New targets for olefin metathesis: organometallic helices from achiral substrates

Efficient synthesis of enatiomerically pure, or single-handed, molecules with desired properties is one of the major challenges for contemporary chemists. Single-handed molecules are used in the industry to manufacture numerous biologically active substances, which are, among others, active ingredients of modern drugs. On the other hand, enantiomeric building blocks are useful in synthesis of chiral organic-inorganic hybrids and functional materials with fascinating properties. Moreover, understanding of mechanisms of growth of homochiral crystals from racemic mixtures might give insights in the question that remains unanswered since the discovery of Louis Pasteur – why live on Earth is homochiral?

The main goal of this pioneering project is to synthesise chiral ferrocene derivatives (Figure 1) from inexpensive achiral organometallic substrates using modern catalytic reactions (olefin metathesis in metal coordination spheres).

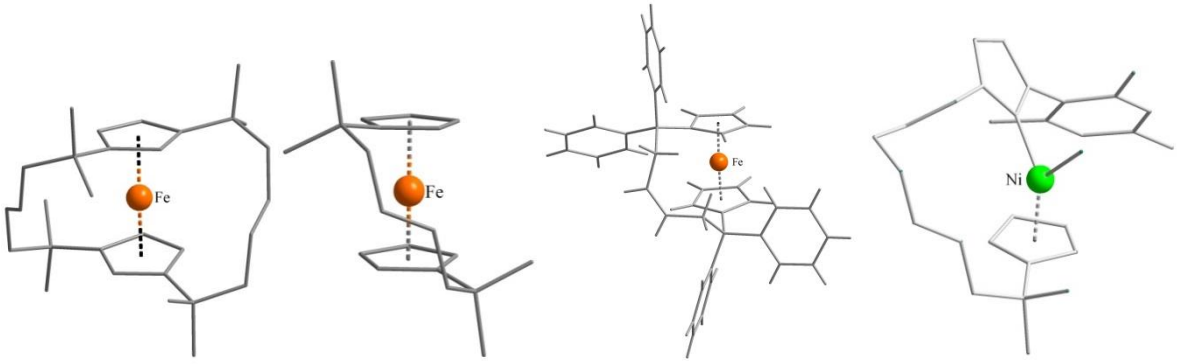
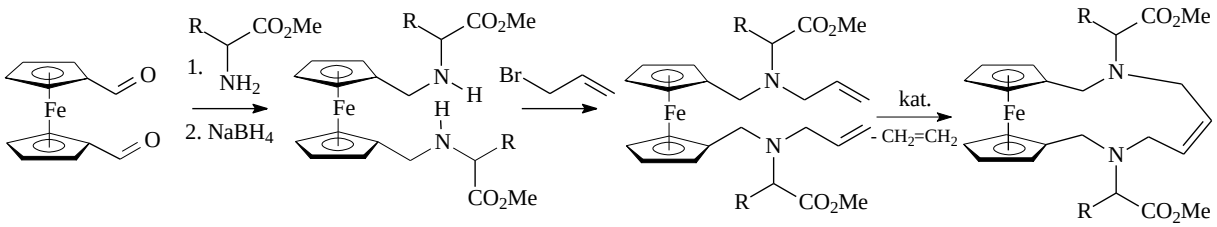


Figure 1. Examples of axially chiral molecules obtained so far in our group through olefin metathesis in metal coordination spheres.

Key substrates for the olefin metathesis reactions, that is bis-alkenyl ferrocene derivatives, will be obtained by one of the two routes:

- from substituted cyclopentadienes (prepared from 6,6-disubstituted fulvenes and allyl magnesium bromide) and anhydrous Fe(II) salt;
- from readily available 1,1′-disubstituted ferrocene derivatives (Scheme 1).



Scheme 1. An example of planned synthesis of the target chiral molecules.

Olefin metathesis reactions will be carried out using commercial ruthenium-based catalysts (first or second generation Grubbs catalyst). The resulting racemic mixtures will be resolved into enantiomers by means of HPLC on chiral columns or through selective crystallization of diasteroisomers formed with chiral auxiliaries. The obtained functionalised screw-shaped *ansa*-ferrocenes will be testes as ligands in asymmetric catalysis and as building blocks in synthesis of hybrid materials.