In conditions unfavorable for the growth and development of the plant organism, its mobilization is aimed at counteracting stress factors. The variety of these stimuli required plants to create a number of defense mechanisms. Numerous studies confirm that the molecules in the signaling pathway leading to acquire immunity are, inter alia, reactive oxygen species (ROS), nitric oxide (NO), calcium ions (Ca^{2+}), phytohormones and cyclic nucleotides (cNMPs), which create complicated interaction network between them. To date, little is known about the structure, mechanisms of action and the location of enzymes (adenylyl (AC) and guanylyl (GC) cyclases) responsible for conversion of ATP and GTP to cAMP and cGMP, respectively.

The presented research project is aimed to characterize elements prior to biosynthesis of cyclic GMP (cGMP), guanylyl cyclases and determine their involvement in responses and interactions that occur after fungal infection of *Brachypodium distachyon.* In this project I have adopted the main hypothesis that cGMPs are control molecules responsible for changing the elementary stabilization program to a repair and defense ones, following fungal infection. These molecules are outside the feedback and act as an intracellular signal, coordinating the activity of independent processes and interacting with other elements of the transduction pathways. By constructing transgenic plants, I will answer the question of what is the place of cyclase and the function of cyclic nucleotides in the follow-up control in plant cells exposed to biotic stress and determine relationship between cyclases, cyclic nucleotides and selected stress hormones.

Experiments will verify the observations made with usage of physiological techniques which revealed that cyclic nucleotides play an important role in the transduction pathways of a stress reactions, including pathogen infection. Also, the obtained results complement our basic knowledge about the mechanisms of the plant response to infection and will allow locate cGMP and enzymes involved in its synthesis among already known elements.