Galactose:PEGamine coated gold nanoparticles adhere to filopodia: effects of nanoparticle synthesis time on cellular uptake and toxicity

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Abstract

Cancer research is drawing major attention of the scientific community. The high death rates, the recurrence after treatment and the widespread occurrence suggests an unmet medical need for successful therapies and early diagnosis. Nowadays, most of the cancer treatments are restricted to surgery, radiation and chemotherapy. All of these methods carry the risk of damaging healthy surrounding cells, tissues and the tumour area. Gold nanoparticles are at the forefront of biological and biomedical research showing an increased promise in targeted cancer therapy due to their unique physicochemical properties. They offer the advantage of interaction with biomolecules both at the cell surface level and inside the cell. This interaction is highly dependent on their ligand composition. Because of their ability to cross many biophysical and biological barriers, they are engineered as platforms for targeted and effective drug delivery and imaging labels. In our study, 2nm AuNPs surface functionalised with a 50:50 ratio of a thiolated α -Galactose derivative and a thiol PEG amine (**Figure 1**) are examined for their toxicity towards normal (HaCaT) and cancer (HSC-3) human skin cell lines *in vitro*. Using this very simple ligand structure, we demonstrate a cancer selective toxicity that depends upon the synthesis duration of the AuNP due to differences in their ligand density. A remarkable adherence to filopodia cellular structure is observed as synthesis time of the AuNPs increases. Such adherence is possibly linked to caspase 8 activation on the cell surface and triggering of death cascades events, thus the higher the toxicity.

Image

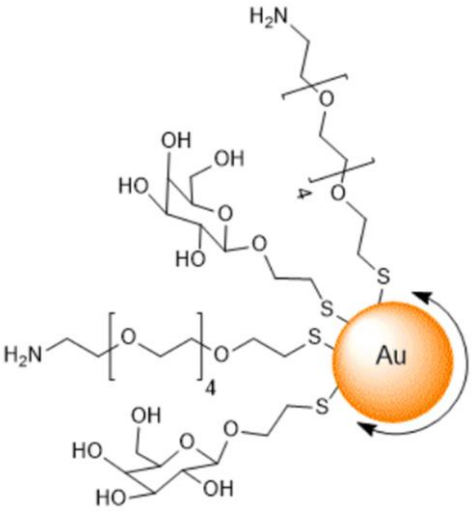


Figure 1: Representation of the chemical structure of the AuNPs. They consist of a gold core with an average diameter of 1.2-1.6 nm to which an organic layer of 50:50 thiolated α -Galactose derivative and thiol PEG amine are attached via gold-sulphur bonds. Synthesis times varied from 1 hr to 5hr. The highly water-soluble carbohydrate layer provides colloidal stability in aqueous solutions, while the thiol PEG amine creates positive charges which enable the particle to interact with biomolecules.



Biography

Konstantina Nadia Tzelepi is a PhD student at The Open University, UK collaborating with the pharmaceutical company Midatech Pharma on investigating the mechanism of gold nanoparticles toxicity in cancer cells. She graduated with a BSc (Hons) in Biochemistry and a Master of Research in Biosciences from Cardiff

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