

Walters Research Group Guidelines and Policies
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<http://www.nku.edu/~walterske/research.htm>
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Objectives (Why would I want to do research?)

The primary goal of undergraduate research is for you, the beginning research student, to develop a proficiency in the study of chemistry by investigating unexplored topics and learning how to produce good scientific results. Emphasis is placed on the development of *independent* scientific thought and practice in experimental design, laboratory work, use of chemical literature, and professional writing and speaking. You will be practicing physical inorganic and organometallic chemistry as it is practiced in the “real world”. In essence, you are a “colleague” in my group, and you should be prepared to assume the responsibilities of such an assignment.

The research experience will serve as a bridge between your academic and professional (or post-graduate) careers and will contribute much to both areas of your life. Favorable progress in research will have a positive effect on your future career potential. Many employers and graduate admissions committees will no longer consider applicants who did not participate in undergraduate research and present their results at a professional conference. Therefore, your hard work here will pay off in many ways that may not be obvious to you right now.

Prerequisites

In order to perform successful full-time research in my group you should have successfully completed CHE 310 (Organic Chemistry I) and its lab course, along with good grades in CHE 120 and CHE 121 (General Chemistry I & II). These courses prepare you for the synthetic aspects of our research. Exceptional students that have completed both general chemistry courses will be considered for research on a part-time capacity. Any additional experience in math, physics, and chemistry is helpful but not required, since you will learn what you need to know as you perform research.

Grade vs. Pay

In general, students do not normally earn credit (CHE 492) for research performed in the summer. Instead, full time researchers receive a summer stipend (currently \$3000) for their work, normally paid in biweekly installments. Part time summer researchers may receive a reduced stipend if funds are available, but more importantly will be considered first for subsequent available full time positions in the research group. During the academic year, students performing research typically enroll in CHE 492 to receive academic credit for their work. Should funds be available from grants, researchers may receive a small stipend in addition to their academic credit (currently \$750/term).

My Expectations of You

I assume that you want to do research because you want to learn and carry out organometallic synthesis and photochemical measurements at a high, independent level. Additionally, you may want to discover if you would enjoy doing chemistry research after you graduate from NKU.

I expect that you will be a self-motivated hard worker, keeping me advised of your progress and seeking guidance as necessary. When you initially start research (or perform a new reaction/technique you have not performed before), I will be in the lab assisting you. However, I will expect you at some point to be able to perform these tasks on your own. I will also regularly walk through the lab when you are performing research to check on your progress. It is my belief that it should never be my job to prod you along. Rather, I expect that *you* will take the initiative to come to me frequently and report on your progress while seeking guidance for new research approaches, directions, and objectives.

I expect you to plan on spending, at the very least, 8 hours a week (per credit hour if you enroll in CHE 492) during the academic year working on and thinking about your research. This time should be split across at least two days during the week (two four hour periods works well) in order to allow you to handle multi-day reactions. During the summer this expectation increases to a minimum of 35 hours a week if you are doing research full time (part-time research hours are set on a case by case basis). I am not, nor do I wish to become, a research director that “watches the clock” and tracks your “on tack” research time (I consider my research colleagues to be mature enough to not require this supervision). I expect you to make sure you are meeting the time requirements set forth in your research proposal contract. If you cannot maintain the time commitments, you will be asked to leave the research group. Also, keep in mind that your research time should be flexible, since the occasional reactions/techniques may not easily fit into your agreed upon research schedule, thus requiring some extra time.

I expect that you will take pride and personal interest in your research project. Chemistry research tends to be *very labor intensive* and somewhat frustrating at times. It can also be extremely rewarding (but only after some initial disappointments, so do not give up!). You should strive to learn from past mistakes and excel in the project you have undertaken. Keep in mind that you will become one of the world's foremost authorities on your research and will earn the professional respect that comes with this knowledge. Thus, you should put in as strong an effort as you can muster. The more you put into this endeavor, the more benefits you will reap.

I expect that you will behave in a mature fashion and respect both me and your other research colleagues, both in our group and other research groups. In essence, treat others as you would wish to be treated. This especially applies to lab equipment and personal belongings in the shared research labs. Please ask others before you borrow any glassware or chemicals, and always return them in a timely manner. In the "real world", we do not always get the opportunity to hand select our coworkers, and this can lead to strife and conflict. The same situation applies in undergraduate research groups. I implore you to deal with any interpersonal problems directly and tactfully. I am your research director. I am your mentor. I am your advocate and even your friend. I am *not*, however, your parent. I do not wish to become involved in these conflicts and tend to take the easiest course of action to rectify the situation (e.g., removing the radio from the lab if no one can agree to the music). If you do not wish to follow my "easy" solution, do not involve me with these problems!

Lab Policies and Safety Contract

You are required to understand the group lab policies outlined here and the separate department safety contract. Signing both your research proposal contract and safety contract signifies that you will abide by these policies and may be dismissed from the research group if you fail to comply.

Research Notebook

The most important aspect of your chemistry research is to keep a good, detailed research notebook and accompanying spectral data binder. This includes organizing all research spectral data in a binder. Since the composition of our research group will change frequently, other researchers will likely review your notes and repeat a reaction or experiment that you previously investigated. Therefore, you should keep records that are detailed enough so that a colleague can repeat your experiment solely based on what is in your notebook! Also, any reports or presentations you make will be based on the work you have recorded in your notebook. Preparing for these activities will be much easier if you take the time to maintain a good notebook. Refer to the separate "Keeping Good Research Records" document for guidelines. I cannot repeat enough times that keeping excellent records of your work is essential! Also note that all research notebooks and spectral data are the property of the research group and should never leave the chemistry department without my prior consent.

Chemical Literature

You should keep an organized file (in your binder) of all chemical literature/reference material you acquire from me (and on your own) during all phases of your research. Specific procedures from primary literature articles should always be referenced in your lab notebook for each experiment. Keeping an organized collection of references allows you to easily refer to them while working and writing.

Reference Library

I maintain a small library of books on chemistry in my office that will be helpful to you in your research. I maintain a collection of Oxford Chemistry Primers that provide concise explanations on chemistry topics. If you are performing spectroscopy in my group, you should read the primer on photochemistry (I have several copies). Other primers are available dealing with other specialized spectroscopic measurements and organometallic syntheses, as well as other chemistry books. I encourage you to read sections of these books during your research to provide you with a better foundation for your work in the labs. Since many of these books are my own personal copies, please take good care of them and return them when finished. Other general organic / inorganic / synthetic references are available on the bookshelves in the wet lab. Most of these books are provided by other department faculty, so treat them with the same level of care.

Synthetic Laboratory Work

Synthetic lab work is conducted in the research "wet lab" (SC 365). You will routinely follow many of the standard procedures you learned in your organic lab course, along with some other specialized methods for organometallic synthesis. You will likely be utilizing the techniques of former group members, which will be detailed in their notebooks. I will help you with new procedures the first time or two, but I expect you to become proficient with the procedure without my help. Refer to your organic and inorganic lecture and lab texts for additional information as needed. Never hesitate to ask questions if you do not understand a technique or procedure!

Spectroscopic Laboratory Work

Your research may involve spectroscopic measurements in the laser spectroscopy lab (SC 467). Again, you will be expected to become proficient in these measurements after my initial assistance. We can do some amazing things with our equipment, making your undergraduate experience very unique. However, the usage of this equipment comes with extra responsibility. While you may work alone in this lab, you should always notify me or another colleague that you are performing a measurement in the laser lab in case of an emergency. You may only carry out experiments *authorized by me* in this lab and always observe the proper safety precautions. You are to wear the provided laser safety glasses at all times while the laser is firing, and the "LASER IN USE" sign above the lab door must be illuminated when the laser is on. Also, you must complete training for any spectroscopy equipment before you can use it independently. Due to the inherent danger and high cost associated with this equipment, the laser lab is a controlled access space. You will be assigned a keycode to open the door, which you should protect to ensure the integrity of the lab. This lab should not be used by members of any other research group *for any purpose* without both my consent and the supervision of a trained group member. Failure to follow these guidelines will result in loss of access to this lab.

Weekly Meetings

You should schedule a weekly 30 minute meeting with me to discuss your research. This meeting gives us a one-on-one opportunity to discuss your specific progress, current problems (and possible solutions), and new directions to explore. You should come to these meetings prepared to discuss your research, so always bring your research notebook and spectral data binder. Since your research work is one of my highest priorities, you should always feel free to seek me out in my office or labs at any time for assistance.

Group Meetings

We will meet as a group regularly, normally once a month during the academic year and twice a month during the summer. During these meetings we will cover any needed administrative items, practice for upcoming presentations (if needed), and learn more about the research being conducted by your colleagues. These meetings are meant to share your research successes and discuss any current problems (the more people we have thinking about your problem, the quicker we can solve it). During the summer we will also conduct "supergroup" meetings amongst the various research groups in the chemistry department (normally on alternating weeks when we do not have our own group meetings). The purpose of these meetings is to learn about other research at NKU and to share your own work. You will be expected to participate in the "supergroup" meetings, and full time researchers will give an oral presentation at some point during the summer.

Presentations

The ability to deliver professional presentations is an important part of chemistry research. The group meetings provide an opportunity to practice these speaking abilities, along with presenting research at department-wide functions and the NKU annual Celebration of Student Research and Creativity. Emphasis will be placed on proper presentation structure and speaking techniques, along with the appropriate utilization of multimedia (Powerpoint). If you complete enough work during your time in our research group, it is very likely that you will make an oral or poster presentation at a regional, national, or even international chemistry meeting. My research funds (supplemented by department, SAACS, and college funds) will allow for travel and accommodation expenses. I strongly encourage you to consider attending a conference given the opportunity because it can be very beneficial to you personally and professionally. Conference presentations can also occupy a prominent place on your future resume.

Written Reports

It is important that you fully document your research in my group in order to help you prepare your presentations and for future members of the research group to continue with new research, as well as help me prepare manuscripts for publication in chemistry journals. Therefore, there are three regular written requirements for researchers in my group, which are summarized below. Please note that all of these should be *neatly typed* and formatted.

1. *Initial Proposal* By the end of the first week of each term (or the week before summer research starts) you should complete the initial proposal form. This document serves as a contract, since you provide a schedule that indicates your planned time in lab (along with other coursework and extracurricular commitments you may have). Your weekly meeting with me (see above) should also be included in this schedule. I will expect to see you in the lab during the indicated times and make *realistic* progress towards your proposed research goals. Failure to maintain your end of this contract (i.e., work on research during the specified times and following research group policies) will lead to loss of research pay and your ultimate dismissal from the research group.

2. *Progress Reports* At the end of every two weeks during the academic year (every week in the summer) you should prepare a short email to me that provides a summary of your work since the last report. This email should also indicate *your research plans for the next time period leading up to your next report*. These reports help you tie up any “loose ends” in your recent work and plan what needs to be done next, so do not treat these lightly. Good progress reports will also make your term summary much easier to write!
3. *Term Summary* At the end of each term you should prepare a formal report describing your research during that term. Imagine that you are writing a communication for the *Journal of the American Chemical Society* that describes all your magnificent accomplishments! There are no set page limits, but the summary should *thoroughly* describe all of your work (both the successes *and* failures). Your report format is set out in an available Microsoft Word template. A complete term summary report should include an abstract (summary of your work), an introduction that provides appropriate background information (and should refer to previous work in the group as appropriate), a synthetic experimental section describing all reactions performed and appropriate characterization of the products, spectroscopic experimental and data sections that describes all measurements performed and tabulates all results (significant spectra should be included as needed), a discussion of results section that describes the significance of your findings, a conclusion/future work section that indicates “what’s next” in your research, and appropriate literature references. This report may appear time consuming to complete at first glance, but it will be significantly easier if you keep detailed records in your notebook during the term and devote sufficient time in writing your progress report emails. Indeed, you should start working on the summary before the end of the term! You should provide me with an initial draft of your summary a week or so before the end of the term so that I can offer suggestions and corrections before you prepare the final draft.

Funding Applications

Conducting chemistry research is expensive. I regularly apply for external grants to support the group, but supplemental grants are commonly needed to fully support our work. Therefore, as opportunities arise I will request group members to apply for both internal and external funding opportunities. These could include NKU funding sources (e.g., Greaves summer fellowships and SURG grants) or national sources (e.g., ACS national meeting travel grants). Preparing these grants usually takes minimal effort on the student’s part, and I will help you as needed. Note that if you are successful at securing one of these funding sources, they will likely require a final report on your progress that you prepare. The funding agency’s guidelines would naturally supplant the report guidelines I specified above.

Leaving the Lab

If (for any reason) you decide to no longer work in my research group, or you graduate from NKU, you must complete the following tasks you are considered “finished”: 1) Turn in your final term summary report; 2) Clean up your lab bench and area; 3) Properly label and store all compounds you have prepared; 4) Turn in an inventory of all compounds stored (structure, ID#, amount, purity and location); and 5) Turn in your lab notebook and spectral data binder (correctly labeled and organized). While changing research groups does happen and is not discouraged by the department faculty, you will not be able to begin research in a new group until your responsibilities with my research group are properly completed. Failure to complete all these tasks will result in withholding of your research stipend and/or your grade (if applicable).

One Final Thought

Finally, remember that the whole purpose of this endeavor is for you to learn what it is like in a chemistry research laboratory along with advanced chemistry principles and techniques. You may not necessarily get the greatest results in the world, and you are probably not going to win the Nobel prize for your work at NKU. However, you will hopefully have a positive experience in my research group, and you will obtain the satisfaction that you are making significant scientific contributions to the frontiers of chemical research. While the frequency of your success and progress towards our research goals is important in our group, it is secondary to your overall educational experience.