

Cell and Molecular Physiology

Student Handbook of Graduate Program Policies



Note that detailed descriptions of the Graduate School's policies and requirements are available online at <http://gradschool.unc.edu/publications/>

IF YOU HAVE QUESTIONS ABOUT DEPARTMENT OR GRADUATE SCHOOL POLICIES, PLEASE CONTACT THE GRADUATE PROGRAM OFFICE OR THE DIRECTOR OF GRADUATE STUDIES FOR ASSISTANCE.

September 2009

Table of Contents

1. Timetable for Graduate Studies	3
2. Your Responsibilities as a Student	5
Attendance at Seminars and Dissertation Defenses	
Full-Time Enrollment and Lab Responsibilities	
Annual Progress Report	
3. Course Work	7
Curriculum Overview and Course Requirements	
Selection of Classes	
4. Composition of the Dissertation Committee.....	10
Selecting the Dissertation Committee – The First Meeting	
Choosing the Additional Members of the Dissertation Committee	
Communication	
The Dissertation Proposal Meeting	
Duties of the Dissertation Committee	
Duties of the Chair of the Dissertation Committee	
5. Exams	11
Doctoral Qualifying Examinations	
Dissertation Proposal Exam	
6. Completing the Doctoral Dissertation	13
7. Graduation	15
Appendix I: The Thesis Proposal and Advice for Writing Grants	16
Appendix II: Master of Science Degree	22

1. A Timetable for Graduate Studies

If your entrance date to the program is:

Before Fall 2008...	Fall 2008 or after...
End of Year 1: Select interim committee chair	End of Year 1, upon joining lab: Select interim committee chair
Select 2 nd year courses	Select 2 nd year courses
Year 2, Fall: Add another committee member	Year 2, Fall: Add another committee member
Year 2, End of Fall semester: First committee meeting	Year 2, End of Fall semester: First committee meeting
Year 2, Spring semester: add 2 more committee members and pick permanent committee chair; Submit list to SSM by June 1	Year 2, Spring semester: add 2 more committee members and pick permanent committee chair; Submit list to SSM by June 1
_____	End of Year 2: Qualifying exam
End of summer, Year 2: Dissertation proposal	Year 3, end of Fall semester: Dissertation proposal

Additional Requirements:

Years 2 and 3 Enroll in Presentation Class both semesters

Years 3 and beyond Present a Summer Research In Progress Seminar (RIPS)

Every year Attend department seminars
 Attend RIPS and dissertation defenses
 Present a poster at Research Day
 Submit annual progress report by May 1
 After dissertation proposal, hold a committee meeting on an annual basis
 (minimum 1 per year)

Students should plan to complete all requirements for the PhD degree and defend their dissertation by the end of their fifth year in graduate school. Students generally complete all of their classroom work by the end of their second year (see Part 3: Coursework for a capsule summary of the program requirements).

END OF YEAR 1:

Select an Interim Committee Chair

After consultation with the thesis advisor and the DGS, choose a faculty member from the department to serve as the interim chair of the thesis committee. Your thesis advisor and committee chair will form the nucleus of your thesis committee, and will be responsible for providing you with scientific, academic and professional guidance.

YEARS TWO and THREE:

The Qualifying Exam

The **qualifying exam** is currently given at the end of the second year and is designed to test critical reading skills, analytical skills, experimental design, scientific methodology, and a

working knowledge of cell and molecular physiology. The first stage of the written exam is a reading period: a set of papers will be assigned for reading during a 2-week period. The second stage is the exam itself, which will consist of a list of questions that will be answered each day, for 2 days. The exam calendar is dictated in part by the dates of final exams and will typically take place at the end of the spring semester. More detailed information on the qualifying exam can be found in the Appendices.

Coursework, the Initial Committee Meeting, and the Thesis Proposal

In your second year you will complete your classroom work and begin your thesis research. In the fall semester you will consult with your thesis advisor and the DGS to pick a third member of the department to serve as the core of your thesis committee. Thesis committees typically consist of 5 faculty members and the graduate school requires that three of these be from the Physiology Department. By the end of the fall semester, you will hold an initial committee meeting with the three or more members of your thesis committee that you have chosen by this point. This initial meeting gives you and your committee a chance to become familiar with the general direction of your thesis project. It also provides your committee the opportunity to establish goals such as completing additional classes, mastering a set of techniques, or completing preliminary experiments.

During the spring semester, you should begin work on your written proposal, and if you have not already done so, choose the two final members of your thesis committee. Since the composition of the thesis committee has to be approved by both the department and the graduate school, you should discuss the composition of the thesis committee with both your PI and the DGS and submit the tentative list of thesis committee members to the department well in advance of your first meeting with your full committee. Plan to have at least one meeting with your committee prior to the meeting in which you will defend your thesis proposal, as this will allow you to collect preliminary feedback on your project before you defend your proposal to your committee.

You will present your ongoing work at a Research in Progress (RIP) Seminar during the summer and as a poster at Research Day in the fall.

YEARS 3, 4 and 5: RESEARCH

The Graduate School requires that students meet *at least* once a year with the thesis committee. It is important to remember that an annual meeting is an absolute minimum, and more frequent meetings may be desirable, especially during periods of either rapid progress or unanticipated difficulties in the project. In addition, in the summer at the end of years 3, 4 and 5, you should present a Research in Progress Seminar to the department and prepare a poster for Research Day.

ALL YEARS

Research Day

Each year in the fall, the entire department hosts a research day to recognize all our investigators, including graduate students. It is expected that each student will present a poster at Research Day, every year. As a new student, your poster can present work from one of your rotations or tentative plans and minimal data from your new research lab.

The Annual Progress Report

Since the Graduate School requires that the department complete an evaluation of each student annually, each year in the program you will receive a guide for writing an annual self-evaluation of progress. This self-evaluation progress report will help you to summarize your academic and research accomplishments during the past year and to outline your goals for the coming year. You will also receive a letter from the DGS and the graduate committee summarizing your progress during the year and indicating any upcoming academic milestones.

After each thesis committee meeting, students prepare a brief written summary of the major points from the meeting and circulate it to each member of the committee for approval. Your committee chair may wish to add his or her comments to the summary report. This report should be sent to the DGS and the student services manager. It can also provide the basis for your progress report to the DGS.

At the same time, your dissertation advisor will be asked to summarize your progress in the lab and plans for the coming year. You should meet with your advisor to discuss the report before submitting it to the Graduate Program office.

2. YOUR RESPONSIBILITIES AS A STUDENT

Your Research Advisor

By mid-May of the first year of the BBSP program, you must choose a research advisor and laboratory. The research advisor will have a primary or joint appointment in the Department of Cell and Molecular Physiology.

You should expect to interact with your research advisor on a regular basis. You should expect that your thesis project will be elaborated during frequent discussions with your advisor. **The responsibilities of your research advisor include:**

- Supervising the research project, including ensuring experiments are well planned, recorded accurately, and conducted safely and in compliance with all relevant guidelines for ethical conduct and handling of animals, recombinant DNA, toxic chemicals, etc.
- Mentoring your professional development by providing you opportunities to give talks, meet with visiting scientists, criticize manuscripts and papers, and attend professional meetings.
- Directing you toward relevant scientific literature and providing opportunities to discuss the papers.
- Providing critical and constructive feedback regarding experimental design, analysis of data, analysis of the literature, oral presentations, and written reports and manuscripts.
- Working with you to complete an annual evaluation of your student progress to submit to the DGS for review by the Graduate Committee.

Attendance at Seminars and Dissertation Defenses

Attending seminar presentations provides students, faculty, post-docs and staff with an excellent opportunity to become broadly informed about current areas of research, new techniques, and unpublished work. Therefore, the Graduate Committee considers student participation in departmental seminars to be an essential part of your training and preparation for your careers in science.

During the academic year, the department sponsors a seminar series that generally meets Monday at 12:00. **Students are required to attend all departmental seminars** and encouraged to sign up for lunch with the seminar speakers. Students should avoid taking classes which conflict with the Cell and Molecular Physiology seminar series. If this is unavoidable, students must choose an alternate seminar series to attend.

During the summer and periodically during the academic year, the Graduate Program sponsors a Research in Progress (RIP) Seminar Series. This is an opportunity for students and post-docs to present research to the department. **You are expected to attend all RIP seminars and to present a RIP seminar every summer beginning in the summer of Year 2.**

At the completion of the Ph.D. program, each graduate will present a formal seminar to the department. **Every student is required to attend all Ph.D. dissertation presentations.**

Your responsibilities as a student are to:

- Complete all required OSHA laboratory safety training when you join the lab. For example, no student should work with radioactive material before completing the Radiation Safety Course.
- Maintain an organized and comprehensive laboratory notebook. This is required by NIH and other granting agencies, and may be requested by them for review. Seek advice on how to do this in your laboratory.
- Participate in lab meetings and journal clubs and interact constructively with all members of the research team.
- Communicate with the research advisor during the planning, performance and analysis of experiments and to adhere to the highest standards of conduct and academic honor.
- Independently seek out the appropriate literature to learn background material and stay current in the research field.
- Seek guidance from the research advisor, the dissertation committee, peers and other members of the scientific community.
- Work with the research advisor and collaborators to prepare abstracts for presentation at meetings and manuscripts for submissions to journals.
- Provide an annual self-evaluation of progress in the graduate program.

Full Time Enrollment and Lab Responsibilities

Enrollment in the graduate program is by 12-month appointment. *With the exception of class meetings, examination schedules, and major University holidays (Thanksgiving, Christmas, and New Year's), the graduate program does not follow the University calendar (including fall, inter-semester, and spring breaks).*

The nature of laboratory research often requires long hours and responsibilities different from a conventional academic or workplace schedule. Obviously, extended and frequent vacations will slow your progress in the program and may negatively impact your own research program as well as compromise goals for your lab. Students who are on-track to complete your dissertation research in a timely manner generally take no more than ~15 additional vacation days per year.

However, there is no formal vacation policy for graduate students, and you should speak with your research advisor about lab responsibilities and expectations. *It is a good idea to discuss vacation plans well in advance so that there are no misunderstandings.*

We realize that family emergencies, health problems, and the birth or adoption of children may require prolonged absences from the classroom or lab (detailed information on the graduate

school's pregnancy policy is available at <http://gradschool.unc.edu>) All efforts will be made to adjust milestones and requirements to accommodate these needs; you should speak with your advisor for help rearranging schedules and assignments. In addition you should discuss personal religious obligations with your instructors, rotation advisor, or research advisor in sufficient time to rearrange schedules and assignments.

Responsibilities - Non-Discrimination, Research Ethics, Equal Access to Education

The University has strict policies on research ethics, amorous relationships, non-discrimination, and racial or sexual harassment. If you feel that you have been placed in a compromising position or experience harassment of any sort, discuss it immediately with your advisor, the DGS or Department Chair. If you develop conflicts with your research advisor, you should speak with the DGS (if your advisor is the DGS, you should speak with the Department Chair or chair of your thesis committee). The DGS, Department Chair, or chair of your committee will advise you and help to resolve any conflicts that arise. It is better to deal with issues promptly rather than to allow problems to accumulate. If you have problems with individual members of the lab, first talk with your research advisor. If your concern is not addressed in a timely or appropriate manner, you should contact the Chair or the DGS.

3. COURSE WORK

Curriculum Overview and Course Requirements

Successful scientists and teachers need a broad background and interdisciplinary approach; participating in classes and seminars is an excellent way to gain exposure to many different disciplines and approaches. We encourage you to develop a curriculum that suits your career goals and allows you explore many aspects of biomedical science.

All required courses should be completed by the end of the student's second year in the program.

Elective coursework occasionally extends into year 3. Requirements may be adjusted if a student entering the program can demonstrate satisfactory mastery in any of the given areas, as might be the case if a student enters with a MS degree or has already taken similar courses.

Students entering from the **MD/PhD program** will have already taken two full years of medical school classes including anatomy, medical physiology, and neurobiology. MD/PhD students are thus only required to take Scientific Communication (PHYI 705/706) and an advanced course chosen in consultation with the DGS and advisor to provide training in the area of research and in research skills such as critiquing papers and designing experiments.

Although there is a great amount of flexibility in the courses you can select, your choices must be approved by the DGS. You should also discuss your plans for classes with your thesis advisor since he or she is also responsible for your education and may feel that certain classes are essential for your development or thesis research. Note also that if program requirements are changed, students are generally "grandfathered in" such that they follow the requirements in effect the year they entered graduate school.

Research and Professional Development

All students will register each semester for **PHYI 750/751 - Physiology Seminar**. Attendance is required at the department seminar series during the fall and spring semesters, at the Research in Progress seminar series, and at dissertation defense seminars.

Students enroll in the presentation/writing skills course, **PHY 705/706 – Scientific Communication**, every semester through Year 3.

The medical school requires a one-week class for all incoming graduate students, “Ethical Conduct in Science”.

The Graduate School and the Medical School also offer a series of professional development short courses, seminars, and workshops throughout the year.

Although the program does not require students to work as Teaching Assistants, teaching skills are covered in the Scientific Communication class and students are encouraged to take advantage of opportunities to gain experience in undergraduate, graduate, and medical teaching. *Major teaching responsibilities, such as working as a TA, require the permission of both the thesis advisor and the DGS. Repeated TAing will be discouraged as it may be inconsistent with timely completion of the thesis.*

Basic Listing of Courses (numbers in parentheses are credit hours)

1. Either: **PHYI 702** - Experimental Physiology of Human Health and Disease (3)
or **NBIO 722/723** - Cellular and Molecular Neurobiology (6/6)
2. **PHYI 705/706** - Professional Development [years 2 & 3; (1/1)]
3. **PHYI 751/752** - Seminar in Physiology (1/1)

Electives: We expect that students wishing to join the Cell & Molecular Physiology program will select a strong series of electives in basic biomedical sciences in the first year, typically but not necessarily including PHYI 702.

At least one elective should be a literature-intensive seminar-style class that develops skills in critical thinking, such as Advanced Cell Biology (CBIO 893, 894), Seminar in Pathology (PATH 801), or other similar courses approved by the DGS. For the second year, electives in addition to PHYI 702 (if not taken in the first year) should be chosen in consultation with the thesis adviser, taking into account the likely needs of the thesis project and the interests and likely career path of the student. For example, a course in the business school might be suitable.

Most graduate-level elective courses in any discipline or scientific area related to biomedical science will satisfy these requirements. Areas that are likely to be particularly pertinent are cell biology, biochemistry, neurobiology, molecular biology, genetics, statistics, and pharmacology. Examples offered by faculty in Cell & Molecular Physiology include courses focused on vascular biology, gastrointestinal biology, neurobiology, renal physiology, cancer, and animal models.

Below are outlined two sample course sequences. The first sequence shows typical courses taken by a student who is sure about joining the Physiology program from the beginning of graduate school. The second sequence shows what course work might look like for a student who isn't sure about joining Physiology until after joining a PhD lab.

For Students Interested in the C&M Physiology PhD program from the start of graduate school

FIRST YEAR: BBSP	
<p>Fall Semester</p> <ul style="list-style-type: none"> • PHYI 702 or NBIO 722A, B, and C • Electives • BBSP 902 (FYG) • Rotation • At least one seminar per week from any series 	<p>Spring Semester</p> <ul style="list-style-type: none"> • One or more of the PHYI 712 series or NBIO 723A&B • Electives in physiology or other pertinent area • BBSP 902 (FYG) • Rotations • At least one seminar per week from any series
<p>Summer (Join a C&M Physiology lab and the Program in June)</p> <ul style="list-style-type: none"> • Dissertation Research • Possibly a course at UNC or elsewhere (e. g., Woods Hole) as appropriate 	
SECOND YEAR	
<p>Fall Semester</p> <ul style="list-style-type: none"> • PHYI 705 Professional Development • PHYI 751 Seminar series • Elective(s) in physiology or other pertinent area • Dissertation research 	<p>Spring Semester</p> <ul style="list-style-type: none"> • PHYI 706 Professional Development • PHYI 752 Seminar series • Elective(s) in physiology or other pertinent area • Dissertation research • Qualifying exam
THIRD YEAR AND BEYOND	
<p>Fall semester</p> <ul style="list-style-type: none"> • PHYI 705 Professional Development (in Year 3) • PHYI 751 Seminar series • Dissertation proposal and fellowship application no later than December • Dissertation research 	<p>Spring semester</p> <ul style="list-style-type: none"> • PHYI 706 Professional Development (in Year 3) • PHYI 752 Seminar series • Dissertation research

For students not sure about joining C&M Physiology during the BBSP year

FIRST YEAR: BBSP	
<p>Fall Semester</p> <ul style="list-style-type: none"> • Electives (wondering about Neuro? Don't wait until second year to take NBIO 722 & 723) • BBSP 902 (FYG) • Rotation • At least one seminar per week from any series 	<p>Spring Semester</p> <ul style="list-style-type: none"> • Electives • BBSP 902 (FYG) • Rotations • At least one seminar per week from any series
<p>Summer (Join the C&M Physiology Program in June)</p> <ul style="list-style-type: none"> • Dissertation Research 	
SECOND YEAR	
<p>Fall Semester</p> <ul style="list-style-type: none"> • PHYI 702 (optional for neuro track) • PHYI 705 Professional Development • PHYI 751 Seminar series • Elective(s) in physiology or other pertinent area • Dissertation research 	<p>Spring Semester</p> <ul style="list-style-type: none"> • one or more of the PHYI 712 series (optional for neuro track) • PHYI 706 Professional Development • PHYI 752 Seminar series • Elective in physiology or other pertinent area • Dissertation research • Qualifying exam
THIRD YEAR AND BEYOND	
<p>Fall Semester</p> <ul style="list-style-type: none"> • PHYI 705 Professional Development (in Year 3) • PHYI 751 Seminar series • Dissertation proposal and fellowship application no later than December of year 3 • Dissertation research 	<p>Spring semester</p> <ul style="list-style-type: none"> • PHYI 706 Professional Development (in Year 3) • PHYI 752 Seminar series • Dissertation research

4. Composition of the Dissertation Committee

The UNC Graduate School requires a minimum of 5 members on a dissertation committee. A majority of the committee must be tenured or tenure-track members of the UNC Graduate Faculty. **At least 3 members of the committee must be members of the Physiology Department.** The membership of dissertation committees should be discussed with the thesis advisor and approved by the DGS before submission to the Graduate School for its approval.

The final dissertation must be accepted by a majority of the examining committee. A majority of those approving the dissertation must be full members of the UNC Graduate Faculty.

Although you are only required to have annual meetings of the full dissertation committee, frequent informal communication with committee members is recommended and **will facilitate your progress through the program.**

Selecting the Dissertation Committee - The First Meeting

The dissertation committee must be chaired by a member other than the research advisor and must be approved by the DGS. The chair of the committee must be a full-time faculty member in the Department of Cell and Molecular Physiology. Two members of the dissertation committee, the research advisor and the interim committee chair, must be appointed at the time the student joins the dissertation lab and no later than July 1; a third member of the dissertation committee must be appointed within 6 months, roughly the end of the Fall semester of Year 2. The first meeting of the student with the dissertation committee is not an examination but should be viewed as an opportunity to assist the student in developing his/her research plan. To help structure the meeting, the student should prepare a brief chalk talk or PowerPoint presentation including an overview of the planned experiments and any relevant data. This meeting should be informal, helpful and certainly non-confrontational.

Choosing the Additional Members of the Dissertation Committee

Following this meeting, and as the work progresses throughout the spring of the second year, the student should add two more members to the committee, in consultation with the PI, the Interim Chair, and the DGS, and then submit these choices to the DGS for official approval by the graduate school. The full committee must be in place by the end of Year 2.

Communication

The members of your dissertation committee can provide you with scientific and career guidance and are an important part of the graduate experience. You are encouraged to communicate with members of your dissertation committee on a regular basis, especially if you are planning to make significant changes in your research plan. In addition, in preparation for your committee meetings, you should provide members of your dissertation committee with copies of abstracts presented at scientific meetings and reprints of your publications.

After every meeting of the dissertation committee, you must prepare a written summary of the decisions and recommendations made at the meeting. The chair of the dissertation committee is responsible for verifying the accuracy of the summary, and once you and the chair agree that the summary is complete, it must be turned in to the Student Services Manager (SSM). In addition, copies of your proposal, abstracts presented at meetings, and manuscripts published should be turned in to the SSM.

The Dissertation Proposal Meeting

The Graduate School requires that Ph.D. students pass an oral qualifying exam. In this Department, this oral exam is the defense of the dissertation proposal. The full committee will meet to hear the thesis proposal no later than December 1 of the third year. The written proposal follows the form of a NRSA predoctoral fellowship (See the appendix for additional information and advice). The proposal should be delivered to the committee members AT LEAST one week in advance of the meeting. A permanent Committee Chair, a member other than the research advisor (can be the Interim Chair), should be named prior to this meeting.

Duties of the dissertation committee include:

- Helping you develop a realistic set of aims for your dissertation proposal.
- Conducting the dissertation proposal examination.
- Being available for consultation about the progress of the dissertation research.
- Participating in at least one formal dissertation committee meeting each year.
- Conducting the final oral examination where you will defend your dissertation research.

Duties of the Chair of the dissertation committee include:

- Verifying that the student's written summary of the decision of the dissertation committee is accurate and that it is completed in a timely manner, and informing the Graduate Committee of any significant concerns that arise at any of these meetings.
- Making sure that all of the points in the departmental evaluation guidelines are covered during the oral exam.
- Confirming that the committee is in agreement about approval of the proposal, the scope of the proposed work, any changes to the dissertation plan, and any areas needing improvement.
- If a dissertation committee does NOT approve the proposal, the committee chair should provide the Graduate Committee with a written report detailing the reasons. This report should include the recommendation of the committee as to the student's continuation toward the doctoral degree.

5. EXAMS

Qualifying Examinations

Two examinations are required for a student to be admitted to candidacy for the PhD. These include the Doctoral Qualifying Exam that is administered in May/June of the second year and the Doctoral Proposal Exam by the end of the Fall semester in the third year in the program. Once the doctoral qualifying exam **and** the dissertation proposal exam (and the associated RIP) are successfully completed, the student is admitted to candidacy for the Ph.D.

Format

The **doctoral qualifying examination** is designed to emphasize analytical skills, experimental design, scientific methodology, and knowledge of cell and molecular physiology. The exam will cover a combination of basic concepts, specialized topics, and research methodology. The exam will test your ability to evaluate the literature, formulate a series of experiments designed to test a specific hypothesis. You should demonstrate your understanding of when and why to use a particular technique, appropriate control experiments, and how to interpret data critically.

Evaluation of Exam

You will receive a summary evaluation of performance on the written examination and will have the opportunity to discuss the exam with the chair of the examination committee, the DGS, and

your advisor. Students who pass the exam, but have deficiencies in writing communication skills, may be required to complete coursework or workshops that focus on developing these skills.

In the event of failure, you will have the opportunity to retake the examination once. The re-take will occur one year after the original exam, to allow time for the student to acquire the skills necessary to pass the exam. If the exam is failed a second time, the student will be no longer eligible to pursue the PhD degree.

The Dissertation Proposal Exam

Goals

The **dissertation proposal examination** has several purposes. These include:

- Providing you with additional experience in the design, writing, and oral defense of a professional quality research proposal.
- Permitting the dissertation committee to evaluate whether you are adequately prepared to conduct dissertation research in the proposed area.
- Permitting the dissertation committee to evaluate whether the proposed dissertation research is feasible and can be completed in a timely manner.
- Helping you to identify areas in which further reading or course work is needed to achieve mastery of the research area at the doctoral level.

The doctoral proposal exam will be completed by the end of Fall semester in the third year of the program.

Format

The dissertation proposal should have a format similar to that of an NIH/NRSA predoctoral fellowship application. This means it should be single spaced using 11 point Arial or Helvetica font and have margins no smaller than ½ inch. The text and figures (excluding the bibliography) should not exceed 10 pages. Proposals should include a Specific Aims section (~1 page), a Background & Significance section (~2-3 pages), an Experimental Plan section (~6-7 pages), and a list of cited references including full titles (no limit). Examples of dissertation proposals are available in the Graduate Program office.

This format requires that you have acquired sufficient knowledge of an area to be able to describe important unanswered questions in the Background & Significance section and that you have sufficient knowledge of the experimental approaches to be able to design and propose realistic experiments. The preliminary data section should indicate technical competence and demonstrate the feasibility of at least part of the proposed experiments. *It is critical that you discuss the caveats and pitfalls of your proposed experiments and indicate possible alternative approaches if your first plan fails.*

Expectations

Because the defense of the dissertation proposal is the oral component of the qualifying exam, it is crucial that the proposal be written by you and not by your advisor. It is appropriate to consult with your advisor in regard to the general aims and organization of the proposal, but the proposed experiments must be attributable to you, and the writing must be in your own words. The importance of your advisor in training you to design good experiments and helping you to

develop good writing skills cannot be overemphasized. However, the dissertation committee cannot adequately evaluate your writing and thinking if the proposal is too heavily edited by the advisor. Students for whom English is a second language or who have difficulty communicating in writing should seek special help from the UNC Writing Center or their advisor.

In choosing a research project and writing a dissertation proposal, you should address the following questions:

- Have I identified an important question or questions that need further research?
- Do I have adequate knowledge and understanding of the historical background for the problem and of the current status of research in this field?
- Have I designed a set of experiments that will address the proposed questions? Will these experiments yield interpretable data and are they technically feasible? Do I understand the limitations of the techniques and have I considered alternative strategies?
- Are the experiments prioritized logically? Have I specified which ones could be considered “optional” for the dissertation, *i.e.* completed if there is enough time, but not absolutely mandatory for the dissertation?

If the committee judges the written proposal or the oral defense of the proposal to be insufficiently scholarly, then the committee has the option of failing the student on the oral qualifying exam. A student who fails will have one opportunity to re-take the oral qualifying exam, and the re-take will be scheduled no less than three months from the date of the original exam, to allow the student time to prepare to be re-examined. The precise format of the re-examination will be chosen by the thesis committee and communicated to the student in writing. If the student fails a second time, then he or she is no longer eligible to pursue the PhD degree.

Timing

Committee members should receive the dissertation proposal for review *a minimum of one week* prior to the meeting. During the exam, you should expect questions about the research area, about the experimental design, and about interpretation of data. In addition, you should be able to answer questions that probe your knowledge and understanding of major concepts related to your area of research.

Written Summary

After the proposal is approved, you are required to prepare a written summary of your understanding of the committee’s decision. This summary should describe any changes in the experimental plan (*e.g.* which specific aims are essential for the dissertation, which (if any) should be dropped, and which are “optional”). It should also include any areas of the literature in which you need to do more reading and any recommended steps to improve writing skills. A draft of the report should be given to the chair of the committee for verification, and the final report should be turned in to the DGS and SSM. **This report should be completed as soon as possible, but not more than one week after the committee meeting. Students will not be admitted into candidacy until this report is completed.**

6. Completing the Doctoral Dissertation

The UNC Graduate School definition of what the dissertation should illustrate:

“Candidates must have gained control of the materials in the chosen field, mastered the methods of advanced study, and illustrated these methods through a dissertation, the results of independent research, which adds to the sum of human knowledge or presents results that have enduring value. Neither the accumulation of facts, however great in amount, nor the completion of advanced courses, however numerous, can be substituted for this power of independent investigation and proof of its possession.”

In the ideal world, the doctoral dissertation is a scholarly presentation and discussion of the results of the experiments in the dissertation proposal. In the real world, plans change, unexpected results stimulate new lines of investigation, unforeseen technical difficulties lead to abandonment of planned experiments, and new publications by other researchers make planned experiments moot. It is actually somewhat rare for a dissertation to consist of exactly what was originally proposed. If you anticipate significant changes in the planned dissertation, you should consult your committee (either separately or collectively). Even if no changes in the planned dissertation are necessary, it is a graduate school requirement that the thesis committee must receive yearly progress reports. This yearly progress report **must** be in the format of a full committee meeting. Consultation with committee members on a more frequent basis is an excellent practice and is strongly recommended.

When you are making plans to write up your dissertation, you should submit an outline of the proposed organization of the dissertation to your committee, so that the members can agree on the format of the dissertation. Among the issues that should be discussed with the committee are:

- the overall format of the dissertation (two common formats are listed below)
- the breadth and depth of the introduction and discussion
- the general content of the results chapters
- the literature citation style

You should read carefully a publication by the UNC-CH Graduate School called “[Thesis and Dissertation Guide](#),” which lists the University requirements.

Hardbound copies of dissertations from previous Physiology graduate students (prior to 2005) are available in the administrative area, and all theses can be found online by searching the ProQuest database at: <http://proquest.umi.com/pqdweb?RQT=302&cfc=1>

Here are two common dissertation formats:

- A set of independent chapters written in the form of manuscripts for publication in professional journals. These chapters can be “sandwiched” between an introduction to the scientific questions they address and a scholarly discussion of their overall implications and significance. This format is often used in cases where the student has already published parts of their dissertation in journal articles. **It is necessary to obtain copyright clearance from the publisher of the journal in which the work appeared. Be aware that obtaining this type of approval can take a significant amount of time, and you are urged to do so soon after the manuscript is published. NOTE: If you are not the sole author of a published manuscript that is included in the dissertation, your contribution to the work included in it must be stated explicitly.**
- Separate chapters that provide an introduction, description of methods, results (typically, there is more than one results chapter), and a single discussion.

All substantial revisions to the final draft of the dissertation should be completed before the final oral defense is scheduled. The dissertation advisor is responsible for determining that the draft is in an appropriate form for the committee to evaluate. After all members of the dissertation committee have had adequate time (a minimum of two weeks) to review the dissertation, you will meet with the committee to defend it. The committee may, at the time of the defense, require alterations and corrections, but they should be relatively minor changes agreed to by a majority of the committee members. The dissertation advisor will be responsible for verifying that changes required by the committee have been made, and may delegate this responsibility to the committee member(s) who imposed the requirements. When these requirements have been met, the Report of the Final Oral Examination form is submitted and the dissertation is registered with the Graduate School.

The Graduate School has two requirements for completing the Ph.D. degree: writing a dissertation and defending it before the thesis committee. In addition, this Department requires a public presentation of the dissertation work. This seminar will be open to the general public and will be followed by a reception sponsored by the PI, with assistance from the thesis committee, and the Graduate Committee.

7. GRADUATION

Carefully read the following information on the Graduate School website:

- “Doctor of Philosophy Degree Requirements” section of the Graduate School Handbook: <http://handbook.unc.edu/phd.html>
- “Preparing for Graduation” section on the Current Students page <http://gradschool.unc.edu/current.html>
 - [Thesis and Dissertation Guide](#)
 - [Electronic Thesis and Dissertation Submission](#)
- “Deadlines” page:
 - Last day for Graduate Students to apply to graduate at [eGraduation Central](#) . This deadline is typically early in the semester.
 - Due date for submission of final electronic doctoral dissertations and master's theses.*

Please be sure to plan ahead. If you think you will graduate in a particular semester, go ahead and apply to graduate at eGraduation Central—there is no consequence if you apply and do not graduate.

*This means your dissertation has been approved by your committee, all final revisions have been made, and its submission online has been accepted by the Graduate School prior to this deadline. *It is important to submit your dissertation early enough that if the submission is rejected (due to formatting, etc.) and you need to resubmit, there is time to do so before the deadline.* If you miss the deadline, your graduation date will be pushed to the following semester even if all other requirements have been completed.

Questions? Check with the DGS or Student Services Manager.

Appendix I: The Thesis Proposal and Advice for Writing Grants

NRSA Pre-Doctoral Research Training Proposal (from the NIH guidelines)

This proposal should be well-formulated and presented in sufficient detail that it can be evaluated for both its research training potential and scientific merit. It is important that it be developed in collaboration with the research advisor, but it is to be **written by the applicant**. Include sufficient information to permit an effective review without the committee having to refer to the literature. Brevity and clarity in the presentation will be considered indicative of an applicant's approach and ability to conduct a superior project.

DEPARTMENT GUIDELINES

- **Subsections (1) through (3) of this item are not to exceed 10 pages, including all tables and figures. Like the NIH, we require single-spaced pages with 1/2 inch margins and 11 point arial or helvetica type.**

Figures are included in the 10 page limit; the bibliography is not.

FOLLOW THE FORMAT BELOW:

(1) Specific Aims (~1 page)

State the specific purposes of the research proposal and the hypotheses to be tested.

(2) Background and Significance (~2-3 pages)

Sketch briefly the background to the proposal. State concisely the importance of the research described in this application by relating the specific aims to broad, long-term objectives. Use this section to provide an account of any preliminary studies that might demonstrate the utility of the proposed project as a training experience.

(3) Research Design and Methods (~6-7 pages)

This should include:

- a) Research design and the procedures to be used to accomplish the specific aims; tentative sequence for the investigation;
- b) Statistical procedures by which the data will be analyzed;
- c) Any procedures, situations, or materials that may be hazardous to personnel and the precautions to be exercised; and
- d) Any courses planned which support the research training experience.

Essentials

Significance

Sound hypotheses

Productivity and demonstration of feasibility -- high quality results and figures

Logical development of experimental design

Specific Aims

- Do your aims address interesting and important issues?
- Are they hypothesis-based?
- Are they "win-win" - i.e., will an outcome consistent with the null hypothesis still be a contribution to the field?

Background

- Clear, well organized -- use subheadings where possible. Make sure the significance of the topic is EXPLICITLY stated.
- State CLEARLY where the gaps in knowledge exist in the field that your results will address.
- Make sure your references reflect an updated knowledge of the field.

(Preliminary Results/Progress Report) Note that NRSA proposals do not always have a separate Preliminary Results section, particularly for predoctoral fellowships. Good preliminary data does greatly strengthen a proposal and is typically included in the Background and/or Research Design. If a separate Preliminary Results section is included, the proposal is still limited to 10 pages of text and figures.

- Draw as much as possible on your past productivity; emphasize how your previous work leads up to the present proposal or at least demonstrates feasibility of methods to be used.
- DO NOT show preliminary results that are not of high quality -- this is your chance to represent yourself.
- Show detailed numbers and representative raw data where necessary, especially if this is work that is unpublished.
- Make sure that the major methods to be used in the proposed work are reflected by preliminary results. (If you do not have expertise or preliminary results with a technique, make sure you list a solid, experienced consultant or collaborator and include a letter agreeing to the collaboration.)
- Put time and effort into preparing METICULOUS figures, graphs, or tables; this is your chance to demonstrate rigor and organization that will increase the reviewer's confidence that you can carry out the project.

Research Design and Methods

- This is one of the most common places where the text is insufficient. This is NOT just a place to tediously list group sizes, detailed methods, etc. This *is* the place to demonstrate your ability to think knowledgeably and logically.
- DEVELOP your aims; of all the sections this may well be the part of the grant upon which you spend the most time.
- One method that often works is to divide this section into subheadings after each specific aim is restated, as follows:

Specific Aim #.

1. *Rationale*: how does this design relate to your hypotheses? What is your reasoning?
2. *Methods*: list general approaches first, explaining why the methods you propose are the best available for your questions.
3. *Anticipated results*: you need to spend a great deal of thought as to potential outcomes and their likelihood. Explain how you will interpret the different possible outcomes and how these results relate back to your hypotheses.
4. *Possible problems and alternative approaches*: Explain any possible pitfalls, and how alternate approaches will be used to overcome them if they occur. Do not think that avoiding mentioning a major pitfall is a good strategy - it usually doesn't work. The reviewer will very likely notice the pitfall and believe that you are not aware of it.

Common Mistakes in Grant Proposals

Problems with significance:

- Not significant nor exciting nor new research
- Lack of compelling rationale
- Incremental and low impact research

Problems with specific aims:

- Too ambitious, too much work proposed
- Unfocused aims, unclear goals
- Limited aims and uncertain future directions

Problems with experimental approach:

- Too much unnecessary experimental detail
- Not enough detail on approaches, especially untested ones
- Not enough preliminary data to establish feasibility
- Feasibility of each aim not shown
- Little or no expertise with approach
- Lack of appropriate controls
- Not directly testing hypothesis
- Correlative or descriptive data
- Experiments not directed towards mechanisms
- No discussion of alternative models or hypotheses
- No discussion of potential pitfalls
- No discussion of interpretation of data

Questions To Ask As You Prepare Your Proposal

HYPOTHESIS

- Is my proposal driven by a strong hypothesis?
- Have I defined what, specifically, I am setting out to prove?
- Is the central research question important to the field?
- Is the hypothesis testable by current methods?
- Did I state my hypothesis in the **abstract** and **specific aims** section?
- Is my idea focused enough? Is it provable in the length of time proposed?

RESEARCH PLAN

Planning - Answer these questions when you *develop* your **research plan.**

- Does my project address the why?
- Does my research approach answer the question posed by my hypothesis?
- Does my project have a coherent direction?
- Are the **aims** of the project I am considering achievable?
- Does my project have a central focus?
- Have I kept myself from being *too* innovative? Can I justify my innovations with sound reasoning?
- Am I attempting a modest amount of work and not too much for my first research grant?

Process - Answer these questions when you *write* your **research plan.**

- Have I started with an outline, and then worked on developing each section?
- Am I presenting the information logically and clearly?
- Am I maintaining a balance between technical and nontechnical language in my writing?
- Am I keeping both of my audiences in mind (my primary reader and my other **reviewers**)?
- Am I highlighting the importance and innovation of my project?
- Am I following the exact format specified in the instructions?
- Am I explaining which gaps in science my project would fill?
- Am I referring to the literature thoroughly and thoughtfully?
- Did I state my hypothesis in the **specific aims** and **abstract**, and provide a logical rationale for the hypothesis?
- Did I include a timetable for the proposed research?

Specific Aims

- Have I written this section in clear, nontechnical terms?
- Have I begun this section by stating the general purpose or objectives of my research?
- Have I limited myself to three or four **specific aims**?
- Do my specific aims and objectives support and test my hypothesis?
- Are they tightly focused?
- Did I present alternatives to my hypothesis and the reasons I chose the one I did?
- Can my objectives be assessed by the **review committee**?

- Did I list the experiments I'll do to support each aim?
- Did I mention what staff I'll need to accomplish my aims?
- Have I organized and defined my aims so I can relate them directly to my research methods?

Background and Significance

Have I written this section in clear, nontechnical terms that all [reviewers](#) will understand?

Did I show how my research is innovative?

Did I explain why my project is worth funding?

Have I conveyed the significance of my research and how it will increase knowledge in the field?

Did I include background information about the field?

Does the literature section show reviewers my understanding of the field?

Have I shown that I know the gaps, discrepancies, or roadblocks in the field?

Did I identify the next logical research beyond this application?

Preliminary Results

- Do the preliminary data support the hypothesis to be tested?
- Do they show the feasibility of the project?
- Did I focus on my own preliminary data, or when using results from other labs, draw a clear distinction between theirs and mine?
- Did I explain how the results from my preliminary studies are valid and how they will be expanded?
- Did I interpret my results critically and provide alternative meanings for them?
- Have I explained how my early work prepares me for the new project?

Research Design and Methods

General

- Does each experiment correspond to one of the [specific aims](#), and are they stated in the same order?
- Do the experiments follow a logical sequence?
- Did I offer a timetable showing how and when I will accomplish my aims, including any overlap of experiments and alternative paths?
- Did I use flow charts and decision trees to show paths of experiments and how they will progress?
- Did I estimate what I expect to accomplish each year and state foreseeable delays?
- Did I describe any hazardous procedures, situations, or materials, as well as appropriate precautions?
- Did I include supporting data?
- Have I included sufficient detail to show I understand and can handle the research?
- Have I only included information that is needed to state my case, i.e., have I avoided including anything I don't plan to do?
- Does my [appendix](#) include publications showing my use of the methods I've described?
- Have I cited references wherever possible?

Approach

- Did I state the expected outcome of my research?
- Did I list each set of experiments in the same order as my [specific aims](#), linking my experiments to the aims so [reviewers](#) can see how I will achieve them?
- Are the experiments in a logical sequence, flowing from one to another with clear end points?
- Did I offer a timeline for experiments?
- Will reviewers think I am knowledgeable about my methods?
- Did I justify my choice of methods in detail?
- Did I outline my methods in detail?

- Did I support my methods with data?
- Did I provide solutions for potential problems?
- Is my proposed model system appropriate?
- Did I address difficulties I may encounter with the proposed approaches, show I can handle them, and propose solutions and alternatives?
- Did I consider how the limitations of the approaches may affect my results and data?
- Did I address possible problems and limitations of the procedures, and propose solutions?
- Did I estimate how much I expect to accomplish each year of the grant and state any potential delays?
- Did I use enough detail?
- Did I include all relevant controls?
- Did I anticipate reviewers' questions about the feasibility of what I propose, e.g., how I will gain access to reagents, equipment, or study populations?

Results

- Did I show I am aware of the limits to and value of the kinds of results I expect?
- Have I convinced [reviewers](#) I will be able to interpret my results?
- Have I enlisted help from a statistician, if needed, and discussed statistical methods to be used?
- Did I define the criteria for evaluating the success or failure of a specific test?
- Did I state the conditions under which my experimental data would support or contradict my hypothesis?
- Did I state the limits I will observe in interpreting results?

Cited Literature

- Have I listed all publications supporting my hypothesis and methods?
- Have I formatted the citations correctly, i.e., the names of all authors (not *et al.*), name of the book or journal, volume number, page numbers (not first page only), and year of publication?

Abstract

- Did I stay within the space provided?
- Did I state my hypothesis?
- Does my [abstract](#) describe my objectives and [specific aims](#)?
- Does it state the importance of the research and how it is innovative?
- Does it outline the methods I will use to accomplish my goals?
- Did I keep the language of my abstract simple and easy to understand for a broad audience?

Writing - Presentation of Information

- Does the application have a pleasing presentation, e.g., well-organized and sufficient white space to prevent crowding of information?
- Have I labeled all materials clearly so that reviewers can easily find information?
- Is the type clean and legible?
- Do I begin with basic ideas and move towards more complex ideas?
- Have I included bullets and lists to draw attention to key facts and create visual breaks?
- Have I included graphics that can help reviewers grasp information quickly and easily?
- Have I only included information that will photocopy well?
- Have I made sure that any colored or glossy materials are in the [appendix](#)?
- Have I put all other graphs and charts (not on glossy paper) in the research plan and *not* the appendix?

Writing - Mechanics

- Do my paragraphs contain only one major point each?
- Do I use short, basic sentences that average 20 words or less?

- Do I include transitions to show the relationship between my ideas, using words such as: furthermore, additionally, in other words, in another area, in contrast, following the same path, and moving to the next stage?
- Do I keep related ideas and information together, e.g., put clauses and phrases as close as possible to (preferably right after) the words they modify?
- Do I use strong, active verbs? Do I avoid passive verbs? (i.e. "We will develop a cell line," not "A cell line will be developed.")
- Do I use verbs instead of **abstract** nouns ending in "ion" and "ment"? (i.e. say "creating the assay leads to..." rather than "the creation of the assay leads to...")

Writing - Editing and Proofreading

- Have I edited and proofread the application thoroughly several times after giving myself a few days away from it to gain perspective?
- Have I eliminated redundant words and phrases?
- Have I checked all my information and data for consistency?
- Have I reviewed my conclusions to see if my supporting facts might lead a reader to different conclusions?
- Did I have several colleagues critique the application on the writing and presentation?
- Have I gotten editorial help from a nonscientist with a strong writing background?
- Have I supported all facts with citations?
- Have I avoided using URLs for source material in my application?

Appendix II: Master of Science Degrees

The department does not have a formal program leading to Master of Science degrees. However, we realize that career goals change, and the completion of a Ph.D. in Cell and Molecular Physiology may not be required for you to achieve your new career goals. Students may choose to obtain a Master of Science degree after consultation with the DGS, the advisor, and additional department faculty. In addition, the DGS, after consultation with the graduate committee, your research advisor, and your dissertation committee may recommend that you consider a Master's degree. In either case, this is not a decision to be taken lightly, and you should obtain significant guidance while considering your options.

Students should consult the Graduate School guidelines for requirements for an MS degree. In addition to the Graduate School requirements, the following departmental requirements must be met to receive a Masters of Science degree:

- Completion of all required coursework with fewer than nine credits of L.
- Successful passage of the written component of the doctoral qualifying exam. This exam cannot be taken until the end of the second year in the program. Students who fail this examination the second time, may retake the examination once with permission of the Graduate School.
- Completion of a research thesis which must include a scholarly discussion of the historical significance of the proposed research. Depending on the circumstances, the experimental section of a Masters thesis may be short or extensive. The precise format should be discussed with the research advisor and DGS.

If you choose to obtain a Master of Science degree, you should form a committee of three faculty; all must be full-time members of the Department of Cell and Molecular Physiology. The three committee members must approve the written thesis. The oral component may be in the format of a formal committee meeting or a RIP presentation to the department. The precise format of the oral examination should be decided in consultation with your advisor and the DGS.