Ultrasmall nanoparticles for bioapplications: potential in droplets based microfluidics

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Recently, ultrasmall nanomaterials (sub-10 nm size) have started to attract increasing attention due to their properties and their potential for medicinal applications [1]. In this direction, ultrasmall silicon nanoparticles (Si NPs) and carbon dots (CQDs) are gaining in importance, especially in the imaging and therapy [3, 4] of e.g. cancer cells. Both types of particles display photoluminescence, high resistance against photo-bleaching, chemical stability after functionalization and biocompatibility. The possibility to modify their surface in a covalent way, render them an advantageous platform to anchor targeting therapeutic drugs and/or labels (red-emitting dyes for optical imaging, bifunctional chelator agents for e.g. radiometals enabling SPECT or PET).

The interactions of this kind of NPs with cells using novel *in vitro* techniques, such as droplets based microfluidics/millifluidics, offer new perspectives. Indeed, due to the automated continuous monitoring of the fluorescence signal [5], cells can be studied for long times and in a controlled way. This would help to implement the state-of-the-art of cells/nanoparticles interactions by creating a more realistic representation of *in vivo* conditions in 3D isolated environments, such as droplets, with the opportunity to perform many simultaneous experiments and the chance to reduce the number of *in vivo* experiments.

References

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Figures

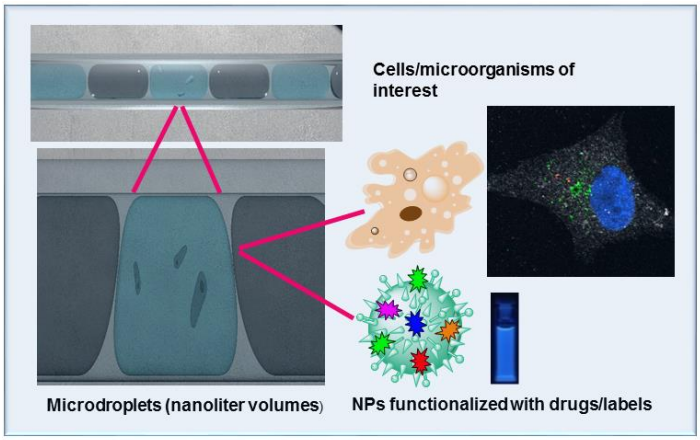

Figure 1. Cells/microorganisms and properly functionalized NPs in microdroplets (nanoliter volumes).