Enzymes are the catalysts which have been created by Nature to govern all the chemical processes in living organisms. Although they are highly specific under natural conditions and dedicated to catalyze precisely defined transformations, a possibility of their use in the transformations of man-made substrates has been known for years. Nevertheless, even in this case they catalyze transformations of such functional groups for which they are designed by Nature. However, it has recently been shown that even this obstacle can be overcome. Thus, it has turned out that the active sites of various enzymes are capable of catalyzing also additional reactions, even such which are completely different from those planned by Nature. Such an enzyme property is called "enzyme catalytic promiscuity."

The aim of the present project is the investigation of a possible increase of the scope of the enzyme catalytic promiscuity via application of enzymes in further reactions. The ultimate aim of this program is to find simple environmentally friendly enzymatic procedures as alternatives to chemical methods. As the substrates of choice, imines will be used. There are two reactions planned for these substrates: an enzymatic version of the addition of nitroalkanes to imines (called the aza-Henry reaction) affording useful products - β-nitroamines and the enzymatic oxidation of imines to oxaziridines, three-membered heterocyclic compounds that are important building blocks in organic synthesis. For the former reaction a number of various enzymes will be screened to find the most efficient and effective. In case of the latter reaction the enzyme called peroxidases will be used. Because of the chiral structure of all enzymes, it is expected that the resulting products will be enantiomerically enriched(optically active.

A positive outcome of the project will enable a wider application of enzymes, the biodegradable natural catalysts, in the chemical synthesis, thus replacing chemical catalysts, including organometallic species, which is of importance for the protection of the environment. Noteworthy, none of the proposed enzyme-catalyzed transformations has been reported in the chemical literature.