The last decade is characterized by extremely rapid development of nanotechnology used in many branches of science, especially in medicine and pharmacy. The synthesis, characterization, and biochemically functionalization of nanoparticles is a subject of many studies. The properties of this type of nanoparticles, such as small size, biocompatibility, wide chemical affinity, non-toxicity and non-immunogenic mean that they are directly applicable in biomedicine. A special class of this type of materials are magnetic nanoparticles, based on magnetite (Fe_3O_4), showing further superparamagnetic properties. Magnetic nanoparticles contains a superparamagnetic core which guarantee a simple separation from the reaction mixture and reusability of material. All of these properties of magnetic nanoparticles allow i. a. their easy separation conscious shaping surface by coating various classes low and macromolecular compounds and the ability for local temperature increase due to an external magnetic field, which is used in selective cancer therapy, which is hyperthermia. The hyperthermia is a method of treatment is a method of treatment of certain varieties of cancers, which is the delivery of heat to cancerous cells and heating them to a temperature of approx. 40 ° C (it is assumed that cancer cells are destroyed at this temperature). The interesting group of compounds for use in medicine are photosensitive compounds based on the rings porphyrin used clinically as a photosensitizer for PDT, which treated with radiation in the wavelength range below 700 nm "sensitize" tissue to radiation and generate the formation of singlet oxygen which eventually leads to its destruction. Photodynamic therapy (PDT) is a widely used method of treatment of cancers characterized by much less side effects compared to standard therapy. Magnetic hyperthermia and photodynamic therapy are effective, widely used, and selective methods “in the fight against cancer”. For cancer suffers more and more group of society. Particular attention should be paid to the threat to civilization connected with the demand for new materials and methods that contribute to the cure of cancer, which number from year to year increases dramatically. According to the report "World Cancer Report 2014" the number of cases of cancer in 2025 will increase from 14 to 19 million per year in 2030. - Up to 24 million, while the number of deaths will increase from 8.2 to 13 million per year. In the literature, the absence of any reports regarding the synthesis of the materials, which also characterize a magnetism (superparamagnetism) and contain on their surface embedded / connected toxic photosensitive compound capable of generating singlet oxygen in a tissue.

The goal of the project is the design, synthesis and characterization of a new class of non-toxic nanomaterials having the ability to produce singlet oxygen, and having activity under the influence of an external magnetic field. Obtaining active, non-toxic nanomaterials would in the future to develop new binary selective anticancer therapy connecting both magnetic hyperthermia and PDT, which are currently used separately give as good results. Thus, this project is justified.

The project relies on the interplay between nanotechnology, photochemistry, and medical sciences, which consequently can lead to significant development of medical science, in particular the fight against cancer.