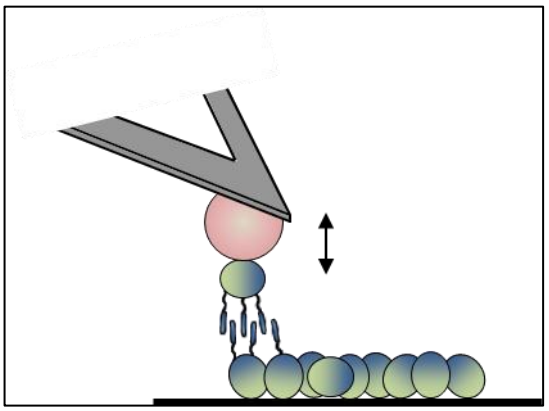
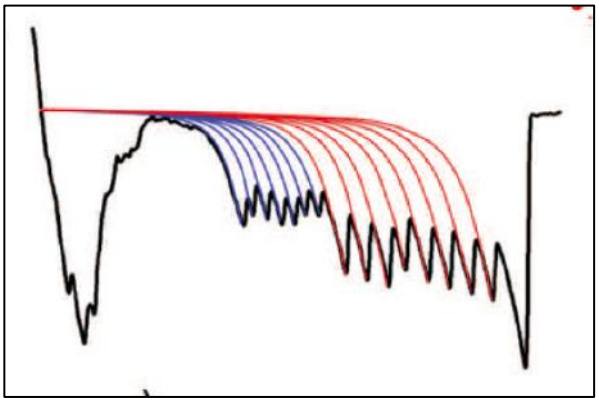
Forces Holding Bacteria Together in Staphylococcal Biofilm

Monday, 18th January, 2016



A collaboration between Assistant Professor Joan Geoghegan, Professor Tim Foster (both at the Department of Microbiology) and Professor Yves Dufrêne at the Université Catholique de Louvain, Belgium has resulted in the publication of several papers including one most recently in the Proceedings of the National Academy of Sciences of the USA. This paper uses Atomic Force Microscopy to study molecular forces that hold staphylococcal cells together in multicellular arrays called biofilm. The ability of staphylococci (including MRSA) to colonize implanted medical devices such as catheters, artificial joints and heart valves is a major factor contributing to infection. Surgery is often required to remove and replace colonized devices. The bacteria adhere to the biomaterial and grow in multicellular communities called biofilm which are impervious to antibiotics and are resistant to host immune defences. Until recently the glue that held the biofilm cells together was considered exclusively to be a sugary polymer. The Staphylococcal Pathogenesis Laboratory discovered that many strains, including some MRSA, are held together by interactions between proteins attached to their surfaces.



Professor Dufrêne is a leading expert in the use of Atomic Force Microscopy to measure the interactions between single cells and molecules. Such nano-scale microbiological investigations have revealed novel insights into the strength of cell attachment to conditioned biomaterial and of the cell-cell interactions that occur as the biofilm develops. The current paper unravels the molecular forces that hold together cells promoted by one particular protein called SasG. This interaction is dependent on the presence of zinc ions which are not only required for the SasG-SasG interaction but also to modify the topology of the bacterial cell surface and to increase the exposure of SasG and its ability to interact with its partner. This work highlights the key role that molecular forces play in guiding cellular functions in staphylococcal biofilms.

Clearer understanding of the nature of cell cohesion and the forces that hold cells together will offer opportunities for the development of novel compounds to prevent or disrupt biofilm.

Formosa-Dague C, Speziale P, Foster TJ, Geoghegan JA, Dufrêne YF. Zinc-dependent mechanical properties of Staphylococcus aureus biofilm-forming surface protein SasG. Proc Natl Acad Sci U S A. 2015 Dec 29. pii: 201519265.[Epub ahead of print] PubMed PMID: 26715750.