Some things to keep in mind for your reports:

Include relative intensities (rel int) for each ion in the MS data line listing; these should be normalized to 100 for the base peak.

Identify hybridization of the carbon when you assign CH stretches in the IR line listing.

Provide entire range of time in the MS chromatogram you print out.

Make sure you are using your own NMR spectrum file (there may be some previous year's data on the server, so double check that you have download your file ending in "…22").

Provide the full range of chemical shifts from <0 to >the furthest downfield resonance in the spectrum (often will be the chloroform proton).

Show a structure on your NMR printout that has the protons labeled in some clear fashion with the same label you use in your line listing.

Provide a *concise* workup description in your procedure section. The procedure examples in the Lab Notebooks and Lab Reports document can help you judge what information is superfluous.

For line listings of spectral data, pay close attention to the appropriate use of spacing and italics.

Below are some *Problems* and suggested *Solutions* encountered in conjunction with Experiments 3-5 and identified by students or TAs in previous years.

Experiment 3 Enolate Alkylation, Ester Saponification, and EDCI-Coupling

Enolate Alkylation

Problem: Poor reaction conversion

Solution: Double check all your stoichiometries. Make sure to **account for the fact that *n*-BuLi is a solution** (~2.5 M in hexanes). Use this number to calculate the amount of solution to measure out, not literature values concerning the density of *n*-BuLi. In other words, if the concentration is 2.5 M, then 1.0 mL of the *n*-BuLi/hexanes solution will contain 2.5 mmol of *n*-BuLi. Because it is much more common for students to be seeing under-methylation (i.e., remaining starting material) rather then over-methylation (i.e., the α,α-dimethylated product), you should consider using a slightly larger excess (e.g., 1.2 instead of 1.1 equiv) of the LDA base.

Solution: You must use **dry** solvents and reagents in this experiment. These need to be removed from the small (100 mL) bottle of "anhydrous THF" that is clamped inside a hood. Similarly, diisopropylamine should be taken from the vessel of dried reagent that the TAs have provided, also clamped in the hood.

Solution: You must use dry glassware for this experiment. At the very least your reaction vessel should be cleaned well in advance and allowed to air dry for >24 h, preferably even longer. Also, consider drying your reaction vessel immediately before use with the heat gun.

Problem: Difficulties in syringe handling

Solution: Because you are having to penetrate in and out of rubber septa, the syringe and needle junction (i.e., luer) can come loose from one another. Be sure to hold the needle firmly to the syringe luer with your second hand when drawing, transporting, and dispensing the reagents. It is wise to always have any reagent/solvent bottle or flask that is capped with a septum firmly clamped so that both of your hands are free.

Problem: Clogged syringe needles

You MUST clean your syringe and needle with a solvent compatible with the reagent being dispensed to then IMMEDIATELTY clean the needle following transfer of the reagent. This is especially critical for the solution of *n*BuLi/hexanes. Have a small beaker of hexanes available in advance and draw up aliquots of it into the needle/syringe you have just used. Dispense it into an empty beaker each time. Do this several times. Then expel all of the solvent from the needle, return it to beside the nBuLi bottle, and let it evaporate dry for the next person to use. Before discarding the hexanes/nBuLi you dispelled into the empty beaker, add a small amount of ethyl acetate. That will consume (react with) any residual nBuLi. The quenched solution can then be added to the organic waste.

Problem: Loading a sample onto the MPLC injector containing a solid precipitate (e.g., ammonium salts or an insoluble urea derivative that is only sparingly soluble in hexanes/EtOAc) caused the injector to become clogged or accumulated on the top filter paper frit under the top fitting of the column, resulting in pressure buildup. This, in turn, can result in lost sample (product) because of leaks and/or loss when a fitting is loosened to relieve the pressure buildup.

Solution: Dissolve your crude sample into the MPLC elution solvent system of choice. Filter away any remaining solid using a pipet that has a cotton plug tightly wedged into its neck, rinse the pipet with a small amount of additional fresh solvent to minimize any loss of material (product), and then take up the filtrate into the injector loop.

Hint: MPLC purification is probably a better choice than flash chromatography for purification of the enolate alkylation product and the DCC-coupling product. If you have >100 mg of either of these samples, use the larger MPLC column. Overloading causes peak broadening/tailing in the chromatogram, which negatively impacts the separation.

Ester Saponification

Problem: Methanol solvent causes aqueous and ether layers to remain as one layer during the extraction step.

Solution: When the reaction is complete, remove most of the methanol with the rotary evaporator before adding the 10% aqueous hydrochloric acid and ether. This will ensure that there are two distinct layers as you perform the extraction.

Problem: It is difficult to remove all traces of ethanol from the carboxylic acid (product **8**). Ethanol is present (~1%) in the diethyl ether and serves as a stabilizer (inhibitor toward autoxidation).

Solution: Longer rotoevaporation time (with a warm water bath), or redissolving the material resulting from the first removal of solvent into dichloromethane and rotovaping again (with heat) helps reduce/eliminate the residual ethanol.

Experiment 4 Metal- and Enzyme-Catalyzed Organic Reactions

Problem: The first coupling reaction can be slow.

Solution: Make sure to use the aryl iodide and *not* the aryl bromide (hopefully there is no longer any bromofluorotoluene left in lab chemical supplies).

Problem: The nutator for the lipase-catalyzed reaction rocks culture tubes such that the liquid contacts all inner surfaces of the tube and cap. Caps can leak if they do not have the proper fit or inner liner.

Solution: To prevent leakage, use a culture tube with a *Teflon lining* on the inside of the cap. Most of the large tube caps have the lining, but some of the smaller ones do not. **Test your tube first with some solvent alone to make sure that it does not leak when upside down**. If you don't have a leak-proof fit, borrow one from a neighbor or check one out from the stockroom.

Experiment 5 Diels-Alder Reaction, Luche Reduction, and 2+2 Cycloaddition

Problem: The methylbenzoquinone-CpH Diels-Alder adduct **17** crystallizes out on the filter paper when filtering the hot solution.

Solution: Don't filter during this recrystallization. Filtering serves to separate the hot saturated solution containing the substance of interest from any particulates still not dissolved. Decanting (carefully pouring away from these solids) should suffice. The only drawback to decanting is that you will not be able to remove every last drop of the solution, enriched in impurities, but that is OK.

Note: Use gloves when handling methylbenzoquinone. The skin on your hands will be stained brown for a period of time if it comes in contact with a solution (or solid sample) of the quinone. Better yet, do not allow any liquid to contact any of your digits, regardless of whether or not they are gloved.

Problem: During the Luche reduction to produce the diol **18**, prolonged reaction times (overnight) appear to lead to more complex product mixtures.

Solution: Plan to not allow this reaction mixture to stand for longer than 3 hours prior to workup.

Problem: The diol product (**18**) does not freely dissolve in *d*-chloroform during NMR sample preparation.

Solution: Prepare an NMR sample with the usual amount of *d*-chloroform. Then add several drops of *d*-DMSO (until you see the solid product dissolve). Submit the resulting, homogeneous sample as usual. Note that you could submit a sample using only *d*-DMSO as the solvent, however this needs to be communicated to the TA submitting the sample. Spectra collected in pure DMSO-d_6 tend not to be as well resolved. (BTW, the DMSO assists in solubilizing the diol because its oxygen atom is an excellent hydrogen-bond acceptor.)