Tracing barnacle's footprint

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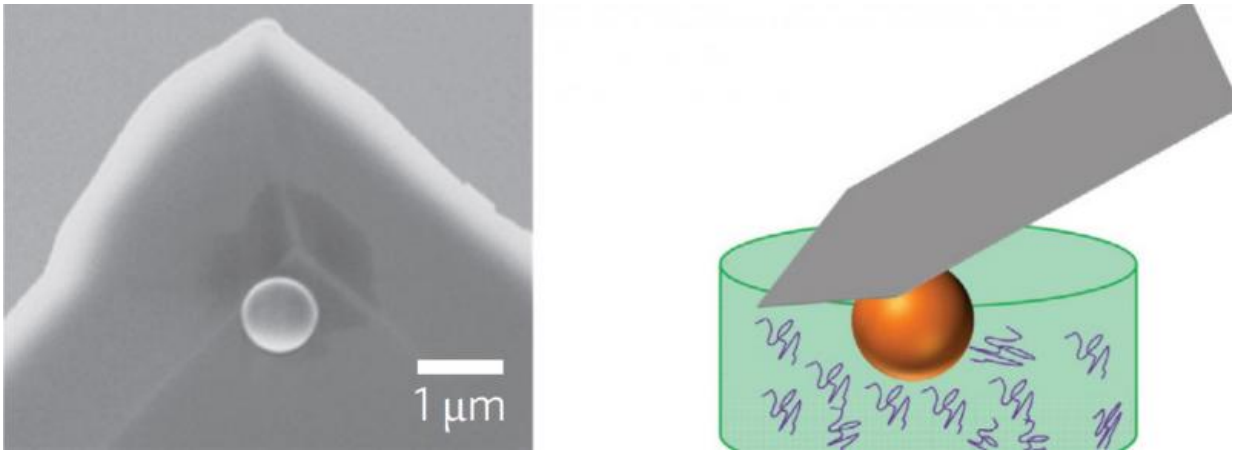


Modified AFM cantilever to which protein molecules will attach. Credit: University of Twente

In infection diseases, membrane fouling, interaction with bacteria, as well as in rapid healing of wounds for example, the way proteins interact with a surface plays an important role. On a surface, they function in a different way than in solution. On a ship hull, the larvae of the barnacle will leave tiny traces of proteins to test if the surface is attractive for long-term attachment. If we get to know more about this interaction, it will be possible to develop surface conditions that are less attractive for the barnacle. Large amounts of barnacles on a ship will have a destructive effect on flow resistance and will lead to more fuel consumption. The new measuring method makes use of a modified Atomic Force Microscope: a tiny ball glued to the cantilever of the

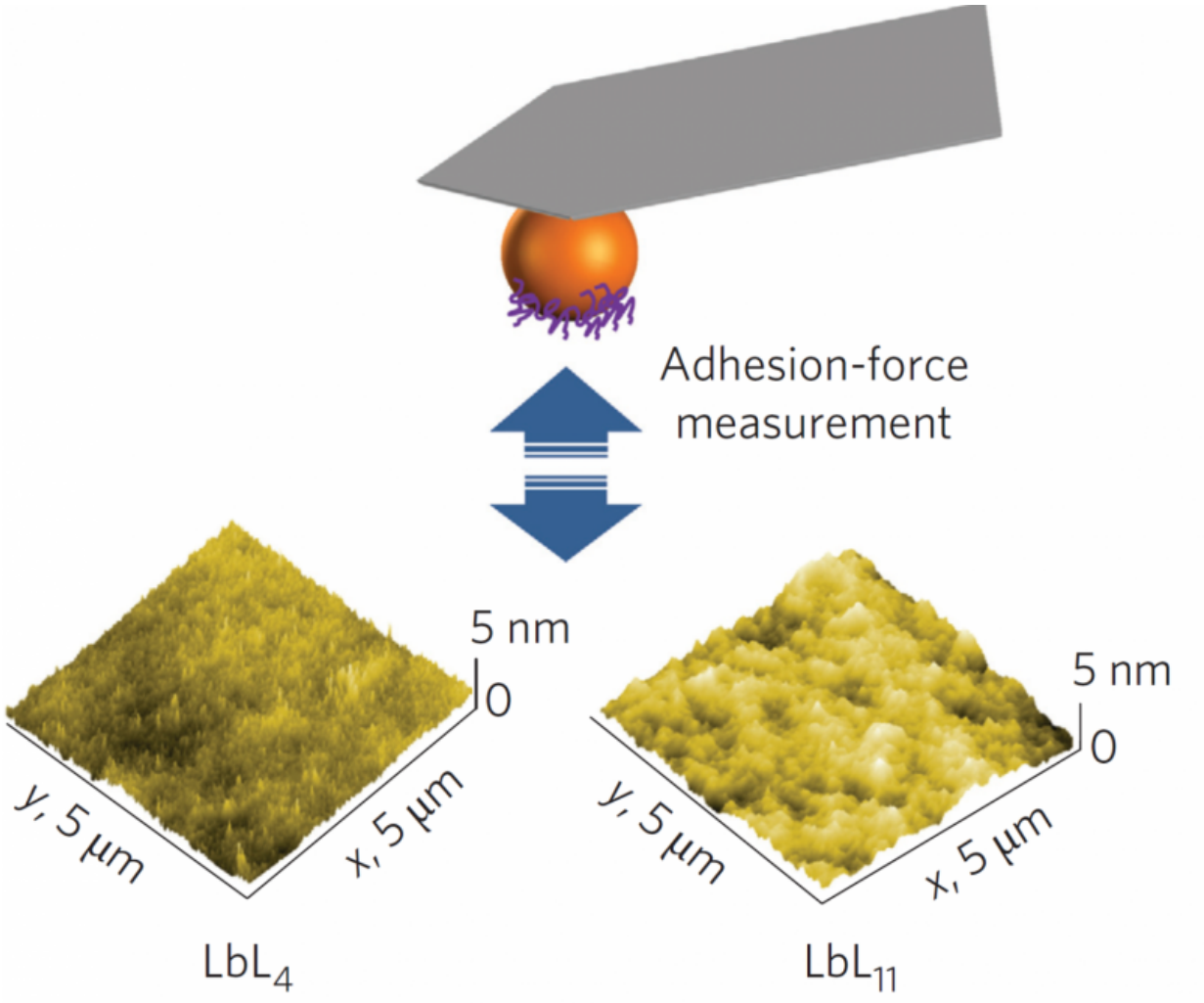
microscope will attract protein molecules.

Force measurements

An amount of just hundreds of protein molecules will be sufficient to determine a crucial value, called the iso-electric point (pI): this is the pH-value at which the protein has net zero electric charge. The pI value says a lot about the surroundings a protein will 'feel comfortable' in, and to which it preferably moves. Using the AFM microscope, of which the modified tip has collected protein molecules, it is possible to perform force measurements for different pH values. The tip will be attracted or repelled, or show no movement when the pI point is reached. For these measurements, the researchers made a special reference material consisting of several layers. Using this, the effect of a number of pH-values can be tested until the pI value is found.

Paint change

The tests have been successfully performed for a number of known proteins like fibrinogen, myoglobine and bovine albumin. And returning to the barnacle: the tiny protein footprint will contain enough molecules to determine the pI value. This quantifies the ideal surface conditions, and using this knowledge, new choices can be made for e.g. the paint that is used on a ship hull.



Force measurements on reference material. Credit: University of Twente

More information: Shifeng Guo et al. Measuring protein isoelectric points by AFM-based force spectroscopy using trace amounts of sample, *Nature Nanotechnology* (2016). DOI: 10.1038/nnano.2016.118

Provided by University of Twente