Plenary 16

How to Poke Holes in Biomembranes - A Lesson from Antimicrobial Peptides

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PG-1, a cationic antimicrobial peptide, kills bacteria by forming pores which increase membrane permeability to ions or larger molecules. It has been proposed that PG-1 selectively disrupts bacterial membrane over mammalian membranes. To study the mechanism of action of PG-1, we directly visualize the topological changes induced by PG-1 in model membranes via atomic force microscopy (AFM). PG-1 induces structural transformations in supported lipid bilayers, progressing from fingerlike instabilities at bilayer edges, to the formation of surface-defects, and finally to a network of stripe-like structures in a zwitterionic dimyristoylphosphatidylcholine (DMPC) model membrane with increasing PG-1 concentration. While DMPC bilayers exhibits surface defects with the addition of PG-1, in the presence of an anionic lipid,1,2-Dimyristoyl-sn-Glycero-3-[Phospho-rac-(1-glycerol)], surface defects are not observed at the intermediate stage of membrane disruption. These and other results obtained from lipids with different chain length indicate the formation of surface defects depends on the phase and charge states of the lipid species. Understanding these effects would help elucidate the mechanism by which PG-1 uses to discriminate between bacterial and mammalian cells. The knowledge gained from antimicrobial peptides has also allowed us to design membrane disrupting agents that are abiogenic in origin.