Growing evidence indicates that the nitroxyl (HNO) as a one-electron reduced and protonated state of nitric oxide (˙NO) may be its important physiological co-partner. Studies carried out on mammalian cells and utilizing the *in vitro* experimental approach reveal distinct or even opposite biological activities for HNO and ˙NO. The complex redox chemistry of HNO makes this molecule suited to signaling in biological processes through a wide range of actions. Simultaneously, the chemical nature of nitroxyl explains how HNO and ˙NO, despite common biotargets, act so differentially in biochemical systems. The unique reactivity of HNO may not be restricted to mammalian systems; therefore, the input of ˙NO in plant biology should be re-evaluated in the light of chemical properties of HNO being different from those of ˙NO.

The main objective of the project is to recognize a new aspect of the reactive nitrogen species (RNS) metabolism in plant organisms associated with HNO in the model *Arabidopsis thaliana*. The research will be focused on the evaluation of potential HNO bioactivity and bioavailability in plant cells, since it would implicate HNO as a critical, endogenous element in the sequence of events in various, thus far puzzling metabolic responses mediated *via* ˙NO.

Firstly, the research will focus on the effects of HNO donors on the selected developmental events, cell viability and the level of nitro-oxidative stress markers. Next, the cell redox state profiling in response to HNO treatment will be conducted. To indicate both the common and characteristic molecular sensors for HNO and other NO redox forms, a comprehensive transcriptome analysis will be performed. Finally, a search for the endogenous HNO and endogenous HNO donor compounds within plant cells exposed to physiological, developmental and stress stimuli will complement the project.

The results obtained during the time-course of the planned project will have an original and significant impact on the basic research related not only to plant biochemistry and plant physiology, but also biology of eukaryotes. The interactions of different redox forms of NO within the cellular environment can act as a functional coordinator favoring specific physiological and/or defense responses or triggering cell metabolism destabilization. Finally, since HNO releasing agents provide interesting prospects as potential therapeutic compounds, an exogenous HNO application could serve as a new-class stimulator priming plants to more potent and faster defence or tolerance responses.