Small Solutions to Large Problems: AFM Studies of Pharmaceutical Nanoparticles

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Atomic Force Microscopy (AFM) is a versatile technique that can quantitatively image and manipulate surfaces by probing them with a very sharp tip. Because of this, close to any system from the atomic to the microscale can be studied with many applications being in biophysics [1]. In pharmaceutical research, however, AFM is often limited to qualitative imaging as a supplement to bulk techniques [2].

In this talk, I will present my work so far in using relatively simple topographical imaging of pharmaceutical nanoparticles on a substrate with my focus being on protamine-microRNA nanoparticles (also known as proticles) [3]. We have found that the results are highly dependent upon which substrate is chosen as only some end up showing proticle-like structures. Furthermore, we have been able to image particle-particle interactions as well as image the effect of different preparation methods with the potential being that AFM results can be correlated to pharmaceutical functionality.

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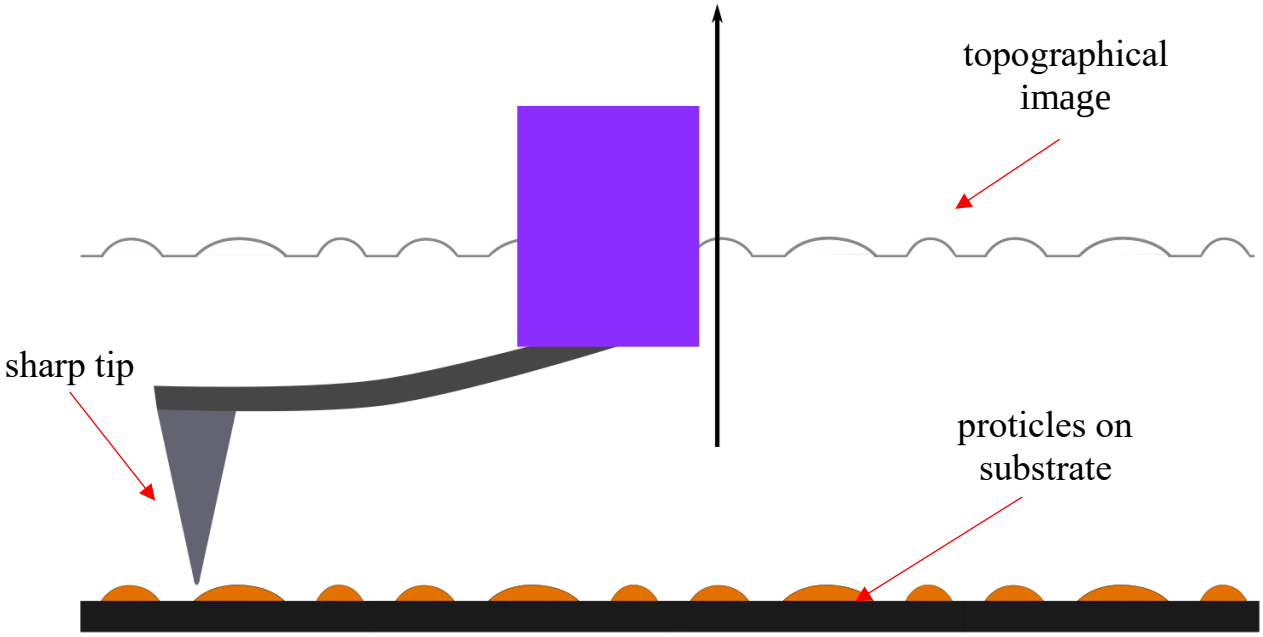

References:

1. Dufrêne, Y. F., Ando, T., Garcia, R., Alsteens, D., Martinez-Martin, D., Engel, A., ... & Müller, D. J. (2017). Imaging modes of atomic force microscopy for application in molecular and cell biology. *Nature nanotechnology*, *12*(4), 295-307.

2. Sitterberg, J., Özcetin, A., Ehrhardt, C., & Bakowsky, U. (2010). Utilising atomic force microscopy for the characterisation of nanoscale drug delivery systems. *European Journal of Pharmaceutics and Biopharmaceutics*, *74*(1), 2-13.

3. Junghans, M., Kreuter, J., & Zimmer, A. (2000). Antisense delivery using protamine–oligonucleotide particles. Nucleic Acids Research, 28(10), e45-e45.