

DESCRIPTION FOR THE GENERAL PUBLIC

Development of new methods for chemical synthesis is of paramount importance to the continuous advances of science. A major objective of the proposed research program is to invent and develop new chemical concepts that allow innovative techniques using abundant metal catalysts by cross-coupling reactions. This chemical tool relies on joining two carbon atoms together, which is necessary for the synthesis of better medicines, more advanced materials and novel electronic devices. The specific aims of this research include: (I) Investigation of New General Methods for Catalysis using New Classes of Benign Ligands; (II) Investigation of New Precursors that can be Engaged in Catalytic Methods; (III) Investigation of New Methods for Coupling of Heterocyclic Substrates. The major topic will be identifying appropriate ligands for metal catalysis. Two main approaches will be taken toward selecting suitable ligands: (1) Ligand design based on ligands that improve stability of metal catalysts during the catalytic cycle. (2) Evaluation of strongly nucleophilic ligands that facilitate elementary steps during the catalytic cycle. The proposed research will provide new methods for more efficient and economically viable synthesis of small molecules, allowing rapid construction of organic frameworks by using abundant metals. These new methods will allow the formation of complex molecules for chemical science. The research will be highlighted in the synthesis of non-steroidal anti-inflammatory drugs; late-stage synthesis of pharmacophores, and synthesis of fused heteroarenes for semiconductor applications. The main motivation for this research program originates from the fact that the ability to construct small molecules in a rapid, modular and highly efficient fashion, while using earth-abundant metals, has a direct and long-lasting impact on the fields of drug discovery, materials science and chemical industry and is central to advances in science, biotechnology, health, biophysics, polymer and energy industries, with the long-term impact on the improvement of the quality of life and the well-being of our society.