

## **Requirements for the Ph.D. Degree**

Department of Anatomical Sciences and Neurobiology  
University of Louisville, School of Medicine

### **General Program Requirements**

Students should familiarize themselves with the general requirements for the Master's and Ph.D. Degrees as stated in the current University of Louisville Graduate Catalog (<http://graduate.louisville.edu/>). The award of a Doctor of Philosophy degree indicates that a student has attained mastery of a field and has demonstrated the capacity to perform independent scholarly research, including the ability to think critically. The doctoral degree is not awarded solely upon completion of a curriculum of courses, even though the student may have done superior work in them; rather, it is awarded in recognition of having both successfully completed coursework and demonstrating creative scholarship in the candidate's chosen field.

All Ph.D. students receiving financial support from the University of Louisville, including University Fellows and Graduate Assistants, must be enrolled as full-time students during the period for which they are receiving support. The minimum and maximum number of credit hours for full time study is 9 and 12, respectively, in the fall and spring semesters (6 and 12 for the summer). To be considered in good standing, a grade average of 3.0 or better must be maintained. The program faculty and unit dean monitor the GPA of every graduate student. A student must be in good standing to receive a degree. Students must be enrolled during the semester in which they wish to graduate.

### **Non-thesis M.S. degree requirements**

All Ph.D. students must complete the requirements for the non-thesis M.S. degree, after which they will be considered a Ph.D. candidate. A minimum of 30 semester hours is required for the Master's degree of which at least 15 semester hours must be in courses of the major subject area. At least one-half of the 30 credits counted toward the degree must be 600 level courses or above, excluding research credit hours. Courses with numbers from 500 to 599, open to both advanced undergraduate and graduate students, can be taken by graduate students for graduate credit (additional course requirements must be completed). In addition, up to 6 credits of earned graduate semester hours can be transferred upon request from other accredited institutions, as long as the course work was taken within the past three years and a grade of B or better was earned (transferred grades do not get calculated in the student's GPA).

### **Course Work**

The Department of Anatomical Sciences and Neurobiology (ASNB) has the following requirements, which are in agreement with the requirements for the M.S. degree as set by the School of Interdisciplinary and Graduate Studies (SIGS):

Integrated Programs in Biomedical Sciences (IPIBS) Course Requirements:

Students receiving a stipend from IPIBS must successfully complete all of the following courses within the School of Medicine:

	<u>credit hours</u>
Cell Biology (BIOC 667) or equivalent	3
Plus one of the following methods courses:	
Methods & Analysis in the Biomedical Sciences (ASNB 610)	2
Matlab 101 (ASNB 610)*	2

\*This version of 610 is taught only in summers

ASNB Course Requirements:

Fundamentals of Neuroscience (ASNB 602) 4  
Research Ethics (BIOC 630) 1

Students must earn at least 12 additional credits by successfully completing any of the following Departmental/University courses:

	<u>credit hours</u>
*Developmental Neurobiology (ASNB 617)	3
*Molecular Neurobiology (ASNB 614)	4
*Synaptic Organization of the Brain (ASNB 666)	3
*Mammalian Sensory Systems (ASNB 630)	4
Gross Anatomy (ASNB 601)	6.5
Microscopic Anatomy (ASNB 603)	5
Human Embryology (ASNB 605)	3
Dental Microscopic Anatomy (ASNB 671)	5
Survey of Dental Gross & Neuroanatomy (ASNB 672)	7
Biochemistry I (Bioch/Che545) or equivalent	3

\*Offered one per semester during first two years, courses designed for Neuroscience research emphasis

In addition, students must take at least two 3 credit lab rotations (ASNB 618) – see description below 6

Seminar: Anatomy Seminar (ASNB 606, 1 credit hour) must be taken for credit each semester prior to Master's candidacy.

Electives: Additional courses (electives) within ASNB or graduate level courses in other departments may be taken during the first two years. The student should consult with his/her advisor on the selection of the appropriate electives.

	<u>credit hours</u>
Translational Neuroscience (NSCI 601)	3
Introductory Immunology (MBIO 602)	2
Biochemistry II (Bioch/Che547)	3
Cellular and Molecular Immunology (MBIO 658)	3
Fundamentals of Neuroscience (ASNB 602)	4
Physiology I (PHY 605)	3
Physiology II (PHY 606)	3

Exceptions that may require different course work will be reviewed on a case-by-case basis by the ASNB Graduate Committee.

### **Lab Rotations and Research Hours**

Lab Rotations: Each student will complete two rotations in different laboratories prior to start of their third semester. Exceptions or the addition of a third rotation require approval from the ASNB Graduate Committee. The objectives of rotations in 2 labs are to expose the student to different approaches and areas of research, and to assist the student in choosing a laboratory for dissertation research. For each rotation, the student will register for the 3 credit course Laboratory Rotation (ASNB 618) which is graded on a pass/fail basis. Once a student has completed a semester rotation in a given laboratory, an ASNB Rotation Report must be completed and submitted to the Graduate Program Director.

Research Hours: Once a mentor(s) and home lab is chosen, research hours are taken as Original Investigation (ASNB 619), in which students earn a letter grade.

### **Advisory Committee**

The purpose of the advisory committee is to act as the primary guiding and assessment body for the student in a course of study and training through which they will acquire the knowledge and skills required to earn the degree of Doctor of Philosophy. The course of study and training will have components that are common for all students, but may have others that are tailored to the particular needs and/or desires of individual students.

The committee must have a minimum of five members. The mentor (Principal Advisor) serves as chair. The majority of committee members must have a primary, joint or associate appointment in ASNB. At least one member must have a primary appointment in a department outside ASNB (this outside committee member must not have a joint appointment in ASNB) and can include a member of the Graduate Faculty from another University. The student, in conjunction with the advisor, should form a committee prior to the start of the second year. Once the committee is formed, the student will meet with the committee at least once per year. A Graduate Student Progress Report, completed by the Advisor, must be filed semi-annually (at the end of the fall and spring semesters) with the ASNB Graduate Program Director. Registration for courses is contingent on this filing

### **Academic Probation**

Any student with a grade point average below 3.0 will be placed on academic probation until the student regains a 3.0 average or is dismissed. Students are ordinarily not permitted to continue on academic probation for more than one semester. Upon request of the student's graduate program, the unit dean may approve continuation beyond a single semester. A student who has received the grade of "C" or lower (in a course that is a degree requirement) may repeat that course upon the approval of the graduate program director and the unit dean. When a student repeats a course, the grade point average will be calculated on the basis of the last grade earned, although all previous grades will

remain on the transcript.

### **Masters Candidacy**

After completion of all course requirements, students must register for Masters Candidacy (MAST 600) and continue this registration each semester until the successful completion of his/her qualifying exam. This registration must be maintained year round (fall, spring and summer). Once a student registers for MAST 600, he/she may not register for additional courses.

### **Qualifying Exam**

The purpose of the qualifying exam is to assure that the student has sufficient knowledge and skills to begin a research project. The exam will be taken within two terms (summer term included) after the successful completion of required coursework but no later than the Spring semester of Year 3.

Each member of the student's Advisory Committee will prepare one question designed to assess the student's ability to integrate course material, demonstrate critical thinking, and evaluate the literature related to the student's area of interest. The student's mentor will submit all the questions (minimum of five) to the Graduate Program Director. The ASNB Graduate Committee will review the questions and select three for distribution to the student. The student will have two weeks to complete two of the three questions (of their own choosing) and submit the answers electronically (pdf format) to the Graduate Program Director. The exam is "open-book" and must be written in the student's own words. The answers represent the student's unaided efforts and should NOT be edited or critiqued in any form by anyone other than the student, including the mentor, the student's committee, or other trainees in the program. The answer to each question should be no less than 10 pages and no more than 20 pages in length, double-spaced, not including references. The use of books and review articles is acceptable; however, a significant portion of the paper must be based on recent, primary sources in scientific journals.

The submitted answers will be evaluated by two members of the ASNB Graduate Committee plus one representative from the student's advisory committee, excluding the mentor. Each answer will be evaluated on a scale from 1 (poor) to 10 (outstanding) on mastery of basic background and conceptual material, familiarity with the literature in the field of study and critical thinking about the cited works and scientific question. To pass the qualifying exam and continue in the Ph.D. program, the student must 1) receive a minimum total score of at least 12 out of 20 and 2) receive at least a score of 5 on each question. A student who does not meet these passing requirements will have one chance for remediation. The remedial examination must be completed no later than 6 months after the student completed the original examination. The exam will again be comprised of answering two questions in the same format; the third question that had been submitted to the student by the ASNB Graduate Committee that was not answered plus a new question. Failure after remediation will result in dismissal from the Ph.D. program.

Upon successful completion of the exam, an evaluation form stating the outcome of the exam will be completed and signed by each committee member and will become a permanent part of the student's record. A passing grade

indicates that the student has completed the requirements for a M.S. degree. At this point the student becomes a doctoral candidate and must register for and maintain candidacy (DOCT 600) until the successful completion of his/her dissertation. This registration must be maintained year-round (Fall, Spring and Summer). The statute of limitation for obtaining a Ph.D. degree at the University of Louisville is four years from the beginning of Doctoral Candidacy. University wide official maximums for fellowships and Graduate Assistantships are typically 6 years.

### **Research Proposal**

The Research Proposal should be defended in the semester following successful completion of the Qualifying Exam but not later than the Fall semester of Year 4. Prior to writing the Research Proposal, the student will develop an outline of the proposed experiments in coordination with their advisor and then present this outline to their committee. It is at this point, prior to writing the Research Proposal that the committee should recommend any changes in the research plan, regarding, for example, the number of experiments, reducing the difficulty of experiments, or introducing experiments that may be more appropriate for addressing the research question. Once the committee is satisfied with the proposed experiments, the student will write a Research Proposal in the following general format.\*

#### *Specific Aims, Hypotheses and Experiments*

This section will consist of a list of the proposed specific aims. Each Aim should include hypotheses to be tested and a brief description of the experiments that will be used to test these hypotheses.

#### *Significance*

Section two will be similar to and/or an expanded version of the Significance section of a National Institutes of Health grant proposal. This review should provide evidence that the student has a sufficient command of the background information relevant to the proposed research.

#### *Experimental Design and General Methods*

This section will consist of a detailed description of the experimental design as well as the methods that will be used to carry out the proposed experiments.

#### *Expected Outcomes*

This section will describe the expected results and how they will be interpreted.

#### *Potential Problems*

This section will describe any potential problems that could occur, how they might affect interpretation of their research results, and how the student will address any potential problems.

\*All eligible students are encouraged to submit (in coordination with their advisor) an application for a National Institutes of Health Predoctoral National

Research Service Award (F31) or a National Science Foundation Predoctoral Award. Therefore, the Research Proposal may be submitted in the format of a relevant application with the exception that the background and significance section should be expanded to include a more extensive literature review than permitted by the NIH or NSF page limitations.

Upon completion of the research proposal, the student will distribute a copy to each committee member, who will have no less than two weeks to read the proposal. ***Students must consider this two-week reading period when preparing the document and scheduling the exam.*** The proposal defense itself will be chaired by the student's advisor. The defense will begin with an oral presentation, open to the public, in which the student will present an overview (approximately 40 min) of their research plan. The presentation will be followed by an oral defense to assess the student's readiness to conduct the proposed research. Non-committee members in the audience will have an opportunity to ask questions first. The general audience will then be dismissed and the student will defend his/her proposal before the committee. Success or failure will be determined by majority vote of the committee. A student who fails the exam will have 2 months to retake the exam. Failure on the second attempt will result in dismissal from the program. Upon successful completion, a Proposal Defense Evaluation Form stating the outcome will be completed and signed by each committee member and will become a permanent part of the student's record.

### **Annual presentation of research progress**

Ph.D. students who have completed their classwork (M.S. and Ph.D. candidates) must present their research accomplishments annually. This presentation should be 30-50 minutes in length, and time and location of the presentation should be formally announced to the department faculty, staff and students at least one week prior to the planned presentation. Presentations at journal clubs are encouraged, but cannot be used as a substitute for the annual presentation requirement.

### **Teaching requirements**

Each Ph.D. candidate must serve as a teaching assistant (T.A.) in at least one ASNB core course. The specific course will be chosen, based on available TA slots, by the student and his/her advisory committee.

### **Dissertation Defense**

With the exception of their training in teaching, the Ph.D. candidate will focus exclusively on completing their research projects and writing a dissertation describing the results of their experiments. The candidate must complete all requirements for the degree of Doctor of Philosophy within four calendar years after passing the qualifying examination. It is expected that the dissertation should contain data sufficient for approximately three publishable manuscripts. Upon completion of a near final draft of their dissertation and prior to scheduling of their defense, the student must distribute a copy to each Dissertation

Committee member. The committee will have two weeks to read a preliminary draft of the dissertation and give approval to schedule a defense date or recommend major changes that need to be completed prior to scheduling a defense date.

Once the dissertation is approved to move forward by the committee, the student will schedule a Dissertation Defense and distribute an edited copy to each committee member. SIGS requires that an announcement of the defense be made at least two weeks prior to the scheduled date. The defense will consist of a public oral presentation (approximately 45 minutes in length) of the research completed during the student's graduate training. Non-committee members in the audience will be allowed to ask questions. The general audience will then be dismissed and the student will defend his/her dissertation before the committee. Upon completion, a written report stating the outcome of the defense will be completed by each committee member and will become a permanent part of the student's record. Approval by the majority of Dissertation Committee members will signify successful completion of the Ph.D. degree.

### **Electronic Format of Dissertation**

Deadlines for the submission are published online in the schedule of classes. Students must follow The School of Interdisciplinary and Graduate Studies (SIGS) requirements for the format of their Doctoral Dissertation. The published *Guidelines for the Preparation and Processing of Theses/Dissertations* can be found at [https://graduate.louisville.edu/Programs/theses-dissertations/Thesis\\_Dissertation%20Guidelines.pdf](https://graduate.louisville.edu/Programs/theses-dissertations/Thesis_Dissertation%20Guidelines.pdf). Any dissertation received by SIGS that does not adhere to their guidelines will be returned to the student.

SIGS requires the submission of a digital dissertation. The digital document must be submitted in Adobe PDF format. The electronic version should not include signatures from the dissertation advisory committee. It should list the committee members' names only. Students must submit a hard copy of their signature page on white paper, with original signatures, to SIGS. If students wish to use in their dissertation material that has been previously published under their names, they will need to contact the original publisher for permission. It is the student's responsibility to provide to ASNB the required bound copy of the finalized dissertation. For archival purposes, it is required that the document be printed on 25% cotton paper.