Over the last decade the number of death due to cancer significantly increased, despite the rapid progress in diagnosis of even small, early stage of cancerous transformations. In some type of advances tumors, like disseminated breast and prostate cancers percent cure is still low. Currently, surgery, next external radiotherapy, chemotherapy and immunotherapy are the most common therapy options. Unfortunately, therapeutic effects of cytostatic drugs are usually hindered by serious side-effects due to their toxic influence on healthy tissues. Moreover, many types of cancer cells show inherited or acquired resistance to the administered drugs including monoclonal antibodies and ionizing radiation.

In the last decades, there has been great emphasis on "targeted therapies" that are designed to kill cancerous cells selectively, leaving the healthy tissue unaffected. One of such therapy is the targeted radionuclide therapy (TRT) in which cancer cells are killed with help of corpuscular radiation emitted by radionuclides conjugated to biological molecules, which recognize and bind to the surface of specific cancer cells. The specificity of binding is effected by recognizing of matching the surface receptors or other proteins overexpressed by cancer cells. Such selective mechanism of radiation delivering minimizes toxicity to the surrounding normal tissues. Depending on the tumor size and location, the choice of proper type of radiation is the critical factor for cancer treatment. In the case of small tumors and cancer metastasis treatment spectacular therapeutic results are achieved recently with use of the targeting molecules labeled with the emitters of short distance corpuscular radiation like α and Auger electron particles.

In the case of Auger electron therapy, the barrier to the wider application of this method is the necessity to transport the radioisotope inside the cell nucleus. This is a very difficult task because we need to construct a radiopharmaceutical that first finds cancer cells and then places the radioisotope in the cell nucleus near the DNA strand. Our idea presented in the project is to obtain radioactive palladium nanoparticles by their synthesis from ^{103}Pd radioisotope ($t_{1/2}$=16.99 d), which is mother radionuclide of ^{103m}Rh, very effective emitters of Auger electrons. In our approach, the synthesized palladium nanoparticles labeled with ^{103}Pd($t_{1/2}$ = 16.99 d) conjugated to trastuzumab and nuclear localization sequence (NLS) peptide will transport the radionuclide to the cytoplasm in the perinuclear area and next to the cell nucleus. As a result of nuclear decay $^{103}\text{Pd} \xrightarrow{EC} {}^{103m}\text{Rh}$, the Auger electron emitter ^{103m}Rh ($t_{1/2}$=56 min) will be formed and remaining on the surface of the nanoparticles will be able to induce a cytotoxic effect. Synthesized bioconjugates will be used for treatment of aggressive cancers like breast and ovarian with HER2 receptors.

The proposed project will be carried out at the Centre of Nuclear Chemistry and Radiochemistry of the Institute of Nuclear Chemistry and Technology (INCT) in Warsaw. Part of the proposed project related to the production of Auger electrons emitting ^{103}Pd will be realized in cooperation with the National Center for Nuclear Research (Świerk, Poland), and Heavy Ions Laboratory, Warsaw University.

Positive results from planned experiments in the project will allow us to proceed in the future to the next stage that will be *in-vivo* studies on animal models. We believe that obtained results will be helpful on designing other future radiopharmaceuticals based on Auger emitters for the precise treatment of cancer metastases. It should also be noted that the toxicity of our drug to healthy tissues will be negligible in contrast to radio- and chemotherapy.