The Last Nanometer – Deep Look into the Hydration Structure of DNA and Solid Surfaces Using Ultra-High Resolution AFM

Uri Sivan, Itai Schlesinger, and Kfir Kuchuk
Technion-IIT, Dep. of Physics, Haifa, Israel
phsivan@tx.technion.ac.il

Abstract

The nature of the interface between biomolecules or solid surfaces with adjacent water molecules governs the interaction of these objects with other molecules or surfaces. Recent advancements in dynamic-mode atomic force microscopy and 3d force spectroscopy open a new window into the study of these short-range phenomena, which are generally inaccessible to other methods. In my talk I will present two recent ultra-high resolution studies of DNA hydration on one hand, and the hydration of hydrophobic surfaces on the other hand. In the first case I'll show that labile water, namely water participating in biological reactions, are concentrated mostly along the DNA grooves and less so on the phosphate backbone. In the second case I'll show that hydrophobic surfaces are coated with a thin layer of gas molecules that renders them certain universality, regardless of the underlying surface. This picture will be used to identify the origin of hydrophobic interaction – a long standing puzzle of physical chemistry.

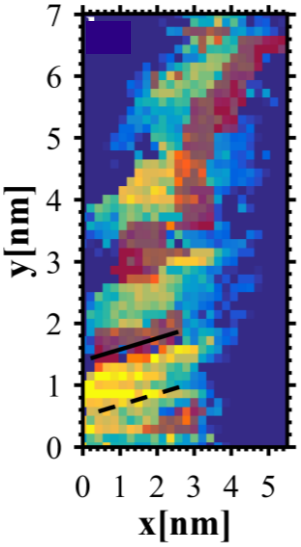

Figure 1: DNA hydration map

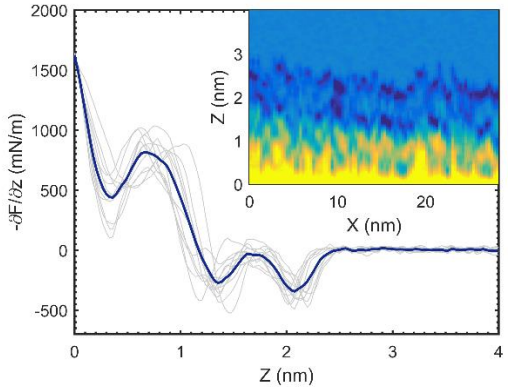

Figure 2: Gas molecules accumulation near hydrophobic FDTS monolayer