Summary of Ph.D. Thesis

The aim of this doctoral dissertation was to synthesize new, effective organocatalysts and evaluate their catalytic activity in the asymmetric Betti reaction. Additionally, the heterogenization of a selected thiourea organocatalyst on porous adsorbents was planned, followed by assessment of its performance in the studied reaction. Another goal was the synthesis of aminoacid derivatives of Betti bases and the investigation of their anticancer properties.

The work is divided into three main chapters - Literature Review, Discussion of own research results and Experimental Section. Due to the hybrid nature of the work, the discussion of results includes a description of research already published in scientific journals as well as research pending publication. The experimental part deals only with the unpublished part.

The literature review is divided into three main subsections. The first subsection presents methods for obtaining enantiomerically pure compounds, with special emphasis on asymmetric synthesis. The next subsection focuses on thiourea and thiosquaramide organocatalysts and their use in asymmetric reactions. The final subsection introduces the figure of Mario Betti and provides a review of literature on the asymmetric variant of the Betti reaction.

The section containing a discussion of my own research results is divided into four parts. The first part focuses on the development of bifunctional thiourea and thiosquaramide organocatalysts for the synthesis of Betti bases. It describes the synthesis of simple Takemoto-type organocatalysts and their application in the reaction of 1- and 2-naphthols with *N*-tosylimine, and 6-hydroxyquinoline with *N*-Boc-ketimine. A dual activation model is proposed and described for each reaction. The next part extends ongoing research, covering the use of homogeneous organocatalysts, including urea and thiourea derivatives with sugar fragment, aziridinylcarbinols and phosphines and their oxides in the reaction of 1-naphthol with *N*-tosylimine, and 6-hydroxyquinoline with *N*-Boc-ketimine. The third part created in collaboration with the staff of the Technical University of Lodz, describes the heterogenization of a selected thiourea organocatalyst on solid supports and its application in the synthesis of Betti bases. HPLC and FTIR analyses of the adsorbents and their modifications (with copper, ammonia, and ethylenediamine) are presented, confirming the efficient deposition of the organocatalyst on the carrier. The final section describes the synthesis of aminoacid ester-modified Betti bases. These derivatives, previously unknown in the literature, were subjected to extensive *in vitro* and *in silico* studies in collaboration with staff from the Department of Molecular Biotechnology and Genetics of the Faculty of Biology and Environmental Protection at the University of Lodz, to assess their anticancer potential against pancreatic (BxPC-3) and colorectal (HT-29) cancer cell lines.

The experimental section presents unpublished research, describes the synthetic methods and the characterization of the compounds using ^{1}H and ^{13}C NMR spectroscopy and mass spectrometry.