The aim of the proposed project is to provide novel compounds for photodynamic therapy with the ability to connect to a much greater extent with cancer or bacteria, than to normal cells. Photodynamic therapy is a relatively new method for the treatment of various diseases, including cancer and certain non-cancer diseases of the skin and mucous membranes, which may also be used to treat a variety of infections caused by bacteria, fungi and parasites. Cancer and bacterial infections represent today two particularly important health challenges. For this reason, a therapy that may be used in the treatment of both these diseases is particularly interesting. Photodynamic therapy requires the use of three components: the drug called photosensitizer, which is capable of selective accumulation in tumor cells or bacteria, oxygen and light. The reaction between the light, the photosensitizer and oxygen leads to the formation of reactive oxygen species, which cause the destruction of cells in which the photosensitizer is located and other closest to them. Currently, there are only a few drugs approved for use in the photodynamic antitumor therapy, but still there is no photosensitizers for the treatment of bacterial infections. Furthermore, drugs currently used in photodynamic therapy have side effects, such as long-lasting hypersensitivity to light, and the need to use high doses. They result primarily from low ability to selective accumulation in diseased tissue in comparison to healthy tissue. Therefore, obtaining new compounds with selective activity against tumors and bacteria can be important for the development of photodynamic therapy.

To obtain the selectivity against tumor, compounds will be combine with special factors which bind to the appropriate target on the surface or inside tumor cells. Three different targets in the structure of cancer cells were selected: folate receptors, thymidine receptors, and glutathione. They are present in certain tumor cells in high levels, but in healthy cells in a small amount or not at all. Moreover, in order to obtain selectivity against bacteria, photosensitizers will be combined with antibiotics or similar compounds possessing the ability to combine with the bacteria and not with the normal cells.

The realization of the project will be divided into several steps:

a) Synthesis of photosensitizers based on boron-dipyrromethane derivatives (BODIPY) containing factors for selective connection with cancers eg. folic acid, thymidine, and with bacteria, eg. antibiotics.
b) Characterization of the obtained compounds using analytical chemistry methods to prove their structure
c) Examination of the different properties of these compounds to determine which ones are the best candidates for use in further studies of photodynamic activity
d) Determining the photodynamic antimicrobial activity of obtained compounds for a variety of bacteria
e) Evaluation of photodynamic antitumor activity against various cancer cells in comparison with the healthy cells