XXVI National Meeting in Medicinal Chemistry

XII Young Medicinal Chemists' Symposium

ABSTRACT BOOK

THERANOSTIC NANOCAGES FOR IMAGING AND PHOTOTHERMAL THERAPY OF PROSTATE CANCER CELLS BY ACTIVE TARGETING OF NEUROPEPTIDE-Y RECEPTOR

Bassanini, I.;[a] Veronese, E.;[a] Avvakumova, S.;[b] Galbiati, E.;[b] Sironi, L.;[c] Locarno, S.;[a] Macchi, C.; Pandolfi, L.;[b] Ruscica, M.;[d] Magni, P.;[d] Collini, M.;[c] Colombo, M.;[b] Corsi, F.;[e] Chirico, G.;[c] Prosperi, D.;[b] Romeo, S.[a]

[a]Dipartimento di Scienze Farmaceutiche, Università degli Studi di Milano, via Mangiagalli 25, 20133 Milano, Italy; [b]NanoBioLab, Dipartimento di Biotecnologie e Bioscienze e Centro di Nanomedicina, Università di Milano-Bicocca, Piazza della Scienza, 2, 20126, Milano, Italy; [c]Dipartimento di Fisica e Centro di Nanomedicina, Università di Milano-Bicocca, Piazza della Scienza 3, 20126, Milano, Italy; [d]Dipartimento di Scienze Farmacologiche e Biomolecolari, Università degli Studi di Milano, via Balzaretti 9, 20133 Milano, Italy; [e]Dipartimento di Scienze Biomediche e Cliniche, Università degli Studi di Milano via Grassi, 74, 20157 Milano, Italy.

E-mail of the presenting author: sergio.romeo@unimi.it

Gold nanocages (AuNCs) have been shown to be a useful tool for imaging and hyperthermia therapy of cancer, thanks to their unique optical properties, low toxicity and facile surface functionalization. Herein, we use AuNCs for selective targeting of prostate cancer cells (PC3) via specific interaction between neuropeptide Y (NPY) receptor and three different NPY analogs conjugated to AuNCs (Figure 1). Localized surface plasmon band of the nanoconjugates was set around 800 nm, which is particularly promising for in vivo applications. Long-term stability of nanoconjugates in different media was confirmed by UV-vis and DLS studies. Active NPY receptor targeting was observed by confocal microscopy showing time-dependent AuNCs cellular uptake. Activation of ERK1/2 pathway was evaluated by Western blot to confirm the receptor-mediated specific interaction with PC3. Cellular uptake kinetics were compared as a function of peptide structure. Cytotoxicity of nanoconjugates was evaluated by MTS and Annexin V assays, confirming their safety within the concentration range explored. Hyperthermia studies were carried out irradiating the cells, previously incubated with AuNCs, with a pulsed laser at 808 nm wavelength, showing a heating enhancement from 6 to 35 °C above the culture temperature dependent on the irradiation power (between 1.6 and 12.7 W/cm2). Only cells treated with AuNCs underwent morphological alterations in the cytoskeleton structure upon laser irradiation, leading to membrane blebbing and loss of microvilli associated to cell migration. This effect is particularly promising in view of possible inhibition of proliferation and invasion of cancer cells. In summary, our Au-peptide NCs proved to be an efficient theranostic nanosystem for targeted detection and activatable killing of prostate cancer cells.

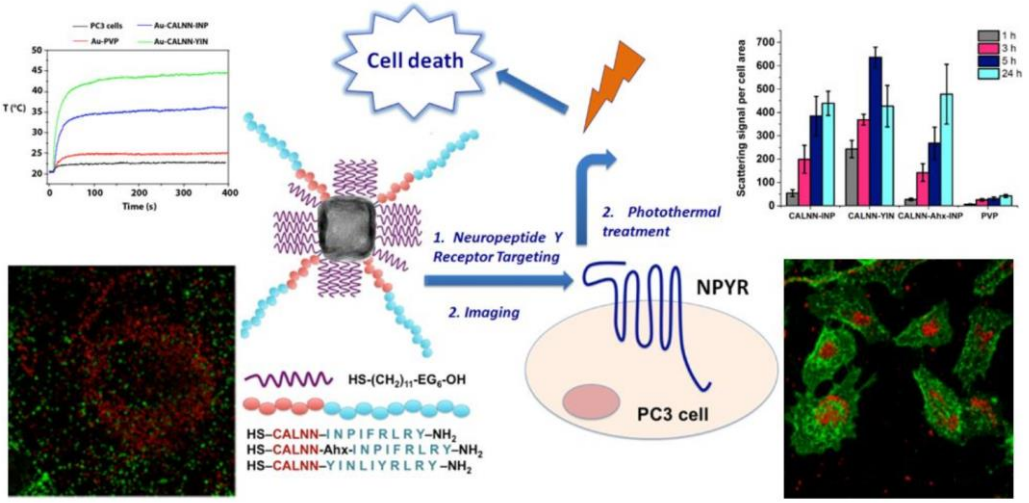

Figure 1. Schematic representation of NPYR targeting on prostate cancer cells by peptide-functionalized gold nanocages and subsequent hyperthermia by NIR irradiation.