of S3 for different periods of time and then air dried for AFM imaging. The observed progressive change in the cell morphology suggests that S3 acts on different strains of GNB through a similar potent mechanism. From the high resolution images we obtained at different concentrations of S3-treated cells, we propose a three-stage mechanism of cell injury: extraction of LPS and perturbation of the bacterial outer membrane; permeabilisation of the inner membrane; and disintegration and lysis of the cell. During this cell damage, the periplasmic and cytoplasmic materials were evidently released. The AFM images have provided vivid and detailed evidence for the antimicrobial action at the nanometer scale. The AFM results support our hypothesis that the S3 peptide perturbs the GNB membrane via the “carpet-model” and thus, provide important insights into their antimicrobial action.

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