



STUDENT GUIDE TO GRADUATE TRAINING

IN

POPULATION BIOLOGY, ECOLOGY, AND EVOLUTION

AT EMORY UNIVERSITY

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I. Purpose and Goals of the Graduate Program

The study of the ecological and evolutionary mechanisms that give rise to the spatial and temporal dynamics of populations and species is one of the most exciting and rapidly advancing areas of modern science. The fields of Population Biology, Ecology and Evolution integrate biological mechanism across many levels of organization, from the molecular forces leading to the evolution of genome organization to large interconnected networks of species in complex ecological systems. Consequently, scientists in this challenging area must cross the normal boundary lines dividing traditional disciplines and employ complex, multidisciplinary approaches to begin to understand the evolution, organization and dynamics of natural populations.

These broad areas of research are uniquely contained within the Emory University graduate program in Population Biology, Ecology, and Evolution (PBEE), which is part of the Graduate Division of Biological and Biomedical Sciences (GDBBS). A detailed description of all aspects of the PBEE program can be found on the program's website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/). The central goal of the PBEE graduate program are to provide the multidisciplinary training required for a successful research and teaching career.

The range of research areas in the fields of Population Biology, Ecology and Evolution is by its nature very broad. The faculty members that participate in the PBEE program are equally diverse. PBEE faculty members are drawn from the Emory College Departments of Anthropology, Biology, Chemistry, and Environmental Studies, the Emory University School of Medicine, the Rollins School of Public Health, the Yerkes National Primate Research Center, the Emory National Vaccine Center, the Carter Center and the U.S. Centers for Disease Control & Prevention (CDC). A complete listing of PBEE faculty members can be found in Appendix A1 of this document or on the web at http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/faculty.htm.

PBEE researchers work with a variety of experimental systems, ranging from bacteria to humans. The central feature uniting these research programs is the application and testing of quantitative methods and models during the course of research. This is a unique feature of the PBEE program that is not found in other GDBBS graduate programs. As a consequence, PBEE faculty members have substantial expertise in a number of quantitative/statistical areas that are routinely used and developed for their research programs. This fundamental characteristic of the PBEE faculty is reflected in the types of graduate students recruited and the content of the PBEE training program.



II. Philosophy of Graduate Training

The PBEE graduate program provides a multidisciplinary, research-focused training program that differs considerably from that offered by undergraduate or professional schools. Our program has a number of overarching goals. First, we require that students become proficient at reading and critically evaluating the primary scientific literature. This includes both older, seminal papers and more current, cutting-edge manuscripts. Given the vast PBEE literature, both in terms of subject areas and historical depth, this can prove a real challenge. We want to train students to develop their facility with these critical thinking tools to devise multiple alternative hypotheses that can then be tested in their own research. The ultimate goal is to enable each student to “think like a scientist” and remain focused on the significant questions that their research aims to explore. We strongly believe that this type of training is essential for our graduate students to pursue successful research and teaching career.

Our formal training program contains three main areas of emphasis that mutually reinforce one another and are vital to the development of graduate students. The first area consists of an academically challenging set of graduate-level core courses that require students to learn the history of the field in addition to currently accepted scientific facts and theories. The formal course work is intended to provide basic knowledge as well as guidance for self-education by the student scholar. Such self-education is a full-time job and must be an active rather than a passive process. The aim of the second area is to aid students in the development of oral and written communication skills and the critical evaluation of the scientific literature. This is accomplished in a variety of ways including mandatory attendance at a weekly PBEE seminar, student presentations of their own research work to the PBEE faculty and students, and participation in small group Advanced Topics classes led by PBEE faculty members. Finally, the third emphasis is on teaching graduate students how to plan, conduct, and critically evaluate primary research with an eye toward preparing to make original contributions to scientific knowledge. First-year students perform laboratory rotations with at least three different faculty members in order to gauge different perspectives and approaches to the performance of scientific research. Ultimately, most of the individualized instruction required for this aim occurs as a result of interactions between students and their advisors, in an atmosphere of cooperative research and discovery. The ultimate goal of this three-pronged multidisciplinary training program is to develop superb research scientists with the skills to become self-sufficient in continuing education beyond graduate school. The program also prepares the student to teach Population Biology, Ecology, and Evolution and other related disciplines in professional and graduate schools.



III. Admission

A. Criteria. Each applicant is judged on the merits of his or her overall record. A minor deficiency in any one area will not necessarily exclude the applicant from admission, especially if compensated for by exceptional strength in other areas.

1. *Graduate Record Examination:* All applicants are required to take the Graduate Record Examination (GRE). A minimum combined score of 1800 for the verbal, quantitative and analytical parts is generally required. Advanced sections are not required. Applicants whose native language is not English can be accepted with a total GRE score of less than 1800 if the score on the quantitative part is at the 80th percentile or higher. All such applicants must also take the Test of English as a Foreign Language (TOEFL).

2. *Undergraduate Curriculum:* Preference will be given to applicants who have taken courses in general and organic chemistry, general physics, calculus and general biology. Genetics is also strongly recommended. Applicants should have an overall undergraduate grade point average (GPA) of "B" or better (i.e., at least 3.0 on a scale of A = 4.0). Applicants who have taken graduate-level courses should have at least a "B" average in these.

3. *Recommendations:* Three evaluations are required from individuals who are familiar with the applicant and his/her capabilities. Considerable weight is given to recommendations by faculty members or other individuals who have first-hand knowledge of the academic and research potential of the applicant.

4. *Statement of Goals:* Applicants should provide a clear, concise statement of their reasons for wanting to enter a graduate training program in population biology, and indicate how such training fits into their long range career goals.

5. *Evaluation:* Completed applications are evaluated by a committee comprised of faculty and students in the Program in Population Biology, Ecology, and Evolution. Interviews with the applicant during special recruiting weekends are usually a part of the application process. Usually, no more than ten students can be admitted to the program each year, typically in the Fall Semester.

B. On Arrival. Incoming students will be sent information several weeks prior to registration from the graduate division office. An incoming student needing a place to stay for a short time while looking for suitable housing is encouraged to contact the Director of Graduate Studies of the Program who will attempt to find temporary accommodation. Upon arrival in Atlanta, the new graduate student should contact the program administrator to ascertain the scheduling of courses and orientation. Students will need to obtain an Emory ID card and check in at the graduate division office. Newly arrived students must also make arrangements for and meet with faculty supervising their fall semester rotation projects. There will be a reception at the beginning of the term for the new students and the other students and faculty of the program to get acquainted and cover various aspects of the program. This is conducted over a lunch during the regular seminar time on the first Friday of the semester.



C. International Students and Language Requirements. The policy of the Graduate School of Arts and Sciences is that all new international students must participate in English language assessments prior to registration and enrollment. Evaluations may occur over the telephone or by direct assessment by a team of linguistics experts. If deemed necessary, students must complete the English as a Second Language Program that includes three required courses. You may direct questions about evaluation and the program to Ms. Grace Canseco, ESL Director, Graduate School of Arts and Sciences, (404) 727-2183.

IV. Director and Executive Committee

The graduate program is coordinated by a member of the program faculty who serves as Program Director (PD). In conjunction with the Director of Graduate Studies (DGS) and the Executive Committee, the director is also responsible for coordinating faculty in monitoring the performance of students, scheduling and organizing the qualifying examination, overseeing selection of research advisors and dissertation committees, and is the representative of the program to the Graduate School Executive Committee which oversees policy and curricular matters. The Program Director and Executive Committee are responsible for providing information on the graduate program to prospective applicants, overseeing admissions, and working with each student to develop an appropriate program of study in the early stages of training before the selection of a research advisor.

The Program Director serves a three year term with the possibility of renewal for an additional three years, beginning on June 1 and ending May 31. Nominations for the position of Program Director are solicited from faculty in the program and final selection is made by the Executive Committee. The Director of Graduate Studies also serves a three year term with the possibility of renewal for an additional three years, beginning on June 1 and ending May 31. The PD and DGS may both change in a given year, although it is preferable to have these positions roll over in different years.

The Executive committee has twelve members, 10 faculty and 2 graduate students. The PD and DGS are both automatically members of the twelve member Executive Committee. The other eight faculty members are selected by the PBEE faculty. The Executive Committee terms will be for three years beginning on June 1 and ending on May 31. Terms of Executive Committee members may be renewed. Typically no more than two new members are elected each year. Two PBEE graduate students are elected by their peers to serve on the executive committee. Their terms will be two years in length and also begin on June 1 and end on May 31. See Appendix A2 for the listing of the PD, DGS and executive committee members.

V. Advising

The timeline and major milestones for a PBEE graduate student can be found in Appendix A3. Upon entering the program in Population Biology, Ecology, and Evolution, the DGS will serve as a temporary advisor until each student has chosen a thesis



advisor. A tentative thesis advisor should be chosen and approved by the Director of Graduate Studies following the completion of the student's first academic year (prior to the summer of their first year) as detailed below. A final thesis advisor is selected after the successful completion of the qualifying examination.

VI. Laboratory Research Rotations

During the first year in the program each student will have the opportunity to perform experimental work in faculty laboratories. These laboratory "rotations" provide students with an early opportunity for research experience. The rotations are designed to expose the student to different research approaches. These laboratory experiences will help familiarize the student with some of the many techniques used to examine research problems in population biology. As such, the rotations can help define each student's own research interests. This is an important antecedent to determining an area for a thesis project and the selection of a research advisor, although the choice of advisor is certainly not limited only to those faculty members with whom the student rotated. The laboratory research rotations also provide the faculty with an opportunity to observe and evaluate the performance of first-year students in a research setting. Laboratory rotations can be performed with any faculty member in the Division, irrespective of the program affiliation of that faculty member, with the approval of the Director of Graduate Studies.

Students are required to complete a total of three laboratory rotations. In rare instances, students entering the program with significant prior research experience may do fewer rotations at the discretion of the Program Director and Director of Graduate Studies. During the semester in which the students satisfy a rotation requirement they should register for IBS 597R (Laboratory Rotations) for a pass/fail grade. MD/PhD students normally complete their rotations during the summer around their required health science classes in the Medical School. In rare instances, students may do their first rotation in the summer prior to their first semester of classes.

The three rotations will be completed during the Fall and Spring academic semesters during the student's first year in graduate school. The three rotations are completed according to the following schedule:

First Rotation: Start of Classes (usually end of August) - 31 October

Second Rotation: 1 November - 31 January

Third Rotation: 1 Feb - 30 April

The schedule of rotations for each student will be arranged by the student in consultation with the Director of Graduate Studies and the faculty who oversee the labs. In arranging these rotations, every attempt will be made to accommodate the wishes of students who are already interested in the research programs of particular faculty members. Faculty information on the PBEE website will allow incoming first year students to contact faculty members in whose laboratory they may want to rotate. Students should choose three or four faculty members from these descriptions, contact



them by email in advance to their arrival at Emory, and arrange to meet with these faculty members during the beginning of the Fall semester. Based on these meetings, each student can make an informed decision as to the most appropriate lab for the first rotation. Students can contact the Director of Graduate Studies for assistance in scheduling these interviews prior to arrival at Emory.

After selecting a rotation advisor, each student must send a rotation proposal to the Director of Graduate Studies stating the name of the faculty member with whom the rotation will be completed. This proposal is a brief (1 page) description of the planned research and should be signed and dated by both the student and the rotation advisor. Students who wish to perform a rotation in the laboratory of someone who is not a member of the Program in Population Biology, Ecology, and Evolution must receive prior approval by the Director of Graduate Studies. The first rotation should begin no later than the second full week of the Fall semester.

At the end of each rotation students are required to submit a report of progress made during the rotation to the Director of Graduate Studies. The rotation summary should be signed and dated by both the student and the rotation advisor. Although in many cases little experimental progress will be made by the student in such a short period of time, the final summary can be useful for discussing analytical or methodological problems that were encountered during the rotation. The written summary should be succinctly written and no more than one page in length. At the conclusion of each rotation the student will be assigned a grade (Satisfactory or Unsatisfactory) by the rotation advisor. The grade assigned for the rotation should be indicated at the end of the rotation report. The rotation report and grade should be submitted to the Director of Graduate Studies on or before the last day of classes for the semester (before the beginning of the exam week). Students who have not submitted a rotation report by the due date will receive an incomplete for the rotation. According to Graduate School guidelines, any student who receives an incomplete for two or more courses will be automatically placed on probation within the graduate program. If the rotation report is not received within 2 weeks of the end of the semester, the incomplete will be changed to an U.



VII. Courses and Related Program Requirements

A. Overview of Course Registration. During any given semester each PBEE student must register for at least 12 credit hours to maintain status as a full-time student. During the first two years in graduate school, this is accomplished by registering for a combination of formal courses, seminars and research credits for time spent in the laboratory. From the third year onwards after a student advances to candidacy, this is usually accomplished largely by registering for research, seminar, and limited formal course credits. The following sections describes this process in greater detail.

B. Required Courses. The overall course requirements to obtain a Ph.D. are published on page 32 of the Graduate School of Arts and Sciences Handbook. The following core courses are required for all PBEE students:

IBS 592 Evolutionary Biology (Spring Semester, every other year)

Course Director: Yun Tao

Teaching Faculty: Todd Schlenke
Chris Beck

IBS 593 Molecular Evolution (Fall Semester, every other year)

Course Director: Michael Zwick

Teaching Faculty: David Cutler

IBS 594 Quantitative Methods in PBEE (Spring Semester, every other year)

Course Director: Lance Waller

Teaching Faculty: Bruce Levin
Leslie Real
Michael Epstein

IBS 595 Ecology (Fall Semester, every other year)

Course Director: Leslie Real

Teaching Faculty: Nicole Gerardo
Jaap De Roode
Chris Beck

IBS 796R Advanced Topics in PBEE (2 semesters). Students must enroll in two Advanced Topics classes during their tenure in PBEE. These are typically 3 credit classes.

Statistics Requirement. The program in PBEE requires a minimum of one year of statistics. The courses to fulfill this requirement include:

BIOS 506 Biostatistical Methods I - Fall - 4 credit hours



BIOS 507 Applied Linear Models - Spring - 4 credit hours

These course will typically be taken during the first year. With prior approval from the Director of Graduate Studies other advanced courses in Biostatistics may substitute for BIOS 506/507 in fulfilling this requirement.

PBEE Graduate Seminar. All PBEE graduate students must enroll in the **PBEE Introductory Graduate Seminar** (PBEE 570R) before they pass their oral and written qualifying examinations. After passing these exams and advancing to candidacy, the students are required to enroll in the **PBEE Advanced Graduate Seminar** (PBEE 790R) in the third year and beyond. In addition to attending the PBEE seminars, students are required to provide the DGS a single written question concerning the content of the seminar.

Laboratory Rotations. Though the Program in Population Biology, Ecology, and Evolution requires three laboratory rotations carried out during the Fall and Spring semesters of the first year, students are advised that under Graduate School guidelines only 4 credit hours of rotation credits may be applied toward satisfying the degree requirements.

Credit Hours: Each student is required to sign up for at least 12 credits each semester. Students wishing to gain additional background in specific areas (for example: mathematics, statistics or probability) can take additional courses in addition to the PBEE required courses. If students wish to exceed 18 credit hours in a semester, they most obtain the permission of the DGS.

A typical schedule, showing the minimum required courses for the first two years of study would be the following:

First Year: Fall Semester

Course Number	Course Title	Credits	Faculty
BIOS 506	Biostatistical Methods I	4	Various
IBS 593	Molecular Evolution	4	Zwick, Cutler
IBS 796R	Advanced Topics in PBEE (as needed/offered)	2-3	Program Faculty
PBEE 597R	Laboratory Rotation	3	Program Faculty
PBEE 570R	Introductory Graduate Seminar	2	DGS



First Year: Spring Semester

Course Number	Course Title	Credits	Faculty
BIOS 506	Applied Linear Models	4	Various
IBS 606	Values in Science	1	Various
IBS 594	Evolutionary Biology	4	Tao, Schlenke, Beck
IBS 796R	Advanced Topics in PBEE (as needed/offered)	2-3	Program Faculty
PBEE 597R	Laboratory Rotation	3	Program Faculty
PBEE 570R	Introductory Graduate Seminar	2	DGS

First Year: Summer Semester

Course Number	Course Title	Credits	Faculty
GRAD 004S	Graduate Residence	12	DGS

During each summer term students should register for GRAD 004S (Graduate residence). The goal is to have students join a laboratory during their first summer in order to begin their research. In some cases, the students may perform an additional rotation at a remote field site over the summer. This should be coordinated with the relevant PBEE faculty member and the DGS.

Second Year: Fall Semester

Course Number	Course Title	Credits	Faculty
IBS 595	Ecology	4	Real, Gerardo, De Roode, Beck
IBS 796R	Advanced Topics in PBEE (as needed/offered)	2-3	Program Faculty
PBEE 570R	Introductory Graduate Seminar	2	DGS
Various	Course Electives	Var	Various
IBS 699R	PBEE Advanced Graduate Research	1-12	DGS

Second Year: Spring Semester

Course Number	Course Title	Credits	Faculty
IBS 592	Quantitative Methods in PBEE	4	Waller, Real, Epstein
IBS 796R	Advanced Topics in PBEE (as needed/offered)	2	Program Faculty
PBEE 570R	Introductory Graduate Seminar	2	DGS
IBS 699R	PBEE Advanced Graduate Research	1-12	DGS



Third Year and Beyond: Fall and Spring Semesters

Course Number	Course Title	Credits	Faculty
PBEE 790R	Advanced Graduate Seminar	1	
PBEE 799R	Dissertation Research	1-12	
IBS 796R	Advanced Topics in PBEE (as needed/offered)	2	Program Faculty
	Course Electives		

Note: After a student passes their qualifying examinations and advance to candidacy (which requires that all requirements be completed and is formally approved by the Dean of the Graduate School, they should register for PBEE 790R and PBEE 799R (replacing PBEE 570R and IBS 699R).

MD/Ph.D. students: MD/Ph.D. students have less time than a typical graduate student to complete course requirements and complete their doctoral dissertation. As a consequence, their required course selection may be modified or accelerated to ensure that they can rapidly complete their dissertation. Typically MD/Ph.D students will spend two years in medical school and join the PBEE upon completing their second year of medical school courses. At this point, the student should meet with the PBEE Director and DGS to plan their course schedule for the next year. The goal is for them to pass their written and oral qualifying examination at the end of the spring semester (their third year at Emory). Specific policies include:

M.D./Ph.D. students are required to take one year of Introductory Graduate Seminar (PBEE 570). This will normally be accomplished during their first year in medical school. Each succeeding semester they will take the Advanced Graduate Seminar (PBEE 790) until they complete their dissertation.

M.D./Ph.D students will be required to take the two core courses (IBS 593/IBS 594 or IBS 592/IBS 595) being taught during their third year at Emory. They will be required to demonstrate proficiency in the core courses not being taught that year. The DGS and course directors will work with them to provide them resources to learn the material that they will need to know for their written and oral qualifying examination.

Laboratory rotations will be performed over the summer and/or during their first full year in the PBEE program. These rotations may be abbreviated if needed.

M.D./Ph.D. students are required to successfully complete two advanced topics courses.

This suggested curriculum for a M.D./Ph.D. student will be coordinated and approved by the PBEE director of graduate studies.

C. Elective Courses. The students must also meet the minimum course credit requirements of the Graduate School by taking a personalized selection of the many elective courses available. A PBEE Elective list is provided as an Appendix A4. Three



elective courses are required. As new courses by the PBEE faculty are added to the curriculum, this list will be updated.

D. Rotation and Research Credits. During their first two semesters in graduate school when students are performing laboratory rotations, they should register for PBEE 597R (Laboratory Rotations) for 3 credit hours. After the first year in graduate school, students should not continue to register for PBEE 597R. After their first year in graduate school, but before they advance to candidacy (which usually occurs after the end of the second year), students should register for IBS 699R to account for their research work. This is for variable credit and the number of credit hours registered for should be the number needed to bring the total (with formal courses) to at least 12 credit hours each semester. After a student has advanced to candidacy, selected a permanent research advisor, they should register for PBEE 799R (Dissertation Research). This is for variable credit and the number of credit hours registered for should be the number needed to bring the total (with formal courses) to at least 12 credit hours each semester.

Students will begin each laboratory rotation with a written agreement between supervisor and student outlining the specific goals of the rotation. During the course of the rotation, the research advisor will ensure that these goals are met. Successful completion of the rotation requires that the student to provide a written summary of the completed research experiences.

D. Journal Club and Common Interest Groups. One of the most effective ways to learn methods and approaches to scientific inquiry is to read and critique the experimental work published by other investigators. Students are required to attend the PBEE Student-Faculty Forums (held during weekly seminar) and urged to participate in Program working groups (such as the Spatial Ecology Working Group or the Viral Evolution Working Group) so as to provide a mechanism for interacting with faculty and developing critical scientific skills.

E. Exemptions From Course Requirements. Students may be exempted from taking one or more of the required courses under appropriate circumstances. Such circumstances usually consist of having taken a prior course with similar content and received a grade of "B" or better, or demonstration of competence in a particular area (usually by special examination). The DGS, in consultation with the Program Director, will make the final decision about any course exemption.

VIII. Grades

The scale of grades in the Graduate School is A (4.0), B (3.0), C (2.0) and F (0); there is no D grade. Some courses, including the required sequence of PBEE seminars and the lab rotations, are taken on a Satisfactory/Unsatisfactory (S/U) basis. All students must maintain a minimum GPA of 3.0 in each semester of graduate work. If a student's semester GPA is below 3.0 in any semester, that student will be on academic probation with the expectation that he/she will maintain a semester GPA of 3.0 in all subsequent semesters. If a student's semester GPA is below 3.0 in any two semesters (contiguous or not), or if he/she receives one F or U grade in any course, that student



will be asked to withdraw from the program and the Division. If a student who is asked to withdraw believes that there were extenuating circumstances that adversely affected his/her performance, he/she may submit to the Director of Graduate Studies a written appeal for consideration of reinstatement. The appeal should clearly outline the extenuating circumstances and must be submitted within one month of grades being recorded by the Office of the Registrar. All appeals will be reviewed by the PBEE Executive Committee and the GDBBS Executive Committee. If both the PBEE and GDBBS Executive Committee's approve reinstatement, the student will be expected to maintain a GPA of 3.0 in every subsequent semester. If the student had received a C or F in a core PBEE course, the course must be repeated and a passing grade (3.0 or higher) obtained. At the discretion of the program, a failing grade in other required courses may also necessitate repeating the course. To advance to candidacy, the student must have a cumulative GPA of at least 3.0 after four semesters.

IX. Selection of Research Advisor

Students must select a tentative research advisor from among the faculty of the Division of Biological and Biomedical Sciences before the Fall semester of the second year. The tentative advisor will guide them to the completion of the preliminary exams and serve on the exam committee. Students must submit a PBEE Tentative Research Advisor Agreement Form, signed by the student and the tentative advisor, to the DGS by the end of the first summer stating their choice for the tentative research advisor. After successful completion of their qualifying exams, students will choose their dissertation research advisor (usually the tentative advisor), contingent on approval of both the student and advisor. The student and the dissertation research advisor will submit the GDBBS Mentor Assignment Agreement to the DGS. This letter formalizes all mentor assignments in the GDBBS and indicates that the advisor will be responsible for supporting the student financially. All choices of dissertation research advisors are subject to final approval by the Executive Committee and the advisor's Department Chair. Both forms can be found on the PBEE website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm).

Students interested in choosing as their research advisor a PBEE faculty member whose main appointment is with the CDC must also choose a PBEE Emory faculty member as a co-advisor. The Emory co-advisor should be a member of the student's dissertation committee. The student and the PBEE Emory co-advisor must provide the DGS a letter indicating that the PBEE Emory faculty member is willing to accept this responsibility. The Emory co-advisor's role is to ensure that the PBEE student's dissertation research meets standards identical to those for PBEE students with Emory research advisors. In addition, the Emory co-advisor should work with the student and DGS in case there are any unexpected problems that may impact the completion of the student's dissertation. The Emory co-advisor does not incur any financial obligation for the student by accepting this role, rather, the aim is to ensure the best possible academic experience for PBEE students working off-site at the CDC.

Although every effort is made to accommodate the student's indicated preferences,



in rare instances it may not be possible to assign a student to his or her first choice. A faculty member who already is serving as research advisor to more than one student may not be able to take on another due to lack of physical resources. It is also possible that a faculty member may not have adequate financial resources to support the research of a new student entering the laboratory. Should a student wish to have a research advisor that is not a member of the program in Population Biology, Ecology, and Evolution and remain in PBEE, this must be explicitly approved by the PBEE Executive Committee. If a student wants to select an advisor from another program and transfer to that program, such a transfer can occur if approved by both programs and the Division. Students entering in Advanced Standing, for example those with a Master's degree, may in consultation choose their advisors immediately, or after optional rotations as discussed above. Additionally, students who join the PBEE program as a member of a laboratory of a faculty member joining Emory University may be excused from laboratory rotations by the DGS.

Students who for valid reasons are unable to make a choice by the Fall semester of the second year should submit a letter to the Director of Graduate Studies requesting extension of the deadline for selecting an advisor and outlining reasons that such an extension is needed. If the request is approved, the student will be given until the Spring semester to select an advisor. In such cases, the student must submit the letter signed by the student and the research advisor before the beginning of the examination period of the Spring semester. Students who do not choose an appropriate research advisor, obtain a commitment of financial support from that advisor, and gain approval of the selection by the Executive Committee by the Spring semester of the second year will have their participation in the PBEE program terminated.

The matching of a student with a research advisor is not irrevocable. On rare occasions it may be in everyone's best interest to reassign the student to a different advisor. For example, research interests might change over time so that those of the student are no longer compatible with those of the research advisor. The student and advisor should discuss any problems with the director and/or members of the Executive Committee. If reassignment of the student seems advisable, the Executive Committee will be asked to review the request and, taking into account the wishes and concerns of all parties, will make the reassignment. Almost invariably the student will lose substantial time when changing laboratories and research projects, therefore reassignment of advisors should be viewed as a permissible, but an extreme and rare step.

X. Qualifying Examination

The Graduate School requires a student to demonstrate adequate intellectual mastery of his or her field of specialization and of appropriate supporting fields by passing a general doctoral qualifying examination before being admitted to candidacy for the Ph.D. degree. In PBEE, the qualifying examination consists of both written and oral exams that allow the program to assess if the student demonstrates adequate mastery of PBEE to be advanced to candidacy. Completion of the qualifying



examination process in PBEE requires four main steps. First, each student is required to form a qualifying exam committee composed of PBEE faculty members. Second, students are required to write a comprehensive review in an area related to PBEE. Third, students are required to write a research proposal outlining the main questions and line of research they intend to pursue for their dissertation research. Fourth, the students are required to pass an oral examination approximately two weeks after they have submitted their research proposal that will be based upon both their general knowledge of PBEE, their review, and their research proposal. The Emory University Honor Code will be observed throughout the examination process. Amplifying detail about each of these requirements is provide below.

A. Establish Qualifying Examination Committee. Students are required to establish a qualifying exam committee who will evaluate their written exam materials (see below) and administer and judge their oral examination. The qualifying exam committee will consist of four PBEE faculty members and requires approval by the DGS. The student's research mentor will not be a member of this committee, although the research mentor should advise the student in the selection of appropriate faculty who may be best qualified to serve on the committee. Formal establishment of the examination committee requires submission of the PBEE Qualifying Examination Committee Form (available on the PBEE website, http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm) to the PBEE DGS. The due date for establishing the Qualifying Examination Committee is February 1st of the student's second year. If February 1st falls on a weekend, the proposal is due the following Monday.

B. Comprehensive PBEE Review. Students are required to write a comprehensive review in an area related to PBEE. The specific area to be reviewed is selected by the student. The student's research advisor is expected to provide advice and assistance in selecting an appropriate topic. Reviews written on topics that are not related to PBEE will constitute a failure. If there is any doubt, the student should discuss the topic they have selected with the DGS and the PD. This review should be approximately twenty pages in length and formatted in the fashion similar that used in an Annual Review of Ecology, Evolution and Systematics article (see website at <http://arjournals.annualreviews.org/loi/ecolsys>). The review should be well written and comprehensive.

This review will constitute the first half of the written exam portion of the qualifying examination. The final version of the review should be submitted to the PBEE DGS. The due date for the comprehensive review is March 15th of the student's second year. If March 15th falls on a weekend, the review is due the following Monday. The review will be graded by the members of the qualifying exam committee on the S/U scale. A grade of U is grounds for dismissal from the Ph.D. program. A student who fails the written comprehensive review portion of the qualifying examination may petition the DGS to be allowed to revise their proposal and resubmit for a regrading by the members of their Qualifying Examination Committee. This must be completed within 1 month of the original due date. A student may revise their research proposal only once.

C. Research Proposal. Students are required to write a well developed and detailed



research proposal that outlines the research they intend to pursue to complete their dissertation. The length of the proposal should be between 8 (NSF Dissertation Improvement Grant) and 12 pages (NIH Grants). The proposal should be detailed and consist of sections with the following titles: Specific Aims (~ 1 page), Background and Significance (~ 2 pages), Preliminary Data (consisting primarily of data generated by the student during their time in their mentor's laboratory), Research Design and Methods. The proposal should be developed by the student and their tentative mentor starting the summer of their first year of graduate school and during their second year in graduate school. While it is expected that there will be overlap between the student's research plan and ongoing research being conducted in the mentor's laboratory, the student's proposal should not simply be cut/pasted from an existing grant proposal that the mentor has previously written.

The research proposal should result from the PBEE student's work and ideas and will constitute the second half of the written exam portion of the qualifying examination. The final version of the research proposal should be submitted to the PBEE DGS. The due date for this proposal is April 1st of the student's second year. If April 1st falls on a weekend, the proposal is due the following Monday. The review will be graded by the members of the qualifying exam committee on the S/U scale. A grade of U is grounds for dismissal from the Ph.D. program. A student who fails the written research proposal portion of the qualifying examination may petition the DGS to be allowed to revise their proposal and resubmit for a regrading by the members of their Qualifying Examination Committee. This must be completed within 1 month of the original due date. A student may revise their research proposal only once.

C. Oral Examination. Approximately two weeks following the submission of the research proposal (in April of the second year), each student will be administered an oral exam by the four members of their Qualifying Exam Committee. The DGS will appoint one of the faculty members to act as the chair of the exam committee. The student's mentor will also attend and observe the examination, act as a time keeper, but otherwise remain silent during the course of the examination.

The oral examination is intended to explore the student's general knowledge of PBEE, explore any areas of weakness in their comprehensive PBEE review, carefully examine their proposed research plan, and assess their ability to express complex ideas and arguments in spoken form. A standard format will be used for all oral examinations. The oral exam structure will consist of two rounds of questions provided by the four examiners. Each question will be discussed for at most 15 minutes. Notwithstanding the time limit for each question, the exam format is free form and any of the examining faculty may interact with the student in the course of answers to questions (even those asked by other faculty members). The first round of questions will focus broadly on topics in PBEE. The second round will largely focus on the student's research proposal. All areas of PBEE are fair game for questions, that include at a minimum the student's comprehensive review, their research proposal and material covered in the PBEE core courses.

D. Preparation. Students are urged to prepare carefully for the qualifying examination.



The written portions of the examination should be carefully researched and written with assistance provided by the research mentor. Additionally, PBEE faculty and other students are usually willing to read drafts and provide comments. Preparation for the oral examination usually consists of two parts: a review of the principles and facts of population biology, ecology, evolution, and other basic biological and mathematical sciences prerequisite to undertaking a successful research career in PBEE. A well written comprehensive review and research proposal are central to the success in the oral examination.

In addition, students are strongly encouraged to practice the oral communication skills that will be necessary to pass the examination by presenting seminars based upon their rotation research projects. Third and fourth year students who have already taken the examination are expected to provide advice and help to the students as they prepare for their qualifying exam. Since many students will not previously have experienced an oral examination, a mock oral defense of the student's general PBEE knowledge, comprehensive PBEE review, and their research proposal before the third and fourth year students will be extremely helpful. Students will generally find many people willing to help in their preparation for this important exam.

XI. Admission to Ph.D. Candidacy

After successfully passing both the written and oral portions of the qualifying examination, a student may become a candidate for the Ph.D. degree upon recommendation of the student's advisor and successfully completing all PBEE graduate course requirements. Application for admission to candidacy must include the designation of an advisor, appointment of a Dissertation Committee and a proposed title for the dissertation. The application should be completed by the student, signed by the advisor, and submitted to the Director of Graduate Studies. The form can be found on the Graduate School website (http://www.emory.edu/GSOAS/gsas_faculty) and on the PBEE website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm).

XII. Selection of Dissertation Committee

In consultation with the advisor, each student must select an advisory committee (i.e. Dissertation Committee) that will assist the student and advisor in formulating and executing an appropriate independent research project to fulfill the requirements of the doctoral program. This should be completed by the end of the summer after the second year. The Graduate School Dissertation Committee form should be submitted to the DGS. The form can be found on the Graduate School website (http://www.emory.edu/GSOAS/gsas_faculty) and on the PBEE website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm). The committee must consist of at least five members of the faculty, including the research advisor who chairs the committee. At least three members of the Dissertation Committee should be members of the PBEE faculty. At the discretion of the student and research advisor, at most two faculty



members on the Dissertation Committee can be selected from among faculty outside PBEE or Emory University.

The primary function of the advisory committee is to make available to the student a broad range of scientific expertise, to support the research efforts of the student, and help to guide the project to a successful conclusion. The advisory committee is also the primary body responsible for reading and evaluating the doctoral dissertation, and for examining the student in the public oral defense of the doctoral dissertation.

The first committee meeting should occur no later than the end of October in the Fall semester of the third year. This is particularly important to help set the general scientific direction of the student's written proposal. After every thesis committee meeting the student is required to submit a Dissertation Committee Report Form to the Director of Graduate Studies. The form can be found on the PBEE website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm). Any changes to the membership of the Dissertation Committee require approval by the DGS and the Dean of the Graduate School. The form can be found on the Graduate School website (http://www.emory.edu/GSOAS/gsas_faculty) and on the PBEE website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm).

XIII. Student Research Proposal

By the beginning of the Fall semester of the third year and after the preliminary exam, each student must first form a dissertation committee and have their first formal meeting. During the meeting, the student will present to his or her thesis committee a written proposal for an original research project and an oral defense of that proposal. The proposal should be based on the project that will form the student's Ph.D. thesis and may be largely similar to that provided for the oral qualifying examination. The dissertation proposal should be written by the student with regular discussions with the research advisor and other committee members. The research mentor may have substantial input into the content of all sections of the proposal. However, the spirit of the proposal is that it should be primarily the student's work. Therefore, the advisor should avoid major rewriting of the proposal but should guide the preparation of the proposal primarily by verbal comments and advice to the student. The student should keep the DGS informed on their progress in forming a dissertation committee and the results of their meeting by providing copies of the required forms discussed above. If the student has any difficulty, he/she needs to inform the DGS and/or PD immediately so that any issues can be resolved quickly.

The length of the proposal should be between 8 (NSF Dissertation Improvement Grant) and 12 pages (NIH Grants). The proposal should be detailed and consist of sections with the following titles: Specific Aims (~ 1 page), Background and Significance (~ 2 pages), Preliminary Data (consisting primarily of data generated by the student during their time in their mentor's laboratory), Research Design and Methods. Copies of the proposal must be presented to the thesis committee at least three weeks before their first dissertation committee meeting. By no later than the end of October of the Fall



semester, the thesis committee will meet to hear an oral defense of the written thesis proposal. The purpose of the defense and the written proposal is for the student, advisor, and thesis committee to reach an agreement on what would constitute a successful research project for completion of the Ph.D. in the PBEE program, and to establish a time line for completion of the project.

XIV. Meetings with the Dissertation Advisory Committee

After successful completion of the qualifying examination and presentation of a research proposal, students should consult regularly with their Dissertation Committee to update them on the progress of their dissertation research. The format for this meeting need not be as formal as that of the oral qualifying exam but should include a summary of the progress that the student has made as well as an outline of the studies that the student and research advisor anticipate will be included in the final dissertation. The committee will give the student and advisor feedback and comments on what they consider necessary for successful completion of the dissertation research. Students are required to arrange a meeting with the Dissertation Committee at least once each year beginning in the third year for the purpose of reviewing research progress. Typically students may prefer to meet with their Dissertation Committee twice a year, once during the Fall semester and once during the Spring semester.

Students must write a letter to or email the Director of Graduate Studies at least two weeks before each committee meeting to inform him or her of the date, time, and place that the meeting will be held. Any members of the Executive Committee can be present at the committee meetings to monitor the student's progress. After every thesis committee meeting the student is required to submit a Dissertation Committee Report Form to the Director of Graduate Studies. The form can be found on the PBEE website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm). This form should be signed by both the advisor and the student. If the committee feels that the student is making reasonable and sufficient progress towards completing the dissertation research, this should be stated. If the committee feels that the student is not making sufficient progress or that there are major issues that need to be dealt with, this should be stated on the form. The Director of Graduate Studies will then transmit this letter to the Executive Committee and they will decide if the Executive Committee or selected members of the Executive Committee should meet with members of the student's Dissertation Committee. If the student's research advisor and/or Dissertation Committee consider the student's research progress to be inadequate for continuation in the program, they can submit a letter to the Executive Committee requesting that the student's participation in the program be terminated. This request will be considered by the Executive Committee after meeting with the student and in consultation with members of the student's advisory committee and other appropriate faculty and administrative personnel in the Graduate School of Arts and Sciences.



XV. Teaching Assistant Training and Teaching Opportunity Program (TATTO)

The Teaching Assistant Training and Teaching Opportunity Program (TATTO) is administered by the Emory University Graduate School of Arts and Sciences to provide teacher training and experience for doctoral students in the Graduate Division of Biological and Biomedical Sciences (GDBBS). Completion of the TATTO program is required for the doctoral degree. There are four stages of participation for Division Students.

A. Summer Teaching Workshop. The summer teaching workshop sponsored by the Graduate School (usually scheduled one week immediately prior to the beginning of the fall semester) is the first stage of teacher training. No student may engage in any classroom related teaching activities in his/her training program until completion of the summer workshop. Normally, Ph.D. students will participate in this teaching workshop in the summer following their first year of graduate study at Emory. However, this may be adjusted depending upon an individual student's previous training and academic program.

B. Division Program Experience in "Teaching in the Biosciences." The Division Program faculty members support the contention that discipline-specific experience and training for their students is best accomplished by requiring their students to enroll and participate in the graduate seminar courses offered by each program. Student participation in these seminars teaches them to: a) lecture, b) manage discussion, c) evaluate student (peer) writing, d) use audio-visual equipment, e) communicate to undergraduate and graduate (including medical) students, f) prepare research seminars, g) communicate research data to peers, etc. Students in all programs are required to enroll in the graduate seminar each semester during their first three years in training. Participation in these seminars reinforces material covered in the graduate school summer workshop and addresses subjects and problems particularly related to each specific program discipline. The Division faculty are firmly committed to assuring that the graduate seminar courses provide each student with ample exposure to, and experience with discipline-specific teaching methods. In the PBEE Program, each student is required to participate in Introductory Graduate Seminar PBEE 570R and Advanced Graduate Seminar PBEE 790R (same seminar, but 790R is for students who have passed their qualifying exams) during their first three years. These courses require each student to read and assimilate the primary literature in PBEE and to present a full length seminar (usually in the second year and at reasonable intervals thereafter, as decided by the thesis committee and seminar committees) to one's peers on a particular aspect of the literature. Faculty participate in and guide the seminar. They also provide help to the students in organizing seminars and give help with presentation techniques. Students will be evaluated on their classroom participation or by a variety of criteria that are based on specific activities from the list above in which they engage. Students will receive a Pass/Fail grade for their performance in Graduate Seminars.

C. Teaching Assistantship. All students in the Division of Biological Sciences are currently required to serve as a Teaching Assistant (TA) for one semester usually during the academic year immediately following participation in the TATTO summer workshop.



TA duties will often consist of serving as a lecturer, laboratory instructor/assistant, and/or a discussion section leader under the supervision of a faculty member. TA's will also assist students with problems during scheduled office hours, help with the preparation of handout and/or laboratory materials, help administer and grade exams, etc. Students assigned to laboratory courses assist in setting up the laboratory exercises and help students with the theoretical and practical aspects of the exercise as it progresses. The supervising faculty member will submit to the Director of Graduate Studies an evaluation of the performance of each teaching assistant at the end of the semester of service.

D. Teaching Associateship. Division students are normally eligible to fulfill their requirement for the Teaching Associateship in their second year of graduate study or later. Because there are limited opportunities for co-teaching in medical school courses and Division Program graduate courses, it will be logistically impossible for most Division students to fulfill the Teaching Associate requirement by co-teaching. Accordingly, this phase of a Division student's teacher training will be most often accomplished by the fourth year students acting as mentors for the second and third year students as they prepare for their oral qualifying examinations and research proposal defense. They will assist them in the development of their written proposal, provide guidance on the oral examination and administer a mock oral examination. They will provide constructive criticism to the student on both the written proposal and their performance on the mock oral exam. A written evaluation of the student mentor, based on his/her effectiveness as a mentor will be submitted to the Director of Graduate Studies by the Chair of the Program Exam Committee. The evaluation becomes part of the student mentor's file and is recorded on the appropriate forms (see below) to verify that the Teaching Associate requirement has been met.

In some instances alternative teaching opportunities can be used to accomplish the Teaching Associateship phase of teacher training.

These Include:

1. Some of the graduate level courses given to students in the Division Programs and to undergraduate students in Biology and Allied Health programs involve students giving the lectures on special topics. Students presenting lectures in these courses will be given credit toward completion of the TATTO requirement when the student works with the course coordinator, and this teaching experience is analogous to that of being a co-teacher.
2. Students also make presentations on the progress of their thesis research. In some instances, these are largely technical and would not qualify as a "teaching" experience. However, there are frequent occasions where these presentations involve explaining a new experimental model, technique or system to a new audience. This involves skills identical to the ones that the student will later use in teaching students, post-doctoral fellows, and technicians under their supervision. Therefore, when this experience is conducted as a TATTO activity, the student will benefit from having his/her presentation undergo an evaluation (with suggestions for improvement from a "teaching"



perspective). In addition, students regularly participate in national conferences and symposia to present their research results. Preparation for these meetings often involves multiple practice sessions with students and faculty where there is critique of the oral presentation (content and delivery), the effective use of AV materials, and handling of questions and unexpected situations.

3. As part of the Division Program curricula, students are required to formulate proposals for research projects, and to present them to faculty and students. They are evaluated on their ability to communicate the background of each proposal, its importance to the advancement of science and the feasibility of the methods they have chosen to study the problem. The students are encouraged to seek advice and guidance in the formulation of their proposals and in the most effective way to present them to others. They receive detailed input on the quality of their presentation with emphasis on content, presentation and communication.

4. A vital part of the teaching experience of Ph.D. level scientists is the supervision of students' research projects in the laboratory. This involves formulation of the hypothesis, design of the experiment, collection of data, data analysis, and reporting of the findings. Often, more senior graduate students help newer graduate students in this capacity and, unfortunately, it usually occurs without any formal planning or evaluation. As part of TATTO, some Division graduate students will perform this function in the capacity of Teaching Associates. In these cases, the activity will be well planned out beforehand with the faculty member. Appropriate supervision and follow-up evaluation (of both the senior and more junior graduate students' experiences) will be conducted.

5. There are also occasional teaching opportunities for Division students outside of the usual undergraduate/graduate courses, and participation in these can be applied toward TATTO if they achieve the goals of the Teaching Associateship. Each of these will be considered for approval and evaluation by the Director of Graduate Studies on a case-by-case basis.

E. Administration and Evaluation. Each of the Programmatic components of the Division TATTO plan falls under the jurisdiction of the Executive Committee within each program, with the Director of Graduate Studies from that program being the primary administrator of each program's plan. Additional faculty members will participate in the various aspects of the program as requested by the Director of Graduate Studies. Evaluation will take the form of course grades, as in the case of graduate seminars, and/or written evaluations by the faculty member primarily responsible for direct supervision of the activity being monitored. Records of completion of TATTO requirements will be entered on forms provided by the Division and these will be retained in each student's file at the program level. Copies will also be forwarded to the Division office which will be responsible for verifying to the Graduate School that each student has met all TATTO requirements prior to graduation.

XVI. Dissertation Research

The most important aspect of a student's training program is his or her thesis research.



Other aspects of the program are designed to lead up to and provide preparation for this research work. Normally this research will begin no later than the second summer in residence. The work must be an original contribution to scientific knowledge and should be of a quality that will lead to several publications in peer reviewed scientific journals. Generally, thesis work will be performed on site at Emory. Completion of thesis work at other institutions will require the explicit approval of the Executive Committee and the Program Director.

XVII. Submission of Ph.D. Dissertation

A. Guidelines for Writing and Submission. The general format of the dissertation includes the following sections: abstract, introduction, historical background, methods, results, discussion and references. Each section can encompass one or more chapters as appropriate. At the discretion of the Dissertation Committee and Program Director some of the methods, results and discussion may be represented by scientific papers on which the student is first author and which have been published or are in press in refereed journals. The dissertation must be typed or printed, using a letter quality printer, on special thesis paper. Figures and other illustrations must be of publication quality. More detailed directions as to the form of the dissertation are available from the Graduate School Office.

B. Submission of the Dissertation. After the dissertation has been read and approved by the thesis advisor, the student must give a copy to all members of the thesis committee. The dissertation must be complete at this time, including figures and references. No sooner than two weeks after distribution of the dissertation a final thesis committee meeting must be held. This should give committee members enough time to read the dissertation thoroughly before the meeting. The Director of Graduate Studies must be notified of the time and location of this meeting using with the Provisional Dissertation Approval Form. The form can be found on the PBEE website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm). Recommendations for changes to the dissertation by committee members and revisions of it by the student can be made prior to the final thesis committee meeting.

C. Final thesis committee meeting. The purpose of this meeting is to insure that the student has a defensible dissertation of high quality before the oral defense date is scheduled. All members of the thesis committee must give provisional approval of the dissertation in writing. This is accomplished by submitting the Provisional Dissertation Approval Form to the Director of Graduate Studies. The form can be found on the PBEE website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm). Once provisional approval has been given, the oral defense can be scheduled and announced. The oral defense must be scheduled at least two weeks after all committee members have signed the provisional approval form at a time when all members of the thesis committee can be present. These two weeks are necessary to give the program and the graduate school sufficient time to advertise the thesis defense. The time and location of the defense and an abstract of the thesis must be provided to the Director of Graduate Studies and to the administrator of the PBEE Program, who will advertise the



defense. The cost of preparing the dissertation is borne by the student.

It is recommended, but not required, that students have a reader of their dissertation from outside Emory who is familiar with the field of research. They should be invited to the final thesis committee meeting, if possible, and to the oral defense. The purpose of such an outside examiner is to raise the bar a bit by having an unbiased examiner who is an expert in the field. The implementation of this may seem unnecessary or cumbersome to some, but the graduate school is considering requiring this of all Ph.D. defenses.

XVIII. Defense of Ph.D. Dissertation

As a final requirement for obtaining the Ph.D. degree, the candidate must orally defend the dissertation before the Dissertation Committee and other interested faculty and students. All PBEE students are expected to attend the dissertation defense for a fellow PBEE graduating student. Students are strongly encouraged to schedule their dissertation defense as a seminar in the PBEE Seminar Series. In order to achieve this, the defense must usually be scheduled well (often months) in advance of the anticipated date. It is the candidate's responsibility to find a date and time that is appropriate and to notify the committee and faculty in writing. Although most dissertation defenses require less than two hours, a three-hour period should be scheduled should additional time be necessary.

The thesis defense will consist of a public seminar with public questioning at the end, followed by private deliberations between the student and the thesis committee. The Director of Graduate Studies must receive written notification of a thesis defense and the public seminar must be announced by sending a written notice to the Division office two weeks prior to the defense. The Provisional Dissertation Approval Form can be found on the PBEE website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm). A copy of the thesis should be made available in the Division Office a week before the defense.

A. Public Dissertation Defense. The public dissertation defense is a formal scientific seminar. The atmosphere should be one that encourages critical questioning so that the student can demonstrate their expertise in an open forum. A member of the Executive Committee will chair the defense. The chair will outline the format of the defense and introduce the thesis advisor. The advisor will introduce the student and their research in a manner similar to other seminars. The defense consists of a short (40 - 50 min) oral presentation by the candidate of a summary of the project. After the student's presentation, the chair will invite questions from the audience. The committee and other members of the faculty will question the candidate on matters related to the dissertation research to assess the thoroughness of the candidate's knowledge and the quality of the work. The candidate is expected to be an authority in his or her research area, and successful defense of the dissertation requires the oral demonstration of that expertise.

B. Private dissertation defense. Following the public defense, the Executive Committee member will again chair the private defense in an administrative capacity. At



this time any issues brought up at the public defense and any other questions that the thesis committee deems appropriate should be addressed. At no time should the advisor answer questions posed to the student. After the student has been dismissed, the student's performance will be discussed and evaluated by the committee. All committee members must confirm in writing that the student has successfully defended the dissertation. This is accomplished by submitting the Report of Completion of Requirements for Doctoral Degree form to the Director of Graduate Studies. This form can be found on the Graduate School website (http://www.emory.edu/GSOAS/gsas_faculty) and on the PBEE website (http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/studentForms.htm).

C. Revisions. In general, all revisions to the dissertation should be made prior to the defense. A final copy of the revised dissertation should be made available to interested faculty who are not on the Dissertation Committee one week prior to the final defense. However, if revisions have not been made in a satisfactory manner, as judged by the committee, final approval of the dissertation will be delayed until the appropriate revisions have been made and reviewed.

XIX. Awarding of Degree

In order for a student to earn a degree in the PBEE Program, he/she must complete BOTH the requirements of the PBEE program and the Graduate Division of Biological and Biomedical Sciences. The latter requirements can be obtained from the GDBBS office. The requirements for PBEE are in this handbook, and it is the responsibility of the student to obtain and fulfill the GDBBS requirements.

A. Deadlines: The Graduate School has several deadlines that must be met by the candidate during the semester in which the degree is to be awarded. These deadlines include: 1) last day to file application for degree; 2) last day for receipt of Degree Clearance Reports for Master's and Doctoral candidates (note: theses and dissertations must have final approval and dissertations must be defended prior to this date); 3) degree candidate's theses and dissertations due in the Graduate School Office. These deadlines are published in the Academic Calendar of the Graduate School Bulletin. All of the requirements for obtaining a Ph.D. are published in the Graduate School of Arts and Sciences Handbook. Please take the time to read the section entitled "Important Information for Degree Candidates".

B. Degrees: The Program in Population Biology, Ecology, and Evolution offers programs for two degrees: The Master of Science (M.S.) and the Doctor of Philosophy (Ph.D.). The program of study is primarily designed for the Ph.D. degree. Students seeking only the M.S. degree are not ordinarily accepted into the Program. Under certain circumstances, a student may be permitted to work for a terminal M.S. degree that requires submission of an appropriate thesis.

1. Master of Science. A student who fails the Qualifying Examination may petition the faculty for permission to complete a Masters thesis. In addition, a student who passes the qualifying examination but chooses not to complete the doctoral program



may request permission to complete a Masters thesis. If the petition is approved, such a student must form a Masters Dissertation Committee consisting of a faculty advisor and two additional members of the program faculty. The student must complete a research project approved by the committee and write a Masters thesis. Guidelines for writing and submission of a Masters thesis are the same as those for the Doctoral dissertation.

2. Doctor of Philosophy. When a student has completed all of the course requirements and has submitted and successfully defended his or her Ph.D. dissertation, the Director will submit the appropriate form to the Dean of the Graduate School. However, formal application for a degree must be made at the beginning of the semester in which the degree is to be conferred. In addition, the student must be registered during the semester in which the degree is to be conferred.

XX. Tenure of Graduate Studies

Students and their advisors should aim for completion of their graduate studies within a period of five years. MD/PhD students should aim for completion of the program within four years after beginning the graduate school portion of their studies. Most graduate students should be able to complete their dissertation research and defense within this period of time. If it becomes evident to a student and his or her advisor that successful defense of the dissertation cannot occur before August 31 of the sixth year, the student must submit a formal petition to the Executive Committee for an extension of this time limit. This petition should be in writing and should include a statement as to the reason for the student's inability to complete the program within 6 years and a clear justification for the extension. The deadline for submission of this request is January 1 of the student's sixth year in the program. Also, the petition should include a projected date for the defense. When considering the petition, the Executive Committee will consult with members of the student's Dissertation Committee to determine whether they consider the projected date of the defense to be realistic and attainable.

XXI. Expectations of Performance

A. Student Performance. Students are expected to perform satisfactorily in required and elective course work. In most cases, this includes active participation in classroom and seminar discussions as a way of contributing to the scientific environment of the University and to the development of the student. Students are also expected to actively participate in the various events and seminars sponsored by the program. Students should be motivated to continually develop their scientific independence and creativity. This is demonstrated by active interest in and knowledge of the current scientific literature and by planning and performing original research. It is expected that the student's research results will be published as independent contributions to the scientific literature. It is obvious that to accomplish these goals, students need to acquire and develop written and oral communication skills.



Students are also expected to make continuing progress throughout the program. This includes selection of an advisor and Dissertation Committee in a timely fashion and submission and defense of the dissertation soon after completion of laboratory research. It is anticipated that most students will complete the graduate program in approximately 5 years. Graduate school policy mandates that students must successfully defend their dissertation within 8 years of entering advanced standing.

Students are encouraged to show a dedication and enthusiasm for their research projects and to continually strive for the excellence and discipline that will make them competitive in the modern scientific world.

Students should be familiar with the regulations governing University-student relationships and with the Graduate School Honor and Conduct Codes as published in the Graduate School Bulletin.

B. Faculty Performance. Students may expect the faculty to enthusiastically give their time and expertise. This is done both in terms of presenting well-prepared, current formal courses and by providing individual instruction and consultation in the laboratory such that students can maintain progress in their research. The faculty provide laboratory space, equipment, and financial support so that students in training can conduct their research. In many cases, student stipends are also provided directly by individual faculty members' research grants. Importantly, faculty should serve as professional role models and encourage and advise students to fully develop their scientific talents. As part of providing a stimulating scientific environment, the faculty conducts a colloquium series featuring well-known scientists in PBEE and related areas. Finally, faculty should counsel students in determining the direction their postdoctoral careers might take.

Faculty are also expected to provide reasonable and clear guidelines for the graduate program and to administer Graduate School requirements at the program level. Student grievances and appeals should be addressed directly to the Program Director, Director of Graduate Studies, or members of the Executive Committee.

XXII. Student - Faculty Communication

Students usually have questions and suggestions about many aspects of the graduate program that can assist the faculty in achieving and maintaining a high-quality training program. Student feedback about all aspects of the program, and particularly about courses, is very important in helping the faculty recognize the strengths and weaknesses in the current program. Student-faculty communication is, therefore, strongly encouraged, and students are urged to make their views known to the faculty. Faculty request feedback, but when they do not hear from students they often assume that there are no problems in the current program.

The student's advisor or members of his or her dissertation committee are in the best position to discuss research or personal problems. The Director, the Director of Graduate Studies or members of the Executive Committee are obvious first choices to approach about procedure and policy questions. However, all faculty attempt to be



readily available to meet with students, within the restrictions of their schedules. If a faculty member cannot see a student immediately, he or she will make an appointment to meet with the student at the earliest available time. Please use the faculty as a resource.

XXIII. Financial Support

Stipends and tuition fellowships, awarded to students on the basis of academic merit, are intended to cover basic living expenses and tuition. With the exception of special awards, such as the Woodruff Fellowship, stipend levels are set by the Division based upon the availability of funds from Graduate School and university sources. The faculty also encourage and assist students in obtaining individual stipend support from extramural sources, such as federal agencies and private foundations.

It is the policy of the Division to continue support for all students in good standing working for a Ph.D up to year six with seventh year support available in special circumstances. Financial support beginning in the third year in residence is partially the responsibility of the student's thesis advisor. However, no student in good standing has ever been refused support by the Division. Typical sources of support after the second year are from research grant funds of the student's advisor or individual fellowships awarded to the student or through graduate research assistantships from outside funding agencies, e.g. the CDC, NSF, Dean's teaching award, and other departmental or programmatic fellowships.

Financial support may be withdrawn from students whose performance in the graduate program is unsatisfactory as stipulated in the sections above. Financial support is normally provided only to full-time students working toward the doctoral degree.

XXIV. Policy Regarding Outside Employment

Stipend and tuition fellowships are awarded to allow students to devote full time to the graduate program and to complete the requirements for the Ph.D. degree in as short a time as is consistent with adequate training and research progress. The student should not engage in additional employment while receiving a stipend through the graduate program, regardless of the source of that stipend. Such outside employment generally causes a serious distraction from the educational process. Graduate education and research are by necessity largely self-motivated processes, and the distractions of outside employment can interfere with the ability of students to prepare satisfactorily for their future professional careers.

If additional income is absolutely necessary, students are encouraged to consider the possibility of low-interest student loans. Advice about such loans can be obtained from the financial aid office of the University. If a student feels strongly that outside employment is necessary while in the graduate program, the student must discuss the need with his or her advisor and submit a formal request to the Executive Committee at least 30 days in advance of beginning employment. The petition must be fully supported and signed by the student's advisor. However, the students should be aware that such



requests will only be granted if it is deemed appropriate and will further the student's ultimate career goals. Also, such requests will normally be considered only for students in Advanced Standing. If outside employment is necessary and allowed by the Executive Committee, the student must not allow it to interfere with high standards of performance.

XXV. Leaving the Program

A. Beyond the Ph.D. The question of what direction a student's career will take following completion of the doctoral training program should arise early and become increasingly important as training progresses. It is never too early to begin to consider career options and to plan a curriculum accordingly. It is common for students receiving the Ph.D. to take a postdoctoral research training position in order to pursue a specific research interest as well as to acquire additional techniques and expertise to prepare themselves further for a career of independent research. Such postdoctoral training is especially valuable and is usually essential for a career in academic research. Some students take permanent positions in industrial or government research laboratories immediately after receiving the Ph.D. degree. Some decide to enter other advanced degree programs, such as medical school. Career objectives can best be realized through the careful planning of a student's graduate training program. The Director, Director of Graduate Studies, Executive Committee, and all members of the faculty stand ready to advise students on career options. Students are strongly encouraged to seek this advice at any time during their training.

B. Poor Performance. The Director of Graduate Studies will review the progress of students once each semester, or more frequently if warranted. All students must meet the Graduate School's definitions of good standing and due progress to continue in the program. Degree candidates must also be conducting satisfactory research as judged by the advisor and dissertation committee. Students who are experiencing difficulty in the program are strongly encouraged to seek assistance at their earliest opportunity from the Director, Director of Graduate Studies and members of the Executive Committee, their advisor, or other faculty. Every effort will be made to assist students in meeting the performance standards that are required for continuation in the program. However, a student who does not maintain an adequate standard of work or make due progress will be placed on probation, and financial support may be withdrawn. The student will be informed in writing of the conditions of the probation, and a timetable for elimination of the probationary status will be established. A student who fails to meet the conditions of the probation will not be allowed to continue in the program.

A student who fails either the written or oral part of the doctoral qualifying examination is considered not to be making due progress and will be dismissed from the program. Such a student may petition the faculty to retake the examination if the student believes that conditions beyond his or her control adversely affected the performance (see section XI). A student who fails the reexamination will be removed from the program.



Appeals of the Executive Committee's decisions in these matters may be made to the Graduate School, as outlined in the Graduate School Bulletin.

XXV. University Requirements

Every effort has been made to make this document as accurate and complete as possible. Formal University requirements are detailed in the current issue of the Bulletin of the Graduate School of Arts and Sciences, and are in addition to those detailed in this document. Policies are subject to change without notice.



Appendix

A1. Listing of PBEE Faculty

Updated: August 13, 2009

Website: http://www.biomed.emory.edu/PROGRAM_SITES/PBEE/faculty.htm

<u>Name</u>	<u>Address</u>	<u>Phone</u>	<u>Fax</u>
Antia, Rustom	Department of Biology 1107 Rollins Research Center rantia@emory.edu	404-727-1015 (O) 404-727-1765 (L)	404-727-2880
Armelagos, George	Department of Anthropology 111 Geosciences Building antga@leanlink.emory.edu	404-727-2215 (O) 404-727-9597 (L)	404-727-2860
Beck, Chris	Department of Biology 1105 Rollins Research Center cbeck@biology.emory.edu	404-712-9012 (O)	404-727-2880
Cutler, David	Department of Human Genetics Whitehead Biomedical Research Bldg, Room 343 dcutle@emory.edu	404-727-5388 (O)	404-727-3949
Dasch, Gregory	NCID/ VR 1600 Clifton Rd., MS G13 ged4@cdc.gov	404-639-4140 (O)	404-639-4436
De Roode, Jaap	Department of Biology 1113 Rollins Research Center jacobus.deroode@emory.edu	404-727-2340 (O)	404-727-2880
Epstein, Michael	Department of Human Genetics Whitehead Biomedical Research Bldg, Room 305K mpepste@emory.edu	404-712-8289 (O)	404-727-3949



Gerardo, Nicole	Department of Biology 1111 Rollins Research Center nicole.gerardo@emory.edu	404-727-0394 (O)	404-727-2880
Gimnig, John	CDC, Division of Parasitic Diseases 4770 Buford Highway, MS F42 jgimnig@cdc.gov	770-488-7549 (O)	770-488-4258
Gillespie, Thomas	Environmental Studies E526 Math and Science Center thomas.gillespie@emory.edu	404-727-7926 (O)	404-727-4448
Glasser, John	Immunization Program – CDC 1600 Clifton Rd., MS E61 jwg3@cdc.gov	404-639-8780 (O)	404-639-8616
Hawley, William	Parasitic Diseases- CDC 4770 Buford Hwy., MS F22 byh0@cdc.gov	770-488-3600 (O)	770-488-4258
Kitron, Uriel	Chair, Environmental Studies E511 Math and Science Center ukitron@emory.edu	404-727-4253 (O)	404-727-4448
Klugman, Keith	SPH 764 Grace C. Rollins Building kklugma@sph.emory.edu	404-712-9001 (O)	404-727-4590
Levin, Bruce	Department of Biology 1109 Rollins Research Center blevin@emory.edu	404-727-2826 (O) 404-727- 2956 (L)	404-727-2880
Lucchesi, John C.	Department of Biology 1011 Rollins Research Center lucchesi@biology.emory.edu	404-727-4943 (O)	404-727-2880



Lynn, David	Department of Chemistry 407 Emerson Hall david.lynn@emory.edu	404-727-9348 (O)	404-727-6586
McGowan, John E.	Department of Epidemiology, SPH 442 Grace C. Rollins Building jmcgowa@sph.emory.edu	404-727-9365 (O)	404-727-8737
Mills, James	Medical Ecology- CDC 1600 Clifton Rd., MS G14 jmills@cdc.gov	404-639-1396 (O)	404-639-1509
Real, Leslie A.	Department of Biology 1001 Rollins Research Center lreal@biology.emory.edu	404-727-4099 (O) 404-727-0394 (L)	404-727-2880
Rudd, Katie	Department of Human Genetics Whitehead Biomedical Research Bldg, Room 315 krudd@genetics.emory.edu	404-727-9486 (O)	404-727-3949
Rupprecht, Charles	Rabies- CDC 1600 Clifton Rd., MS G33 cry5@cdc.gov	404-639-1053 (O)	404-639-1564
Schlenke, Todd	Department of Biology 1017 Rollins Research Center todd.schlenke@emory.edu	404-727-0817(O)	404-727-2880
Sherman, Stephanie	Department of Genetics 615 Michael St., Suite 301 ssherman@genetics.emory.edu	404-727-5862 (O)	404-727-3949
Stephens, David	Emory University Hospital 1364 Clifton Rd., Suite H-153 dstep01@emory.edu	404-727-8357 (O)	404-727-3099



Tao, Yun	Department of Biology 1015 Rollins Research Center james.taylor@emory.edu	404-727-0815 (O)	404-727-2880
Taylor, James	Department of Biology 1015 Rollins Research Center Ytao3@emory.edu	404-727-0815 (O)	404-727-2880
Tauxe, Robert V.	Food Borne & Diarrheal Diseases, CDC 1600 Clifton Rd., MS A38 rtauxe@cdc.gov	404-639-2206 (O)	404-639-2205
Taylor, James	Department of Biology 2019 Rollins Research Center james.taylor@emory.edu	404-727-4906 (O)	404-727-2880
Thomas, James	Department of Human Genetics Whitehead Research Bldg. 305J jwthom2@emory.edu	404-727-9751 (O)	404-727-3949
Udhayakumar, Kumar	Parasitic Diseases- CDC 4770 Buford Hwy., MS F12 vxu0@cdc.gov	770-488-4047 (O)	770-488-4454
Waldman, Irwin	Department of Psychology 317 Psychology Building psyiw@emory.edu	404-727-7430 (O)	404-727-0372
Waller, Lance	Department of Biostatistics, SPH 326 Grace C. Rollins Bldg. lwaller@sph.emory.edu	404-727-1057 (O)	404-727-1370



Worthman, Carol	Department of Anthropology 221 Geology Bldg. worthman@emory.edu	404-727-4489 (O)	404-727-2860
Zwick, Michael	Department of Human Genetics Whitehead Biomedical Research Bldg., Room 331 mzwick@emory.edu	404-727-9924 (O)	404-727-3949



A2. Graduate Program in PBEE Executive Committee

Name	Title	Year
Les Real	Director	2002
Michael Zwick	Director of Graduate Studies	2005
Bruce Levin	Past Director	2002
Todd Schlenke	Co-Director of Recruiting	2007
Yun Tao	Co-Director of Recruiting	2007
James Thomas	Past Director of Graduate Studies	2002
Lance Waller	Executive Committee Member	2007
Uriel Kitron	Executive Committee Member	2009
Nicole Gerardo	Co-Director of Seminars	2009
Jaap De Roode	Co-Director of Seminars	2009
Neil Milan	Student Representative	2007
Benjamin Parker	Student Representative	2008

Rotation Schedule:

First Rotation: Start of Classes (usually end of August) - 31 October

Second Rotation: 1 November - 31 January

Third Rotation: 1 Feb - 30 April



A3. PBEE Graduate Student Timeline and Milestones

	Item	Date
Year 1		
Fall Semester		
	Submit Rotation 1 Plan to DGS	1st Week of Classes
	Submit Rotation 1 Summary to DGS	31 October
Spring Semester		
	Submit Rotation 2 Plan to DGS	1 November
	Submit Rotation 2 Summary to DGS	31 January
	Submit Rotation 3 Plan to DGS	1 February
	Submit Rotation 3 Summary to DGS	30 April
Summer Semester	Select Tentative Advisor	Beginning of Summer Semester
	Submit Tentative Advisor Letter to DGS	Beginning of Summer Semester
	Begin Preparation of Research Proposal	Summer Semester
Year 2		
Fall Semester		
	Continue to Prepare Research Proposal	Fall Semester
Spring Semester		
	Research Proposal to DGS	15 March
	Provide DGS name of Faculty Member for Program Exam Committee	15 March
	Written Qualifying Examination	Beginning of April
	Oral Qualifying Examination	Mid -April
	Select Dissertation Research Advisor	May
	Submit GDBBS Mentor Assignment Form to DGS	May
Summer Semester		
	Select Dissertation Committee	end of August
Year 3		
Fall Semester		
	Submit Graduate School Dissertation Committee Form to DGS	September
	Submit Graduate School Application for Admission to Candidacy Form to DGS	September
	Dissertation Committee Meeting #1: Present Student Research Proposal to Dissertation Committee	End of October
Spring Semester		
	Dissertation Committee Meeting #2	May
Summer Semester		
Year 4		
Fall Semester		December
	Dissertation Committee Meeting #3	
Spring Semester		May
	Dissertation Committee Meeting #4	
Summer Semester		
Year 5		
	Submit Graduate School Report of Completion of Requirements for Doctoral Degree to DGS	



A4. Elective Courses for PBEE Students

Electives Recommended for PBEE Program Students

IBS 591	Population Biology and the Evolution of Infectious Disease
IBS 736	Genetic Epidemiology
ANTH 503	Evolutionary Processes
ANTH 586Q	Evolutionary Medicine
EOH 583	Spatial Analysis in Disease Ecology
EPI 505	Modern Epidemiology
EPI 740	Epidemiological Modeling
BIOS 524	Analytic Methods for Infectious Diseases
PSYCH 770L	Quantitative Genetic Methods
PSYCH 552	Psychobiology Proseminar II: Evolution of Behavior
ANTH 586G	Anthropology of Emerging Infectious Disease
ANTH 586S	Human Evolution
ANTH 505	Primate Ecology and Social Organization
IBS 513	Virology
IBS 542	Concepts of Immunology
IBS 543	Medical Microbiology Lectures
IBS 745	Infection and Immunity
IBS 727	Genetics of Bacterial Pathogenicity
MATH 115	Life Science Calculus I
MATH 116	Life Sciences Calculus II
MATH 555	Ordinary Differential Equations I
MATH 755	Ordinary Differential Equations II
MATH 515	Numerical Analysis I
MATH 516	Numerical Analysis II
BIOS 510	Probability Theory I
BIOS 511	Statistical Inference
BIOS 724	Analytic Methods for Infectious Disease Interventions
BIOS 737	Spatial Analysis of Public Health Data
PSYCH 770B	Evolution and Psychology