Advancements in silica nanoparticle fabrication techniques have resulted in their increased utilisation for a variety of biomedical applications including diagnostic imaging, drug delivery and novel therapeutics. The ease of surface modification provides tremendous opportunity for tailoring properties for developing multifunctionality in a single particle. Two particle designs including core shell and mesoporous silica nanoparticles will be discussed with regard to providing a flavour of the versatility these constructs afford.

1) Core shell: The nanoparticle surface interaction with biological media critically affects their toxicity. Silica nanoparticles (SiNPs) are widely reported to be biocompatible, however, this has been shown to be surface charge dependant[1]. Our group has demonstrated that attenuated vasodilator responses induced by SiNP incubation, can be partially restored after coating in ceria [2].

2) Mesoporous silica: Mesoporous silica nanoparticles (MSNs) are widely used for drug delivery applications owing to their well-ordered pore architecture giving them very high surface area to volume ratios (>1100 m2/g). The MSNs utilised were monodispersive and spherical with a diameter of ~100 nm and the interior pores had an average diameter of ~3 nm. We have loaded these pores with endothelial-independent vasodilator, sodium nitroprusside (SNP) and demonstrated real time drug delivery by the MSNs on by assessing the degree of aortic vessel dilation, in real time, using an organ bath system, ex vivo[3]. Our results suggest that MSNs have great implications for future biomedical applications in the treating of conditions where attenuated dilation occurs. The MSNs are promising drug delivery platforms for the delivery of drugs to the vasculature.

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