Nowadays the synthesis of a new molecules is not well appreciated by society what is related to its impact on the natural environment and living organisms. Therefore, as scientists we need to show that those molecules obtained using existing and new synthetic methods are indeed important, not only from scientific point of view.

Public health is one of the most valued factors by society and any efforts towards its improvement is strongly recommended. Currently, an increase in the incidence of cancer is observed, thus it is extremely important to eliminate or limit them. One of types of cancer is multidrug resistant (MDR) solid tumors. This is the subject of COST action CA17104. The key challenge of this action is an identification of a new diagnostic/predictive biomarkers, producing new and safe compounds applicable to personalized treatments of MDR tumors. In order to achieve such goal, we need to design new synthetic protocols providing organic compounds of defined structure, free from any impurities. Therefore, during the realization of project we will study the two new types of organic reactions which provide molecules of high activity towards MDR. These reactions are catalyzed by palladium and copper catalysts and can be successfully performed in water. To achieve success, we need to know reaction scope and limitations, reaction mechanisms and optimal conditions for successful synthesis. Since the obtained products will be applied for biological and medical studies by COST specialists, they should be free from impurities including residual metal catalyst. Therefore, in the project special attention will be paid on reaction conditions and catalyst immobilization/inclusion to design experimental procedure providing metal free products. At present the synthesis of biologically active compounds used for MDR studies is complex and requires tedious and multistep syntheses. As the newly developed reactions can be performed in water, we show that they can be used as a component to design chemoenzymatic cascade processes leading to complex target structure in one-pot procedures. Such protocols are very difficult to develop and highly valued by the scientific community and industry. The research group has very good experience in organic chemistry, biocatalysis, chemoenzymatic tandem and cascade processess and medicinal chemistry. The cooperation with specialists from other fields of knowledge such as biology and medicine within the international COST action will allow for a direct transfer of results from chemical laboratories to biological and medical laboratories. This unique organization will combine modern organic chemistry with biocatalysis and medical chemistry. The newly designed chemical reactions will be an excellent starting point for the development of chemoenzymatic cascades leading to the formation metal-free products. As an additional benefit, the biological activity of the most promising compounds will be evaluated, especially against MDR. The cooperation with specialists from other fields of knowledge will enable research to develop new methods for the synthesis of the most active target molecules. The results of the project will expand the area of organic chemistry by at least two new chemical reactions and also provide collection of highly attractive and structurally advanced compounds attractive from the point of view of medical chemistry.