Intracellular drug release using mesoporous silica nanoparticles as drug vectors

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Mesoporous silica nanoparticles have attracted immense interest as drug carriers over the last years, and successful targeted drug delivery has been demonstrated in vitro and occasionally in vivo in small animal models. The flexibility in terms of particle size, shape, and surface chemistry makes it possible to fine-tune the physical and chemical properties to correspond to the requirements of a specific administration route. The presentation will critically discuss biodistribution issues found when moving from in vitro to in vivo studies, and relate these to the physicochemical properties of the nanoparticles controlling the extent of protein adsorption to the particles. Special focus will be put on the optimization of passive targeting of these particles to tumors. In the second part of the presentation approaches towards local administration of the particles for local therapies or tissue engineering applications will be discussed, with focus on organic scaffolds serving as hosts for the mesoporous silica nanoparticles. Efficient control of stem cell differentiation based on local, intracellular drug delivery will be demonstrated.