

CELL & DEVELOPMENTAL BIOLOGY GRADUATE PROGRAM GUIDELINES FOR STUDENTS AND FACULTY

(revised 9/3/08)

The guidelines outlined below are intended to supplement the regulations of the Graduate School. Students and faculty are encouraged to be familiar with the contents of the Graduate School Bulletin and Regulations.

I. General Information

A. Philosophy

The Cell and Developmental Biology Graduate Program is designed to prepare students for careers as innovative research scientists. Graduates of the Program typically pursue a range of research and teaching careers in academia, biotechnology, or government. First-rate research training, at technical and conceptual levels, is the main focus of the Program. Students should select a mentor for their dissertation research by the end of the first year of the IGP (Interdisciplinary Graduate Program in Biomedical Sciences), and expect to spend an additional four years carrying out original research, under direction of the mentor, leading to completion and defense of a Ph.D. dissertation.

B. Administrative Structure

1. Steering Committee for Graduate Education. The Steering Committee for Graduate Education is comprised of the Department Chair, the Director of Graduate Studies, the IGP Representative, and three Cell and Developmental Biology faculty members appointed by the Chair of the Department. Both the Director of Graduate Studies and the IGP Representative are appointed by the Department Chair. The Steering Committee is responsible for all policy decisions regarding the Graduate Program.

2. The Director of Graduate Studies monitors student progress, ensures that there is representation from Cell and Developmental Biology in IGP affairs, and signs or countersigns all official documents submitted to the Graduate School. The Director of Graduate Studies is available to provide counsel to students and faculty should difficulties arise with respect to the student-mentor relationship.

3. The IGP Representative sits on the Selection Committee for incoming graduate students and the committee for Graduate Education at the Medical School. The IGP Representative also acts as a liaison between the graduate programs of the IGP and the Department, and facilitates the transition of students from the IGP into the Department.

C. Teaching

There is no formal teaching requirement for the Ph.D. degree. Students interested in gaining formal teaching experience should consult the Director of Graduate Studies about the availability of teaching assistantships. Openings in other departments are sometimes available.

D. Master's Degree

A Masters degree in Cell and Developmental Biology is awarded only under special circumstances and with the approval of the Director of Graduate Studies. The student must have spent at least one year in residence at the university, and have satisfactorily completed at least 24 semester hours of course work. A satisfactory pass of the qualifying exam is also a pre-requisite.

II. Requirements for the Ph.D. Degree

A. Course Requirements

1. The total number of graduate credits must conform to the specification of the Graduate School (i.e. 24 didactic hours and 72 total hours). A minimum GPA of a 3.0, or a B average, must be maintained in all formal course work. In addition, a grade of C in one of the major courses required by the Department may lead to dismissal based on the consideration of this and other criteria by the Graduate Faculty of the Department.

2. The Department requires students [except Medical Scientist Training Program (MSTP) students] to complete the Core Curriculum governed by the IGP. In accordance with the IGP, each student rotates through laboratories of their choosing during the first year of graduate study. Students participate in experiments in these laboratories. Grades, and a written evaluation of the student's performance, are provided by the faculty member involved. As many as 16 hours didactic credit may be earned from the IGP curriculum excluding elective courses. Students entering the CDB Program from elsewhere are generally expected to complete the IGP Core Curriculum. However, in exceptional circumstances, a student transferring into the Department may petition the Director of Graduate Studies to waive this requirement.

3. For students entering the Cell and Developmental Biology department from the MSTP program, The Graduate School permits a transfer of up to 48 credit hours for the first two years of medical school, toward a total of the 72 total required hours for a Ph.D. degree. The Cell and Developmental Biology department recognizes Molecular Foundations of Medicine (CBIO 381) for one didactic credit, and Structure, Function and Development (CBIO 382) for ten didactic credits. Thus, incoming MSTP students begin their G1 year with the equivalent of 11 didactic credits toward the requirement of 24 didactic hours. MSTP seminars are recognized as providing 2 hours of didactic credit during the student's G1 year.

4. All Cell Biology students must take Advanced Topics in Cell Biology (Cell Biology 310, 4 didactic credit hours). Participation in two departmental seminar series, Research Colloquium (Cell Biology 330) and Research Seminar (Cell Biology 339), are also required.

5. The advanced course work taken by each student is variable and will depend on the student's special interests, field of specialization, and training grant support. Such courses should be selected with the assistance of the student's mentor, and/or the Director of Graduate Studies.

6. Research Ethics. Every student must take a course in research ethics (0 credit hours). Generally, this course is taken during the IGP year. MSTP students take a course in research ethics as part of their first-year program or they arrange to take this course after they join the department.

B. Admission to Ph.D. Candidacy

Admission to Ph.D. candidacy consists of one exam, the Qualifying Exam. The Qualifying Exam consists of a written grant proposal in the NIH-NRSA postdoctoral format and an oral examination by an Examining Committee of faculty. The goals of the Qualifying Exam are: 1) to assess the student's ability to formulate a series of hypotheses and specific aims to test these hypotheses that will likely constitute the basis for a Ph.D. dissertation, 2) to immerse the student in the scientific literature relevant to the Ph.D. dissertation; 3) to assess the student's general knowledge base and aptitude for a research career, to provide training in the grant writing process; and 5) to form a thesis committee to foster and monitor the student's continued development.

1. Preparing for the Qualifying Exam

a. Topic Selection. The Qualifying Exam is taken soon after the Spring semester of the student's second year at Vanderbilt (first year in the Cell and Developmental Biology Department). The topic for the Qualifying Exam is the anticipated research topic for the Ph.D. dissertation, and should be chosen by the student with guidance from their mentor. It is important to note that the research proposal is not a contract for either the student or mentor. In recognition of the fact that scientific research can be a creative and fluid process, research objectives may be altered after the qualifying examination in consultation with the student's Ph.D. thesis committee.

b. Grant Writing Workshop. Students will attend a workshop geared to helping them successfully complete the Qualifying Exam. The workshop will cover specifics on how to prepare a grant proposal in the NIH-NRSA format. There will be in depth discussions on good grant writing practices and common pitfalls. Copies of outstanding Qualifying Exam proposals will be distributed. The workshop will be led by senior faculty, chosen for their expertise in grant writing and knowledge of the grant review process.

c. Submission of Qualifying Exam Specific Aims Page. The student should write a Specific Aims Page of his/her Qualifying Exam research proposal (1 page limit). 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 precise deadline for submission of Qualifying Exam Specific Aims Page varies each year but is in mid-April. Five copies of the Specific Aims Page should be submitted to the Director of Graduate Studies for distribution to the Steering Committee for Graduate Education. Failure to meet this deadline can result in dismissal from the Graduate Program. In rare instances, where extenuating circumstances necessitate delaying the process for an individual student, the Director of Graduate Studies will approve a later deadline for submission of the specific aims.

d. Guidance for Qualifying Exam Specific Aims. The specific aims should be written by the student. The student is encouraged to discuss the research topic and experimental details with the mentor. The mentor may read and critique the Qualifying Exam Specific Aims Page or the final document. The student is free to consult faculty, staff, students, or other individuals to obtain feedback concerning the specific aims or final document.

e. Qualifying Examination Committees. The Steering Committee for Graduate Education will meet to make assignments for the Examining Committees. Each Examining Committee will usually consist of four members of the University Graduate Faculty and one of these should not be a member of the Cell and Developmental Biology Faculty. A tenured Cell and Developmental Biology faculty member, chosen by the Steering Committee for Graduate Education, will serve as Chair. The student's mentor may not serve on the Examining Committee but may attend the qualifying exam meeting. The student and mentor should suggest potential committee members by completing the Qualifying Exam Committee Selection Form, which is submitted to the Director of Graduate Studies at the time of submission of the specific aims. Students can meet with the Director of Graduate Studies to discuss the selection of the Qualifying Exam Committee prior to submitting the Specific Aims and the Qualifying Exam Committee Selection Form. The Steering Committee for Graduate Education will consider issues of exam consistency, educational oversight, and topic, in conjunction with the comments of the student and mentor, as indicated on the Qualifying Exam Selection Form, when making committee assignments. The Graduate Program Manager (Elaine Caine) will inform the student and mentor of the committee selection. The student will then provide the specific aims page to the committee and schedule the pre-examination meeting and examination. The student will inform The Graduate Program Manager of the dates and times immediately and The Graduate Program Manager will be responsible for scheduling rooms for these events and sending out reminders.

2. Pre-examination Meeting

a. The goal of the pre-exam meeting is simply to determine whether the student's anticipated research proposal (based on a one-page abstract) will be "defendable" in a qualifying exam. The committee confers in the student's absence at the start of the meeting, which lasts one hour maximum. The student gives a ~15 minute presentation (brief background and outline of proposal) interspersed with discussion of the logic, feasibility, and scientific merit of the proposal. The committee ideally gains a clear understanding of the student's plan for the proposal, and the student ideally gains a clear understanding of the committee's expectations with regard to the qualifying exam (both written and oral components). The committee confers in the student's absence after the presentation/discussion, at which time the chair polls each member as to the suitability of the proposed research plan. Possible outcomes are as follows: approval, approval with revisions, extensive revision of abstract necessitating second pre-exam meeting.

b. Upon approval of the specific aims by the Examining Committee, the student, mentor, and Committee members should set a date for completion of the research proposal. The Graduate Program Manager will be informed as soon as possible and will reserve a room for a three-hour block of time for the Qualifying Oral Examination. The examination should take place about five weeks after acceptance of the Specific Aims Page by the Committee. The student should provide the Committee members with the finished research proposal document and completed self-evaluation form at least one week prior to the Oral Examination. The mentor should provide the Committee with a completed student evaluation form at least one day prior to the Oral Examination.

3. Written component of the qualifying examination

a. NIH/NRSA grant booklets can be obtained online at <http://grants.nih.gov/grants/funding/416/phs416.htm>. The student is required to complete the Research Plan and the Specific Aims page. While the student is not required to fill out the portions of the grant dealing with vertebrate animals, he/she must adhere to the NIH guidelines for the humane and ethical treatment of animals for any studies proposed. Studies involving human subjects must adhere to institutional guidelines.

b. The student should assume that the research proposal will cover three to four years of work. The proposal should be realistically accomplished with the available resources.

c. The student is encouraged to refer to successful grant proposals as a guide.

d. The student is responsible for all scientific aspects of the proposal: background information; approach; experimental design; and methodology for all experiments. The student may consult anyone concerning methodologies, format, references, etc.

e. Students are encouraged to have their mentors and other students or postdocs critique the proposal for general overall readability. Readers may make suggestions to improve the format of the grant, the amount of detail in the methods, or the rationale for specific experiments.

4. The qualifying examination

The qualifying exam comprises two parts: written proposal and oral exam. The qualifying exam meeting should last approximately two hours, including the oral exam and closed discussions. The committee confers in the student's absence at the start of the meeting, at which time the committee discusses whether the written proposal is satisfactory. Criteria for assessing the document include (but are not limited to) the following: hypothesis-based, scientifically sound, logical, sufficient background/review of field, sufficiently independent aims, explanation of expected outcomes, consideration of alternative approaches, well-organized, clearly written, proper grammar/spelling. The chair polls each member to reach a consensus as to whether the written proposal is acceptable or needs revision.

The oral exam consists of a ~20-30 minute presentation (brief background and specific aims) given by the student interspersed with questioning, which typically follows the flow of the written proposal. Roughly two-thirds of the overall exam time should correspond to a presentation and defense of the written proposal. Questions from the committee ideally probe the student's ability to pose a scientific question, state a hypothesis, develop reasonable strategies and alternatives to test the hypothesis, anticipate possible outcomes, and interpret these possible outcomes. Roughly one-third of the overall exam time (spread throughout the exam) should be used to probe the student's knowledge of cell and developmental biology principles in general as well as knowledge of his/her field of specialization. Committee members would ideally prepare in advance for the meeting by reading the entire proposal and identifying several lines of questioning (on both the proposal itself and general background) to pursue during the oral exam. All committee members should actively participate in questioning the student. The student's mentor is expected to remain silent during the oral exam unless specifically addressed by the committee or granted permission by the committee to speak briefly.

Although a wide variety of questions may be deemed appropriate during the oral exam, the committee's focus should be to ascertain whether the student has established a critical knowledge base essential for understanding his/her research project and achieving success as he/she progresses through graduate school. It is the chair's responsibility to keep everyone "on track" (in terms of time, lines of questioning, and overall direction) during the oral exam. Upon conclusion of the oral exam, the committee confers in the student's absence to evaluate the student's performance. The chair polls each member to reach a consensus and three forms will be completed, two for the department and one for the graduate school. It should be noted that both the department and the graduate school allow a student to repeat the examination should the student fail the first examination.

Both the student's written proposal and performance during the oral exam must be deemed satisfactory by all committee members. Disapproval of the proposal and/or inadequate performance by the student in the oral exam (either in defense of the

proposal or in general knowledge) will necessitate a redrafting of the proposal (within 90 days), a second oral exam (within 90 days), and/or additional remediation. In such cases, it is the chair's responsibility to delineate (with input from the committee) what remedial steps are most appropriate for a particular student. Examples of remediation used successfully in the past include the following: provide student with a specific reading list to augment background knowledge relevant to his/her project followed by a second oral exam to test understanding of the assigned material; student meets with an assigned faculty member for "tutorials" to remedy specific gaps in knowledge (e.g. mouse genetics) or to improve breadth of understanding of fundamental cell and developmental biology topics (e.g. discuss chapters from Alberts textbook). The chair of the committee will inform the student of the results and go over in detail the committee's evaluation at the end of the meeting.

After the qualifying exam, the chair will prepare a brief report summarizing the student's performance and outcome of the exam. The chair will ask for input from all committee members and then provide the report to the Graduate Program Manager within one week of the exam who will forward to committee members and student. Both the advisor and the student should submit a student evaluation form directly to all committee members in advance of the oral exam (student-submit with proposal; advisor-at least one day prior to exam). Committee members will use this self-evaluation form to aid discussion about the student's progress, and a final version will be included in the summary report. The report will also indicate the time frame (e.g. 3, 6, 9, or 12 months) for scheduling the student's first regular committee meeting based on the committee's recommendation.

C. Admission to Ph.D. Candidacy

1. Dissertation Committee

The Qualifying Examining Committee comprises the nucleus of the Dissertation Committee. In addition, the mentor is also a member of the Dissertation Committee. While the mentor plays a critically important role, the mentor will not serve as the Chair of the Dissertation Committee to avoid potential conflicts of interest. The Chair of the Qualifying Examining Committee will serve as Chair of the Dissertation Committee. If for some reason, the Chair is unable to fulfill this obligation, the Steering Committee for Graduate Education will appoint a tenured member of the Cell and Developmental Biology faculty as Chair. While the Dissertation Committee must be formed by at least 5 members of the University Graduate Faculty including the mentor, a sixth member may be added at any time if the Dissertation Committee decides that it would be beneficial. This is particularly important in circumstances in which the dissertation broadens in scope and would benefit from the participation of faculty members who can contribute a new dimension of expertise. Any proposed changes in the composition of the Dissertation Committee must be approved by the Director of Graduate Studies or the Steering Committee for Graduate Education.

2. Annual Meetings

The student is required to meet with their Dissertation Committee at least once a year but specific recommendations are made by the Dissertation Committee. The Graduate Program Manager will be responsible for reminding students of their upcoming obligation but the student is responsible for scheduling the annual meetings and informing the Graduate Education manager of dates and times. The Graduate Program Manager will inform the Director of Graduate Studies if a student is not organizing their meetings in a timely manner. At all stages of the student's graduate training, continuation in the program is dependent on satisfactory progress in research-oriented activities and successful completion of annual Dissertation Committee meetings. Prior to the annual meeting, the student should prepare a brief report (3-5 pages) and distribute it to the Committee members at least 1 week prior to the meeting date. At this same time, the students will provide their committees with a completed self-evaluation form. At the annual meeting, the student will present a 15-20 minute talk to update the Committee on progress towards completion of the dissertation research.

In addition, the Dissertation Committee Chair will submit a meeting report using the report form provided by the Graduate Program Manager. These brief reports should include a summary of the work presented and a statement as to whether satisfactory progress is being made in the various aspects of scientific training, including knowledge in the field of research, and an ability to present data both in an oral and written form, attention to the literature, critical and independent thinking skills, evaluation of results, and design and implementation of experiments. Attention should be given to delineating any perceived problems or deficiencies. Clear recommendations and goals relating to the above outlined areas should be communicated in the report. The report and form should be given to the Graduate Program Manager who will forward to the student and Director of Graduate Studies. Cases in which performance at two consecutive meetings of the Dissertation Committee are judged by a majority of committee members to be unsatisfactory are reviewed by the Steering Committee for Graduate Education of the department. Unsatisfactory performance at two consecutive meetings will be grounds for dismissal from the graduate program.

D. Dissertation Completion and Final Defense

1. The dissertation should be written by the student in close consultation with the mentor. A reasonable time should be allotted by the mentor and student for dissertation writing and career development. The mentor must read and approve the dissertation before it is distributed to other Dissertation Committee members. The Dissertation should describe the results and analysis of independent research. The student's results should constitute a significant advance in understanding as evidenced by a first-author peer reviewed publication. The dissertation must conform to the Guidelines set by the Graduate School and must be submitted to the Dissertation Committee at least one week before the final defense. The student should consult the "Regulations" bulletin issued by the Graduate School for detailed information on the dissertation requirements. The student may wish to consult previous examples of successful Ph.D. dissertations available in the department conference room.

2. The final defense is administered by the Dissertation Committee. The student will schedule the defense with the Committee members and inform the Graduate Education Manager. The Graduate Education Manager will reserve a room and inform the

Graduate School and the BRET office of the date, time, and place of the defense and the title of the dissertation. Graduate School regulations require that this be done at least four weeks prior to the defense. Committee members will receive a notice from the Graduate School of the final defense. The date and time of this examination will be published in the Vanderbilt Calendar as a public announcement. The final approved thesis including signed versions of the title page, must be submitted to the Graduate School by the student at least 30 days before the end of the term in which the degree is to be conferred.

3. The Graduate Program Manager will inform the Department of Cell and Developmental Biology at least one week prior to the defense. Flyers will be sent to Medical School departments, as well.

4. The defense begins with a public seminar. Following the seminar the committee meets with the student for the Final Oral Examination part of the defense. The Final Examination is concerned with the student's dissertation, the literature relevant to the research topic, methods employed in the investigation, conclusions, and the significance of the study. Passing the written dissertation is signified by signing the required page in the dissertation, and can occur at a later date if additions or corrections are required.

5. The policy regarding distribution of fees and costs associated with preparing the dissertation is as follows:

a. The mentor's primary department will be responsible for payment of fees required by the Graduate School for microfilming the dissertation for the Graduate School. Microfilming of the dissertation is mandatory. The mentor's primary department will also be responsible for payment of fees for optional copyrighting of the thesis.

b. The mentor will pay for photocopying the dissertation drafts for him/herself and committee members. The mentor also will pay for photocopying and binding of final copies of the dissertation. Three required copies are for the mentor, the student, and the Cell and Developmental Biology library. An additional bound copy for the Graduate School will also be paid for by the mentor **IF** the student does not submit their thesis to the Graduate School electronically. Copies for the Graduate School, the mentor, the student, and the Department of Cell and Developmental Biology library should have original figures and be on bond paper. Final copies for committee members are optional and their wish to have one should be determined by the student. These copies can be soft-bound on copy paper. Any costs for additional copies of thesis, bound or otherwise, will be the responsibility of the student. Students are responsible for timely delivery of final bound copies to the mentor, the Graduate School (if not submitting electronically), and the Graduate Program Manager for the Cell and Developmental Biology library.