Lecture 17: Assessing nanotoxicity at the single cell level

I. Outline – the need for single cell measures of nanotoxicity
   A. There is more than one way for a cell to die...
   B. "Necrosis" vs. "Apoptosis"
   C. There are other forms of "toxicity"
   D. Some other challenges in measuring toxicity of nanomaterials

II. Necrosis vs. Apoptosis mechanisms
   A. Necrosis is unplanned "cell injury"
   B. Apoptosis is planned "programmed cell death"
   C. Why it is important to distinguish between necrosis and apoptosis

III. Single cell assays for necrosis and apoptosis
   A. Dye exclusion assays for necrosis
   B. TUNEL assays for late apoptosis
   C. Annexin V assays for early apoptosis
   D. COMET assays for DNA damage and repair
   E. Light scatter assays

IV. Nanotoxicity in vivo – some additional challenges
   A. Single cell nanotoxicity, plus....
   B. Accumulations of nanoparticles can change toxicity locally to tissues and organs
   C. Filtration issues of nanoparticles – size matters – toxicity to liver and lung

References


Ryman-Rasmussen, J.P., Riviere, J.E., Monteiro-Riviere, N.A. Surface Coatings Determine Cytotoxicity and Irritation Potential of Quantum Dot Nanoparticles in Epidermal Keratinocytes Journal of Investigative Dermatology. 10 August 2006; doi:10.1038/sj.jid.5700508