Fusarium oxysporum causes diseases in crop plants, and are the emerging threat to *Linum usitatissimum* production. It is estimated that due to infection the lost in world's flax production is 20%. The aim of this project is to develop and optimize the method for plant protection against pathogenic infection based on genetic and epigenetic engineering of secondary metabolic pathways. The vision is that overexpression of genes involved in secondary metabolites biosynthesis which also respond to environmental stressed situation is expected to be a suitable idea for resistance improvement of linseed.

Cyanogenic glucoside present in linseed is the example of compounds that participate in protection against infection however the compounds are toxic for mammalian consumers of plant products. The toxicity of cyanide is due to its ability to bind to the metal functional groups of many enzymes. It inhibits reduction of oxygen in the respiratory electron transfer chain. .
Thus, the overriding purpose of this proposal is to search new concept with the potential to improve plant resistance and to valorize their raw products which positively affect plant breeding economy.
The rationale of this proposal is to decline in cyanogenic glucoside content by inhibition of critical step of its biosynthesis or/and by detoxification of its decomposition product (cyanide) while retaining flax defence potential and increase the quality of its raw products.

To retain anti-pathogenic potential and decline alkaloid content the novel approach based on metabolite engineering is propose. Reduction of key step of cyanogenic glucoside biosynthesis or/and cyanide re-assimilation to produce asparagine or/and redirecting amino acid substrate from nitrogen containing alkaloids route to glutathione pathway or/and conjugating cyanogen's to sulfur containing molecules or/and re-directing the substrates for alkaloid biosynthesis to molecules with antioxidant potential is the basis of this approach.

It is expected that with the use of specified approaches would be possible to gain efficient enough method for plant adapting to changes of environmental condition and producing safer row product. Development of novel plant types through epigenetic/genetic regulation of genes could be most surely useful in crop plant breeding. It is believed that novel plant types generated by optimized epigenetic (OLIGO) technology will be valuable alternative for GM types. After accomplishing the proposal, seedcake from flax plants currently used as low value feed and in limited amounts, will be granted new application as a source of valuable ingredients for food and feed products. Decline in cyanogen glucoside content in flax increases significantly the end-product uses.

Healthy plants will be the source of products primarily dedicated to prophylaxis of civilize diseases such as skin disorder (rosacea), atherosclerosis, microbial infections and chronic ulceration.