First, we will describe a new general method for preparing chiral secondary alkylolithium reagents using a stereoselective I/Li-exchange reaction. This chemistry will be used to prepare the natural occurring pheromone (+)-lardolure in a very predictive manner (Scheme 1).

We will then describe new efficient direct insertion procedures of zinc to aromatic and heterocyclic halides and use these methods to prepare a range of polyfunctional organozinc reagents. By using a directed ortho C-H activation triggered by TMPZnOPiv, we will be able to prepare zinc reagents having an air- and moisture-enhanced stability and show their utility in organic synthesis (Scheme 2).

We will also report a new quite general cobalt-catalyzed cross-coupling procedure allowing the preparation of various unsaturated molecules. Notice that the catalyst used CoCl₂ is 1000 times cheaper than PdCl₂ generally used in cross-couplings (Scheme 3).

Finally, we will demonstrate that organozinc and organomagnesium reagents are compatible with various strong Lewis-acids. This can be applying to achieve unusual metalations. The use of flow-technology further extends the reaction scope (Scheme 4).

Key references: