Every year, many thousands of people are diagnosed cancers. In Poland, there are three main methods of cancer treatment: chemotherapy, radiation therapy and surgical intervention. Very often, these methods are combined to achieve the highest efficiency of anticancer therapy. Other modern methods are photodynamic therapy and hyperthermia. Chemotherapy is based on the intravenous administration of cytostatics. They are served as a sole method of fighting cancer, or following a surgical treatment. The objective of chemotherapy is to destroy tumor cells. Unfortunately, chemotherapy drugs work not only in cancer cells. The drugs destroy also healthy cells and because of this chemotherapy is accompanied by a number of side effects. Only a few percent of the drug reaches the diseased cells, the rest is diffused around the body killing healthy cells. In addition, research confirms that a number of cytostatic drugs are mutagenic, teratogenic and cancerogenic. Nevertheless, chemotherapy may prevent the most severe symptoms of some cancers. To increase the chance of curing cancer targeted anticancer therapies are used. Most scientists agree with targeted therapy's definition as highly targeted, specific mechanisms. They work at a precisely defined place and defined conductivity ways in cells. Hitting specific metabolic pathways in tumor cells, they are blocking their activity and growth, causing tumor regression. Appropriately functionalised nanoparticles may help treat cancer, without exposing the whole body to undesired side effects. Unfortunately, it is not easy to match perfectly the drug to the tumor, so often drug mixtures are applied in chemotherapy. Another solution could be using the benefits of nanotechnology. Nanoparticles with cytostatic drugs inside may increase the selectivity towards cancer cells and reduce their toxicity to normal cells. Many types of materials and many different shapes of nanostructures have already been tested for kinetics of drug release. The results seem to be promising in terms of both the amount of drug release, and biocompatibility for, inter alia, silica materials, or polymers. There are also substances which are able to detect mutant cells among other healthy cells.

The combination of a biocompatible structure having a large specific surface area, with targeting molecules may open up new opportunities for conventional chemotherapy.

This project aims at the synthesis, physicochemical characteristics and biocharacteristics of two-dimensional mesoporous silica nanostructures connect the ability to transport drugs to strictly defined cancer cells and with the possibility to control the place and time of drug release.

According to the literature review so far no-one has undertaken a studies on this subject. There are no reports of mesoporous silica flakes combined with targeting molecules. The only reports on such nanostructures come from publications of which the applicant is a co-author. Studies of this type are very important because of the increasing number of cancers. Conventional chemotherapy has many side effects, and the use of nanostructures allows not only to limit the interaction drug-healthy cells, but also to reduce the amount of the drug introduced into the body. The results of future studies will be a prelude to the study of nanostructured directional capabilities to combat cancer, combining the therapeutic efficacy of drugs and selectivity for cancer cells.