Reading Guide for “Synthesis and Reactivity of Oxorhenium(V) Methyl, Benzyl, and Phenyl Complexes with CO; Implications for a Unique Mechanism for Migratory Insertion,” Robbins, LK; Lilly, CP; Smeltz, JL; Boyle, PD; Ison, EA;, *Organometallics* **2015**, *34*, 3152-3158.

This reading guide focuses on the synthesis, characterization and kinetic studies of the title compounds. The DFT studies are not emphasized. Be sure to refer to your textbook or other resources to answer any questions that arise as you read. \* Indicates more challenging questions that will require additional reading and thought.

1. Read the **Introduction**. After reading this section, you should be able to
   1. Describe the mechanism for forming C-C bonds in a migratory insertion
   2. \*Describe the experiments that were performed by Caldezarro and Wojcicki to determine the mechanisms.
   3. Explain how “direct insertion” differs from the accepted mechanism (Scheme 1)
2. Examine **Figure 1** and read the corresponding description in the text under **Scheme 2.** After reading this section, it should be clear that **3a** is diamagnetic and the NMR is consistent with the proposed product.
3. Examine **Figures 2** and **3**. Note the “distorted square pyramidal coordination environment.”
4. Read **Insertion Reactions with CO** (top of page 3154) and examine **Scheme 3**.
   1. Note the pressure of CO used, the temperature and the time required for the reactions.
   2. \*Complex **2** [(DAAm)Re(O)C(O)CH3] is described in reference 5. You should be able to describe how this complex compares to the one described in this work.
   3. Note how the 1H NMR of the product (**5a**) changes.
   4. Note the CO stretching frequencies in the products (**5a-d**). Consider how these compare to free R-C(=O)-R stretching frequencies and why the metal-acyl frequencies are different.
5. Read **Kinetics of Insertion Reactions** and examine **Figure 5**.
   1. Note how the experiments were performed. How do the authors convince you that the reactions were clean (no decomposition occurred and only one product was formed)
   2. \*Note the term “pseudo-first-order observed rate” and know what it means.
6. Read **Rate Law for CO Insertion** and examine **Schemes 4** and **5**.
   1. Note equations (1), (2), (4) and (8).
7. Read **Determination of Activation Parameters**.
   1. \*Review Eyring plots; review how to find thermodynamics of activation from Eyring plots.
   2. \*Be able to explain how the entropy of activation relates to the nature of the transition state.
8. Read the **Conclusions**.
   1. Note the authors’ comments on the importance of the oxo ligand in determining the mechanism of the insertion reaction.