3. Streszczenie w języku angielskim (abstract)

Currently, physicians and scientists are facing the problem of increasing morbidity of civilization diseases, such as cancers or multi-drug resistant infections, the treatment of which generates severe financial costs. To counteract this, the key point is to search for new substances with therapeutic activity, to better understand cell signalling and metabolic pathways, as well as to develop techniques allowing for the selective treatment of disease in its foci while saving the surrounding healthy tissue. In this context, nanotechnology seems to be the one of potentially promising research areas.

In 1959, Richard Feynman pioneered nanotechnology, a branch of science based on miniaturization. Thanks to the intensive evolution of this interdisciplinary field, it is possible to synthesize almost unlimited amounts of nanoparticles of various origins, with varying sizes and properties. Besides, the functionalization of the already existing nanoparticles, understood as the covalent attachment of various types of molecules to their surface, such as acid residues, allows for further improvement of their physicochemical properties and additionally extends the range of their biological applications. It is assumed that, in the future, nanoparticles could act as efficient, selective and controlled delivery platforms for diverse therapeutic substances directly to the pathological sites, simultaneously protecting healthy tissues. The presence of nanostructures as co-transporting particles would modulate the biological activity of the transported substances, possibly reducing their toxicity and improving their therapeutic index.

This doctoral dissertation aimed to verify the hypothesis that selected carbon- and metal-based nanoparticles are able to directly interact with model biologically active low molecular weight compounds, thus modulating their biological activity. Biologically active compounds with well-established properties were selected as model substances: the acridine mutagen ICR-191, and anticancer drugs, doxorubicin and cisplatin. First, the ability of carbon- (fullerene C_{60}) and metal-based (nanosilver, nanoplatinum) nanoparticles to form mixed heteroaggregates with molecules of biologically active

substances was determined. Next, the modulating potential of the tested nanoparticles for the biological activity of substances temporarily trapped in heteroaggregates was described. All the experiments were designed to, first, understand the essence of the mechanism responsible for the nanostructures-active substances interactions, then, moving on to the research models based on bacterial cells, through eukaryotic cell lines, finishing with the multicellular model organism *Caenorhabditis elegans*.

The results obtained from the performed experiments suggest that carbon- and metal-based nanoparticles are promising candidates for the modification of existing therapies as co-transporting and modulating the action of biologically active molecules.