Dynamics of magnetically driven magnetically active nanotubes in fluids for bio-medical applications

K. Kempa, Department of Physics, Boston College

In a seminal paper [1] the nanospearing techniques was invented, which allows for a dramatically improved molecular delivery (transfection) into biological cells. The nanospearing effect is caused by accelerated motion of a special kind of, magnetically active carbon nanotubes, that would accelerate in the presence of external, rapidly changing magnetic field, "impaling" or "nanospearing" the cell membranes, thus enabling molecules attached to these nanotubes to enter the cell interior. While this technique is presently used in many circumstances, the details of the nanotube dynamics in the fluid surrounding the cell have been unknown. In this talk, I will present some recent calculations and simulations explaining this dynamics. I will also discuss the possibility of using a modified version of this technique to terminally damage selected cells, such as bacteria and/or cancer cells. This could lead to new medical therapies.

[1] D. Cai, J. Mataraza, Z. H. Qin, Z. Huang, J. Huang, T. C. Chiles, D. Carnahan, K. Kempa, Z.F. Ren, "Highly efficient molecular delivery into mammalian cells using carbon nanotube spearing", *Nature Methods*, 2, 449 (2005).