

**Title:**

Getting to the Root of Bacterial Hairs: What is “s”?

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**Abstract:**

An atomic force microscope (AFM) was used to measure the steric forces of lipopolysaccharides (LPS) on the biofilm-forming bacteria, *Pseudomonas aeruginosa*. It is well known that LPS play a vital role in biofilm formation. These forces were characterized with a modified version of the Alexander and de Gennes (AdG) model for polymers, which is a function of equilibrium brush length,  $L$ , probe radius,  $R$ , temperature,  $T$ , separation distance,  $D$ , and an indefinite density variable,  $s$ . This last parameter was originally distinguished by de Gennes as the root spacing or mesh spacing depending upon the type of polymer adhesion; however since then it has been commonly thought of as the root spacing. This study aims to clarify the ambiguity of this parameter as a first step in characterizing biofilm formation. Varying the temperature and pH at which the steric forces of the LPS are measured and then analyzing the produced force curves with Matlab, should allow us to measure  $s$ . The Matlab program has been written to crop large numbers of force curves in accordance with the Alexander and de Gennes polymer model objectively and quickly. If  $s$  is the root spacing it should remain constant regardless of the changing polymer lengths, on the other hand if it is the mesh spacing it will be proportional to the temperature and pH. Preliminary data suggest that the LPS vary with temperature and pH. The data also suggest that  $s$  represents the mesh spacing. Once  $s$  has been described, further studies can be done to determine how environmental changes influence  $L$ , and  $s$  and consequently biofilm formation.