P038 Investigating the Effect of Nanoparticle Size on Diffusion Through Mucus.

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We do not, as yet, have a complete understanding of how nanoparticles, less than 100nm, interact with biological membranes. It has been hypothesised that the negligible effects of gravity and inertia on nanoscale particles mean they can offer enhanced diffusivity for transport through biological membranes such as mucus. However, the exact relationship between nanoparticle size and diffusivity is currently unknown. Previous experiments have shown deviation of the observed data from the predictions of the Stokes-Einstein model. This model however, does not take the effects of nanoscale size and heterogeneity of the membrane into consideration.

Using Vertical Diffusion Chambers, we have conducted diffusion experiments on 20nm, 40nm and 100nm fluorescent, carboxylate-modified, polystyrene nanospheres through reconstituted mucus to determine how decreasing nanoparticle size effects particle diffusivity through mucus. We aim to identify the importance of size as a factor for pulmonary administered, nanoparticle-based gene delivery and toxicology.

On the basis of the results obtained using these three nanoparticle sizes through mucus, the relationship between nanoparticle size and diffusivity does not appear to be inversely proportional as predicted by the Stokes-Einstein equation. The experimental diffusion coefficient for the 20nm particles is much larger than would be expected from an extrapolation of the results obtained for the 40nm and 100nm particles.