DESCRIPTION FOR THE GENERAL PUBLIC

The use of systems that control the delivery of active substances, has led many researchers to focus on the development of nanocarriers based on inorganic particles, synthetic polymers and biopolymers. Great progress has been made, in particular, through the development of methods for the synthesis of new materials with controllable/dedicated physicochemical properties. With the use of the nanoparticle platform as a drug delivery system, it is necessary to develop knowledge of their behaviour in biological systems. Unfortunately, despite careful selection of many favourable physicochemical parameters of nanocarriers, they are often eliminated from the biological system as a result of rapid deactivation in the process of opsonisation. The use of protective layers on the carriers is a way to trick the immune system and thereby modify the pharmacokinetic profile of drug delivery.

Nanoparticles entering biological systems are almost always covered with biofluids. Thus, to develop selective delivery of nanoobjects to particular compartments of the body it is crucial to understand phenomena involved in conformational changes and the displacement of proteins at the interface. From the nanomedical viewpoint, the phenomena of competitive binding and protein displacement – defined as the Vroman effect – are also extremely important because they determine selective delivery of nanoscale objects to specific compartments of the body.

The main scientific objective of this project is to develop a complete, quantitative description of the mechanisms governing the phenomena of protein adsorption on the dendrimer surface.
Multidimensional research using advanced in-situ measurement techniques and molecular dynamics (MD) simulations allows conducting multifaceted study of the protein structure formation. The mechanisms of interaction of functional materials with different types of proteins present in the plasma, together with the analysis of conformational changes and reorganization of protein structures on the functional surfaces has great cognitive value. It will also contribute to a better understanding of the physicochemical mechanisms of creating protein layers on the polymer surface.

The results obtained in this project will contribute to a better understanding of the physicochemical mechanisms of the formation of protein layers with controlled architecture and functionality at interfaces.