

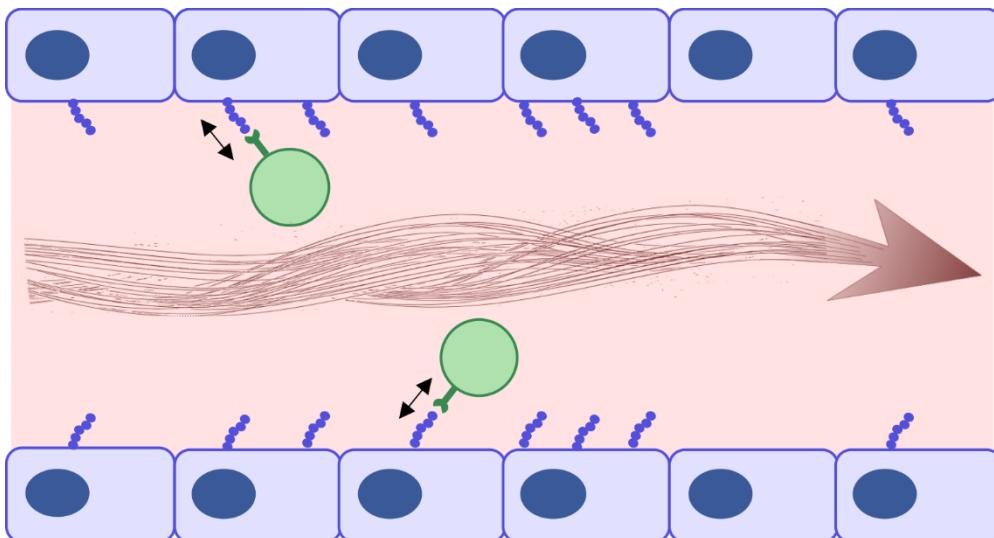
Unraveling what strengthens bacterium-host adhesion at the molecular level using AFM force spectroscopy.

Albertus Viljoen

Institut de Pharmacologie et de Biologie Structurale (IPBS), CNRS, Université Toulouse III - Paul Sabatier (UPS), 31400, Toulouse, France

albertus.viljoen@ipbs.fr

A crucial first step in bacterial infection is the adhesion of pathogenic microbes to host cells and tissues. During this process, bacteria must overcome physical forces such as shear stress and tissue deformation to establish stable attachment. Understanding how pathogens strengthen adhesion at the molecular level remains a key challenge in microbiology. In this talk, I will address this issue by focusing on two clinically important pathogens, *Staphylococcus aureus* and *Mycobacterium tuberculosis*. Leveraging atomic force microscopy (AFM) force spectroscopy, we have uncovered distinct molecular mechanisms that enable these bacteria to achieve robust adhesion. In *S. aureus*, we identified adhesin-ligand complexes with remarkable mechanostability and have elucidated how this stability is enhanced at the single-molecule level. For *M. tuberculosis*, we revealed that ligand clustering at the bacterial surface plays a critical role in facilitating stable interactions with a host receptor expressed on innate immune cells. These insights, enabled by AFM, provide a deeper understanding of the molecular strategies pathogens use to secure adhesion under challenging conditions, and may open new avenues for developing antimicrobial interventions.



Professional summary: I obtained my PhD in Molecular Biology in 2013 from Stellenbosch University, South Africa, where I focused on the metabolic pathways used by pathogenic bacteria to survive within host cells. After completing my PhD, I moved to France and Belgium for postdoctoral research, where I explored bacterial lipid production, export mechanisms, and biophysical properties. Over the past

decade, my work has resulted in over 60 peer-reviewed publications and multiple research grants, including a recent ANRS allocation de recherche. Beyond my passion for science, my love for France—especially its rich culture and cuisine—has been a key reason why I was eager to continue my research here. This year, I was recruited through the CNRS CRCN competition in Section 20 as a *Chargé de Recherche*. Now, at the Institute of Pharmacology and Structural Biology (IPBS) in Toulouse, I am dedicated to uncovering new molecular mechanisms of mycobacterial adhesion and biofilm formation, with a particular focus on molecular and biophysical approaches.