

DESCRIPTION FOR THE GENERAL PUBLIC

World Health Organization (WHO) reported that cancer and neurodegenerative disease are still the world's leading causes of death. In particular, due to aging of the population - Alzheimer's and Parkinson's diseases, multiple sclerosis, and stroke-related brain damage are a challenge for modern medicine and also have a huge impact of human economic and social life. In the clinical treatment, we can find only a few neuroprotective (mainly water-insoluble) substances but their efficiency in the treatment is not satisfactory. One of the major limitation is an inefficient drug delivery to the affected part of the human body. On the other hand, there exist only a limited number of nano-particulate formulation of anticancer drugs and their efficiency is still insufficient. There is therefore an urgent need for innovative and more efficient treatments for neurodegenerative disorders as well as for anti-cancer therapy.

Nanotechnology has brought a breakthrough in medicine and now entails promising solutions. The formulations in the nano-scale (one billionth of a meter) can bring unique properties, that can contribute to their high effectiveness in therapeutic action along with simultaneously minimizing undesirable side effects. Recently, we may observe the continuously growing interest in theranostic nano-medicine that is based on the idea of delivering both therapeutic and imaging agents. So these nano-systems, generally called 'hybrid nano-systems' or theranostic nano-particles, allows to track therapeutic agents as they move through the body (using e.g. Magnetic Resonance Imaging (MRI)), as well as simultaneously targeting them to the pathological changed places of cells, tissues or organs. Another examples of hybrid nanosystems are "thermo-sensitive" nano-particles that are sensitive to heat due to use of magnetic field. The magnetic-loaded hybrid nanoparticles can be also used as nanocarriers for magnetically responsive nano-drug delivery systems. This type of magnetic nanocarrier could be guided with magnetic field gradients and therefore, could transport drugs to the desired parts of the body.

The scientific objective of this project is to develop a novel strategy of preparation and modification of both magnetic- and drug-loaded biopolymer hybrid nano-carriers, for water-insoluble (hydrophobic) substances that could be efficiently delivered to the pathological changed parts of human body. We will characterize the physicochemical properties of prepared nano-carriers. Their surface properties will be modified to improve delivery efficiency. We will also evaluate the toxic effects of synthesized nano-carriers on model cell lines.

The final results of this project will broaden the knowledge in the field of both nano-medicine and pharmacology, especially in the area of designing and preparation of novel, as universal as possible, nano-scale drug delivery systems. The synthesized hybrid nano-carriers will be useful for encapsulation of various, hydrophobic drugs. Moreover, that will provide the basis for further research directed to its potential application as contrast agents in e.g. Magnetic Resonance Imaging (MRI).

In the future, but not directly, the results of these research can improve the progress of personalized medicine hence can improve the patient's economic and social life.