

**DEPARTMENT OF MOLECULAR  
AND BIOMEDICAL PHARMACOLOGY  
COLLEGE OF MEDICINE  
UNIVERSITY OF KENTUCKY**

**GRADUATE STUDENT  
INFORMATION HANDBOOK  
2011**

This handbook includes guidelines and general information on the graduate student program and departmental policies. The handbook is meant to assist students by providing general information, and a basic framework and timeline for their studies according to present procedures. However, it is not intended as a formal commitment or binding agreement. Policies, requirements and suggested timeframes can vary in any given year from those outlined here, in response to altered circumstances, and may be changed without notice. Specific policies are set by the Director of Graduate Studies and the faculty and must be approved by the Chair and be consistent with the broader regulations of the Graduate School.

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## **I. Introduction**

### Welcome to New Graduate Students!

The Department of Molecular and Biomedical Pharmacology hopes to help you make your graduate student years cheerful ones, but also challenging and successful. This information is intended to make your transition as smooth as possible. This handbook is intended to both provide practical information useful to pharmacology graduate students, and more importantly, to guide students through the important milestones of their graduate career.

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## **II. Integrated Biomedical Sciences Program (First Year of Graduate School)**

Typically, first year graduate students enroll in the IBS program. The IBS program integrates most biomedical graduate students in the University of Kentucky College of Medicine. The seven participating departments and centers include Anatomy & Neurobiology; Microbiology, Immunology & Molecular Genetics; Molecular & Biomedical Pharmacology; Molecular & Cellular Biochemistry; Nutritional Sciences; Physiology; and Toxicology. The IBS program consists of both coursework and laboratory rotations. The 2010-2011 curriculum is described below. Detailed information about these courses can be obtained at [www.mc.uky.edu/ibs/overview/curriculum.asp](http://www.mc.uky.edu/ibs/overview/curriculum.asp).

### **FALL Semester**

IBS 601 Biomolecules and Metabolism (3 hours)

IBS 603 Cell Biology (3 hours)

IBS 605 Experimental Genetics (3 hours)

IBS 607 Seminar in Integrated Biomedical Sciences (0 hours)

IBS 609 Research in Integrated Biomedical Sciences (1 hour)

### **SPRING Semester**

IBS 602 Biomolecules and Molecular Biology (3 hours)

IBS 604 Cell Signaling (3 hours)

IBS 606 Integrated Biomedical Sciences (4 hours)

IBS 607 Seminar in Integrated Biomedical Sciences (0 hours)

IBS 609 Research in Integrated Biomedical Sciences (1 hour)

TOX 600 Ethics in Scientific Research (1 hour)

All IBS students take four laboratory rotations (two per semester) among any of the participating programs. The purpose of the rotations is for the student to both gain experience in a working scientific lab, and to find a faculty member who will serve as a research advisor. Selection of a research advisor is a mutual decision of the student and faculty member and is made at the end of the spring semester.

Additional information about the IBS program can be obtained at the IBS web page (<http://www.mc.uky.edu/ibs>), or by directly contacting the IBS program by web form (<http://www.mc.uky.edu/ibs/contact.asp>) or by phone at (859) 323-0004.

### III. Pharmacology Graduate Program (2<sup>nd</sup> and Later Years of Graduate School)

#### A. The Pharmacology Curriculum

Most Pharmacology students follow the curriculum described below. Students with extensive prior training in pharmacology may ask the Graduate Committee to evaluate whether the student may modify the curriculum. Also, students may take statistics in a different semester than suggested below. Note that graduate students must register for a total of 9 hours per semester until the semester they take their qualifying exam.

All Pharmacology students are expected to earn either an "A" or "B" grade in the required PHA courses. In order to ensure that all pharmacology graduates have demonstrated competency in the discipline of pharmacology, students who receive a grade of "C" in PHA 621 or average less than a "B" in the four sections of PHA 622 may be asked to take an additional written exam as part of their qualifying examination. This exam will be administered by the Graduate Committee and DGS, and will provide the student with an additional opportunity to demonstrate that they possess the requisite knowledge of pharmacology to be allowed to proceed with the remainder of the qualifying exam. Alternatively, the Graduate Committee, after consulting with the student's major professor, may ask the student to repeat PHA 621 or appropriate sections of PHA 622.

#### The Core Curriculum

##### Fall, 2<sup>nd</sup> year

- PHA 621 PRINCIPLES OF DRUG ACTION (3 hours) Dr. Swanson/Piasek  
This course covers the interaction of drugs with pharmacologic receptors, the coupling of these receptors to intracellular signaling cascades, and the techniques used to identify and differentiate receptor subtypes. The factors governing drug absorption, distribution, metabolism and excretion will also be discussed in detail.
- STA 580 BIOSTATISTICS I (3 hours) Dr. Breheny  
Descriptive statistics, hypothesis testing, paired and unpaired tests, ANOVA, contingency tables, log rank test, and regression with biostatistics applications. STA 570 can be taken instead, if preferred.
- PHA 750 RESEARCH IN PHARMACOLOGY (1-5 hours) Dr. Hadley  
Students register for this course every semester until they have passed their qualifying examination, and should register for just enough credit hours to meet the required minimum number of hours per semester.
- PHA 770 SEMINAR IN PHARMACOLOGY (1 hour) Dr. Hadley  
Students register for this course every semester until they are ready to take their qualifying exam.

##### Spring, 2<sup>nd</sup> year

- PHA 622 MOLECULAR DRUG TARGETS AND THERAPEUTICS (4 hours) Dr. Piasek  
This advanced course provides state of the art information regarding drugs, drug action and targets for drug action. Four course sections are designed to function as independent one hour courses, emphasizing Cardiovascular Pharmacology (Section 001), Neuropharmacology (Section 002),

Chemotherapeutic Agents (Section 003), as well as Autocoids, Endocrine Pharmacology, and Toxicology (Section 004) .

PHA 750 RESEARCH IN PHARMACOLOGY (1-5 hours)  
 PHA 770 SEMINAR IN PHARMACOLOGY (1 hour)

**Fall, 3<sup>rd</sup> year (and following terms)\***

PHA 767 DISSERTATION RESEARCH\* (2 hours) Dr. Hadley

\* PHA 767 should be taken fall and spring semesters, beginning with the term the qualifying exam is taken (usually Fall, 3<sup>rd</sup> year).

Pharmacology Electives

Students should consult their major professor and advisory committee about any departmental or extra-departmental electives they wish to take.

PHA 616 BIOLOGY AND THERAPY OF CANCER (3 hours) Dr. Rangnekar

Cancer biology will be discussed at the molecular, cellular and organismic level. Emphasis will be placed on aspects of cellular signaling, apoptosis and the cell cycle which are unique to cancer cells. Same course as MED/MI 616. Taught in the Spring semester of alternate years.

PHA 617 PHYSIOLOGICAL GENOMICS (2 hours) Drs. McClintock & Chen

The study of function by global analysis of gene expression. Teaches the concepts, techniques, and functional significance of analyzing gene expression patterns. The technical emphasis is on the design and analysis of DNA microarray experiments. Same as PGY 617. Taught in the Fall semester.

Registration for Courses

Registration is the student's responsibility, and must be done each semester after consultation with the major advisor. Registration is usually done using the myUK portal (<https://myuk.uky.edu/irj/portal>). Instructions are available at <http://www.uky.edu/Registrar/docs/myUK.pdf>. Initial registration typically occurs in March or April for the summer session and fall semester, and in November for the spring semester. Check the Registrar's web page for the exact dates. The department does not pay late fees for student registration. Any problems that appear while registering for classes using the myUK portal should be reported to Deborah Turner so that they can be corrected promptly for all students.

**B. Formation and Responsibilities of the Advisory Committee**

Graduate students select their major professor or research advisor at the end of their first year. The student's major professor will chair or co-chair the student's advisory committee. The committee is typically formed during the student's second year, a year before the qualifying examination.

The advisory committee must have four or more members. Three members must be Pharmacology faculty, and one member must be from outside the department. The four "core" faculty on the committee must be members of the UK Graduate Faculty, and three must be full (not associate) members. If the student's major professor is an associate Graduate Faculty member, a full member must chair the advisory committee with the major professor as co-chair. A list of Pharmacology Graduate Faculty (as of June, 2011) is available in Appendix B. The Graduate School must approve the formation of the advisory committee.

The advisory committee oversees the progress of the student towards a doctoral degree. **The committee must meet at least once a year to review student progress and give the student a written evaluation (see Appendix A).** This includes guiding the student's coursework and dissertation research, as well as administrating and judging the qualifying and final examinations. Advisory committee decisions are made by majority vote.

### **C. Responsibilities of the Pharmacology Graduate Committee**

**The five members of the Department's Graduate Committee set departmental policies and oversees student assessment. The Graduate School requires each department to annually review whether a student is making good progress towards their degree. The Provost's office also has specific requirements for student assessment. Assessment procedures and forms are included in Appendix A. Students will receive copies of all assessments.**

### **D. The Qualifying Examination (Introduction)**

The objective of the qualifying examination is to evaluate the student's general scientific knowledge, ability to think critically, and competence in their research field, in order to determine whether the student is qualified to be a candidate for a doctoral degree. Student evaluation is the main purpose of the qualifying exam, so the exam should not be regarded as a formal dissertation proposal. A student's dissertation research is allowed to differ from the experiments described in the qualifying exam.

The qualifying examination consists of two components: 1) a written research proposal, which follows the same format as a NIH predoctoral fellowship application, and 2) an oral examination in which the research proposal is evaluated by the advisory committee. The qualifying exam is usually completed in the fall semester of the student's third year. The actual exam can be taken at any point during the term, as long as classes are in session. However, the date must be submitted to and approved by the Graduate School within the first six weeks of the semester.

### **E. The Written Qualifying Examination**

Students should first submit an abstract of one to two pages to the advisory committee. This abstract should summarize the research proposal that the student wishes to write up for the written examination. The proposal is usually related to ongoing research in the major professor's laboratory, but can be on a different topic. The abstract should briefly describe: 1) the scientific background of the proposal, 2) the main hypothesis, and 3) the specific aims and methods that would be used to test that hypothesis. The members of the advisory committee should either approve or recommend revision of the abstract within one week.

The student has four weeks to submit a research proposal after approval of the abstract. In order to be fair to all students, it is essential that all creative work on the proposal (literature review, development of the hypothesis and research design, and all writing) be done by the student alone. The proposal may be related to ongoing laboratory work, but no part of the proposal should be adapted from a grant or manuscript written by someone else.

The student is encouraged to discuss drafts of the proposal with the major professor. The major professor should not edit the proposal, but instead advise the student on language and formatting, or point out elements of the proposal that the student should reconsider (e.g. "Do the specific aims really

test your hypothesis?" "Have you considered the limitations of, or alternative approaches to this experiment?").

The research proposal must be given to the advisory committee two weeks before the oral examination.

### Required Format

The research proposal should follow the format of a NIH predoctoral fellowship application. The following abbreviated description is derived from pages 84-85 of ([http://grants.nih.gov/grants/funding/424/SF424\\_RR\\_Guide\\_Fellowship\\_VerB.pdf](http://grants.nih.gov/grants/funding/424/SF424_RR_Guide_Fellowship_VerB.pdf)).

Use a black Arial, Helvetica, Palatino Linotype, or Georgia font, 11 points or larger. A smaller font size may be used for figures, graph and tables. Use standard paper size (8 ½" x 11) with at least one-half inch margins (top, bottom, left, and right).

Divide the research proposal into the following sections and sub-sections.

#### *1. Specific Aims (limited to one page)*

State concisely the goals of the proposed research and summarize the expected outcome, including the impact that the results will exert on the research field.

List succinctly the specific objectives of the research proposed, e.g., to test a stated hypothesis, create a novel design, solve a specific problem, address a critical barrier to progress in the field, or develop new technology.

#### *2. Research Strategy (limited to six pages, including all figures, charts, tables, and diagrams)*

##### *(a) Significance*

- Explain the importance of the problem in the field that the proposed project addresses.
- Explain how the project will improve scientific knowledge or technical capability in the field.
- Describe how the concepts, methods, technologies, or preventative interventions that drive this field will be changed if the proposed aims are achieved.

*(b) Innovation* – Skip this subsection for fellowship applications.

##### *(c) Approach*

- Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project. Include how the data will be collected, analyzed, and interpreted.
- Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims.

#### *Preliminary Studies (not a separate subsection)*

Discuss any pertinent preliminary studies, data and/or experience in either the Significance or Approach sub-sections.

#### *3. Bibliography & References Cited (no page limitation, but be concise)*

Each reference must include the names of all authors, the article and journal title, book title, volume number, page numbers, and year of publication. When citing articles that fall under the Public

Access Policy, provide the PubMed Central (PMC) reference number (e.g., PMID234567) . Citations that are not covered by the Public Access Policy, but are publicly available in a free, online format may include URLs or PMID numbers along with the full reference.

## **F. The Oral Qualifying Examination**

Students are expected to present the outline of their research proposal at the beginning of their oral exam, which should include a discussion of the hypothesis and aims, background, preliminary data, methods, experimental design, and data analysis and interpretation. The advisory committee will ask questions aimed at evaluating the student's general scientific knowledge, familiarity with the relevant literature, and ability to critically think about the rationale and design of the research proposal.

If the student fails the qualifying examination, Graduate School regulations allow the student to take a second qualifying examination within 4-12 months, with the permission of the advisory committee.

## **G. Doctoral Candidacy**

Students become doctoral candidates after passing the qualifying exam. Students have five years to earn their doctoral degree after the exam, unless the Graduate School is petitioned to allow additional time.

Doctoral candidates register for PHA 767 (Dissertation Research, 2 hours) each Fall and Spring semesters, even after all other class work is completed.

## **H. The Research Dissertation and Final Examination**

### Dissertation Guidelines

Students should first review the Graduate School's dissertation requirements at [http://www.gradschool.uky.edu/CurrentStudents/theses\\_prep.html](http://www.gradschool.uky.edu/CurrentStudents/theses_prep.html).

The department permits the main body of the dissertation (called "text" on the printed dissertation format page at the above URL) to be written in one of two formats. The classical format must include the following separate sections: Introduction, Hypothesis, Materials & Methods, Results, and Discussion.

The alternative format allows the incorporation of manuscripts into the dissertation. The main body must include the following sections: Introduction, Results (a separate chapter for each manuscript), and Discussion. The alternative format must include at least two manuscripts where the student is the first author. The manuscripts must already be published, in press, or submitted for publication. Note that journal reprints may not be directly included in the dissertation, and that the manuscripts must be retyped in a format that is acceptable to the Graduate School. **Each manuscript included as a chapter in Results must include its own Introduction, Materials and Methods, Results and Discussion sub-sections. The main Introduction and Discussion sections should be written specifically for the dissertation (not adapted from another manuscript), and should integrate the material covered in all of the included chapters.** References must be uniform in style throughout the dissertation, and conform to Graduate School requirements.

The dissertation must be submitted to the advisory committee three weeks before the final examination. The advisory committee will expect the dissertation to be proofread and corrected before submission.

### Final Examination

The final examination is conducted by the advisory committee, including an outside examiner appointed by the Graduate School. The purpose of the examination is to evaluate the student's dissertation research, familiarity with relevant scientific literature, and general scientific background. The examination can be as comprehensive as the committee desires. The dissertation research is expected to be an original and valuable contribution to the student's field of research, and the dissertation itself should be suitable for publication.

The student must schedule a dissertation research seminar to be presented immediately before the final examination. The student is also responsible for scheduling their final examination. This is a multi-step process and the student is urged to look carefully at the Registrar's current academic calendar (<http://www.uky.edu/Registrar/AcademicCalendar.htm>). Students must file an application for a degree with the Graduate School by thirty days after the beginning of the graduating semester, or fifteen days in the summer session. Students must also file a Notification of Intent to Schedule a Final Examination at least eight weeks prior to when the examination will occur. The final examination must occur at least eight days prior to the last day of classes in the semester or summer session. The Graduate School must also approve the scheduling of the examination at least two weeks beforehand.

## **I. Additional Responsibilities**

### Seminars

The department considers research seminars to be an essential feature of graduate education, so *students are expected to attend all official departmental seminars*. Students should notify the Director of Graduate Studies by e-mail if they were unable to attend. Students are also expected to register for PHA 770, Seminar in Pharmacology, until the semester they take their qualifying exam. Students may be asked to assist seminar speakers in setting up their presentations, or in guiding visitors around campus. Advanced graduate students may be asked to present a seminar, so that the department can be informed of the student's research progress.

### Journal Clubs

Pharmacology students meet to discuss a variety of research topics, including papers written by upcoming seminar speakers. The journal club typically meets at least monthly. The graduate student representatives are responsible for informing graduate students about journal club meetings.

### Assisting Pharmacology Faculty in Teaching or Grading Exams

Students are expected to sign up at the start of the fall term to proctor at least two pharmacology exams. Students should see the graduate student representative to sign up for proctoring assignments. Proctoring assignments are very important to the department, and should only be missed for emergencies. If an emergency necessitates a student's absence, the student must inform the student representative in advance, and will be expected to make up the proctoring assignment. During the course of the year, the graduate student representative may be asked to assign students

other duties as the need arises. An effort will be made to distribute duties fairly among graduate students.

Integrated Biomedical Sciences Program

Students are expected to assist the department in introducing new students to the IBS program. This may include attending lunches and question/answer sessions, or giving tours or demonstrations.

## IV. M.D./Ph.D. Students

### A. Transition from M.D. Training to Ph.D. Training

This usually takes place following the second year of medical school, after selecting a graduate program and major advisor. In order to make the transition as smooth as possible, students should be aware of the following points.

- Formal leave from medical school should be obtained from the Division of Student Affairs.
- Students must be admitted to the Graduate School ([http://www.research.uky.edu/gs/gspcedure\\_onlineapp.html](http://www.research.uky.edu/gs/gspcedure_onlineapp.html)). Students should apply early, in order to allow time for receipt of transcripts, etc. Check with your advisor and the DGS about whether to apply for summer or fall admission.
- Have your major advisor contact Deborah Turner before May to set up employment as a research assistant.
- Health insurance coverage usually begins in August.

### B. The Modified Graduate Curriculum

Entering M.D./Ph.D. students are regarded as second-year graduate students. They are expected to follow the second-year curriculum (page 3), but are excused from taking PHA 622. A typical timeline for the M.D./Ph.D. curriculum is as follows.

#### Fall, 1<sup>st</sup> year

PHA 621 PRINCIPLES OF DRUG ACTION	(3 hours)	Dr. Swanson/Piascik
PHA 750 RESEARCH IN PHARMACOLOGY	(5 hours)	Dr. Hadley
PHA 770 SEMINAR IN PHARMACOLOGY	(1 hour)	Dr. Hadley

#### Spring, 1<sup>st</sup> year

STA 580 BIostatistics I	(3 hours)	Dr. Breheny
PHA 750 RESEARCH IN PHARMACOLOGY	(5 hours)	Dr. Hadley
PHA 770 SEMINAR IN PHARMACOLOGY	(1 hour)	Dr. Hadley
TOX 600 ETHICS IN SCIENTIFIC RESEARCH	(1 hour)	Dr. Mellon

#### Fall, 2<sup>nd</sup> year (and following terms)\*

PHA 767 DISSERTATION RESEARCH*	(2 hours)	Dr. Hadley
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\* PHA 767 should be taken fall and spring semesters, beginning with the term the qualifying exam is taken (usually Fall, 2<sup>nd</sup> year).

## V. General Information

### A. Financial Topics

#### Stipends

Graduate students in good standing receive a competitive stipend jointly set by the departments participating in the IBS program. Note that the University treats the stipends as wages paid to part time employees, and thus they are tax-liable. The stipends may be derived from a variety of sources, including departmental funds, research grants, scholarships or fellowships, and training grants.

In return for the stipend, students are expected to follow the course of study, conduct research, assist in teaching, and assist the department in other assorted duties. Some funding sources (e.g. training grants) may have additional requirements. Graduate school is regarded as a full-time endeavor, so the department discourages outside employment.

#### Tuition

Students awarded a research assistantship or fellowship receive payment of tuition, both in-state and out-of-state. Students should be aware that tuition fees paid for the student may be viewed as taxable income by federal and state governments.

Students are guaranteed payment of tuition related to their doctoral programs subject to the following conditions. (1) The coursework for which the student has registered has been approved by the IBS director during the IBS year, and by the chair of their advisory committee and the DGS of their program, once they have entered a doctoral program. (2) The student is in good academic standing. Students who have been notified by the Graduate School that they are officially on scholastic probation will be responsible for payment of in-state tuition charges while they remain on probation. During this time, out-of-state tuition will be paid by the PI/program for out-of-state students. Once they have raised their GPA to the required 3.0 to regain good academic standing, payment of any future tuition charges will be covered by their PI and/or program, subject to condition #1.

#### Student Health Insurance

The Graduate School provides student health insurance, and pays a fee allowing access to the Student Health Center for minor illnesses. Health insurance for dependents is offered through the University. Insurance coverage usually begins in August. **Further information is available at the Graduate School homepage ([http://www.research.uky.edu/gs/StudentFunding/health\\_insurance.html](http://www.research.uky.edu/gs/StudentFunding/health_insurance.html)) under “Health Insurance Coverage”. Additional information can be obtained by calling the Graduate School at 257-6608, or by e-mailing the health insurance coordinator at [GSFH@uky.edu](mailto:GSFH@uky.edu).**

### B. Vacations and Holidays

New students should be aware that graduate school differs from undergraduate study in that graduate work is a full-time endeavor throughout the 12 months of the year. In general, students are expected to be in lab during the workweek when not in class or studying. The department has no specific guidelines governing holidays and vacations, so the research advisor should be consulted before planning time off. Students should also be aware that time-sensitive scientific research can often require work on holidays, weekends, and nights.

### C. Personal and Lab Safety

Students should always consult with a faculty member before using new equipment, toxins, chemicals or infectious agents. Students should also be aware that the University requires specific safety training before using various methods and equipment. The following is a partial list of University web pages where you can register for specific training classes or review appropriate safety manuals.

- Checklist for required safety training: <http://ehs.uky.edu/rescklst.html>
- Blood Borne Pathogens: [http://ehs.uky.edu/classes/bloodborne\\_specific/](http://ehs.uky.edu/classes/bloodborne_specific/)
- Chemical Hygiene and Lab Safety: <http://ehs.uky.edu/classes/chemhyg/>
- Hazardous Waste: [http://ehs.uky.edu/classes/hazardous\\_waste\\_general/](http://ehs.uky.edu/classes/hazardous_waste_general/)
- Lab Animals: [http://www.research.uky.edu/ori/univet/training/Web-Based\\_Training.htm](http://www.research.uky.edu/ori/univet/training/Web-Based_Training.htm)
- Radiation Safety: [http://ehs.uky.edu/classes/classes\\_radiation\\_0001.php](http://ehs.uky.edu/classes/classes_radiation_0001.php)
- Additional training classes: <http://ehs.uky.edu/classes/>. These include Autoclaves, Biological Safety, Biological Safety Cabinets, Chemical Fume Hood, Laser Safety and several others.

### D. Disciplinary Issues

Reasons for dismissing a student from the department's graduate program include the following.

- Failure to make adequate progress towards a doctoral degree, as judged by the student's advisory committee.
- Failure to pass the qualifying exam.
- Plagiarism on class assignments or exams, or else on the qualifying exam or dissertation.
- Academic cheating, falsification of research data, or misuse of University equipment or grant funds.
- Violation of the Code of Student Conduct.  
(<http://www.uky.edu/StudentAffairs/Code/part1.html>)
- Scholastic probation. When students have completed 12 or more semester hours of graduate course work with a cumulative GPA of less than 3.0, they will be placed on scholastic probation. Students will have one full-time semester or the equivalent (nine hours) to remove the scholastic probation by attaining a 3.0 cumulative GPA. If probation is not removed, students will be dismissed from the Graduate School.

It is by mutual consent that a graduate student carries out dissertation research in the major professor's laboratory. The dissertation research can be terminated if desired by either the advisor or student. If requested, the department will make a good-faith effort to place the student with another research advisor, but cannot guarantee this.

## **E. Miscellaneous**

### Keys

Requests for lab or equipment room keys must be approved by your research advisor and departmental chair. Key forms are obtained from the departmental administrator.

### Photocopier Privileges

Students may use the departmental photocopier for either research or academic, but not personal, use. An access code may be obtained from the departmental administrator.

### Mailbox

Students have mailboxes at the end of the third floor MS corridor. Check for announcements regularly.

**APPENDIX A**  
**Department of Molecular and Biomedical Pharmacology**  
**Program Assessment (revised 2011)**

### **Mission Statement**

The mission of the graduate program is to provide students with a strong foundation of knowledge in pharmacology, and well as training and experience in scientific discovery, to prepare them for productive careers in research, education, and public service.

### **Learning Outcomes**

1. Be able to demonstrate mastery of the discipline of pharmacology.
2. Be able to critically analyze scientific presentations and articles.
3. Be able to collect scientifically sound experimental data and interpret it correctly.
4. Be able to formulate an innovative hypothesis and design a rational experimental strategy to test it.
5. Be able to give an oral presentation and lead a discussion of research findings to an audience of scientific peers.

### **Assessment Responsibilities**

Students will be assessed for learning outcomes by faculty on either the Pharmacology Graduate Committee, or on students' individual Advisory Committees. Reports will be sent to the Director of Graduate Studies for analysis. The Director of Graduate Studies, along with the Pharmacology Graduate Committee, will use the statistics for program review as outlined below. Recommendations will be formulated based on the program review and taken to the full faculty for discussion and implementation.

### **Assessment Methods and Procedures**

Program assessment will include both indirect and direct measures of learning.

#### *A. Indirect evidence of learning*

1. Statistics on grades earned in the PHA core courses of PHA 621, PHA 622, and STA 580 will be evaluated every 2 years. This is an indirect measure of learning outcomes 1-4.
2. The number of manuscripts accepted in peer-reviewed journals for each incoming class will be evaluated every 2 years. This is an indirect measure of learning outcomes 3 and 4.
3. The number of presentations at local, regional, national, and international conferences will be evaluated for each class every 2 years. This is an indirect measure of learning outcomes 3-5.
4. Student graduation rates and time to graduation will be evaluated every 2 years. This is an indirect measure of learning outcome 1, 3 and 4.

### *B. Direct evidence of learning*

1. Baseline information will be acquired from 1st year students using the Integrated Biomedical Sciences laboratory rotation evaluations. These data will be tabulated for each 1st year student and statistically analyzed for the entire first year class. At matriculation to departments, data for the entire first year class will be broken down by department and will be forwarded to each department.

Specifically, this baseline information will cover learning outcomes 2-4.

2. Students will give annual oral research presentations, starting in their third year. The department's five member Graduate Committee, including the Director of Graduate Studies, will assess their performance during both the presentation and the following discussion, following a rubric scoring guide. This information will cover learning outcome 5.

3. Individual student Advisory Committees, including the dissertation advisor, will provide an annual evaluation of each student. Included in these evaluations is a rubric to provide measures of learning outcomes 3 and 4. Scores will be averaged for students during each of their years in the department and assessed for progress from the 2nd year until graduation.

4. Advisory Committees will evaluate students for learning outcomes 1-4 during the qualifying exam and again at the final dissertation exam. The same rubric used in the annual evaluations will be used for outcomes 3 and 4, with an additional rubric covering learning outcomes 1 and 2.

### **Assessment Cycles**

We will accumulate data for two incoming classes prior to program evaluation by the DGS and Graduate Committee. Moreover, we will examine trends over multiple cycles once we have sufficient data for comparison. Data for the indirect measures of learning outcome can be gathered for preceding years. Direct measurements of learning have been implemented in this academic year, so evaluation will occur once two years of data have been gathered.

## Curricular Map

<b>Learning Outcome</b>	<b>PHA 621</b> Principles of Drug Action	<b>PHA 622</b> Molecular Drug Targets	<b>STA 580</b> Biostatistics	<b>PHA 750</b> Research in Pharmacology	<b>PHA 767</b> Dissertation Research	<b>PHA 770</b> Pharmacology Seminar
1) Mastery of Pharmacology	IER	IER		I	A	A
2) Critical Analysis	IE	IE		IE	RA	RA
3) Data Collection & Interpretation			IE	IE	RA	RA
4) Hypothesis & Experimental Design			IE	IE	RA	RA
5) Oral Presentation & Discussion				IE	RA	IERA

**I = Outcome Introduced**  
**E = Outcome Emphasized**

**R = Outcome Reinforced**  
**A = Outcome Assessed/Applied**

## Artifact Map

Learning Outcome	IBS Evaluations	Advisory Committee Evaluations	Student Seminar Evaluations	Qualifying Exam Evaluations	Dissertation Defense Evaluations
1) Mastery of Pharmacology				Start of 3 <sup>rd</sup> year	End of dissertation research
2) Critical Analysis	First year			Start of 3 <sup>rd</sup> year	End of dissertation research
3) Data Collection & Interpretation	First year	Annual, beginning in 2 <sup>nd</sup> year		Start of 3 <sup>rd</sup> year	End of dissertation research
4) Hypothesis & Experimental Design	First year	Annual, beginning in 2 <sup>nd</sup> year		Start of 3 <sup>rd</sup> year	End of dissertation research
5) Oral Presentation & Discussion			Annual, beginning in 3 <sup>rd</sup> year		

## STUDENT SEMINAR EVALUATION

Student Speaker: \_\_\_\_\_

Date: \_\_\_\_\_

Faculty Evaluator: \_\_\_\_\_

Presentation Criteria	Attributes of an Experienced Speaker	Attributes of an Inexperienced Speaker	Summary
<b>Be able to prepare an effective visual scientific presentation.</b>	<input type="checkbox"/> Number of slides was appropriate for the time allotted. <input type="checkbox"/> Slide text and figures were legible and visible to the audience. <input type="checkbox"/> Slides proofed for errors. <input type="checkbox"/> Captions made clear the purpose and conclusions of slides.	<input type="checkbox"/> Too many slides causing a rushed presentation. <input type="checkbox"/> Too few slides causing an incomplete presentation. <input type="checkbox"/> Slides were dark, had small or crowded elements, or frequently had typos. <input type="checkbox"/> Slides were not easily comprehensible without extensive explanation.	
<b>Be able to prepare a well-organized and effective oral presentation.</b>	<input type="checkbox"/> A clear hypothesis/rationale was presented. <input type="checkbox"/> Amount of background material was appropriate to appreciate the significance of the research. <input type="checkbox"/> Conclusions and limitations of the study were clear, and well-justified.	<input type="checkbox"/> A hypothesis and rationale was absent, or was not directly addressed by the study. <input type="checkbox"/> Background material was insufficient, or so extensive that it affected the presentation of results. <input type="checkbox"/> Conclusions were absent or not justified by results.	
<b>Be able to present a lucid and engaging scientific talk about a research project.</b>	<input type="checkbox"/> Spoke clearly and audibly, engaging the audience. <input type="checkbox"/> Presentation was well-practiced. <input type="checkbox"/> Complex ideas and terms were adequately explained.	<input type="checkbox"/> Presentation was difficult to hear, was rushed or slow-paced, or presented in a monotone. <input type="checkbox"/> Speaker faced the presentation more than the audience, or mostly read directly from slides or notes. <input type="checkbox"/> Complex ideas and terms were unexplained or confusing.	
<b>Be able to carry out a high-quality scientific discussion on a research project.</b>	<input type="checkbox"/> Speaker understood questions, or asked for clarification. <input type="checkbox"/> Speaker provided audible, clear, relevant answers to questions. <input type="checkbox"/> Speaker demonstrated extensive knowledge about the research area.	<input type="checkbox"/> Speaker misunderstood audience questions. <input type="checkbox"/> Answers were inaudible. <input type="checkbox"/> Answers did not directly or correctly address audience questions. <input type="checkbox"/> Speaker was not familiar enough with the research area.	
<b>Overall Seminar</b>			

### Explanation of Evaluation

Outstanding (4): most checked attributes are in the experienced column.

Proficient (3): more experienced than inexperienced attributes were observed.

Good (2): more inexperienced than experienced attributes were observed.

Novice (1): most checked attributes are in the inexperienced column.

Specific Comments/Suggestions:

## ANNUAL ADVISORY COMMITTEE STUDENT EVALUATION

Student: \_\_\_\_\_

Date: \_\_\_\_\_

Faculty Evaluator: \_\_\_\_\_

Learning Outcomes	Criteria and Evaluation			
<b>Be able to collect scientifically sound experimental data and interpret it correctly.</b>	<b>1) Demonstrates expertise in relevant laboratory methods and techniques.</b>			
	<input type="checkbox"/> Fully independent	<input type="checkbox"/> Mostly independent	<input type="checkbox"/> Requires guidance	<input type="checkbox"/> Lab skills under development
	<b>2) Applies appropriate statistical analysis to data.</b>			
	<input type="checkbox"/> Thorough analysis	<input type="checkbox"/> Analysis needs to be expanded	<input type="checkbox"/> Analysis inappropriate or in error	<input type="checkbox"/> Analysis largely absent
	<b>3) Demonstrates awareness of limitations of experimental approaches.</b>			
<input type="checkbox"/> Thorough discussion	<input type="checkbox"/> Discussion needs to be expanded	<input type="checkbox"/> Discussion fairly limited	<input type="checkbox"/> Not discussed	
<b>4) Conclusions justified by data</b>				
<input type="checkbox"/> All are well-justified	<input type="checkbox"/> Most are well-justified	<input type="checkbox"/> Some are speculative	<input type="checkbox"/> Many are speculative	
<b>Be able to formulate an innovative hypothesis and design a rational experimental strategy to test it.</b>	<b>1) Hypothesis is novel, and its evaluation will make a valuable scientific contribution.</b>			
	<input type="checkbox"/> Hypothesis is novel and important.	<input type="checkbox"/> Hypothesis is novel, but importance should be better explained.	<input type="checkbox"/> Hypothesis is largely confirmatory of prior work.	<input type="checkbox"/> Hypothesis unstated or under development.
	<b>2) Experimental design is achievable and will provide a thorough test of the hypothesis.</b>			
	<input type="checkbox"/> Well-thought out design	<input type="checkbox"/> Design needs minor revisions	<input type="checkbox"/> Design needs moderate revisions	<input type="checkbox"/> Design will not successfully test the hypothesis, or under development
	<b>3) Limitations of the experimental design and alternative approaches were considered.</b>			
<input type="checkbox"/> Thorough discussion	<input type="checkbox"/> Discussion needs to be expanded	<input type="checkbox"/> Discussion fairly limited	<input type="checkbox"/> Not discussed	
<b>4) Student has made a major independent contribution to the experimental design.</b>				
<input type="checkbox"/> Student demonstrates substantial initiative	<input type="checkbox"/> Experimental design is collaborative effort	<input type="checkbox"/> Limited involvement in experimental design	<input type="checkbox"/> Student not yet actively engaged in experimental design	

Specific Comments/Suggestions:

## QUALIFYING EXAM/DISSERTATION DEFENSE EVALUATION (Page 1 of 2)

Student: \_\_\_\_\_

Date: \_\_\_\_\_

Faculty Evaluator: \_\_\_\_\_

Learning Outcomes	Criteria and Evaluation			
<b>Be able to collect scientifically sound experimental data and interpret it correctly.</b>	<b>1) Demonstrates expertise in relevant laboratory methods and techniques.</b>			
	<input type="checkbox"/> Fully independent	<input type="checkbox"/> Mostly independent	<input type="checkbox"/> Requires guidance	<input type="checkbox"/> Lab skills under development
	<b>2) Applies appropriate statistical analysis to data.</b>			
	<input type="checkbox"/> Thorough analysis	<input type="checkbox"/> Analysis needs to be expanded	<input type="checkbox"/> Analysis inappropriate or in error	<input type="checkbox"/> Analysis largely absent
	<b>3) Demonstrates awareness of limitations of experimental approaches.</b>			
	<input type="checkbox"/> Thorough discussion	<input type="checkbox"/> Discussion needs to be expanded	<input type="checkbox"/> Discussion fairly limited	<input type="checkbox"/> Not discussed
	<b>4) Conclusions justified by data</b>			
<input type="checkbox"/> All are well-justified	<input type="checkbox"/> Most are well-justified	<input type="checkbox"/> Some are speculative	<input type="checkbox"/> Many are speculative	
<b>Be able to formulate an innovative hypothesis and design a rational experimental strategy to test it.</b>	<b>1) Hypothesis is novel, and its evaluation will make a valuable scientific contribution.</b>			
	<input type="checkbox"/> Hypothesis is novel and important.	<input type="checkbox"/> Hypothesis is novel, but importance should be better explained.	<input type="checkbox"/> Hypothesis is largely confirmatory of prior work.	<input type="checkbox"/> Hypothesis unstated or under development.
	<b>2) Experimental design is achievable and will provide a thorough test of the hypothesis.</b>			
	<input type="checkbox"/> Well-thought out design	<input type="checkbox"/> Design needs minor revisions	<input type="checkbox"/> Design needs moderate revisions	<input type="checkbox"/> Design will not successfully test the hypothesis, or under development
	<b>3) Limitations of the experimental design and alternative approaches were considered.</b>			
	<input type="checkbox"/> Thorough discussion	<input type="checkbox"/> Discussion needs to be expanded	<input type="checkbox"/> Discussion fairly limited	<input type="checkbox"/> Not discussed
	<b>4) Student has made a major independent contribution to the experimental design.</b>			
<input type="checkbox"/> Student demonstrates substantial initiative	<input type="checkbox"/> Experimental design is collaborative effort	<input type="checkbox"/> Limited involvement in experimental design	<input type="checkbox"/> Student not yet actively engaged in experimental design	

Specific Comments/Suggestions:

**QUALIFYING EXAM/DISSERTATION DEFENSE EVALUATION (Page 2 of 2)**

Learning Outcomes	Criteria & Evaluation			
<b>Be able to critically analyze scientific presentations and publications.</b>	<b>1) Demonstrate familiarity and a thorough understanding of the relevant scientific literature.</b>			
	<input type="checkbox"/> Demonstrates expertise	<input type="checkbox"/> Satisfactory level of knowledge	<input type="checkbox"/> Some important gaps in knowledge of literature	<input type="checkbox"/> Not yet familiar with key literature
	<b>2) Be able to identify controversies or knowledge gaps in the literature, and use them to develop hypotheses and experimental design.</b>			
	<input type="checkbox"/> Experimental design well-integrated with literature discussion	<input type="checkbox"/> Substantial integration of literature discussion and experimental design	<input type="checkbox"/> Some integration of literature discussion and experimental design	<input type="checkbox"/> Experimental design and hypothesis not yet developed
<b>Be able to demonstrate mastery of the discipline of pharmacology.</b>	<b>3) Be able to identify weaknesses and limitations of relevant scientific publications.</b>			
	<input type="checkbox"/> Thorough analysis and discussion of literature	<input type="checkbox"/> Satisfactory analysis and discussion of literature	<input type="checkbox"/> Largely passive literature discussion with limited critique	<input type="checkbox"/> Passive discussion of literature
	<b>1) Be able to apply key pharmacological principles (e.g. drug-receptor interactions, agonists/antagonists, dose-response, pharmacokinetics, drug transport, metabolism, or excretion) to applicable aspects of experimental design, data analysis, or literature discussion.</b>			
	<input type="checkbox"/> Thorough understanding	<input type="checkbox"/> Satisfactory understanding	<input type="checkbox"/> Some important gaps in knowledge	<input type="checkbox"/> Not yet familiar with key concepts

Specific Comments/Suggestions:

**APPENDIX B**  
**PHARMACOLOGY GRADUATE FACULTY**

Blalock, Eric	(Full Member)
Chen, Kuey	(Associate Member)
Craven, Rolf	(Full Member)
Hadley, Robert	(Full Member)
Head, Elizabeth	(Full Member)
Head, Elizabeth	(Full Member)
Jo, Misung	(Associate Member)
Kaetzel, David	(Full Member)
Kilgore, Michael	(Full Member)
Landfield, Philip	(Full Member)
Littleton ,John	(Full Member)
Norris, Christopher	(Full Member)
Pavlik, Edward	(Full Member)
Piasek, Michael	(Full Member)
Plattner, Rina	(Full Member)
Porter, Nada	(Full Member)
Slevin, John	(Full Member)
Smyth, Susan	(Full Member)
Swanson, Hollie	(Full Member)
Thibault, Olivier	(Full Member)
Xu, Ren	(Associate Member)
Yang, Xiuwei	(Associate Member)