Smog (contraction of the words “smoke” and “fog”) is a type of intense air pollution, a phenomenon which affects more and more people around the World, leading not only to the deterioration of life quality, but more importantly to many health consequences and even death. According to the WHO, 4.2 million deaths each year can be attributed to ambient air pollution. In recent years, significant research efforts were made to examine the biological consequences of the impact of ambient particulate matter on human life and health. These studies focus mainly on the toxicity of suspended particles on respiratory, nervous and circulatory systems. It was not until recently that researchers attention was attracted by a potential toxicity of particulate matter against human’s natural barrier against various harmful factors – skin. The studies point out that they can induce skin barrier dysfunction, advance skin aging and lead to intracellular oxidative stress. However, despite the fact particulate matter may contain such photochemically active ingredients as benzo[a]pyrene and heavy metals, only a single study have considered the potential role of light in these processes demonstrating only a limited insight in the field. Thus the primary objective of the project is to determine whether sunlight can increase the toxicity of fine particulate matter ($PM_{2.5}$, particles with aerodynamic diameter ≤ 2.5 μm) towards skin cells and if so, what are the biological consequences of such light-induced phototoxicity.

To understand the role of light in $PM_{2.5}$-mediated toxicity we are going to incubate immortalized human keratinocytes (HaCaT cell line) with particulate matter samples and irradiate them using solar simulator that can generate light imitating the solar spectrum. We would like to perform an array of experiments to examine how light-induced PM affects cell viability, oxidative damage in cellular and mitochondrial DNA, cell membrane, and disrupts the integrity of cell cytoskeleton. Furthermore, we are going to characterize the ability of ambient particles to photogenerate reactive species and singlet oxygen, which could be viewed as a key reactive oxygen species.

We believe that this project will provide a thorough insight into skin phototoxicity of ambient particulate matter and its mechanisms.