DESCRIPTION FOR THE GENERAL PUBLIC

The aim of the project entitled „ *Raman spectroscopy in vitro studies of chemotherapeutic impact on endothelial cells*" is investigation with using multi-parameter methodology using confocal Raman spectroscopy, infrared spectroscopy, atomic force microscopy (AFM) and biological assays for simultaneously assessment of the effects of anticancer drugs administered intravenously to cancer patients on endothelial cells. Within the project it is planned to investigate the impact of a number routinely used in oncology cytostatics on vascular endothelial cells.

In the course of chemotherapy, anticancer drugs are administered intravenously over several cycles infusion over a several months. It is therefore inevitable that endothelial cells (single layer of cells lining the inside of blood vessels) are in direct contact with the cytostatics, what in turn is not without significance for its function and homeostasis. Planned researches in this project with using inter alia Raman imaging, represent an innovative approach in pharmacology and provide information on biochemical changes occurring in the endothelium at the subcellular level following exposure of these cells to chemotherapeutics.

Chemotherapy is often complicated by cardiotoxicity, which can in some cases lead to symptomatic heart failure, and even cardiac death. Past researches have shown that cardiotoxic side effects can occur during: the active anti-cancer therapy (ie. early cardiotoxicity), within one year after the end of treatment, and many years after the end of chemotherapy.

While the exact mechanism of cardiotoxicity of some chemotherapeutic agents is still not fully understood, recent *in vitro* studies suggest that e.g. induced by anthracycline toxicity includes the result of action on the vascular endothelium. An example can be doxorubicin, that induces apoptosis of endothelial cells, leading to dysfunction of the vascular system, manifests itself *inter alia* to impaired vasodilation. It is believed that the DOX-induced apoptosis of endothelial cells is associated with production of reactive oxygen species, leading to an oxidative stress condition.

Based on Raman spectrum, which gives a unique chemical signature of a specimen and using multivariate statistical and chemometric approaches it is possible to investigate biochemical changes induced by pharmacological treatment in single cells. Raman imaging at the single cell level represents a potential avenue for probing various cellular processes and monitoring cell–drug interactions. Application of vibrational spectroscopy to study the endothelial cells exposed to anticancer agents provide information about the biochemical changes observed in compare to the healthy cells, unstimulated. Combining vibrational spectroscopy with other methods such as biochemical assays and atomic force microscopy (AFM) will allow for a comprehensive assessment of changes and may contribute to a better understanding of the toxicity of some anticancer drugs on vascular endothelial cells.

Proposed in this project research methodology, taking into account the combination of vibrational spectroscopy with atomic force microscopy, will allow for a significant increase the knowledge about the biochemical changes occur in the endothelium upon intravenous chemotherapy, the mechanism of cytotoxicity of anticancer drugs present in the bloodstream, as well as the presentation of a new methodology, which can be successfully applied to other pharmacological studies.