

Handbook
of the
Graduate Program
in
Biochemistry and Molecular Biology
West Virginia University
School of Medicine

For Students Admitted Fall 2007 and later

Approved by the Faculty May, 2008

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GOALS AND OBJECTIVES OF THE PROGRAM

This Handbook developed by the Faculty of the Graduate Program in Biochemistry and Molecular Biology outlines the requirements for graduate training leading to a degree in Biochemistry and Molecular Biology. This program adheres to the standards set forth by the American Society of Biochemistry and Molecular Biology (ASBMB) and the International Union of Biochemistry and Molecular Biology (IUBMB).

IUBMB Standards for the Ph.D. Degree in the Molecular Biosciences*

1. The candidate should demonstrate a general knowledge of physics, chemistry, biology and cell biology, biochemistry and molecular biology, and a detailed knowledge of his or her area of research.
2. The candidate should be familiar with the research literature in biochemistry and in their specific field of study and should have the ability to keep abreast of major developments and to acquire a working background in any area.
3. The candidate should demonstrate skill in the recognition of meaningful problems and questions for research in Biochemistry and Molecular Biology.
4. The candidate should possess technical skill in laboratory manipulation.
5. The candidate should demonstrate that oral, written, and visual communication skills have been acquired.
6. The candidate should demonstrate skill in designing experimental protocols and in conducting productive self-directed research.

*This list is adapted from the publication "Ph.D. Degree in the Molecular Biosciences".

<http://www.asbmb.org/CareersAndEducation.aspx?id=256&linkidentifier=id&itemid=256>

In addition to the information contained in this handbook, the student is urged to also consult the current Graduate School Catalog for additional information regarding the requirements of the Graduate Council at West Virginia University.

I. ENTRY TO THE GRADUATE PROGRAM

Graduate students join the graduate program in Biochemistry and Molecular Biology by electing to do their dissertation research with a faculty member affiliated with

this program. The graduate program in Biochemistry and Molecular Biology is able to accommodate students with diverse backgrounds and wide ranges of interests. Any student admitted to the undifferentiated first year curriculum is eligible to join the graduate program. Students with MS degrees desiring direct entry into the program must still apply through the school-wide admissions committee and may need to complete portions of the first year curriculum. Students are encouraged to have a strong academic preparation in qualitative/quantitative chemical analysis, organic chemistry, calculus, physics, and physical chemistry. For students with demonstrated abilities, course deficiencies can be corrected after enrollment with the guidance of their graduate advisory committee.

II. PH.D. PROGRAM

A. Formal Course Curriculum

A sample curriculum is provided at the end of this document. The Ph.D. program averages 5 years in length.

A.1. Formal Courses

The first year of study, the student takes the undifferentiated core curriculum. Students who did not take the module offered by this graduate program as part of the first year curriculum will be required to take it in the second year. In the second year, the students will take a 2 credit course in protein chemistry and enzymology, this course will be offered for the first time in the fall of 2006. The remainder of the student's plan of study is designed under the guidance of the student's advisor and will ultimately need to be approved by the student's advisory committee. The student is required to take two advanced courses, one of which must be one of the program's advanced courses:

Advanced Protein Chemistry and Enzymology
Advanced Molecular Biology

and the other course is an elective . The elective should be a graduate level course to complement the student's background as well as research interests. The student must consult with their advisor when choosing an elective. Suggested electives include:

Protein Structure/Function (Biology Department)
Proteomics (Chemistry Department)
Advanced courses offered by the other School of Medicine
Graduate Programs
An additional advanced course listed above

Additional coursework is optional but many students will find that they desire the additional enrichment.

A.2. Seminars and Research Forum

The student will present three seminars during their graduate study. One seminar will be the dissertation proposal which is the background and proposed research for the student's dissertation project. This seminar should be given by the end of the first semester of the third year in graduate school. A second seminar will be on a subject unrelated to the student's research. The topic is selected by the student, with the approval of his/her advisor and the seminar coordinator. Students may choose to present from the topic of their written exam. This seminar should be given during the spring semester of the third year. A list of guidelines in preparing this seminar should be obtained from the seminar coordinator once the topic is selected. The final seminar will be the student's dissertation defense.

Students should avail themselves of all opportunities to present their research in an oral presentation. The Departmental Research Forum is a less formal mechanism for presenting one's research and students will be asked to participate in this. It is designed to keep members of the department abreast of new developments, provide a forum to address complex experimental problems, and to permit students an opportunity to develop their skills at presenting and defending their research results. A schedule for this is developed in August of each year and the advisor selects the dates for presentations by the lab personnel. Students may also present as part of retreats, research forums in Centers, the Van Lierre student research convocation, and at national meetings. Any opportunity to practice these skills is strongly encouraged.

The Department also hosts a weekly seminar series to include faculty, students and invited speakers from outside the University. Time is allotted for the students to meet with invited seminar speakers generally at a lunch following the seminar. Each semester, the graduate students as a group are encouraged to invite a speaker of their choosing. The Graduate Student Representatives will coordinate this effort with the seminar coordinator.

The students should attend all student seminars, research forums and the Departmental seminar series. Experiments and other obligations should be planned to allow attendance of these very important educational opportunities. Repeated absences from these events may result in the required enrollment in a credit of graduate seminar that will be graded based on attendance.

A.3. Journal Club

All students are required to enroll in Biochemistry and Molecular Biology Journal Club each semester they are in residence. This course involves the presentation and discussion of current research papers. It is also the time for students to become acquainted with the variety of methods used in scientific research. The journal club is facilitated by the faculty. Students may participate in other journal clubs at the discretion of their advisor.

A.4. Teaching

Teaching experience is a valuable part of Ph.D. training. Every effort will be made to provide the student with training in this area. Students with a particular interest in teaching should make this known to both their advisor and the Graduate Program coordinator so that ample experience can be planned. Possible experiences include a teaching practicum taught in combination with other graduate programs and presenting a lecture in a course. The student should discuss their goals in this area with their advisor.

A.5. Doctoral Research

The dissertation advisor is the student's sole advisor for his/her time in the graduate program. Most of the student's time will be taken up with this research. Students register for research credits each semester as BIOC 797, and their performance is graded satisfactory or unsatisfactory by their dissertation advisor. A critical aspect of this is for the student to learn to continue to make progress on their research while engaging in course work, journal club, teaching, and seminar attendance.

A.6. Vacations, Sick Leave, and Work Schedules

Once in the second year of graduate study, the student no longer adheres to the vacation schedule of the undergraduate University calendar. If the student is sick for a journal club or seminar, they should inform the faculty member in charge of that activity of their absence. Please note any policies regarding absenteeism in the syllabi of courses. This can be by phone or email and should be done prior to the time of the class or meeting. Do not assume that informing your advisor or a single course director of your absence will result in that absence being communicated to all other faculty. Each faculty member with whom you have a class or other obligation must be informed individually each time an absence is going to happen.

The student should discuss vacation and sick policies with their advisor. The student is cautioned that the degree is granted based on completion of the dissertation research and not based on length of time in the program. The general University guideline for sick leave is 1 day per month. Vacation time varies with appointment; 1 day per month for research staff and 2 for faculty. Most faculty advisors find that they do not use all of the allotted 2 vacations days per month or their sick leave. Graduate students should have a similar expectation. The University does not have policy for maternity/paternity leave for graduate students. Students who need this leave should discuss expectations with their advisor. A general guideline would be 6 weeks maternity leave and 2 weeks paternity leave and University policy is that this time is deducted from sick and vacation leave. Many women and men find that they can return to some activity prior to this time. Remember, time spent away from the laboratory either due to illness or vacation will hamper the student's progress on their research.

The student should discuss the expectations for total hours of work as well as the days of service (weekends/holidays) with their dissertation advisor. These expectations are likely to vary between laboratories so it is important to establish what these are upon

entry into a laboratory. The student should be aware that these decisions are made in the best interest and safety of the student and for the efficient conduct of the experiments.

B. Academic and Professional Standards

B.1. Grades

It is expected that students will perform satisfactorily on all required courses. To remain in good standing in the Ph.D. program a student is required to maintain the following standards:

- a. An overall grade point average of 3.0 in graduate level coursework excluding research credits.
- b. Should receive no less than a C grade on all course work. Students receiving a grade lower than a C in a core course will need to repeat that course. During the first year curriculum, the student should receive no less than a B in Cell Structure and Function, Molecular Biology, and the graduate program module. Students receiving a grade lower than a B may need to repeat that course.
- c. Removal of any incomplete grades within one semester of their award, unless special permission is granted by the Graduate Studies Committee.

Failure to comply with these standards will result in the student being placed on academic probation and may result in dismissal from the graduate program.

B.2. Evaluation of the Student's Progress

The progress of each student will be reviewed by the faculty once each year; generally at the end of the second semester. Each major advisor will be responsible for presenting the progress of their respective student(s). The Graduate Studies committee will monitor that program requirements are being met in a timely fashion. When a student is overdue for the completion of a requirement, the committee will first contact the advisor. Failure to complete the requirement within a reasonable time thereafter may result in action by the committee.

B.3. Student Code of Academic and Professional Integrity

Developing and practicing high standards for professional conduct are critical for the scientist. Both the University Graduate Council and the Graduate Faculty consider maintaining scientific integrity to be of utmost importance. All students are required to take a course in Scientific Ethics as part of the integrated first year curriculum. These standards are to adhere to throughout the student's graduate education and into his or her career. All students are directed to be familiar with the University's policy on this subject. This can be found at:

<http://www.arc.wvu.edu/admissions/integrity.html>

Students should pay particular attention to the avoidance of plagiarism in all scientific writing. The University's definition and position on plagiarism is:

"Plagiarism is defined in terms of proscribed acts. Students are expected to understand that such practices constitute academic dishonesty regardless of motive. Those who deny deceitful intent, claim not to have known that the act constituted plagiarism, or maintain that what they did was inadvertent are nevertheless subject to penalties when plagiarism has been confirmed. Plagiarism includes, but is not limited to: submitting, without appropriate acknowledgement, a report, notebook, speech, outline, theme, thesis, dissertation, or other written, visual, or oral material that has been copied in whole or in part from the work of others, whether such source is published or not, including (but not limited to) another individual's academic composition, compilation, or other product, or commercially prepared paper." (from: <http://www.arc.wvu.edu/admissions/integrity.html>)

Students who have any questions regarding what constitutes plagiarism should request clarification from the faculty before embarking on any writing assignment. Failure to adhere to these standards of scientific integrity will result in disciplinary action by the graduate faculty and may jeopardize the student's status in the graduate program.

C. Ph.D. Candidacy and Dissertation

Admission to candidacy occurs following successful completion of the qualifying exams. Consistent with University requirements, the qualifying exam has both written and oral components.

C.1. Written Qualifying Examination

Students who have received all A's in their graduate coursework will be exempt from the written exam.

The qualifying examination is given in May of the second year of graduate study. The student shall select, in consultation with their dissertation advisor, any topic in the broad area of Biochemistry and Molecular Biology, which will be the subject for the exam. The student shall prepare an abstract outlining the current understanding of that topic, limited to two pages and a maximum of 10 literature citations. This will be submitted to the student's examination committee by the end of the first week in May. The exam committee will be the student's advisory committee with a member of the graduate faculty substituting for the student's advisor. All exam committees will have this same faculty member to provide consistency between exams and they will function as the chair of the committee. The committee will meet within one week of receiving the topic and prepare questions relating to the topic and which address general areas of biochemistry and molecular biology such as protein structure and function, enzymology, intermediary metabolism, molecular biology and genetics, cell structure and function, and signal transduction. The student shall have 2 weeks to write essay answers to the questions.

These may be completed in an open book format but in the student's own words and without consultation with other students. The student shall meet with the advisory committee one week after submission of their answers to discuss the answers and approve or disapprove continuation to the oral exam. Failure to pass the exam may result in either placement of the student in the Master's track or dismissal from the program.

C.2. Oral Qualifying Examination

The oral qualifying examination involves the preparation and defense of a written proposal of the student's dissertation research project. The purpose of this portion of the exam is to demonstrate that the student is prepared to undertake doctoral research. The presentation should include background information, rationale for the proposed experiments and available preliminary data. Most students revise their proposals at some point in their graduate work. Thus, this exam should not be delayed so as to include yet one more experiment. The dissertation proposal shall be submitted to the student's advisory committee and the Graduate Program coordinator by the first day of classes of the fall semester of the third year. Every effort should be made to defend the proposal by September 30 of that semester. Failure to pass this exam by the end of March of the third year unless prior approval is provided by the graduate program steering committee will result in dismissal from the doctoral program.

To accomplish these goals, the student will prepare a written dissertation research proposal to be submitted to their advisory committee (see section C.3 below). The written report is to be prepared in NIH format, as per the directions for the application for a Public Health Service Grant (PHS 398), to include:

- Abstract (Form page 2)
- Table of contents (Form page 3-CC)
- Detailed budget (form page 4-DD) and budget justification (one page)
- Biographical sketch (form Page 5-EE)
- Research plan (25 pages total)
 - Specific aims – 1 page
 - Background and Significance – 3 to 4 pages
 - Preliminary Studies – 4 to 5 pages
 - Research Design and Methods – remaining pages

The page limitation of 25 pages will be strictly enforced. The student should determine the aims of the project in conjunction with their advisor, and should consult with their advisor on writing style and grantsmanship issues. The proposal must not be a copy and paste effort from the advisor's grants. The written proposal should be given to the advisory committee at least two weeks before the meeting to allow them sufficient time to evaluate the project.

The dissertation proposal will be presented as a public seminar to the Biochemistry graduate faculty. Following the seminar, the student will meet with the advisory committee to evaluate the proposal in depth. During this meeting, the advisory committee will be charged with examining the student in broad areas of Biochemistry

and Molecular Biology including an understanding of the techniques used in the proposal and the student's ability to use deductive reasoning. During the proposal defense, all subsequent advisory committee meetings, and the dissertation defense, the student's advisor must not speak for the student or answer questions directed at the student.

The proposal defense must be completed following the time line delineated above. In extenuating circumstances, such as a change of advisor, the student may petition the Biochemistry steering committee to delay their proposal defense for a period not to exceed six months.

C.3. Student Advisory Committee

A student advisory committee will be chosen during the second year of study to evaluate the student's progress in research, to provide a sounding board for problems encountered or progress made, and to examine the student during the proposal and dissertation defense seminars (see below). The members of this committee will be selected by the major professor and student. The committee will consist of five members: three must be on the faculty of the Graduate program, including the major professor who will act as chair, one must be a faculty member from another program (including adjunct faculty) within the University, and the fifth member can be either from within the program or from another program. In each case, the selection will be based on the nature of the research to be carried out and on the student's interests. In general, the first meeting of this committee will be at the proposal defense

C.4. Admission to Candidacy

Based upon the advisory committee's recommendation, with satisfactory performance during the proposal defense, the Graduate Program Coordinator will recommend to the Graduate Council that the student be elevated to candidacy for the Ph.D. degree. The committee chair (student's advisor) will submit to the Graduate Council a completed Qualifying exam form indicating the successful completion of both the written and oral exams.

C.5. Schedule for Advisory Committee Meetings

Following admission to candidacy, the student should have meeting with the advisory committee at least once each year to evaluate progress on the goals of the proposed research. During the yearly meeting, the advisory committee will be charged with examining the student in broad areas of Biochemistry and Molecular Biology including an understanding of the techniques used in the proposal and the student's ability to use deductive reasoning. It should be emphasized that the biomedical sciences are ever-changing disciplines in which new research information appears at a rapid pace. Consequently, the Ph.D. candidate must keep abreast of these developments, as well as obtain a solid grasp of fundamental biochemical and pharmacological concepts. A written record of this meeting using the "Advisory Committee Evaluation Form" provided on the website must be placed in the student's file.

C.6. Dissertation Preparation, Seminar, and Defense

When research has progressed to a point considered satisfactory by the major professor and the advisory committee, the student will write their doctoral dissertation describing the work according to Graduate Council guidelines. A copy of these guidelines can be obtained from the Health Sciences Graduate Programs office. A dissertation draft will be read and approved by the major professor and the advisory committee members before the final oral defense. This draft must be given to the committee members one month prior to the defense. Exceptions to this time schedule are strongly discouraged and will require the approval of every member of the advisory committee.

The student will not be allowed to defend their dissertation without a minimum of one paper in press in a peer-reviewed journal, on which the student is first author. Submission of the paper must be approved by the student's advisor. In some cases, students share first authorship with another member of the laboratory. The use of such papers to fulfill this requirement will be at the discretion of the student's advisory committee. The student is cautioned that their first authorship status on papers in preparation or only submitted at the time of defending is not guaranteed. If this paper requires substantial revision with additional experiments before acceptance by the journal, the student risks the loss of first authorship on the paper. Following this minimal requirement should only be used by students whose projects cannot generate publications during the course of the degree and should not reflect lack of initiative on the part of the student or laboratory to submit manuscripts more often.

The final examination for the Ph.D. degree will consist of presenting a dissertation seminar before the advisory committee, Program and any other interested parties, after which the student will continue with their dissertation defense before their advisory committee. Satisfactory performance in the oral defense as judged by the advisory committee will result in a recommendation for granting of the Ph.D. degree. Following a satisfactory defense of the dissertation, the student must prepare the dissertation for electronic submission to the University. Approval of the written dissertation and the electronic submission, which includes signatures from all committee members, must be completed before the Ph.D. can be conferred. Students should not make firm commitments for start dates in postdoctoral positions or other employment prior to completion of these requirements.

C.7. Deadline for completion of the degree

The University has 2 deadlines by which the degree must be completed or the student will need to retake introductory coursework. Once a student has been admitted to candidacy, you have 5 years to complete the degree. Overall, the student must complete the degree by the end of the eighth year in graduate school. The expectation is that the student will finish well before this time. To ensure timely progress, the Office of Research and Graduate Studies will send letters to students at the beginning of their sixth year to inquire as to their progress towards completion.

D. M.D./Ph.D. Students

1. Two years of the medical school curriculum will satisfy the first year course requirements. The medical school curriculum includes an introduction to statistics as part of the Evidence Based Medicine course.
2. Laboratory long rotations are chosen through the M.D./Ph.D. program and are completed prior to entry of the student into the Ph.D. portion of the curriculum.
3. Passing the national boards will satisfy the written qualifying examination requirement.
4. The oral qualifying exam will be the proposal defense and it will follow the guidelines for regular graduate students. It is recommended that this exam be taken during the first year of research but must be completed by the end of the fall semester of their third semester in the graduate program. Failure to pass the oral exam by the end of the third semester in the graduate program, unless prior approval is provided by the Graduate Studies Committee, will result in dismissal from the doctoral graduate program.
5. Other course work and seminar requirements are two advanced courses, journal clubs, three seminars, as required of other students in the Ph.D. program, and 1 credit of teaching experience.
6. The students will take the course in scientific ethics taught by the Office of Research and Graduate Studies.

III. THE MASTERS DEGREE PROGRAM

A. Thesis Masters

1. Admission to this program is restricted to students currently enrolled in the Ph.D. program and will be by recommendation of the faculty based on academic performance in the Ph.D. curriculum. Exceptions to this will only be made by following a meeting of the graduate program faculty.
2. The expected duration of study is 2-3 years.
3. The student must satisfactorily complete (consistent with the Ph.D. program grade requirements) a minimum of 30 course hours following the same curriculum as the Ph.D. candidate. At least 6 of these hours must be research and 24 formal coursework, as required by the Graduate Council
4. The M.S. student seminar requirement consists of two formal seminars, one of which is to be the thesis defense. They are also required to register for the Journal Club each semester.
5. A yearly evaluation of the student's progress will be conducted according to that of the doctoral program described above.
6. Thesis research and student advisory committee. Analogous to the Ph.D. candidate, a thesis M.S. student will choose an area of research and major professor/advisor after their first two semesters of graduate study. At that time, a student advisory committee will be chosen that consists of three members of the Program faculty, including the major professor, and one member outside the Program. The major professor will serve as chair of the committee. The main function of the advisory committee will be to examine and evaluate the student's performance during the thesis preparation and defense, similar to that described above for the doctoral dissertation defense. Summaries of all advisory committee meetings prior to the final oral defense will be submitted to the Graduate Studies Committee by the major professor. The proposal for the Master's thesis will be presented to the advisory committee only. The proposal will follow the format outlined in section II.D.3 but will be shortened to a total of 15 pages.
7. Defense of the thesis proposal must be scheduled by the end of the next semester after entering the master's program.

B. Master's to Ph.D. Candidacy Change

At the approval of the Faculty, the Master's candidate may retake the qualifying examination as a prerequisite for readmission to the Ph.D. program. Such program approval shall be based on satisfactory and timely progress toward completion of the M.S. degree. Following satisfactory performance on re-examination and defense of

the M.S. thesis, the faculty will review the student's status and approve or disapprove admission to the Ph.D. program. Students must be in good academic standing (GPA of 3.0 or better for non-research courses) to re-enter the Ph.D. program.

SAMPLE COURSE SCHEDULE
(Note this may vary by student)
BIOCHEMISTRY AND MOLECULAR BIOLOGY
PH.D. PROGRAM

1st Year

Credit Hours

UNDIFFERENTIATED FIRST YEAR CURRICULUM:

Semester 1:	Cellular Structure and Function	4
	Fundamentals of Integrated Systems	4
	Statistics for the Biomedical Sciences	1
	Discussions on Scientific Integrity	1
	Laboratory Rotation (1 st)	<u>1</u>
		11
Semester 2:	Molecular Genetics	3
	Modules: (student chooses 2 from this list	
	Cancer Cell Biology	2
	Cardiovascular and Respiratory Biology	3
	Topics in Biochemistry*	3
	Immunology and Microbial Pathogenesis	3
	Muscle Structure and Function	2
	Neurobiology	2
	Laboratory Rotations (2 nd and 3 rd)	<u>2</u>
		10-12

*This course is required of students in the program but may be taken in the second year.

Summer:	Scientific Writing	2
	Research	4

2nd Year

Semester 1:	Intermediary Metabolism	3
	Biochemistry and Molecular Biology Journal Club	1
	Research	<u>8</u>
		12
Semester 2:	Advanced Course	4
	Protein Structure and Function	3
	Biochemistry and Molecular Biology Journal Club	1
	Research	<u>4</u>
		12

Written exam – submit topic the first week of May. Receive questions by the third week of May. Submit answers 2 weeks later.

Summer:	Research	6
	Write proposal defense-due the first day of classes in August.	

3rd-5th Year

Semester 1:	Teaching Experience*	1
	Biochemistry and Molecular Biology Journal Club	1
	Research	<u>10</u>
		12
Semester 2	Biochemistry and Molecular Biology Journal Club	1
	Research	<u>11</u>
		12

By March of the 3rd year the student must have completed the proposal defense.

Summer:	Research	6
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*This will only be one time.

To retain full time student status and to qualify for the graduate tuition waiver a student must register for a minimum of 9 credit hours each regular semester and 6 credit hours during the summer session.

Signature Page

I have read and understand the Handbook of the Graduate Program in Biochemistry and Molecular Biology for the Ph.D. and M.S. degree programs. I agree to abide by the requirements outlined in this document as well as the University requirements governing these degrees.

Signature: _____

Name
(printed): _____

Date: _____

I pledge to adhere to the Student Code of Academic and Professional Integrity for the Ph.D. and M.S. degree programs (section B.3) and to maintain the highest standard of scientific integrity in all that I do.

Signature: _____

Name
(printed): _____

Date: _____