Unimaginable numbers of bacteria are around us, attached to almost every possible surface. This is a natural process, but depending on the situation it can be either desirable or not. In food or medical industry usually bacteria cause problems and even grave threats. Usually, just killing the bacteria does not resolve the problem, as they can be still dangerous even when dead. It is rather more desirable to target forming aggregates or biofilms that enhance bacterial survival abilities.

Thus, our research is aimed at identifying the mechanisms of the bacterial adhesion to various surfaces, reactions to antibiotics and response to lateral mechanical interaction and its influence on the detachment of bacteria from surface. The atomic force microscope (AFM) is an ideal tool for our aims. The apparatus allows not only to collect three-dimensional topography images from the sample but also to investigate its mechanical properties. In principle AFM is a tiny and a very sharp tip attached to a lever that scans the substrate line by line with a nanometer precision. By acquiring its movement distortions due to the interaction with the surface we can create a highly magnified three dimensional image of scanned surface. Since the cantilever is typically 200 microns long and its tip is approximately 10 nanometers in radius, those distortions are barely visible even with an optical microscope. In the AFM a laser beam is deflected from the lever and its movement is converted to a voltage signal by photodetectors with a nanometer precision. Additionally, using sophisticated calibration methods we are able to translate this movement to force units. While investigating bacteria properties we are going to measure the forces both perpendicular and lateral to the surface. We are going to perform those force measurements for single bacterial cells and over the biofilms, registering their subtle differences and ways to detach them from the surface in the optimal way.

After acquiring the understanding of the process in nanoscale we may be able to mimic it on the macroscale.

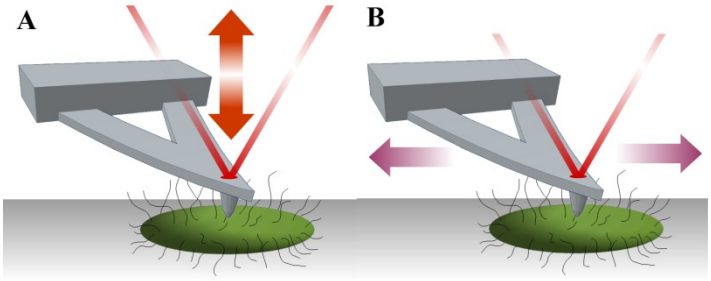

Figure 1: Study of the perpendicular (A) and lateral (B) bacterial adhesion forces using AFM