Gold nanostars loaded erythrocyte ghost membrane as biomimetic nanotheranostic agent for homotypic targeting and hypoxic tumor treatment

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Cancer has been one of the leading causes of death globally. Although nanomedicine have been made progress in alleviating cancer, certain types of tumor remain challenging to completely obliterate and becomes treatment resistance due to the severe hypoxic microenvironment[1]. Herein, gold nanostars (AuNSts) loaded erythrocyte ghost cell membrane (AuNSt@ghost) were fabricated for homotypic targeting and the presence of residual hemoglobin in the erythrocyte ghosts acts as an oxygen carrier to relieve the hypoxia. AuNSts have been evidenced as a dual photo based photodynamic therapy (PDT) and photothermal therapy (PTT) abilities, generating reactive oxygen species (ROS) for PDT and inducing an incomparable light-to-heat conversion for ablating tumor environment under near infrared (NIR) laser irradiation. AuNSts with tunable optical properties in the NIR optical window gives a strong emission intensity at two-photon excitation. This property of AuNSts offers a great potential for bioimaging applications. Here, AuNSts with plasmon absorption peak around 800 nm wavelength was synthesized and loaded in erythrocyte ghosts. The intracellular localization of AuNSt@ghosts was visualized using two-photon FLIM. A strong emission of AuNSts at two-photon excitation was observed with estimated fluorescence lifetime of 0.5 ns[2, 3]. The enhanced antitumor effect of AuNSts were confirmed in 2D monolayer and 3D spheroid cultures under 808 nm laser irradiation. The obtained results demonstrate that AuNSt@ghost can work as an oxygen vehicle, offering an enhanced therapeutic effect. Therefore, AuNSt@ghost can be considered as a novel biomimetic agent for nanotheranostics applications.

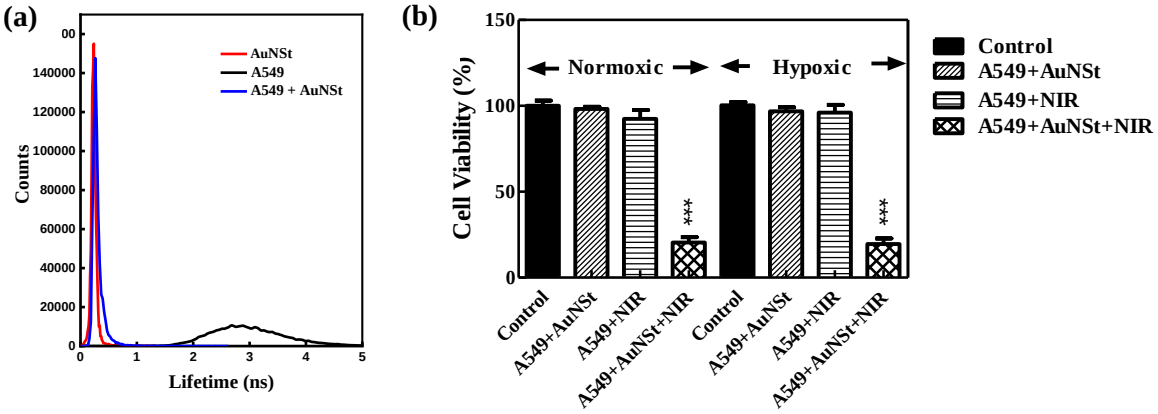

Fig. 1 (a) represents the histograms of lifetime distribution of AuNSts in A549 cells and (b) represents the cell viability after 808 NIR irradiation of A549 (2D monolayer) normoxic and hypoxic cells incorporated with AuNSts

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