Breast cancer is the most common invasive cancer in females worldwide**.** It accounts for 16% of all female cancers and 22.9% of invasive cancers in women. 18.2% of all cancer deaths worldwide, including both males and females, are from breast cancer. Although breast cancer in early stages can be treated effectively by different curative therapies such as radical mastectomy, conventional chemotherapies, combined chemo- and radiotherapy, brain metastasis from breast cancer are the main cause of death. Due to the significant mortality and morbidity rate associated with the progression of this disease, there is an urgent need for new and targeted treatments. Generally, breast cancer is an excellent target for targeted therapies. Targeted radionuclide therapy has the advantage of delivering a highly concentrated absorbed dose to the targeted tumor while sparing the surrounding normal tissues. In addition, the selective ability of radionuclide therapy is advantageous in the treatment of systemic malignancy, such as in bone metastases, where whole body irradiation using external beam radiotherapy is impossible. Since the administration of radionuclides is minimally invasive and the duration of treatment is shorter than chemotherapy, targeted radionuclide therapy has become one of the most preferred types of cancer therapy. For therapeutic purposes, β-particles and α-particles are preferable. Experimental therapies with drug-conjugated and β-emitter-conjugated HER2 antibodies have provided limited benefits to them as efficacy remains unsatisfactory. Recently, α-emitter-conjugated bioconjugates are the most preferred agents for targeted treatments. Taking this into account, we propose pioneering approach which consists in using new compound (based on peptide-conjugated nanomaterials labeled with alpha-emitter) as a potential radiopharmaceutical for targeted therapy of breast cancer. The main objectives of the project are: (1) analysis of toxicity of unlabeled peptide conjugated nanomaterials as carriers *in vitro*, (2) analysis of efficacy of peptide-conjugated nanomaterials labeled with α-emitter *in vivo* and (3) comparison of efficiency of peptide-conjugated nanomaterials labeled with α-emitter with combined action of cilengitide and radiation. *In vitro* experiments will be performed on human breast cancer and normal mammary cells.

This interdisciplinary project involves chemical and physicochemical methods as well as quantitative and qualitative biological methods, including molecular biology methods, cell biology methods and immunological methods. The results which will be obtained from planned experiments will make an important contribution to the knowledge about new nanostructure-based radio-bioconjugates for targeted cancer therapy.