Plants are exposed to various types of adverse environmental factors, both biotic and abiotic. An example of an abiotic factor is anthropogenic environmental pollution by cadmium. One of the defense strategies in biotic and abiotic stress in higher plants is the activation of the phenylpropanoid pathway, providing secondary metabolites such as flavonoids, lignins, and stilbenes. These metabolites reduce the damage caused by oxidative stress. Our research has shown that the phenylpropanoid pathway is induced by dinucleoside polyphosphates (Np_nN's) such as diadenosine triphosphate (Ap_3A) and diadenosine tetraphosphate (Ap_4A). We were the first to prove that Ap_3A and Ap_4A induce gene expression and enzyme activity of the phenylpropanoid pathway in *Arabidopsis thaliana* seedlings and *Vitis vinifera* suspension cultured cells. Dinucleosidopolyphosphates are atypical nucleotides that occur naturally in living organisms. It is known from the literature that various dinucleoside polyphosphates (Ap_3A, Ap_4A, or Ap_4G) can be accumulated in cells of microorganisms subjected to stress factors such as elevated temperature, ethanol, or cadmium. Our hypothesis regarding the function of dinucleoside polyphosphates in plants assumes that these nucleotides may be signaling molecules under stress conditions. We believe that dinucleoside polyphosphates are involved in plant response to cadmium-induced stress. We postulate the participation of these molecules in signal transduction through the MAP kinase cascade. We are convinced that the conducted research will identify signal networks that participate in regulating plant defense responses to cadmium-induced stress, and dinucleoside polyphosphates are an essential element of these pathways.

The research planned in the project will be carried out on suspension cultured cells of *Vitis vinifera*. We will determine the level of dinucleoside polyphosphate in cadmium treated grapevine cells. We will identify transcriptomic changes in the *V. vinifera* cells caused by cadmium and dinucleoside polyphosphates. We will determine changes in the cadmium and nucleotide treated grapevine proteome. The results of the transcriptomic and proteomic analysis will be subjected to comprehensive bioinformatic analysis. We will perform a metabolomic analysis of compounds synthesized in grapevine cells in response to cadmium and the molecules studied. The metabolomic analysis will focus on determining, among other secondary metabolite levels, such as stilbenes and lignins. In addition, the content of selected plant hormones (abscisic acid and salicylic acid) and thiol compounds (glutathione and phytochelatins) will be measured. Based on the results obtained, we will select and thoroughly examine the course of the signal pathway (or pathways) involved in the plant's response to cadmium, in which dinucleoside polyphosphates play an important role. Next, we will analyze the selected signaling path on *Vitis vinifera* seedlings.

The research proposed in the design is only of a basic nature. They focus on understanding the signal function of dinucleoside polyphosphates in response to cadmium in higher plants. The project will identify metabolic pathways regulated by dinucleoside polyphosphates and provide evidence to support our hypothesis that they are signal molecules involved in cadmium-induced defense reactions in *V. vinifera*.