Enhanced Physiological Microenvironment for Improved Evaluation of Nanoparticle Behavior

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Enhanced Physiological Microenvironment for Improved Evaluation of Nanoparticle Behavior

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Rationale

• Nanoparticles (NPs) are being incorporated into numerous products and applications.
• Thus, the safety of NPs needs to be evaluated.
• Both standard in vitro and in vivo methodologies pose significant concerns, giving rise to the need for an enhanced in vitro microenvironment for evaluation of NP-induced bioeffects.

Methodology

• A549 human alveolar epithelial cells
• Flow rate chosen to match relevant physiological linear velocity within pulmonary artery

Results

AuNP Characterization

Fig 1: Research approach

Fig 5: Agglomerate sizes of AuNPs

Fig 7: Deposition efficiency of AuNPs

Fig 8: TEM image of AuNP uptake (static, AAF)

Nano-Bio Interface

Fig 2: Establishment of dynamic flow through the use of a peristaltic pump

Fig 3: TEM image of 60 nm TA coated AuNPs

Fig 4: Spectral signature of AuNPs in various fluids

Fig 6: Rates of dissolution as a function of environment

Fig 9: Visualization of the nano-bio interface. A-D: Static; E-H: Dynamic; A,C,E,G: Media; B,D,F,H: AAF; C,D,G,H: with AuNPs

Conclusions

• NP characteristics and the nano-bio interface are highly dependent upon environmental composition and flow patterns.
• AAF caused increased agglomeration and deposition.
• Dynamic flow modified dissolution and cell morphology/behavior.