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(G*) Analysis of cytotoxicity trends in breast cancer cells using total reflection X-ray fluorescence (TXRF)

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Gold nanoparticles (AuNPs) have unique physical and optical properties that make them ideal for various medical uses such as biomedical imaging, photothermal therapy, and drug delivery. With higher concentrations used in cancer therapy, it is imperative to understand both the benefits and potential side effects of AuNPs. Several studies have been done to quantify the toxicity of naked AuNPs. Still, it is unclear whether the trends in toxicity can be attributed to variations in the cell line, size, and shape of the AuNPs, or to the absolute gold nanoparticle mass taken up by the cell. Utilizing the total reflection X-ray fluorescence (TXRF), rapid and precise uptake quantification for trace-levels of gold, complemented with a cell assay to measure short-term toxicity, is proposed. By incubating breast cancer cells MDA-MB-231 with different sizes, concentrations, and shapes of naked AuNPs, while measuring total cellular uptake of gold, the correlation between these parameters is investigated. Following the incubation, cell toxicity is measured using flow cytometry to draw conclusions regarding toxicity trends. We trust that this work will provide insight on the safety of AuNP use in vitro, which could be extrapolated to the safe in vivo clinical use of AuNP.

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