Theranostic nanoparticles based approach targeting a set of microRNAs in drug resistant breast cancers

Preclinical molecular imaging is a fundamental tool for in vivo testing of the efficacy of selected targets for both diagnosis and therapy in mouse models of human disease. The use of small-animal models in preclinical oncology represents a bridge between discoveries at the molecular level and clinical implementation in diagnostics and/or therapeutics. The development of high-resolution in vivo imaging technologies provides a unique opportunity for studying disease in real time, in a quantitative way, at the molecular level, along with the ability to repeatedly and non-invasively monitor disease progression or response to treatment.

Our research, aims to develop an innovative theranostic approach for in vivo delivery of miRNAs to breast tumors. In detail, Nanoparticle (NP) complexes conjugated to peptides anti-EGFR carrying miRNAs loaded with Gadolinium-based Contrast Agents (CAs) and Indocyanine Green (ICG) are developing as a theranostic tools to serve as multimodal probe for near-infrared (NIRF) and Magnetic Resonance Imaging (MRI) and therapeutic agents. We characterized the expression levels of EGFR in breast cancer cells in order to determine the most suitable cells for the development of peptides. Moreover, the selected cell lines, were stably silenced for EGFR through CRISPR / Cas9 genome editing. Currently, we are analyzing cellular uptake and target effects of the miRNA-loaded NPs labeled with a 680/750 model dye and loaded with Gadolinium-based Contrast Agents. Furthermore, we are studying the biodistribution of nanoparticles in mice using fluorescent molecular tomography (FMT) and MRI. We are developing orthotopic triple-negative breast cancer mouse model using MDA-MB-231 cells implanted into the mammary fat pads. Mice will be monitored for tumor growth and tumor vascularity with HFUS and photoacoustic imaging. The mice bearing tumors will be i.v. injected with theranostic nanoparticles and they will be studied using FMT and MRI to evaluate their biodistibution in tumors and metastasis as well as their therapeutical effect.

References:
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