

RS-SRS-MED: Spontaneous and stimulated Raman scattering microscopy for sensitive and ultrafast imaging of cells upon development of life style diseases

Lifestyle diseases are a growing problem in aging societies. Although they are studied by an army of scientists around the world, many mechanisms of their development are still unclear. Better diagnostics and successful therapy could be based on the knowledge gathered from studies on biochemical processes associated progress of pathologies and their treatment at the cellular level, but it is very challenging since requires really fast methods of high sensitivity and selectivity.

There are several biological models available to study biochemical processes, e.g. animals (*in vivo*), tissues (*ex vivo*) and cell cultures (*in vitro*). In the project, we plan to use animal models of civilization diseases and carry out measurements on tissues and cells. In particular, we are interested in the endothelium, whose dysfunction may lead to the development of many diseases (in some cases we observe secondary endothelial dysfunction as a result of these diseases).

In this project we declare to develop a new methodology to study fast process at the subcellular level, including cellular transport of macromolecules. Transport of macromolecules across vascular endothelium and its modification, by e.g. fluid mechanical forces, are important for normal tissue function and in the development of various pathologies.

Using spectroscopy, i.e. a method in which we examine the interaction of radiation with a sample, information on the biochemical status of samples can be obtained in a non-destructive and comprehensive manner.

We plan to study biochemical changes at the cellular level using spectroscopic methods, first of all - Raman imaging, a classical approach (**RS**, *Raman scattering microscopy*) and non-linear one (**SRS**, *stimulated Raman scattering microscopy*), and biological models – cells of specific organs (e.g. vessels, heart, liver and brain) of animal models, mimicking atherosclerosis, fatty liver and Alzheimer's disease (**MED**ical samples). **RS-SRS-MED microscopy is not yet available in Poland; so we plan to design, build and test this approach, and for the first time to use the potential of SRS microscopy together with other techniques for analysis of cells of various organs.**

We strongly believe that **RS-SRS-MED microscopy** can be used as a tool to get new knowledge and to find new markers of lifestyle diseases, that will have an important societal impact, also related to alternative diagnostics and therapy of these diseases.