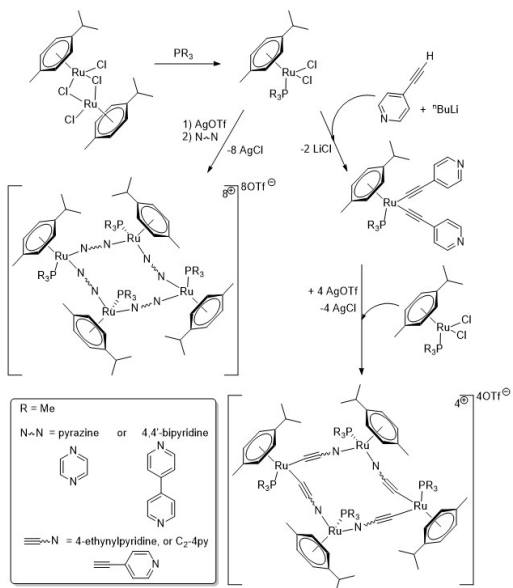


The Utility of Organometallic Chemistry – Squares, Catalysts, and Anti-Microbials

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The use of organometallic transition metal complexes has had a significant impact in the field of organic chemistry as these complexes function as catalysts, and now nearly all organic syntheses of any complexity include at least one metal-catalyzed reaction. Metal containing complexes also have biological roles and are being explored for medicinal purposes. Two examples germane to this proposal include ruthenium compounds for anti-cancer and cobalt compounds for anti-fungal.



Scheme 1. Proposed synthesis of ruthenium-based molecular squares.

of electronically tunable molecular squares involving ruthenium in the four corners. The Ru ions are proposed to be able to electronically communicate with one another via bridging ligands. This will be accomplished by using a facially coordinating tridentate ligand and a monodentate phosphine ligand, which would create a template for coordination driven molecular self-assembly through bridging ligands while providing an opportunity for different R groups to attach to the phosphine (Scheme 2). This is a collaborative project between the Lee and Pienkos research groups.

In addition to working on current challenges in inorganic chemistry, you will learn synthetic inorganic and organometallic chemistry, including air-free chemistry in a nitrogen filled glove box and Schlenk techniques.

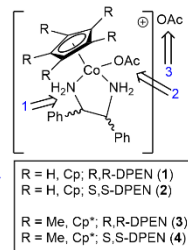
A significant amount of the Department's instrumentation will be used for characterization, which includes NMR spectroscopy, infrared and UV-vis spectroscopy, electrochemistry, and single-crystal X-ray diffraction through a collaboration. In addition, you will be encouraged to present your work at the Regional American Chemical Society meeting in 2026.

Students in my group have gone on to pursue a PhD in chemistry at UTK, Texas A&M and Delaware, pursue professional degrees in medicine and pharmacy at UT Memphis, and have found positions in industry immediately after graduation. These students have presented at regional and national meetings of the American Chemical Society and in some cases had their results published in peer-reviewed journals such as *Polyhedron* and *Journal of Coordination Chemistry*.

This summer we will be working on two projects. Project 1, organometallic compounds are of interest to fight anti-microbial resistance (AMR) because of their ability to be readily modified in five key areas: the metal choice, metal oxidation state, ligand identity, charged and neutral compounds, and numerous geometries available to metal compounds. We have prepared a series of water soluble and stable cobalt complexes (Scheme 1) and in collaboration with the Giles lab (BGES) tested against a variety of Gram positive and Gram negative bacteria for effect on the antimicrobial growth. Our next steps this summer will involve modifications to the first generation compounds as outlined in Scheme 1 where we can change the ligands to monodentate, remove the chirality, and change the charge balancing outer sphere anion. Project 2, the synthesis

Proposed Work:

- 1-Change the ligand from a bidentate to a monodentate.
- 1-Remove the chirality and keep bidentate.
- 2-Add or remove acetate bound to the cobalt.
- 3-Change charge balancing outer sphere acetate to other anions.



Current Work:

- These four compounds have shown
- Both the ligand and the cobalt center are required.
- MIC values for Gram + and Gram - bacterial that are around 100-200 µg/mL.
- The chirality of the DPEN does not play a role.

Scheme 2. Cobalt complexes to look at AMR.