

Navigating MS Graduate Studies and Research Warnell Graduate Affairs Committee, 2020

As will be outlined below, your graduate studies will be very different from your undergraduate experience, and so the Warnell Graduate Affairs Committee has created this guidance to facilitate your journey through an MS program.

Getting Started

The big difference between being an undergraduate and a graduate student is that your focus now is your research project, not your classes. You are now expected to take ownership of your project and your intellectual development. Your goal is to learn to think, make decisions, and work independently. If you are simply doing what your advisor is telling you to do, you aren't being a graduate student, you are continuing an undergraduate education.

A great deal of science is conducted by graduate students. Usually, the Principal Investigator has received competitive grant money to conduct an experiment or undertake a set of observations to address a question or test a hypothesis. They have an idea, an experimental plan, and funding to pay graduate students and technicians to collect and analyze data. What this means is that you are going to be responsible for the data collection and answering the question(s).

Your graduate student experience depends upon the working relationship you develop with your major professor, your committee, and often your research team. You need to set up effective regular communication and develop a mutual understanding of expectations. You need to review progress regularly and decide when adjustments are needed. More communication is better than less. If you are having trouble, aren't making progress, or have made a mistake, it is human nature to keep quiet. Don't do that. If your professor doesn't hear from you, they will assume you are doing well and making progress. They need to hear if you are struggling with anything.

Treat graduate school like a job. Work a regular schedule – come in at 8am, go home or go to the gym at 5pm. Put in a solid 40+ hour week covering your assistantship obligations, your class work, and your intellectual development in the field. Take time for yourself and your personal life, but don't wait for things to happen. Push forward. Make your office a place where you can work effectively, and work from there, not from home (except during a pandemic!). If you aren't assigned an office, work with the Office of the Associate Dean for Research and your advisor to secure one. Use the library or the computer room until an office can be arranged. You need to start work between 8 and 9 in the morning. At least five days a week you need to be either in the field, in your office, or reading. Get regular sleep. Of course you need time for exercise and recreation, but those activities should be secondary.

Learn from other graduate students. Early on, attend MS and PhD defenses to see what other graduate students have done (attend two defenses in your first semester, so you can see what the end product looks like). Similarly, read some Warnell Master's theses from your field. Go to seminars in your field. Don't pursue your graduate studies alone.

So, what do you need to do in your first semester?

- Think about skills you want to develop.
- Plan courses for your whole program.
- Form a committee.

- Start reading the literature relevant to your project.
- Conceptualize and outline a proposal. Draft your proposal if possible.

Remember, this is your degree. For that reason, our graduate program provides flexibility in courses and encourages interdisciplinary committees.

Regarding ownership, you need to manage your graduate program milestones and deadlines. It is not your professor's responsibility to do that for you. You should read the graduate student handbook. However, those are guidelines that allow some flexibility and are useful to keep progress on a schedule. The Graduate Office is a primary point of contact and can provide a wealth of knowledge and experience for successfully navigating your graduate studies. The Graduate Coordinator's main job is to help when the student-professor working relationship isn't working very well.

What are your goals?

There are two main reasons to pursue a Master's Degree. The first is to prepare yourself better for a professional career. A Master's Degree will expose you to more advanced concepts in your field, introduce you to the process of knowledge creation (research), and give you experience in planning, conducting, and managing a project. The second reason to pursue a Master's is to build the foundation for a long term career in research science or academia, in which case the Master's Degree is often a stepping stone to a Ph.D. The objectives for your Master's program will vary according to your reasons for pursuing the degree as described below:

Professional Preparation Track: Your basic objective is to do a creditable job on your project, advance and support your lab, learn, and graduate. Most employers of MS graduates are primarily concerned that you have completed a satisfactory thesis and earned good grades in your course work. What you researched or whether you made a significant contribution to science may not be a consideration in staffing a position. A published refereed paper looks good on your resume. If that is an objective, you will need to plan for that early on and when you write your thesis. A paper for publication will be a very different and separate document from your thesis. The Warnell School also gives you the option of writing your thesis as a paper for publication. If publication is an objective of your MS research, this is an excellent idea and should be your preferred format.

Research Track: Unlike the professional track student, the research track student must make sure that the study leads to a quality published paper or papers and that the Master's Thesis is a work of pride. The steps outlined in *Navigating the Thesis Process* are the same, but your attitude must be more scholarly and less utilitarian.

Navigating the Thesis Process

The most common problem Masters' students experience is completing their theses in a timely manner. The primary reason for this problem is they wait to start writing after they have collected and analyzed all their data. The thesis will be a large document, and it is very difficult to write all at once. A student will get bored and suffer from chronic writer's block if they attempt to write the thesis in one long effort. To address this problem, you should write each part of your thesis as soon as you have enough information to do it. Even if you know you can write only a draft of a chapter or a section of a chapter, because other information will eventually be developed, you should still write the draft. Many chapters, such as the literature review, the objectives, and the methodology, can and should be written before you have collected your data. A thesis draft will undergo multiple revisions before a final document is

completed. The process outlined below will help you write your thesis efficiently and reduce the time you spend in your program.

It is your advisor's responsibility to provide you guidance on your research, answer questions that you have, work with you to design an appropriate curriculum, and provide you timely comments on your proposal and thesis drafts. It is not their responsibility to motivate you. If you can't work semi-independently, you need to reevaluate your reasons for pursuing a MS degree. It is appropriate for the advisor to let you learn to manage your own time, and to intervene only if things aren't moving along.

Another common problem encountered by Master's students is being surprised by committee requests for new data and analysis when they are defending. You can avoid this by giving the committee members well-defined opportunities to revise your efforts well in advance of your defense. The process outlined below suggests two committee meetings prior to your defense.

1. In the first semester you need to
 - Decide on a research topic
 - Conceptualize and outline a proposal
 - Select and recruit an appropriate advisory committee
 - Complete the committee form and submit it to the Graduate Office
 - Develop a draft program of study and give it to your committee members
 - You should provide a list of your desired classes using the class names because professors can't remember all of the course numbers
2. Early in the second semester you need to
 - Give your committee a short (5-7 page) research proposal. This proposal should provide basic background for the research, present questions or hypotheses, describe proposed methods, and outline the expected results
 - Schedule a meeting to discuss the proposal and solicit feedback, including suggestions for modification
3. Write your literature review first, this will help:
 - Scope and direct your data collection and analysis
 - Minimize redundant effort
 - Give you a clearer picture of how your study fits into the other research in the field and what questions are critical
 - Every time you read a paper, take some notes on the paper, write up a summary and add the reference to your bibliography
4. Decide on the format of your thesis, either traditional thesis format or manuscript format.

Manuscript format:

Chapter 1 - Introduction and Objectives

Chapter 2 - Literature Review (extended)

Chapter 3 - journal format manuscript describing investigation

This includes Introduction with literature review, Methods, Results, Discussion

Chapter 4 - Discussion and Conclusions (extended version of what is in manuscript)

Appendices

Traditional format:

Chapter 1 - Introduction and Objectives

Chapter 2 - Literature Review

Chapter 3 - Methods
Chapter 4 - Results and Discussion
Chapter 6 - Conclusions
Appendices

5. Write your introduction and objectives. It is important to be able to clearly explain to yourself and to others why you are doing what you are doing. You must ask yourself, “who really cares?” If you can’t answer that, rescope the study.
6. Draft your methodology. It’s good to try to define how you are going to do your study before you start doing it.
7. Collect data (or run computer models).
8. Analyze your data. Make sure that you have included the appropriate statistics classes in your program of study before you realize that you don’t understand the statistical analysis you need to run.
9. Write your results.
10. Draft your conclusions.
11. Put all your raw data in appendices.
12. Briefly present your results and conclusions to your committee. Format it as you would to deliver the crux of your study at a conference where each speaker is given 10 minutes. Schedule a 30-60 minute meeting with your committee where you spend the first 10-15 minutes giving your presentation and allow time for answering questions and taking comments. Your committee won’t expect a final product at this time, but it is good to get a preliminary indication of what weaknesses may be perceived in your results. Schedule this well in advance so that you still have time to address any concerns.
13. Finish writing your thesis. If you really want your committee to read the thesis and give you comments, you should deliver it to them at least three weeks before you defend.
14. Defend.
15. Allow time and energy for post-defense revisions (a week or two).

General Tips

Keep a notebook. Use it for TO DO lists, for ideas, for jotting down the highlights of your communications with your advisor, etc. You may need an additional notebook for lab work. Either an agenda or digital calendar is a must.

Take advantage of educational opportunities like seminars, workshops, conferences, etc.

Read about your research every week. Make it a habit to read something about your research weekly. This may overlap with coursework, but you should be learning about your research on a weekly basis. Your goal is to become an expert in your area. Reading the literature allows you to “internalize” how scientific papers are written, their style, etc and to recognize good vs mediocre writing. To become a good writer, you have to read a lot.

Write about your research every week. Once you start collecting data, write your Materials and Methods in detail, now, before you forget. It’s easy to let “writing” go for later. Trust me, don’t do that. Write outlines and ask for feedback on them.

Become intimately familiar with the general deadlines of your program and how your funding may impact those. The graduate school/Warnell have deadlines for course work, for research proposals, for choosing a committee, for taking your comprehensive exams, etc, etc. It is your responsibility, not your advisor’s or your committee’s, to meet these milestones.

There are many requirements at the University for every single thing you do. For example, if you are working with animals, you will need an approved Animal Care and Use Proposal and you can't start any work without it. It takes at minimum a month or two for an AUP to be reviewed and approved (after we've gone back and forth with several drafts/edits). When you travel, you must do a travel authorization form and it must be approved and it must be done no later than 2 weeks before travel. If you don't do that, you will not be reimbursed for expenses.

Prioritize Efforts. A big part of graduate school is learning how to prioritize your time. If you are stressed out, start dropping low priority activities.

Help your lab mates and lean on each other. They will help you. You are here to collaborate, not compete. You are all different with different strengths and challenges. You will all need more or less help at different times. You will also learn a lot from other people's work.

Be respectful to our Warnell staff. They will help you a ton. Keep them on your side and be empathetic to the fact that they are overworked and underpaid. You will be in their offices a lot, get to know who does what and how they best communicate.

Remember, you represent your lab. Keep that in mind when you communicate with the world. You represent UGA, Warnell, and your lab.

Keep in mind we share intellectual ownership of the data. This cannot be fully explained in a paragraph and it can vary between MS and PhD students, but ideas we generate and data we collect while at the University belong to UGA. It's not yours.

Take advantage of low-hanging fruit. That may mean an easy publication, or an award, or a small grant. This goes back to learning to prioritize your time, but an advisor's job is to help shape your CV so that you are competitive for the jobs you want.

Work hard but have fun. Science should be fun. If you are depressed/bogged down by details, logistics, problems, see your advisor to reset why you are here. It's easy to get lost in the everyday minutia and forget that we are here to learn and enjoy science.

Data Handling

Most of the science you have done up to this point in your life has been in laboratories for science classes, and you may have developed a blasé attitude about field data. This is dangerous. In some sense, field data cannot be replaced. In all senses, field data are expensive and precious. Treat it that way.

Before you begin field work, think carefully about what data you will need and how you will analyze it. I like to draw graphs of imaginary data to help me think about how I will analyze and use my data. Think about the questions you are trying to answer and questions people will ask of you. Create a field form so that you collect the same information on each sampling trip. Make sure to leave space for notes so that you can describe unusual conditions. Each time you return from the field,

1. Xerox 2 copies of your field notes. Keep one set of copies separate from your originals and give the other copies to your advisor.
2. Enter your data into a spreadsheet or database.
3. Take good care of your originals. Don't leave them stuffed in a book bag.

Statistics

No matter what you plan to study, you need to improve your understanding and expand your tool set in statistics. Taking Bob Cooper and/or Richard Chandler's experimental design class is a must and should be completed in the first or second semester. Other than that, you need to make sure you learn and understand the following:

Normal and logarithmic distributions, transformations;

t-tests and pairwise t-tests;

Multiple regression and analysis of residuals;

Autocorrelation;

One-way and two-way ANOVAs;

Non-parametric tests like Kruskal-Wallis;

Chi-square analysis;

Logistic regression;

Ordination techniques like PCA;

Aikake Information Criteria (AIC); and

The basics of Bayesian analysis.

Learn to use the shareware program called R. It has become a standard tool of the trade. There is a lot of R expertise in the school, and R workshops are held from time to time.

Some good statistics references:

Quinn, G.P. and M. J. Keough. 2002. *Experimental Design and Data Analysis for Biologists*. Cambridge University Press. Cambridge, UK.

Zar, J.H. 1984. *Biostatistical Analysis*, Second Edition. Prentice Hall, Englewood Cliffs, New Jersey.

Publications

Practically, science doesn't exist until you publish it. The sad fact is that Theses and Dissertations are rarely read. It is your responsibility to publish, or help publish, your work. If you, the student, prepare a manuscript that is nearly ready for journal submission within a year of your graduation, then your professor will likely agree to your being the first author. If, however, it takes you longer than that, and the professor takes over writing the manuscript, you will probably move down the author list. When you graduate, your professor expects an editable electronic copy of your thesis, and electronic copies of all your data and graphics files.

Who should be co-authors? There is varying guidance on this matter, but a good rule of thumb is that anyone who contributes to any three of the following five aspects of research and publication should be an author: 1) funding, 2) experimental design, 3) data collection, 4) analysis or modeling, and 5) writing and review. Or anyone who contributes a lot to any one or two of the above.

Review this document periodically during your graduate studies.