GEMNS

Self-navigated integrin receptors seeking "thermally-smart" multifunctional few-layer graphene-encapsulated magnetic nanoparticles for molecular MRI-guided anticancer treatments in "real time" personalized nanomedicine

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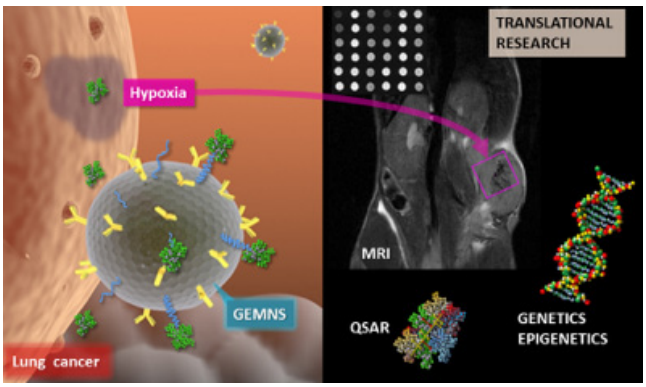
Partner countries: Poland, Norway, Romania

The integration of multifunctional nanoparticles in the treatment of cancer shows great promise for the advance of personalized medicine. The GEMNS project is designed to develop novel, thermally "smart", multifunctional, multi-layered graphene-encapsulated magnetic nanoparticles (GEMNS) for molecular MR imaging (mMRI) and anticancer treatments. The theranostic GEMNS will be bioengineered with self-assembled polymeric nano-gels and decorated with antibodies that recognize certain integrin receptors on lung cancer tissues and identify new cancer vessels. A chosen enzyme will be adsorbed onto the GEMNS and released in a controllable and fully predictable manner in order to promote anticancer activity, creating a "Trojan-horse" effect. The release of the enzyme triggers "on-off" hypoxia states at the molecular level in lung cancer cells and tissues. After several courses of such enzymatic-based molecular pre-sensing, mMRI-guided targeted X-ray radiotherapy will be applied to target lung cancer in preclinical animal models. A new nanosafety paradigm for the PRE-FIM strategy will also be developed using comprehensive QSAR, microfluidic, and genetic/epigenetic approaches to characterize the GEMNS theranostic contrast/drug candidates compliant with regulatory requirements.

"The theranostic GEMNS will be bioengineered with self-assembled polymeric nano-gels and decorated with antibodies that recognize lung cancer tissue"



A schematic presentation of GEMNS recognizing and releasing a thermostable enzyme into lung cancer cells (left), T2-weighted images of solid cancer in mice (right) and cancer cells (insert, right) using a 7T system (Grudzinski IP et al.). The nanosafety paradigm for the PRE-FIM strategy is listed (right).