

During the evolution of living organisms proteins that perform undisturbed reading and copying of genetic material were formed. Moreover, to ensure smooth copying of DNA, proteins that allow repair of damaged DNA have also evolved. Many of these proteins have similar functions, in various groups of organisms, in bacteria, fungi, animals and plants. While the processes of replication and repair of yeast and animal DNA are intensively studied, analogous studies using plants are limited. One of the important players involved in copying and repairing DNA in eukaryotic cells is FEN1 endonuclease. It is located in nucleus of yeast, animal and plant cells. Previous studies have shown that the lack of proper FEN1 activity significantly impairs the functioning of human and plant cells. For a long time in biology, a dogma was in force: one gene - one mRNA - one protein, but it turned out that the situation is much more complicated. mRNA formed on the template of one gene can be assembled in various ways, as a result proteins of different structure and function can be produced. While only one type of mRNA encoding FEN1 has been found in human cells, bioinformatic analyses indicate that up to five mRNA variants of this gene can be produced in the model plant, *Arabidopsis thaliana*. These variants are *supposed* to encode three protein isoforms of different amino acid *chain* lengths. Being identical at the N-terminus, these isoforms differ only in the amino acids composition at the C-terminus. One of the goals of this project will be to determine the substrate specificity and function of *Arabidopsis* FEN1 protein isoforms. *It is also known* that protein properties including *activity can be* regulated by small modifiers. Our preliminary studies have shown that *Arabidopsis* FEN1 protein is modified by phosphate group. What is the function of phosphorylation of *Arabidopsis* FEN1, how it changes the mode of action of this protein, how it affects the functioning of plants and their response to adverse environmental conditions, are further *important and intriguing* questions of the proposed scientific project.