Intracellular uptake and toxicity of gold nanoparticles (AuNPs) in representative cell lines

***Millicent Magogotya*[1, 2], *Melissa Vetten*[1] *and Mary Gulumian*[1,3]**
[1] Department of Toxicology, National Health Laboratory Service, Braamfontein, South Africa
[2] Department of Biotechnology and Food Technology, Tshwane University of Technology, Pretoria, South Africa
[3]Haematology and Molecular Medicine, University of the Witwatersrand
E-mail-address: millicentm@nioh.ac.za

Introduction
The first frontier to gold nanoparticles (AuNPs) entering the body through direct ingestion is the gastrointestinal (GI) and through transdermal delivery. In this study, internalization, cytotoxicity and genotoxicity of negatively charged 14 nm citrate-stabilized AuNPs and positively charged PEG-liganded amine AuNPs were assessed on human epithelial colorectal adenocarcinoma (Caco-2) cells and the human skin keratinocyte (HaCaT) cells.

Methods
Intracellular uptake of AuNPs was assessed by exposing both the Caco-2 and HaCaT cell lines to either 1 nM or 5 nM concentration of AuNPs for 24 hours and the uptake was assessed using the CytoViva hyperspectral imaging (HSI) system. The xCELLigence system was used to assess cytotoxicity at a range of concentrations between 0.5 nM and 5 nM of AuNPs. For the assessment of genotoxicity, the *in vitro* micronucleus assay was used.

Results
Dark field images were acquired and AuNPs were visualized in both cell lines, therefore confirming NP internalization, with a high level of citrate-stabilized AuNPs in both cell lines. The 14 nm citrate AuNPs were cytotoxic to both the Caco-2 and HaCaT cells and 14 nm amine-AuNPs were observed to be non-cytotoxic, even at the highest concentration. However, concentration-dependent genotoxicity was observed in both cell lines treated with the citrate and amine AuNPs.

Conclusion
Even though AuNPs entered the cells, only the citrate-stabilized AuNPs showed cytotoxicity. Therefore, non PEGylated AuNPs enters the cells better than their PEGylated counterparts. Cytotoxic and non-cytotoxic AuNPs were genotoxic to the Caco-2 and HaCaT cells.