A Mechanical Engineer’s Approach to Bacterial Infections

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Biofilm formation is a significant problem within the American healthcare system, accounting for 17 million infections, 550,000 deaths, and an estimated cost in the billions of dollars annually. Infections from biofilm formation are prolific in implantology, accounting for half a million cases annually. While there have been many advancements in the study of biomaterials, device related infections remain a critical problem. To prevent bacterial biofilms from forming it is paramount to study and quantify the adhesion of bacteria onto various surfaces.

Our lab leverages experimental thin film mechanics to investigate biological adhesion onto implants. We have adapted the laser spallation technique to determine dominant parameters that promote strong biofilm adhesion and are establishing a novel Adhesion Index – a ratio of mammalian cell adhesion to biofilm adhesion. We have also developed protocols for combined confocal microscopy and atomic force microscopy, to facilitate live, in-solution, data collection (e.g., surface morphology, elastic modulus, pull-off force, and surface roughness) on same-cell samples to couple these mechanical properties with the presence or absence of cell wall components. With these new tools, we investigate the role of biofilm mechanics and contribute a better understanding about how to develop new devices that will be less prone to infections.