Flax is a valuable industrial plant grown in our climate zone and one of the few crops that give two types of products - fiber and oil. The fibers are of good quality and the oil contains unsaturated fatty acids beneficial to human health. In addition, flax seeds contain many other valuable ingredients, including vitamins, phytosterols and lignans. Linseed oil and fibers are used in many industries, and generation of new improved varieties can further increase their use. Also products considered as waste products (shives, seedcake) are a source of many valuable components, such as polyphenols, which place in a waste- free trend, because all its parts can be used in various industries.

The cultivation of flax is however restricted by environmental stress factors, but the biggest crop losses worldwide are caused by fungal infections. Those fungal diseases cause significant losses in its crops and thus contribute to a decrease in interest in the cultivation of this valuable plant. In Poland, the main cause of losses in flax is fusariosis. Due to the ability of Fusarium, the main causative agent of these diseases, to survive in soil for many years, it is necessary to identify the mechanisms of resistance to Fusarium and develop resistant varieties of flax. One of the possibilities to improve plant resistance is the manipulation of secondary metabolism pathways which can have added value - increased plant resistance coupled with simultaneous diversification of the application of plant products, as those metabolites are often beneficial for humans.

One of these groups of compounds are polyamines, chemicals containing at least two amino groups, found in plant and animal cells, where they perform numerous biological functions. They occur as free molecules or are associated with other low molecular compounds, such as hydroxycinnamic acids, or can bind to macromolecules, including DNA, RNA, proteins and cell wall components. In plants, they are primarily considered as having a protective role in stress conditions, especially of an abiotic nature: salinity, drought, low temperature, but also in the case of biotic stress, e.g. attack of pathogens (fungi or viruses). Their mechanism of action as well as the significanse in the interaction of plants with pathogens is not definitively determined.

The goal of this project is to investigate the role of polyamines in the flax resistance to Fusarium. Based on preliminary data, we assume that higher levels of polyamines in flax will lead to improved resistance to pathogens. We plan to test this hypothesis by creating plants with altered levels of polyamines and assessing susceptibility to diseases in modified plants. At the same time, this project will provide basic knowledge about which genes are key in synthesis of polyamines and what actions individual polyamines can have. In addition, the project, by observing other metabolic and signaling pathways, will hopefully help approaching unraveling polyamine signaling pathways and interaction with other signaling molecules.

In addition to gaining new knowledge about the interaction between flax and pathogenic fungi, in the future these discoveries could lead to the development of more effective ways of controlling fusarium diseases. Flax fibers with an increased content of polyamines could also possibly in future be used in the production of wound dressing materials because, as we have shown earlier in in vitro tests, they show a positive effect on skin cells proliferation in tissue cultures.