Nature has encoded the secret of life in sequence of biopolymers such as nucleic acid and proteins. For example, enzymes are capable of catalyzing several biochemical reactions with absolute selectivity. This is attributed to the 3-dimensional geometry of enzymes which determines their functions and activity. Recapitulating similar functions in synthetic macromolecules is a challenge in modern polymer chemistry. The non-natural sequence-defined polymers have great potential to exhibit self-assembly and programmed folding and received widespread attention in material and life sciences. However, there is limited prior information in inducing enzyme-like catalytic properties of synthetic sequence-defined polymer for abiotic chemical transformations. Therefore, we aim to investigate sequence-defined polyurethanes as a ligands in asymmetric catalysis. The project will add fundamental knowledge on synthesis and conformational characteristics of stereo-controlled sequence-defined polyurethanes. This understanding of sequence-structure correlation will further be applied to develop potential ligands for catalytic hydrogenation of alkenes with high selectivity.

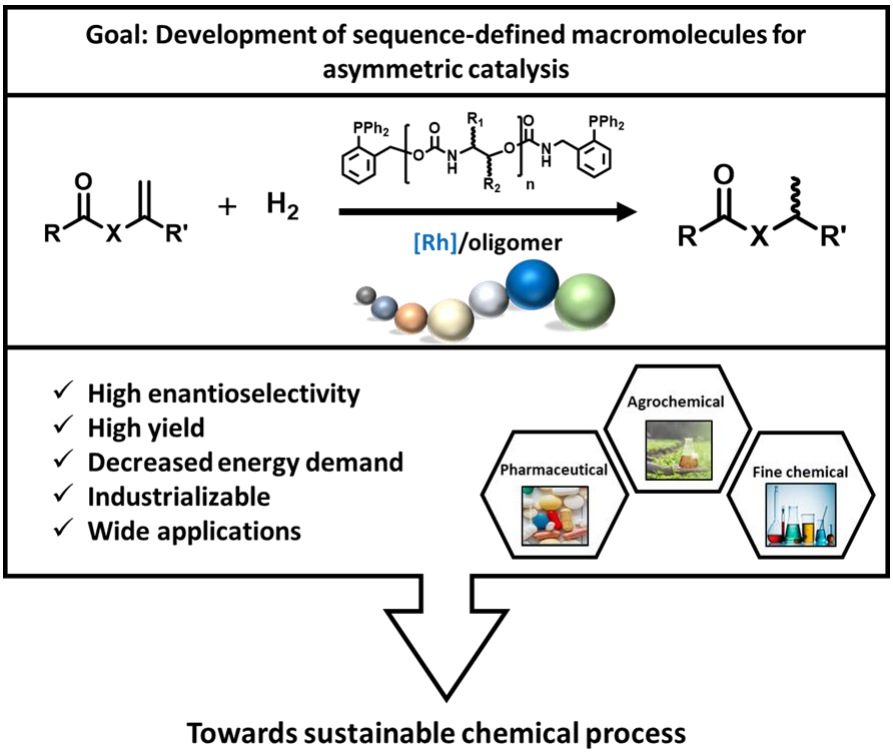

Figure 1. The project aims to explore library of chiral monomers as a polymer building blocks as ligands for stereoselective hydrogenation reaction.

In particular, we propose to explore library of chiral monomers in well-defined arrangements on phosphine-based macromolecules and use them as ligands for asymmetric catalysis. We will evaluate library of different sequences in stereo-controlled alkene hydrogenation reactions. This research will address new routes for the development of advanced catalytic systems for clean energy production, sustainable and environment-friendly catalysis which will be highly beneficial for the synthesis of value-added products used in the pharmaceutical, agrochemical, and fine chemical industries.