AFM of wet viruses and wet virus models

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Biological processes are usually associated with the presence of aqueous electrolytes. However, many organisms can develop "dry" interfaces to air. This is also true for biological matter such as viruses, especially when they are transmitted by air. In analogy to solid surfaces, there are open questions about "dry surfaces", "ultrathin water layers", adsorption and absorption of water.

The tubular Tobacco Mosaic Virus has a simple helical surface structure. Although the averaged structure is known since many decades, we were able to resolve the coat proteins on a single virion by AFM. Besides recording fascinating images even on highly curved surfaces, AFM also provides new insights: The dry virion shows a complex buckling, consisting of irregularly spaced stripes of very low corrugation (<0.1 nm), while wetting gives rise to the well-known helical packing, with a pitch of only 2.3 nm. Such a purely physical surface reconstruction should occur also in many, if not all air-stable viruses, with consequences for virus transmission in general.

To address more complex mammalian viruses, specifically influenza, we have developed several model systems, which allow to characterize changes upon drying in the adsorbed state by AFM. For example, we try to model the outer virus coat, which is dominated by glycosylated proteins, by gold particles, which are covalently linked to sugar moieties.