Description for the general public

During the evolution plants have developed a complex mechanisms that provide resistance to various pathogenic microorganisms. One of the first reactions of the plant to the pathogen attack is activation of signaling pathways leading to the changes in expression of specific pathogenesis-related proteins genes (*PRs*). It has been documented that an important role in the initiation and coordination of these events is exerted by endogenous signaling molecules, such as nitric oxide (NO). As demonstrated, the generation of NO in biological systems, may lead to the formation of other reactive nitrogen species (RNS) including peroxynitrite ($ONOO^{-}$). In the case of animals, $ONOO^{-}$ readily penetrates biological membranes causing by the nitration of proteins, fatty acids and nucleic acids, a serious damage within cell structures. Recent literature assumes that the selective nitration of proteins *via* $ONOO^{-}$ may also be an important regulatory mechanisms, both competing and affecting the intracellular signaling pathways based on the reversible phosphorylation of tyrosine residues.

In plant biology, knowledge concerning the physiological function of NO-derivatives, particularly during plant-pathogen interaction remains poorly understood. Interestingly, recent studies indicated that $ONOO^{-}$ could potentially be involved in initiation of defense response of potato leaves to the pathogen *Phytophthora infestans*. Namely, the sequential treatment of the susceptible potato genotype with $ONOO^{-}$ and *P. infestans* caused a faster and more efficient induction of *PRs* genes, being considered as an important markers of plant defense against pathogens. Moreover, the preliminary studies obtained during PhD thesis realization, revealed that beta-1,3-glucanase and chitinase (representatives of the PRs group) potentially might undergo nitration in potato leaves inoculated with *P. infestans*. However, the protein nitration phenomenon in the aspect of both, the participation of this posttranslational modification in activity regulation of the key plant defense proteins and the influence on the phosphorylation-dependent signaling remains completely unrecognized and requires an intensive research.

Therefore, the goal of the proposed project is to answer the following research problems:

-whether and to what extent the tyrosine nitration *via* $ONOO^{-}$ can modulate the biological activity of the one of the key enzymes of plant resistance – beta-1,3-glucanase;

-whether and to what degree the $ONOO^{-}$-mediated nitration can modify the phosphorylation / dephosphorylation of critical tyrosine residues in the structure of beta-1,3-glucanase.

Therefore, the planned research have innovate character – this will be the first experimental study concerning the role of the nitration in the regulation of the biological activity of beta-1,3-glucanase, a representative protein from PRs group. The experiments will be conducted on the leaves of two potato (*Solanum tuberosum* L.) genotypes radically differing in the resistance to *P. infestans.* As it is known, potato is a species of the very significant economic importance because after rice and wheat, it is the most important crop in the world. On the other hand, the second component of the studied plant-pathogen interaction – *P. infestans* is the cause of potato late blight disease, contributing each year to the trillionth loss in yielding of this economically important plant. Therefore, characterization of the nitration role in the regulation of biological activity of PR proteins may serve as a starting point for studying a new defense mechanisms *via* NO engaged in limitation of the pathogen development.