Force nanoscopy of microbial pathogens

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Progress in nanomedicine relies on the development of advanced tools for imaging and manipulating biological systems on the nanoscale. Among these, atomic force microscopy (AFM) techniques have emerged as a powerful platform for analyzing the structure, properties and functions of living cells, including microbial pathogens. AFM imaging enables researchers to observe microbial cell walls in solution and at high resolution, and to monitor their remodelling upon interaction with drugs. In addition, single-molecule force spectroscopy analyzes the localization, mechanics and interactions of the individual cell wall constituents, thereby contributing to our understanding of how cell surface receptors are spatially-organized (e.g. clustering) and respond to force (e.g. single specific bonds, sequential unfolding of single protein domains, zipper-like adhesion, and spring-like properties). Knowledge of these molecular properties is critical to our understanding of pathogen surface interactions. In the future, we expect this new form of nanoscopy to have an important impact on nanomedicine, particularly for understanding microbe-drug and microbe-host interactions and for developing new anti-microbial strategies. I will survey recent breakthroughs we have made in applying AFM to microbial pathogens (1-4).

References

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