The effect of shape of gold nanoparticles in cytotoxicity of prostate cancer cell lines

Soares, S.[1], Guerreiro, S.G.[2], Sales, M.G.F. [3], Correa-Duarte, M.[4], Fernandes, R.[5]
[1]BioMark-CEB/ISEP, School of Engineering of the Polytechnic Institute of Porto, Portugal; Instituto de Ciências Biomédicas Abel Salazar – University of Porto; Portugal and University of Vigo, Vigo, Spain, silvia_27_01@hotmail.com;
[2]IPATIMUP/I3S Research Institute; University of Porto, I3S Research Institute, University of Porto, Department of Biomedicine, Biochemistry Unit, Faculty of Medicine, University of Porto, Porto, Portugal, scgomes@med.up.pt;
[3]BioMark-CEB/UC, Department of Chemical Engineering, Faculty of Sciences and Technology, University of Coimbra; BioMark-CEB/ISEP, School of Engineering of the Polytechnic Institute of Porto, Portugal, goreti.sales@eq.uc.pt;
[4]Department of Physical Chemistry, Center for Biomedical Research (CINBIO), University of Vigo, Spain, macorrea@uvigo.es;
[5]Superior Health School of the Polytechnic Institute of Porto, Portugal, rfernandes@ess.ipp.pt.

ABSTRACT
Gold nanoparticles (AuNP) can be applied in medicine to treat many diseases, such as cancer. Over the years, they have attracted a lot of interest for therapies. In this study, we synthetized three different shapes of gold nanoparticles – spherical, stars and rods and analyzed their cytotoxicity in prostate cancer cell lines (PC3, DU145 and LNCaP). Cells were treated with different concentrations of gold nanoparticles, from 0 to 1.0 mM during 24h. The results showed that gold nanoparticles were nontoxic to concentration until 1.0 mM.

Key words: Gold nanoparticles, cytotoxicity, *in vitro* assay, prostate cancer

INTRODUTION
Gold nanoparticles (AuNP) are inorganic materials with unique chemical, optical and physical properties. They can be easily synthesized in several sizes and shapes. Thus, it became a choice for researchers that explore these nanoparticles in therapy, image contrast agents and for diagnostic purposes [1, 2].
Although AuNP are relatively biocompatible, it is necessary evaluate the cytotoxicity of the nanoparticles wherever other methods of synthesis are used. It is known that cytotoxicity are depended of concentration, time interval of incubation, type of cell line used, type of assay used and surface coating [3].
In our study, we evaluated the shape effect of AuNPs on cytotoxicity in three prostate cancer cell lines – PC3, Du145 and LNCaP. We synthetized spherical gold nanoparticles (AuNPs), gold nanostars (AuNPst) and gold nanorods (AuNPr), coated with polyethylene glycol (PEG) to improve the interaction with cell membrane and stability.

MATERIALS AND METHODS
AuNPs were prepared according to Turkevich and coworkers and AuNPst were synthesized through similar protocol from a method reported by Kumar and co-workers [4, 5]. Also, AuNPr were produced by seed-mediated approach according the method of Ye and colleagues [6]. After, PEG was added to change the surface of gold nanoparticles.
PC3 and LNCaP cell lines were cultured and maintained in RPMI-1640 media (Sigma Aldrich® LLC, St. Louis, MO) and DU145 cell line was maintained in Eagle's Minimum Essential Medium (EMEM – ATCC® 30-2003™), supplemented with 10% fetal bovine serum (FBS), 1% antibiotics mix and hydrocortisone (1mg/L). Both cell lines were initially cultured and grown to ~80% confluence and then were sub-cultured. Cells were cultured in 96-well plates ($1x10^5$ cells/ mL) for viability determination. All treatments were performed in serum-free conditions. Cells were incubated at 37ºC with 5% CO_2 in a humidified environment.
Cells were seeded ($1x10^5$ cells/mL) in 96 well plates. After 24h, cells were exposed with various concentrations of AuNPs, AuNPst and AuNPr ranging from 0 to 1 mM for 24h. Next, PrestoBlue (PB) assay was used to evaluate the metabolic activity. To this end, 10µL of PB reagent was added directly into the cells in culture medium and then incubated for 1h. The resulting fluorescence/absorbance was measured for excitation and emission wavelengths of 560 and 590nm, respectively.

RESULTS AND DISCUSSION

No significant differences related to cytotoxicity were found between the different shapes of AuNP in all cell lines studied. However, concentrations over 1.0 mM tended to decrease cell viability. This work is in progress and other tests are being carried out in order to understand the impact of these nanostructures on cells.

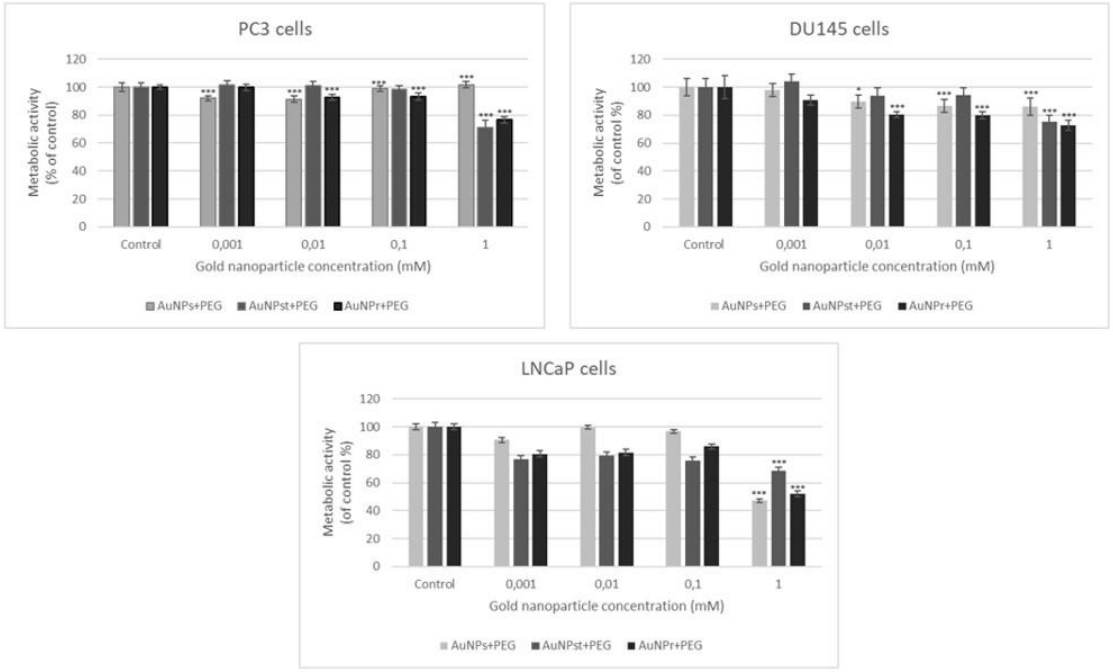

Figure 1. Metabolic activity of AuNPs, AuNPst and AuNPr in prostate cancer cell lines

CONCLUSIONS

In summary, our results demonstrated that the cytotoxicity of AuNPs, AuNPst and AuNPr were shape dependent. In all cell lines, AuNPr are the ones that most affect cytotoxicity. Further studies should be performed to understand if all three shapes affect the proliferation of cells.

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