Non-Technical Abstract: Catalysts have promise for improving the manufacture of important drugs and are key to their faster, cheaper and safer production. One crucial process in the preparation of many pharmaceuticals is a chemical reaction to make substances known as alcohols. The product alcohols can be formed as either (or both) of two mirror-image geometries which give rise to two different molecules that can exhibit very different pharmaceutical properties. While one of these mirror images is beneficial, the other could be a harmful source of undesirable side effects. The reactions that prepare the alcohols usually make both mirror-image species in about the same proportions which is undesirable, so catalysts are needed to strategically prepare only the desired mirror-image molecule which can eliminate unwanted drug side effects.

The long-term goal of the Kelson group is to develop catalysts that can selectively deliver only the desired product. This innovation would reduce costs, delays, and resins to drug product. In prior work, the Kelson group has developed two families of catalysts consisting of pairs of closely spaced ruthenium metal atoms supported by organic ligands that successfully carry out the preparation of alcohols in which

the desired mirror image molecule is the primary product formed. However, more work is needed to develop better catalysts that form the desired product more efficiently and do not break down as readily. To advance these new catalysts toward the long-term goal, the proposed work will pursue the following specific aims:

- New supporting ligands will be prepared that will bind ruthenium ions spatially closer so the resulting ruthenium-ligand complex will be more stable and carry out the catalytic reaction in greater yield.
- Ruthenium will be inserted into the new ligands and the resulting compounds will be confirmed.
- The ruthenium-ligand complexes will be tested as catalysts to confirm that the new ligands improve activity and longevity.
- A family of ligands will be prepared that are designed to carry out the catalysis reaction on specific sites in a broad range of ketone pre-drugs.