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

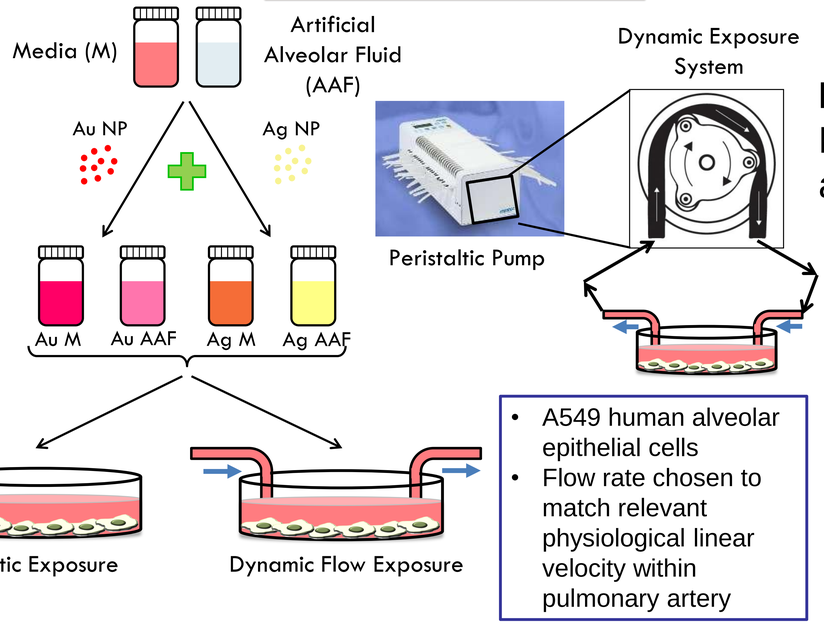

Fig 1: Research approach

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

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

Results

AuNP Characterization

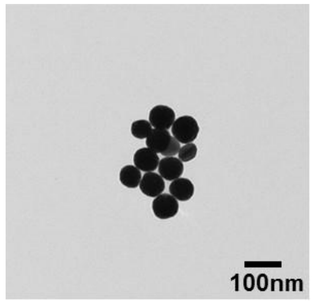

Fig 3: TEM image of 60 nm TA coated AuNPs

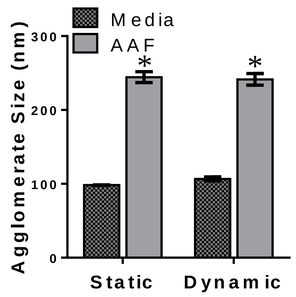

Fig 5: Agglomerate sizes of AuNPs

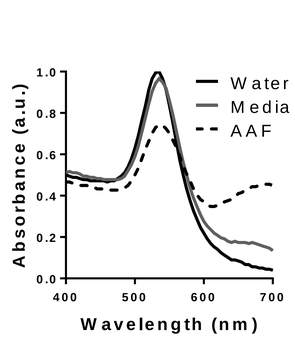

Fig 4: Spectral signature of AuNPs in various fluids

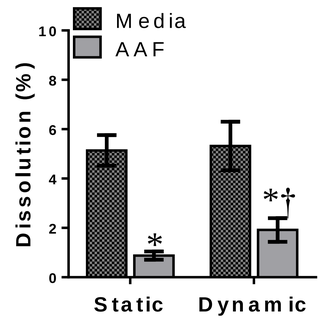

Fig 6: Rates of dissolution as a function of environment

Nano-Bio Interface

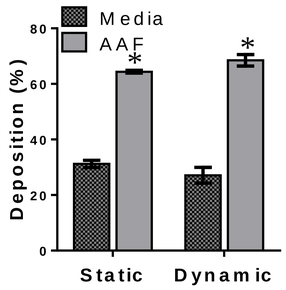

Fig 7: Deposition efficiency of AuNPs

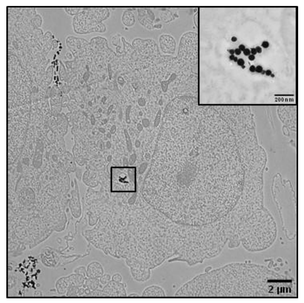

Fig 8: TEM image of AuNP uptake (static, AAF)

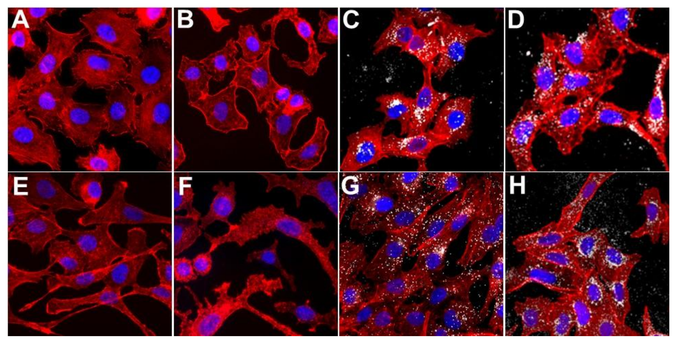

Fig 9: Visualization of the nano-bio interface. A-D: Static; E-H: Dynamic; A,C,E,G: Media; B,D,F,H: AAF; C,D,G,H: with AuNPs

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.