Due to the widespread use of antibiotics in medicine or their excessive preventive application in animal husbandry (for increasing the weight gain and reduction of death rates), these compounds reach natural environment, *e.g.* soils or surface waters, contributing to the spread of multidrug resistance among microorganisms. It is also worth to notice that deactivation of chemotherapeutics from liquid medical or agricultural wastes, by-products of big pharma industry or the sewage sludge, by methods commonly used in sewage treatment, is extremely inefficient due to the strong biocidal properties of this group of chemical compounds. In response to the above-listed problems, we present this research project proposal.

The main aim of the herein proposed research project is to investigate the possibilities of cold atmospheric pressure plasmas (direct current atmospheric pressure glow discharge, pulse-modulated radio-frequency atmospheric pressure glow discharge, and microwave discharge) application for inactivation of antibiotics from liquid wastes of different origin (from medical facilities, pharmaceutical industry or agriculture). The before-mentioned cold atmospheric pressure plasmas will be generated in contact with a flowing liquid solution, in the developed for this purpose flow plasma brushes. The impact of the plasma generation atmosphere (nitrogen, helium or oxygen) as well as the plasma operating parameters on the efficiency of degradation of the analyzed chemotherapeutic agents in relation to the total organic compounds' concentration and the loss of the biocidal activity of the analyzed post-plasma solutions will be determined. On this basis, we shall define the optimal flow plasma brushes operating conditions assuring the highest effectiveness of antibiotics degradation rate. In addition, the intermediate products of distinct antibiotics degradation due to cold atmospheric pressure plasma will be identified. This will lead to unraveling the mechanisms of decomposition of the above-mentioned compounds as well as describing the plasma processes occurring in the plasma-treated antibiotics' solutions interfaces. Various antibiotics (of different chemical structure and biocidal mechanism of action), in different concentrations, will be treated with cold atmospheric pressure plasmas, generated in the flow plasma brushes. In addition, we will examine the efficiency of antibiotics degradation in complex mixtures mimicking wastewaters of diverse origins (medical, pharmaceutical or agricultural). Both plasma-treated antibiotic solutions and complex mixtures will be examined for the loss of biocidal properties against virulent human pathogens and the microorganisms commonly forming microconsortia in the active sludge of sewage treatment plants. Then we will investigate bacterial ability to develop resistance to the plasma-inactivated antibiotics in addition to the potential of transmitting antibiotic resistance in such suspensions. In addition, we shall estimate the ecotoxicity of the plasma-inactivated antibiotic solutions.

This interdisciplinary research project is based on the long-term and extremely effective cooperation between scientists from the Department of Chemistry of the Wroclaw University of Science and Technology (Leader) and the Intercollegiate Faculty of Biotechnology of the University of Gdansk and Medical University of Gdansk (Partner). To ensure the adequate selection of research methodology for successful accomplishment of the project research tasks associated with ecotoxicity and molecular evolution, a world-class specialist in these fields, Prof. Alessio Mengoni from the University of Florence agreed to play the role of our foreign consultant. Bearing the above-mentioned in mind, we believe that implementation of the research tasks proposed in the project will both contribute to the development of environmental engineering, plasma physicochemistry, environmental chemistry, microbiology and electrotechnics, as well as to build theoretical foundations for the development of new, fast, cheap, and effective practical methods for wastewater treatment.