Gold and silver nanoparticles as carriers for delivery of 5' mRNA analogues with potential therapeutical application

Nanotechnology is one of the most intensively evolving field in recent years. One of its applications in medicine is the design of a drug delivery systems (DDS) based on nanomaterials such as liposomes, dendrimers, nanocapsules, nanospheres, the use of which improves the pharmacodynamic and kinetic properties of medicinal substances e.g. bioavailability, release time, and the ability to reach a precise target. Among the nanomaterials used, unique features such as chemical passivity, durability, biocompatibility are exhibited by gold and silver nanoparticles. Because of this, we are planning to develop a system for providing translation inhibitors in the form of cap analogues to cancer cells using nanoparticles of gold and silver. Mono- and dinucleotide cap structure analogues occurring at the 5' end of all eukaryotic messenger ribonucleic acid (mRNAs) are an interesting class of compounds with potential therapeutic use. The structure of the cap by interacting with the eIF4E protein present in cell in a very limited amount (and thereby acting as a regulator), plays a key role in the process of initiating of the protein biosynthesis. In the case of numerous cancers, a rapid increase of the amount of eIF4E was observed, accompanied by uncontrolled overexpression of oncogenic proteins. For this reason, eIF4E is considered as a good target for the action of anticancer drugs. In this context modified cap analogues with a strong affinity to eIF4E, which act as a competitior with mRNA for eIF4E, are translation inhibitors. Intensive research for such inhibitors have been going for many years and have led to the discovery and testing of many compounds. Unfortunately, all of synthesized cap analogues cannot be used in *in vivo* studies because they are unable to penetrate the cell membrane due to the presence of negative charge within their structures. Developing a system for delivery of cap analogues to cancer cells would open up the possibility to make their usage more practical. Within the project we will develop methods for synthesizing the conjugate of cap analogues with gold and silver nanoparticles using various types of bonds degradable in the cell. The resulting conjugates will be characterized by a number of structural and physicochemical methods and subjected in the last phase to preliminary *in vitro* biological studies.