**Application of biomimetic coatings in advanced therapy of liver cancer**

The number of new cases of cancer as one of the most deadly diseases in the world increases each year. Current treatments may include chemotherapy, radiation, and surgery, but the effects of these procedures may damage not only the tumor tissue but alsonormal tissue.Nanotechnology, although still in the early stages, has the potential to revolutionize the early diagnosis, treatment, and monitoring of cancer progression. Application of nanometer molecules in medicinewith the aim of fighting and curing ailments is the globally definition of nanomedicine.The *nano*- refers to the size that nanoparticles reach, i.e. the order of10-9 m. For comparison, 1 nm is one thousandth of the bacteria length or 10 carbon atoms arranged in onerow. Human hair has a width of approx. 80 000 nm and blood cell approx. 7 000 nm.Nanoparticles arethe key components of nanomedicine and have receivedextensive interest as promising drug-delivery systems in anticancer therapy.The latestgeneration of nanomaterials for nanomedicine allow also to combine conventional methods with othertreatment approaches like photothermal therapy what results in synergistic effect of treatment.However, although nanoparticles are promising drugcarrier systems, their poor oral bioavailability, instability incirculation, inadequate tissue distribution, and toxicity aresome limitations to practical application that remainunresolved. To overcome the problem of low delivery efficiencyresearchers havecontinued to develop nanomedicine with improvedcharacteristics.Biomimetic functionalization of nanoparticles through camouflaging with cellularmembranes has emerged as a promising strategy for cancer targeting.

The aim of this project is to develop biocompatible cancer cell membrane coated polymeric nanoparticle platform (biomimetic NPs) for prolonged blood circulation, superior tumor targeting, delivery of small molecular drug, imaging and photothermal therapy of a murine model of liver cancer.Hepatocellular carcinoma (HCC) is the most common primary malignancy of the liver.Conventional chemotherapy yields low objective response rates in HCC treatment.Thus, development of some new approach of anticancer agents is an imperative task to improve the therapeutic efficacy of HCC. The literaturefrom the past 10 years on nanoparticle-based drug carriers showed that only 0.7% of theadministered NPs dose was delivered to a solidtumor.Therefore, an efficient tumor-specific drug delivery system needs to be designed to provide prolonged circulation in the body with specific targeting towards tumors.Biomimetic functionalization of nanoparticles through coating with cellularmembranes may contribute to development of new class of anticancer pharmaceutics. New concept of this study is to use the polydopamine (PDA), a biocompatible polymer with photothermal properties, as a platform for drug encapsulation, contrast agent deposition and cancer cell membrane coating. We believe that this study will demonstrate the promise of using a biomimetic coating approach for the design of functional, safe, and compatible PDA based nanocarriers for cancer drug delivery, photothermal therapy and imaging of liver cancer.

The projectwill be realized at the NanoBioMedical Centre (NBMC) AMU in cooperation with the Partner institution – the Poznań University of Medical Sciences (PUMS). Firstly,polydopamine nanoparticles will be synthesized, functionalized with anticancer drug (doxorubicin) as well as contrast agent and coated with cellular membranes isolated form the HepG2 liver cancer cells. The NPs will be characterized in terms of their size, chemical composition, porosity, contrast and photothermal properties as well as drug loading and release profiles. Cancer cell membrane proteins of biomimetic NPs will be alsoanalyzed. Next, the ability of the biomimetic NPs to be internalized by the cancer cells and to homotypically target cancer cells will be demonstratedas well as comprehensive analysis of their cytotoxicity will be performed. Subsequently, the efficiency of combined chemo- and photothermal therapy using an animal model will be evaluated.