Developing a Targeting System for Bacterial Membranes

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Abstract: An ammonium picket porphyrin that targets bacterial membranes has been prepared and shown to bind to phosphatidylglycerol (PG), a bacterial lipid, when the lipid was in solution, contained within synthetic membrane vesicles, or when in Gram-negative and Gram-positive bacterial membranes. The multifunctional receptor was designed to interact with both the phosphate anion portion and neutral glycerol portion of the lipid headgroup. The receptor’s affinity and selectivity for binding to surfactant vesicles or lipid vesicles that contain PG within their membranes was directly measured using fluorescence correlation spectroscopy (FCS). FCS demonstrated that the picket porphyrin’s binding pocket was complementary for the lipid headgroup, since simple Coulumbic interactions alone did not induce binding. The lipid-receptor binding motif in solution was shown to mirror the binding motif of membrane-bound PG and receptor. Cell lysis assays with E. coli (Gram-negative) and Bacillus thuringensis (Gram-positive) probed with UV/Visible spectrophotometry indicated that the receptor was able to penetrate either bacterial cell wall and to bind to the bacterial inner membrane. Interestingly, the receptor itself inhibits gram-negative bacterial growth in low concentrations while not being degraded or metabolized.