

## ACADEMIC GUIDELINES FOR STUDENTS IN THE DEPARTMENT OF BIOCHEMISTRY

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### **Admission into the Biochemistry Ph.D. Program**

Students enter the Biochemistry graduate program following admission into the Integrated Graduate Program (IGP), the Quantitative and Chemical Biology Graduate (QCB) Program, or the MSTP program. Students who enter Vanderbilt through the IGP or QCB programs normally select a mentor and Ph.D. program following laboratory rotations at the end of their second semester of study. Eligible mentors for the Biochemistry graduate program are tenured or tenure-track faculty who have a primary or secondary appointment in the Department of Biochemistry. Entry into the Biochemistry graduate program is by consent of the dissertation mentor, Director of Graduate Studies (DGS), and Chair of the Department. Acceptance is contingent upon satisfactory performance in coursework and lab rotations during the first year. Upon joining a lab, student expenses (stipend, tuition, fees, and research costs) become the responsibility of the Ph.D. advisor. When the advisor holds a secondary faculty appointment in Biochemistry, the primary department of that faculty has ultimate financial responsibility for all student expenses throughout their training. As indicated below, some decision-making within the program is made by the Biochemistry Graduate Education Advisory Committee. This committee is composed of the DGS, the Chair of the Department and, as needed, additional faculty appointed on an *ad hoc* basis by the DGS and the Chair (most often faculty who previously served as the DGS).

### **Requirements for the Ph.D. in Biochemistry**

#### **1. Course requirements**

A total of 24 hours of didactic courses are required for the Ph.D. in Biochemistry. These didactic courses are comprised of three parts: (1) first year courses required for all entering students as part of the IGP or QCB programs (16 hours are usually completed in the first two semesters, which may include elective hours), (2) those required by the Department of Biochemistry, and (3) those taken as electives (6 hours, required in addition to any elective hours completed as part of the 16 hours completed during the first two semesters).

#### **The required course in the Department of Biochemistry is:**

Biochemistry 8327 (old BCHM327) Seminar/Scientific Communication (Fall)	2 hours
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#### **The Department of Biochemistry offers the following courses as electives:**

Biochemistry 8300 (old 300) Introduction to Structural Biology (Spring)	1 hour
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Biochemistry 8301 (old 301) Molecular Structure & Function (Spring)	2 hours
Biochemistry 8302 (old 302) Advanced Biochemistry, Cell Biology and Genetics (Fall)	3 hours
Biochemistry 8303 (old 303) Biomolecular X-Ray Crystallography Prerequisite BCHM 300	2 hours
Biochemistry 8323 (old 323) Special Problems & Experimental Techniques* (Fall, Spring & Summer before prelims)	1-6 hours
<i>*The mentor of the student is the instructor for these courses. The mentor must provide a written description to the Graduate School of the student's activities for these courses prior to registration. The Graduate Program Administrator will facilitate obtaining the approval from the Graduate School.</i>	
Biochemistry 8336 (old 336) Biochemical Toxicology and Carcinogenesis (Fall)	3 hours
Biochemistry 8337 (old 337) Molecular Aspects of Cancer Research (Spring)	1 hour
Biochemistry 8343 (old 343) Biomolecular NMR Spectroscopy (Fall)	3 hours
Biochemistry 8349 (old 349) Graduate Seminar in Molecular Biophysics (Spring)	1 hours
Biochemistry 8352 (old 352) Analytical Proteomics (Spring)	2 hours
Biochemistry 7999 (old 369) Research for M.S. Degree*	Variable
Biochemistry 8999 (old 379) Research in lab before qualifying exam*	Variable
Biochemistry 9999 (old 399) Research in lab after passing qual exam*	Variable

\*Research project courses [Biochemistry 7999 (old 369), 8999 (old 379), and 9999 (old 399)] are not considered didactic courses.

The Graduate School requires 72 hours (didactic and research—minimum of 24 didactic-- ) for a Ph.D.

*It is very important to stress that at the stage where a Biochemistry Ph.D. or M.D./Ph.D. student advances to candidacy s/he will be expected to have a textbook-level knowledge of general biochemistry, such as a would be represented by a classical undergraduate textbook on this subject, such as that by L. Stryer or Voet and Voet. A student who did not take biochemistry as an undergraduate or who needs to brush up on this material*

*should do so during their first two years of graduate study (prior to their qualifying exam) either through independent study or through elective course work.*

A typical curriculum for a Biochemistry Ph.D. follows:

	<b>Total Credits</b>	<b>Didactic Credits</b>
<b>Year 1 - IGP or QCB core courses and electives</b>	16	16
<b>Year 1 Summer Semester</b>		
BCHM 8999 (old 379) - PhD Dissertation Research	6	
<b>Year 2 Fall Semester</b>		
BCHM8327 (327)–Seminar/Scientific Communication	2	2
Elective(s)	3	3
BCHM 8999 (379) - PhD Dissertation Research	4	
<b>Year 2 - Spring Semester</b>		
Elective(s)	3	3
BCHM 8999 (379) - PhD Dissertation Research	6	
<b>Year 2 - Summer Semester</b>		
BCHM 8999 (379) - PhD Dissertation Research	6	
<b>Total Credits at End of Second Year</b>	<b>46</b>	<b>24</b>
Year 3 and 4 - BCHM 8999/9999 (Ph.D. Dissertation Research)	26	
<b>Total Credits Needed for Graduation</b>	<b>72</b>	<b>24</b>

The exact timing of when the student completes the required hours BCHM 8999/9999 needed to reach the 72 hour total for the Ph.D. program is flexible.

In addition to the Graduate School requirement for an overall ‘B’ average, the Department of Biochemistry stipulates that students who obtain one ‘F’ or 2 ‘C’s in any courses, which include first year IGP/QCB courses, will not be permitted to continue. Exceptions to this rule will be permitted only by consent of the Biochemistry Graduate Education Advisory Committee. Any such exceptions will include probationary conditions.

## **2. The Qualifying Examination**

### **Background**

Prior to the qualifying exam the DGS, mentor, and Department Chair will serve as the advisory committee for entering students.

After completion of the required Biochemistry course and, normally, near completion of the Graduate School requirements of 24 didactic hours, the student will take the

qualifying examination, usually starting in March of the student's 2<sup>nd</sup> year after beginning graduate studies.

Passing the qualifying exam admits students to Ph.D. candidacy. The qualifying exam is comprised of a 6 page written research proposal and an oral examination by an exam committee. The primary goals of the qualifying exam are:

- 1) To provide an assessment of whether the student has a satisfactory general knowledge of biochemistry and related areas of genetics, cell and molecular biology. This means a textbook-level knowledge of general biochemistry and an IGP Bioregulation-level knowledge of genetics, cell and molecular biology.
- 2) To determine whether the student is able to articulate and defend sound scientific hypotheses and specific aims to test such hypotheses. This includes mastery of the relevant background literature. Students are also expected to have mastered the literature related to their specific Ph.D. project, although the aims of the Ph.D. project are not the topic of the qualifying exam proposal (see below).
- 3) To assess the student's aptitude and motivation for completing the Ph.D. degree.
- 4) To provide training in the proposal writing process.
- 5) To form a Ph.D. Committee to foster and monitor student development.

The following sections explain the procedures for the qualifying exam.

- i). Students taking their qualifying exam will have completed Biochemistry 8327 (old BCHM 327) (Scientific Communication), usually during the Fall semester before their spring qualifying exam. This course includes specifics on how to prepare a grant proposal and in-depth discussions on good grant writing practices, common concerns and mistakes. The aims of the 8327 (327) proposal are the tentative aims of the student's Ph.D. project, as determined by the student and her/his advisor.
- ii) The DGS will hold a January or February meeting with all students preparing to take the qualifying exam to overview the process and address student questions.
- iii) The topic for the qualifying exam is a mock-up proposal of the student's own device. While it may be related to the research being undertaken in the Ph.D. lab of the student it must be distinct from the student's Ph.D. aims or any other existing project known to the student. While the aims must come from the student, s/he is encouraged to use their advisor or other program faculty as a sounding board before finalizing.
- iv) The student will first write and submit a preliminary Specific Aims page for his/her qualifying exam research proposal (1 page limit, 11 or 12 point font). This document should describe the hypotheses to be tested and list the specific aims designed to test the hypotheses. The general experimental approaches and methodologies utilized to test the hypotheses should be briefly described. The Specific Aims page should be submitted to the DGS on or before March 1. In rare extenuating circumstances, the DGS can approve a later deadline. The specific aims page should include the name of the student, the title of the proposal, and should indicate that these are *qualifying exam* aims.

v). For each student the Qualifying Exam Committee will be comprised of four members of the graduate faculty, three of whom must have primary or secondary appointments in the Department of Biochemistry, one of whom must be tenured. One committee member should *not* be a primary faculty in Biochemistry. *The student's advisor is not on the Exam Committee, but will join the other members of this committee to constitute the student's full Ph.D. Committee.* The student and advisor should first draft a list of 5-6 possible Biochemistry faculty in order of preference and 3-4 non-departmental faculty and present this list to the DGS for approval. Upon DGS approval, the student may then solicit commitments by faculty members on the list until the committee is composed. The DGS will then appoint the committee chair (who must be a tenured primary member of the Department of Biochemistry).

vii) Approval of specific aims. Once their committee is composed, the student will provide two specific aims pages to each committee member. One specific aims page will be on the qualifying exam proposal (and should be marked as such). The other specific aims page should be on the student's actual Ph.D. project aims. The student will also schedule a one hour pre-qualifying exam meeting with their committee within the March 15-April 15 time range. *The Ph.D. advisor must attend this meeting.* Once a time and date is found, the student will inform the Graduate Program Administrator and confirm the date, time and place with the Exam Committee. The student should work with the Departmental Administrator to reserve a room for this meeting. At this pre-exam meeting the student will present their qualifying exam proposal aims to the committee in a presentation that includes no more than 1 introductory slide and one slide per aim. The committee will determine whether the student's anticipated qualifying exam research proposal (based on the Specifics Aims) will be "defendable" in a qualifying exam. If not, the committee will help the student to craft aims that appear to be defendable. This adjustment of aims can take place either at that meeting or immediately following via iterative e-mail. The committee will also preview with the student the likely types of questions that will be asked at the actual oral qualifying exam. Near the end of this one hour meeting, the student should also present a slide that lists their actual Ph.D. project aims.

viii) Scheduling the qualifying exam. When the student schedules their pre-qualifying exam meeting, the student should also poll committee members to schedule a date and time for the oral qualifying exam. This meeting should normally take only 2 hours, but should be scheduled for 2.5 hours in case the committee needs extra time in special cases. This exam should be scheduled no earlier than 4 weeks after the pre-qualifying exam meeting and no later than June 1. The Graduate Program Administrator will be informed of the scheduling of the qualifying exam as soon as possible by the student and will reserve a room for a 2.5 hour block of time for the oral qualifying examination. The student should work with the Departmental Administrator to reserve a room for this meeting

ix) Written qualifying exam proposal. The written component of the qualifying exam is a grant proposal. The proposal section of the written qualifying exam is strictly limited to 6 pages, including all figures the Specific Aims Page, Background and Significance, and Research Plan. In addition to the 6 page proposal there is also a face page and references. The face page should include the name of the student, the name of the advisor, the title of the proposal, and the date, time and place of the oral exam. The student should assume a timeline of three to four years for the proposed experiments, which can realistically be accomplished with typically available resources. The student is responsible for all

scientific aspects of the proposal including background information, approach, experimental design, and methodology for all experiments. The student may consult with anyone concerning methodologies, format, references, etc. Students are free to orally discuss the proposal with their advisor or other faculty and also to have students or postdocs (but not faculty) critique the written proposal. Faculty are not allowed to attend practice qualifying exams.

The student should provide the qualifying exam research proposal to the qualifying exam committee no later than one week prior to the oral qualifying exam. The mentor should also provide the committee chair with a letter providing an evaluation of the student's performance to date, at least one day prior to the oral examination. In advance of the oral exam, the Graduate Program Administrator should provide the chair of the committee with a copy of the student's Vanderbilt academic record. The Administrator will also provide the examination outcome forms the student taking the exam. These forms are to be completed and returned by the committee chair to the Program Administrator following the exam.

The student should present their proposal at the oral exam using no more than 15 simple-format slides. During the oral qualifying exam the student should demonstrate:

- Mastery of knowledge concerning the background, methods, and literature related to their specific project.
- A firm grasp of textbook-level biochemistry. This does not imply extensive memorization of metabolic pathways, etc., but does imply fluency in all major areas of biochemistry as defined by the consensus topical composition reflected by most biochemistry textbooks (for example, those authored by Stryer and Voet and Voet).
- An understanding of cell and molecular biology and of genetics at a level consistent with what is taught in the Bioregulation survey course sponsored by the BRET office.
- The ability to think critically, defend the proposed science, and communicate reasonably well.
- General student motivation and track record in terms of work ethic, lab aptitude, responsible conduct of research, general motivation, and scholarship are also expected to be satisfactory. These traits will be evaluated in part based on the advisor's letter to the committee and their grades.

The possible outcomes of the qualifying exam are pass or fail, with a single opportunity to re-take a failed oral exam within 30 days (no later than July 1). A pass may in some cases be accompanied by a requirement by the committee that the student carry out certain tasks (such as completing specific research training or coursework) in order to be considered a Ph.D. candidate in good standing, as will be assessed at future Ph.D. committee meetings.

If a second oral exam needs to be scheduled, the student should poll the committee for this purpose, with the Departmental Administrator then helping to locate a suitable room. As for the initial exam, the student should provide their committee with their proposal (revised, if needed) at least a week prior to the exam.

Following the exam (or both exams, if the student takes the exam twice), a letter addressed to the student should be prepared by the committee chair that summarizes committee discussion and states the outcome of the exam. This letter is sent to the student, the Ph.D. advisor, and the Program Administrator.

The DGS maintains a “qualifying exam checklist” document that provides a detailed checklist and timeline for the qualifying exam process. To receive a copy just request this from the DGS.

### **3. Required Research Presentations**

The Biochemistry Student Association (BSA) holds a research presentation series in which Biochemistry students (and sometimes others) give seminars on their research. Biochemistry Ph.D. students are required to present in this series twice before graduating. The first presentation is during the year immediately following passing the Qualifying Examination and is comprised of a 25-30 minute oral presentation (including question/answer time). This first presentation can focus on plans as well as progress to date. The second presentation is a full length seminar (50-60 minutes, including Q/A) on research progress and is given during the 3<sup>rd</sup> year following passing the qualifying exam. These presentations provide students with experience in public speaking to a broad audience, as well as providing a venue for showcasing research going on in the department and receiving feedback from colleagues. The scheduling of these presentations is coordinated by the BSA leadership.

### **4. Dissertation Research and Ongoing Evaluation**

The Ph.D. Committee is comprised of the Qualifying Examining Committee plus the student’s Ph.D. advisor. The chair of the Qualifying Examining Committee will serve as chair of the Ph.D. Committee. If for some reason, the chair is unable to fulfill this obligation, the DGS will appoint another tenured member of the Biochemistry primary faculty as chair. While the Ph.D. Committee is initially composed of five members, a sixth member may be added. This may be helpful if the dissertation broadens in scope and would benefit from the participation of a faculty member who can contribute relevant new expertise. If it becomes impossible for one of the five members to continue on the committee, meetings can proceed with a minimum of four committee members present, as proscribed by the Graduate School. Changes in the composition of the Dissertation Committee must be approved by the DGS.

Regular meetings of the Ph.D. Committee should be held at least once each academic year or more often as advised by the committee or mentor. Students may also request an “emergency” meeting with their committee to address acute crises. The regular meetings are to keep the committee informed of progress and to provide an opportunity for the committee to advise the student with regard to unforeseen problems or new avenues of research. It is the responsibility of the student to schedule these meetings and then inform the Graduate Program Administrator of the date, time, and place. Ordinarily, meetings should be scheduled for 90 minutes. Students are encouraged to employ an on-line scheduling tool such as “Doodle” to poll faculty regarding availability for committee meetings. The student should work with the Departmental Administrator to reserve a room for these meetings. The student should also provide the members of the committee with a 3-5 page (including figures and references) summary report of research progress/plans one week before the scheduled meeting. In addition, include a face page should also be included that gives the student’s name, project title, advisor’s name, and

time and place of the meeting. *Please note that the format of this report for the first committee meeting following a successful qualifying exam is different from subsequent reports, as follows.* The “report” for the first post-candidacy meeting should be written in the style of a short research proposal that gives the aims of the Ph.D. project, background and significance, a plan of attack and, as appropriate, a short description of progress to date, including references for any publications. This document should be roughly 5 pages long (single-spaced) plus a cover page (with name, project title, and the date, time, and location of the meeting, plus references. It is advisable that the advisor look at this document before the student finalizes it and distributes it to the committee.

The Graduate Program Administrator will provide meeting outcome/evaluation forms to both the student and the committee chair. At the conclusion of each meeting the committee will fill out a numerical progress evaluation form. If a majority of committee members deem overall progress to be unacceptable, this will be indicated on this form and the Ph.D. advisor will also enter a grade of U (unsatisfactory) for Biochemistry 399 at the end of that grading period. Two consecutive or three total unsatisfactory progress reports will result in termination from the Ph.D. program. In addition, a letter addressed to the student summarizing the committee’s discussion and specifying the timing of the next meeting will be drafted by the chair of the committee. The letter should be sent to the student. Both the letter and the evaluation forms should be submitted to the Graduate Program Administrator.

A minimum of one publication in a peer-reviewed journal with the student as the primary (first or co-first) author is required for receiving the Ph.D. in Biochemistry. A defense cannot take place unless such a paper has been fully accepted by the journal at the time of the defense. The Ph.D. Committee has the responsibility to see that this requirement is fulfilled before a Ph.D. defense takes place. Review articles and chapters based on proceedings of symposia and meetings do not satisfy this requirement. This requirement can only be waived by consent of the Biochemistry Graduate Education Advisory Committee.

Upon completion of the dissertation project to the satisfaction of the Ph.D. Committee, the student will prepare and submit a dissertation, in accordance with the rules of the Graduate School. Students must receive approval from their Ph.D. Committee prior to scheduling their final examination. The completed dissertation should be submitted to the members of the Ph.D. Committee no later than two weeks prior to the day of the final examination. It is the responsibility of the student to notify the DGS, the program administrator, and the office of the department Chair in advance of the time and place of the examination and of the title of the dissertation. This should be completed no later than two weeks prior to the examination.

## **5. The Final Examination**

The initial phase of the Defense of the dissertation takes place as part of a public seminar of the Department. The members of the Ph.D. Committee are required to attend. After the public seminar is over, the candidate and members of the Ph.D. Committee adjourn to conclude the examination in private. The result of the examination should be reported immediately afterward.

In some cases, Ph.D. Committees require extensive revisions to the dissertation prior to acceptance. In these circumstances, students are strongly discouraged from leaving

Vanderbilt prior to completing final revisions. In cases in which students do leave, they will be personally responsible for all expenses including a continuing registration fee, *i.e* this will be paid by the student, not the advisor. The dissertation advisor and Ph.D. Committee may place a deadline on correcting any deficiencies identified during the final examination. Failure to meet this deadline may result in termination from the program.

Biochemistry students usually complete their graduate studies and defend roughly four to five years after entering graduate school. Completion is required by the Graduate School within four years of successfully passing the qualifying exam. If a student has not completed all degree requirements four years after the qualifying exam, he or she may request an extension of six months. An extension request should be addressed to the Director of Graduate Studies and submitted to the Program Administrator at least 8 weeks in advance and should be accompanied by a letter from the Ph.D. advisor indicating the reasons for the extension. Upon consent of the Biochemistry Graduate Education Advisory Committee, the request will be submitted to the Graduate School. A student is allowed a maximum of two 6-month extensions. Students will be dismissed from the program if they have not completed all degree requirements by the end of the second extension period, which is a stated policy of the Graduate School.

## **6. Requirements for the M.S. in Biochemistry**

Students may become candidates for an M.S. in Biochemistry by one of two routes; through failure to be admitted to candidacy for the Ph.D. or as a result of withdrawing (or being terminated) from the Ph.D. program after passing the qualifying exam. Approval for a Master's degree is contingent on completion of the requirements below and also approval by the Biochemistry Graduate Education Advisory Committee in consultation with the student's advisor and Ph.D. committee (if formed). In rare cases, such as in an instance where serious scientific misconduct took place, a student may be denied an M.S. degree even if they have complete the following requirements.

### **1. Course Requirements**

The course requirements for Biochemistry must be complete [a total of 24 hours of didactic courses including Biochemistry 8327 (old BCHM327)].

### **2. Thesis Requirement**

A short thesis describing a piece of original work must be submitted. This must be approved by two members of the Department of Biochemistry (one being the student's advisor, the other usually being the chair of that student's Ph.D. Committee), who are also members of the Graduate Faculty. There will be no examination of the thesis research. The thesis requirement can be waived for students that have already passed the Ph.D. qualifying exam by consent of the student's advisor and the Biochemistry Graduate Education Advisory Committee.

## **7. Requirements for the Ph.D in Biochemistry as Part of the M.D./Ph.D. (MSTP) Program**

MSTP students enter the Biochemistry Ph.D. program at the beginning of the fall semester, following completion of their first two years of medical school. The MSTP program covers tuition and stipend for the student's first year in the Ph.D. program, after which responsibility shifts to the Ph.D. preceptor.

The Graduate School requires 72 hrs for the Ph.D. degree. 48 hours of credit from medical school coursework/training transfer from VUSM years 1 and 2 to the Graduate School and count towards the required 72 hours of credit. (According to the program proposed here 15 hours of the 48 hours of credit count towards didactic credit hours and 33 hours of credit will count for research hours). This leaves 9 didactic hours of coursework to be completed by the MSTP student during their first year of Ph.D. study.

The 15 didactic hours that transfer to the Biochemistry program are derived from the following year 1 VUSM courses:

Human Blueprint and Architecture:	6 hours
Microbes and Immunity	2 hours
Homeostasis	2 hours
MSTP seminar (Fall)	1 hour
Endocrine, Digestion, and Reproduction	2 hours
Brain, Behavior, and Movement	1 hour
MSTP seminar (Spring)	1 hour

The coursework to be completed by the MSTP student during their first year in the Biochemistry Ph.D. program is as follows:

MSTP seminar (Fall)	1 hour
Biochemistry 8327 (Scientific Communication)	2 hours
Electives	6 hours

Electives should be chosen based on student's interest and should be approved by their mentor.

After joining the Ph.D. program, students will continue to participate in the MSTP seminar, but register only for the Fall semester of year 1 in the Ph.D. program.

In addition to the above didactic requirements, students will need to complete 15 hours of research after joining the Ph.D. program to reach the 72 total hours required for a Ph.D.

Students will work with their advisor and the DGS to compose a Ph.D. committee according to the same timing and criteria as for the standard Ph.D. program (see earlier sections of this document), with one exception: one member of the Ph.D. committee should be a current or former member of the MSTP Faculty Advisory Committee. This member can be either one of the 5 required members or a 6<sup>th</sup> member of the committee.

The qualifying exam process is exactly the same for MSTP students as for regular Ph.D. students. The same is true for all post-candidacy requirements for completing the Ph.D. degree. In terms of timing, MSTP students undertake the qualifying exam process during their first spring after joining the program, in synch with the students in regular Ph.D. program.

MSTP students are expected to complete their Ph.D. degrees by the end of their 4<sup>th</sup> complete year in the program (end of 6<sup>th</sup> year after entering VUSM).

MSTP students are strongly encouraged to apply for an NIH F30 fellowship during their 1<sup>st</sup> year of Ph.D. training. The proposal developed in Biochemistry 8327 (327) can often be adapted for this purpose, in which case students would likely submit their applications for the April or

August deadlines. The MSTP office provides assistance with preparing and submitting these proposals.