# pH-responsive hybrid gold nanoparticles for intracellular delivery applications

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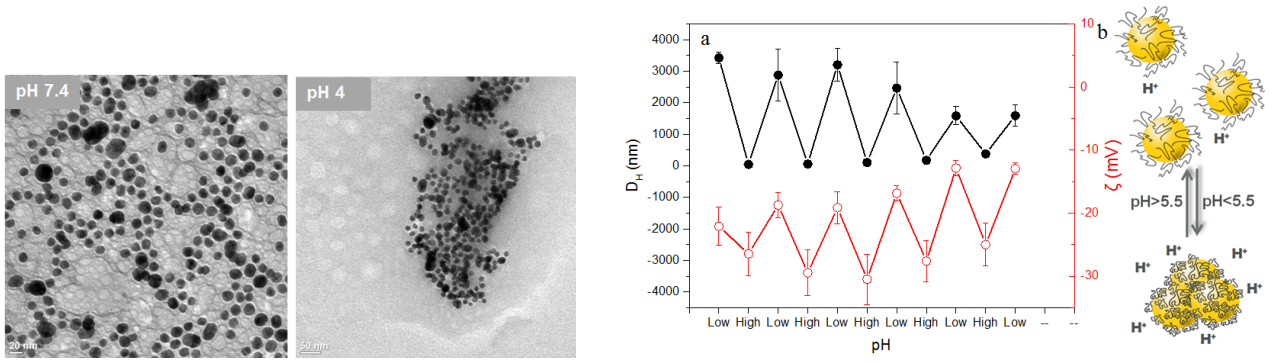
## Abstract

Gold nanoparticles (AuNPs) have been attracting considerable interests in nano-oncology as novel theranostic agents combining drug delivery and imaging abilities1. “Smart” hybrid nanosystems have been extensively studied in particular those responsive to temperature and pH changes. pH responsiveness has drawn attention for various purposes such as controlled reversible assembly; enhanced internalisation and intracellular drug delivery.

AuNPs were functionalized with a pH-responsive amphiphilic polymer designed to promote endosomal escape. PP75 (75mol% of L-phenylalanine grafted on poly(L-lysine iso-phtalamide)) has previously demonstrated a high membrane disruption of sheep erythrocytes at early endosomal ~pH6.52 at a low concentration of 25 µg/mL and has proved to enhance the intracellular uptake and delivery of various payloads such as siRNA in vitro and in vivo3. The changes in the chemical and physical properties of the hybrid nanoparticles and their membrane disruption ability have been investigated with the pH change. Our results demonstrate that the functionalized AuNPs exhibit good colloidal stability at physiological pH (~pH7.4) and start to agglomerate at pH below 5.5 due to the enhanced hydrophobicity of polymer chains. The pH-response has proved to be very fast and highly reversible. This enhancement in hydrophobicity in response to pH decrease is correlated to the membrane activity of the hybrid nanoparticles, indicating their potential use as pH responsive intracellular delivery agents in oncology.




*Left: TEM images of AuNPs@PP75 in pH7.4 and pH4. Right: variations of hydrodynamic sizes and zeta potential values of AuNPs@PP75 solutions with pH cycling between pH~7.4 and pH~3; b. scheme of the pH response*

**References**

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