



School of Graduate Studies in the Health Sciences Department of Pharmacology & Toxicology

May 15, 2012

MEDICAL PHARMACOLOGY

PROGRAM DESCRIPTION

The Department of Pharmacology and Toxicology offers a program in Medical Pharmacology leading to the Ph.D., with the primary objective of training individuals for a successful career in pharmacology, toxicology or a related biomedical science. That objective is achieved through a combination of formal course work, independent study and both faculty-directed and independent research. Students are exposed to fundamental principles of pharmacology as well as current concepts related to mechanisms of actions of an array of different classes of drugs and modern research techniques. The curriculum provides ample opportunities for students to improve their written and verbal communication skills and to develop skills in critical thinking, problem solving and experimental design. Research in the Medical Pharmacology program focuses on renal - cardiovascular diseases, with an emphasis on metabolic disorders, and cancer biology. The Ph.D. is awarded to students who demonstrate mastery of pharmacological principles, complete a research dissertation and have a minimum of one first author publication.

ADMISSION REQUIREMENTS

Admission to the graduate program in Medical Pharmacology requires an academic degree from an accredited college or university, a superior academic record, and satisfactory performance on post-graduate (GRE or Graduate Record Examination) and English proficiency (TOEFL or Test of English as a Foreign Language) examinations or its equivalent. Although a background in one of the basic sciences (e.g., pharmacy, biology, chemistry, biochemistry) or mathematics is recommended, outstanding students with a background in any discipline will be considered.

PROGRAM OUTCOMES

Graduates of the program in Medical Pharmacology will be able to

Identify gaps in current knowledge of the pharmacokinetics and pharmacodynamics of drugs and other chemical agents.

design, implement and direct basic research aimed at alleviating knowledge gaps applicable to the pharmacokinetics and pharmacodynamics of drugs and other chemical agents.

collaborate with colleagues in the basic and clinical sciences in translational research aimed at identification of novel therapeutic agents and improvement of clinical outcomes for the pharmacological treatment of disease.

relate pharmacological data to their colleagues in the basic and clinical sciences as well as to leaders in the health care and regulatory communities.

participate in the training of basic and clinical scientists and health care providers in the areas of pharmacology and toxicology.

EXPECTATIONS OF STUDENTS

It is expected that a student will, within 5 years of enrollment in the program, complete the core curricula for the School of Graduate Studies and the Medical Pharmacology program with a grade point average of 3.0 (80%) or better.

complete the major pharmacology courses, Mechanisms of Drug Action and Pharmacology & Therapeutics, with a grade of 80% or better.

pass the Qualifying Examination with a score of 80% or better.

complete dissertation research under the director of a faculty mentor and advisory committee.

author a minimum of two peer-reviewed manuscripts, with first authorship on at least one.

write and successfully defend a dissertation.

Additional information about the Medical Pharmacology program, the curriculum, requirements for the doctoral degree and processes by which a student meets these expectations are provided in the remainder of this document.

CURRICULUM

Core component

Required Pharmacology Courses

- PHARM701 Seminar
- PHARM702 Recent Advances in Pharmacology and Toxicology (student journal club)
- PHARM722 Pharmacology and Therapeutics
- PHARM723 Mechanisms of Drug Action
- PHARM790 Special Topics (Cell Signaling) [*or BIOCHEM744 Cellular Biochemistry II*]
- PHARM792 Research Rotations (minimum of 2)

Required Support Courses

- BIOCH704 Fundamental Biochemistry
- PHYSIO725 Fundamental Physiology

Required Interdisciplinary Courses

- ID709 Research Ethics (SOGS)
- ID710 Research Tools in Molecular Biology (SOGS)
- ID714 Professional Skills for Graduate Students and Postdoctoral Fellows (SOGS)
- ID740 Statistical Methods in Research 1 (SOGS)

Elective component

Electives in Pharmacology

- PHARM 785 Principles of Modern Drug Design
- PHARM 790 Special Topics, offered on request

Electives offered by other Graduate Departments

- ANAT713. Histology and Cell Biology
- BIOCH743 Cellular Biochemistry I (Fall Semester, even years)
- BIOCH744 Cellular Biochemistry II (Spring Semester, even years)

ID704 An Introduction to Animal Research
 ID715 Teaching in Higher Education
 NSCI701 Fundamental Neuroscience
 NSCI706 CNS Pharmacology
 PHYSIO704. Molecular Physiology
 PHYSIO717. Circulatory Physiology
 PHYSIO731. Renal and Body Fluid Physiology

Dissertation/Thesis

PHARM798 Dissertation and Dissertation Research

Other Requirements

Peer-reviewed 1st author publication

PLAN OF STUDY

Upon entry into the program, students complete the required courses in the Interdisciplinary and Medical Pharmacology programs. A recommended plan of study follows. The sequence of courses and other activities depicted are based on a progression from fundamental to more advanced course work and skills development. Upon completion of fundamental courses, the plan of study can be tailored, through the provision of advanced courses in this or other graduate programs, to more closely meet the interests and needs of individual students. More detailed explanations of the requirements for the Ph.D. are provided later in this document.

Suggested Pre-Candidacy Plan of Study

Yr	Semester	Course	Description	Hours
1	Summer	Pharm 792	Research Rotation ¹	1
				subtotal ² 1
Fall	Biochem	704	Fundamental Biochemistry	R ³ 7
	ID	709	Research Ethics ⁴	R 1
	Pharm	701	Seminar ⁵	R 1
	Pharm	792	Research Rotation	R 3
	Physiol	725	Fundamental Physiology ⁶	R 4
	PM	740	Statistical Methods in Research	R 3
				subtotal ² 19
Spring	ID	710	Research Tools for Molecular Biology ⁷	R 3
	ID	714	Professional Skills ^{4,8}	R 3
	Pharm	702	Recent Advances in Pharmacology ⁹	R 1
	Pharm	790	Special Topics (<i>Cell Signaling</i>)	R 2
	Pharm	792	Research Rotation	R 3
	Physiol	725	Fundamental Physiology	R 4
				subtotal ² 16
2	Summer	Pharm 792	Research Rotation	1
				subtotal ² 1

2	Fall	Pharm	701	Seminar ⁵	R	1	
		Pharm	722	Pharmacology & Therapeutics	R	6	
		Pharm	723	Mechanisms of Drug Action ¹⁰	R	4	
		Pharm	792	Research Rotation	R	3	
					subtotal ²		14
	Spring	Pharm	722	Pharmacology & Therapeutics	R	6	
		Pharm	723	Mechanisms of Drug Action ¹⁰	R	4	
		Pharm	792	Research Rotation	R	3	
					subtotal ²		13
					Total⁵		63

This proposed pre-candidacy curriculum is based on information available at the time of preparation and is subject to changes dictated by modifications in the curricula of other programs as well as stipulations imposed by the School of Graduate Studies, the Registrar, the MS Institute of Higher Learning (IHL) or other accrediting bodies.

Explanations for 'Suggested Pre-candidacy Plan of Study':

Shading indicates that a course is part of the core graduate curriculum. Courses shaded in green are required by the Graduate School, whereas those with yellow shading are pharmacology specific.

1. Applicable only to students entering the program during the summer semester.
2. Totals and subtotals do not include Dissertation Research. Also, credit for 1st year summer Research Rotation does not apply to students who enter in the fall semester. A minimum of 30 semester hours is required for the M.S., whereas a minimum of 45 semester hours is required for the Ph.D. In both cases, hours must be for graded courses.
3. Indicates that a course is required as part of the pharmacology and toxicology program.
4. Required as part of the core curriculum for the Graduate School. Research Ethics (ID709) is required for award of a 'Master of Science in Biomedical Sciences' degree, whereas both ID709 and ID 714 (Professional Skills) are required for award of a Ph.D. ID709 is to be completed prior to the qualifying examination. ID 714 may be taken any time prior to award of the Ph.D.

Note also that Research Ethics is limited to 30 students per semester so it might be taken in the spring rather than the fall semester.

5. Students participate during both the fall and spring semesters, but only register for Pharm 701 in the fall semester.
6. Fundamental Physiology (Physiol 725) begins in mid October of the fall semester and ends early March of the spring semester.
7. Offered alternate (odd) years; thus, it might be taken during either the first or the second year.
8. Interdisciplinary course, required for the Ph.D.; may be taken during any year, but must be completed prior to the expected date of graduation.
9. Students participate during both the fall and spring semesters, but only register for Pharm 702 in the spring semester.
10. Taken in conjunction with Pharm 722.

In addition to curriculum outlined above, a student may take an elective offered by any graduate program. Electives should be chosen on their potential to enhance the student's fundamental

understanding of his/her identified research area and to strengthen his/her dissertation. Depending on the circumstances, an elective may be taken before or after admittance to candidacy for the Ph.D. Permission of the course director, Pharmacology program director and the student's mentor (if applicable) are required prior to registration for the course. (see Electives below, page 7, for additional information).

Post-Candidacy Plan of Study

The registration schedule for a Ph.D. candidate might be similar to the one that follows:

Yr	Quarter	Course	Description	Hours
3	Summer	Pharm 790	Qualifying Examination ¹	R ² 1
	Fall	Pharm 798	Dissertation Research	R 1
	Spring	Pharm 798	Dissertation Research	R 1
		ID 715	Teaching in Higher Ed ³	E ⁴ 2
4	Summer	Pharm 798	Dissertation Research	R 1
	Fall	Pharm 798	Dissertation Research	R 1
	Spring	Pharm 798	Dissertation	R 1

Explanations for 'Post-candidacy Plan of Study':

1. The Qualifying Examination is taken after successful completion of other courses required by the Graduate and Medical Pharmacology programs. A possible exception is ID714, which is required for the Ph.D. but could be taken later in the program. In any event, the student must pass the Qualifying Examination before admittance to candidacy for the Ph.D. Note that after successful completion of the Qualifying Examination, Dissertation Research replaces Research Rotation, and hours decrease accordingly from 9 to 1 per semester for a student to be considered 'full time' and eligible for stipend support.
2. Required
3. May be taken prior to admittance to candidacy or later in training; A candidate might also choose to take ID714 'Professional Skills'
4. Elective; a candidate might also elect to take an advanced course if it relates directly to the candidate's dissertation research

BENCHMARKS FOR PROGRESSION TOWARD THE PH.D.

It is anticipated that students who enroll in the Medical Pharmacology program will complete the requirements for the Ph.D. within 5 years. Benchmarks for progression through the curriculum in that period are summarized below. Benchmarks represent minimum program expectations and a guide by which both the student and the mentor can assess progress. It is also recognized that there will be variations between individual students that are dependent on the nature of their dissertation research.

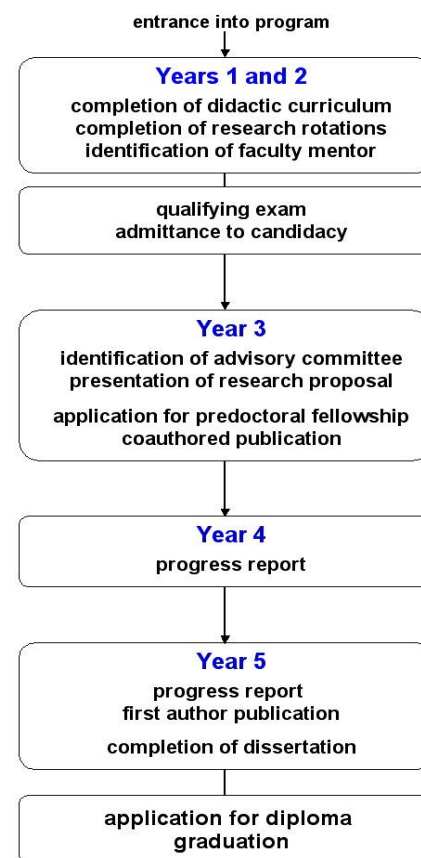
Student are introduced to research (as laboratory rotation) in their first term and continue research training throughout the first two years. Students also complete formal course work during years 1

and 2. Students take the Qualifying Examination and apply for admittance to doctoral candidacy during the summer term between years 2 and 3. Students should also have identified a mentor for dissertation research by the end of year 2.

Midway through the third year, students have identified a dissertation project and an advisory committee and have defended a research proposal. It is expected that by the end of the third year a student will have been in a laboratory long enough to have contributed to on-going research and coauthor a first manuscript. The student is also expected to submit an application for a pre-doctoral fellowship during year 3.

During year 4, students are fully engaged in dissertation research. They are expected to present at least one formal progress report to program faculty and their advisory committee. Also, if previously unsuccessful, they are expected to apply for a pre-doctoral fellowship.

In year 5, students present an update of their progress, have an accepted first author paper, and are granted permission by the advisory committee to complete dissertation research. By the end of the fifth year, students submit a written dissertation to the advisory committees and publically defend the dissertation to the program and other graduate faculty.



DIRECTION AND SUPERVISION

Decisions related to a student's course of study are made under the direction of the graduate program director until such time the student identifies a faculty mentor for dissertation research. Thereafter, the mentor will assume primary advisory responsibility for the remainder of the student's graduate training. Selection of a mentor – i.e., a laboratory in which to do dissertation research – occurs through mutual agreement between the student and the faculty, with approval from the Graduate Director, Department Chair or both.

The student, with approval by the mentor, will also select a faculty advisory committee. The advisory committee is often selected after admittance to candidacy and prior to presentation of the research proposal. However, students are encouraged to select an *ad hoc* advisory committee as soon as a dissertation project is identified and formalize the committee after admittance to candidacy. Members of the committee should be selected on the basis of their potential to contribute to the breadth and depth of the dissertation research. The committee will be chaired by the mentor and will include a minimum of four other members. Four of the members, including the primary mentor, must be affiliated with the graduate program of the Department of Pharmacology & Toxicology (as indicated by the current Bulletin), and at least one member must be from outside the pharmacology program. All members of the committee must be members of the graduate faculty or approved by the Dean of the Graduate School if from outside the University of Mississippi Medical Center. The committee will function in an advisory capacity for the student – as well as the mentor – during the research portion of graduate training. It will aide in the definition of objectives, direction, and limits to the dissertation research. The committee is also responsible for the final recommendation as to whether the student has satisfactorily completed the research and first author requirements for the

Ph.D. At least five members of the Advisory Committee must be present at the final oral examination.

A review of student progress occurs regularly during the student's tenure in the program. It occurs at the end of each term by the program director and, after being identified, the mentor. All program faculty contribute to student review at the end of each research rotation (years 1 and 2) and at least annually thereafter. The advisory committee formally begins contributing to the evaluation of student progress at the defense of the research proposal (year 3), but can offer guidance if identified prior to a student's admittance to candidacy.

As a part of their annual evaluation with the program director, the department chair and/or their advisory committee, it is expected that the student will identify goals for the upcoming year. For students within the first two years of the program, goals might relate to courses they will take or methods they wish to master in laboratory rotation. The goals of more senior students should reflect the progress they wish to make toward completion of their dissertation.

COURSE REQUIREMENTS AND CREDIT HOURS

A minimum of 60 semester hours of formal training is required for the Ph.D. A minimum of 45 of those credit hours must be derived from graded courses, whereas the remainder can be derived from dissertation research. *[Graded courses are those in which the student receives a numerical or letter grade; pass-fail courses do not apply.]* Course requirements are generally fulfilled within the first two years of the program as outlined above in the Plan of Study.

Descriptions of specific courses available through the Medical Pharmacology program are provided at the end of this document. In addition to the indicated required courses, students must complete a minimum of two advanced, graduate level courses of their choice. This latter requirement can be met, with the prior approval of the Graduate Director, by an advanced graduate course from any basic science department.

Within the total of 45 credit hours of graded course work required for the Ph.D., there are specific requirements defined by the Graduate School which stipulate minimum credit hours needed from courses within and outside a student's major area of study. For a Ph.D. with an emphasis in pharmacology, a minimum of 24 credit hours are obtained from completion of courses offered by this program, whereas a minimum of 15 credit hours must be obtained by completion of courses from outside the program in Medical Pharmacology. Part of the latter requirement is fulfilled with a core graduate curriculum. The remainder can be for course work from any graduate program.

Transfer Credit

The Director of the Graduate Program may make recommendations to the graduate school for transfer of credit granted by another accredited institution. Only credit for graduate-level courses can be considered, and the content of a course for which transfer is requested must have been equivalent to the corresponding course taught at UMMC. Moreover, no more than half the credits for a stipulated degree can be transferred. Requests for transfer of credit should be initiated as soon as possible (i.e., at the time of application or acceptance to the program) and prior to the onset of classes.

Electives

Any course offered by the various schools at UMMC can, in theory, be taken as an elective. However, students are encouraged to choose electives from this or other programs that are most relevant to their interests and, consequently, will provide the most benefit to them. The number and

type of electives a student might take will be determined largely by available time. In addition, permission is required from the student's primary advisor, the director of the course, and the directors of the applicable programs. Permission will be granted most readily when a course relates directly to the student's primary area of research.

Although some electives must be taken as part of the pre-candidacy curriculum, a student may choose to take an elective after admittance to candidacy. For instance, a student might take an advanced course that is related directly to the student's dissertation research. Also, a student might take a course that would better prepare him/her for a post-doctoral or academic position near completion of the dissertation.

A list of potential electives is on pages 2-3, and course descriptions begin on page 15.

Other Activities

All students are required to attend and participate in Seminar and Recent Advances in Pharmacology and Toxicology.

Seminar (PHARM. 701) - Participation in Seminar involves attendance at both department and UMMC research presentations and is required during the entire tenure of the graduate student. During their first and second years, students will present formal reports of their laboratory rotations to the department faculty; during subsequent years, students are required to present at least one formal progress report of their dissertation research to all department faculty.

Recent Advances in Pharmacology and Toxicology (Pharm 702) –Participation in Recent Advances is required only of first year students. The course involves a combination of informal presentations and discussions of experimental design and evaluation of scientific papers. More senior students are encouraged, but not required, to participate.

Laboratory Rotations and Selection of a Mentor - Typically, students register for laboratory rotation (Pharm 792; Research in Pharmacology and Toxicology) each term prior to admittance to candidacy for the Ph.D. in Medical Pharmacology. As noted previously, students enrolled in the Master of Biomedical Sciences Program, with an emphasis in pharmacology, are not obligated to take laboratory rotation.

For students who enter the program without a clear research focus, it recommended that a minimum of two rotations be completed in different laboratories. The selection of laboratories (i.e., research faculty) should be premised on the student's research interests, but approval from the appropriate faculty member is required prior to registration. Students who enter the Medical Pharmacology program with a mentor already identified are encouraged to take at least one laboratory rotation outside the mentor's to gain a broader research scope. Baring unforeseen circumstances, laboratory rotations last for the duration of the term (approximately 9 weeks during the summer term; approximately 18 weeks during the fall and spring semesters). Students are strongly encouraged to identify a faculty mentor by the end of the first year or as soon as possible thereafter. Once the mentor is identified, subsequent research rotations can be directed toward definition of a dissertation project. However, additional laboratory rotations may be taken to aid in that decision. In any event, a student must declare a mentor after completion of the qualifying examination.

Toward the end of each rotation, the student is required to prepare a written report and to make a 20-30 minute oral presentation to program faculty related to his/her experiences during the rotation. Completion of these requirements is expected by the end of the term in which the rotation is

scheduled. The written report should be submitted to the research advisor and the program director and be in the form of a manuscript prepared for publication in a peer-reviewed journal. The format of the oral presentation should follow that of a typical research seminar. Both should include the general premise and rationale, statement of a hypothesis or problem being addressed, the experimental approach, results (albeit, perhaps anticipated), and a discussion/conclusion.

The hours received for laboratory rotation (PHARM 792) can vary with the term and in relation to other academic requirements. During the summer term, students typically register for Laboratory Rotation for 1 h, the minimum number of hours required by the Registrar for the student to be considered full-time. During most other semesters, students will register for 3 hours of Laboratory Rotation. However, with prior arrangements between the student, the faculty and the Program Director, credit for Laboratory Rotation can vary from 1-3 hours.

MASTER OF SCIENCE

The Medical Pharmacology program does not award a Master of Science in Medical Pharmacology.

A Masters in Biomedical Sciences can be awarded to students who specifically enroll in the Biomedical Sciences program through the School of Graduate Studies and focus on pharmacology during their training. In all cases, the minimum course requirements and academic standing stipulated by both this and the Biomedical Sciences program must be met for award of the degree.

The basic course requirements for students enrolled in the M.S. program with an emphasis in medical pharmacology are the same as those for students enrolled in the doctoral program. The exceptions are laboratory rotations (Pharm 792) and Professional Skills (ID 714). Neither is required of students enrolled in the M.S. program, but either or both may be taken if a student chooses to do so. For students in the M.S. program who might subsequently want to pursue a Ph.D., completion of one or more laboratory rotations would be advantageous.

A minimum of 30 credit hours from graded courses is required for the M.S. degree, with 15 of those hours from completion of 'core' interdisciplinary (ID) courses and 15 from completion of courses in any graduate program. For students focusing on pharmacology, the majority of the latter 15 credits should be from the Medical Pharmacology program. Completion of a Master's thesis in medical pharmacology, although perhaps beneficial both personally and professionally, will not be reflected on the Master of Biomedical Sciences diploma.

A student who is enrolled in or completes the Masters of Biomedical Sciences program who subsequently wishes to continue toward a doctorate within the Medical Pharmacology program must formally apply and be accepted.

Students who initially enroll in the doctoral program are not eligible for a Master of Science as an intermediate degree. Rather, a degree of Master of Science in Biomedical Sciences can be awarded as a terminal degree to students who enroll in the doctoral program in Medical Pharmacology but do not fulfill the requirements for the Ph.D. or who select to withdraw for other reasons. Although basic course requirements for the medical pharmacology program fulfill those for the M.S., a student enrolled in medical pharmacology must have successfully completed 30 hours of graded courses including ID 709, Research Ethics, and a biomedical statistics course such as ID 740 Statistical Methods in Research, in order to receive a Master of Science as a terminal degree.

EXPECTATIONS FOR ACADEMIC PERFORMANCE

Graduate students should anticipate spending a minimum of 40 hours per week within the department (or on campus) participating in class work, research or other scholarly activity. Students are also expected to exhibit satisfactory performance in these activities, as evidenced, in part, by an overall average of 80% or better. Although students might be given the opportunity to repeat courses, they should strive to perform as well as possible. Failure to achieve a minimum grade of 80% in some required pharmacology or support courses – or to maintain an overall average of 80% or better in all courses – can be grounds for dismissal from the program or loss of stipend support.

Comprehensive Qualifying Examination and Admission to Doctoral Candidacy

Performance in courses is an important determinant of success during the first two years of training. In addition, student progress toward development of an understanding of basic pharmacological principals and their relationship to other basic sciences will be assessed at the end of second academic year through a formal comprehensive examination or Qualifying Examination. Students must pass the qualifying examination before application for and admittance to candidacy for the doctoral degree.

Prerequisites for the Qualifying Examination

- (1) completion of all required courses or activities in the core curriculum for the Graduate School, totaling at least 15 semester hours and excluding ID714 (Professional Skills for Graduate Students and Postdoctoral Fellows).
- (2) completion of all required courses or activities in the core curriculum for the Medical Pharmacology program, excluding advanced graduate courses.
- (3) an overall grade point average of 3.0 (80%) or better.
- (4) a grade of 80% or better in Pharmacology & Therapeutics (PH722).
- (5) a grade of 80% or better in Mechanisms of Drug Action (PH723).
- (6) no more than two grades below 80%.
- (7) approval of the Graduate Director and Department Chair

Format of the Qualifying Examination - The Qualifying Examination will consist of 12-14 essay questions that encompass the principles of the major areas of pharmacology:

- pharmacodynamics/pharmacokinetic, including aspects of biotransformation.
- central and peripheral nervous systems.
- renal/cardiovascular pharmacology, including anticoagulant, antianemic and antihyperlipidemic drugs.
- endocrine - metabolic pharmacology.
- cancer chemotherapeutic drugs.
- antimicrobial/anti-parasitic drugs.
- antiinflammatory/immunosuppressant drugs.

The examination is taken over two consecutive days, with 6-7 questions covering different areas each day. The student will be given 6 hours to answer any 5 questions. The exam will be 'closed book' and administered in a reserved room. Answers will be graded numerically on the basis of content (knowledge), logic and application/synthesis, as appropriate, The student must obtain an overall grade of 80% to pass.

Upon successful completion of the qualifying examination, the student can apply for admittance to candidacy for the doctoral degree. For students enrolled in the Biomedical Sciences program through the School of Graduate Studies with an emphasis in pharmacology, completion of the Qualifying Examination leads to the award of a Master of Biomedical Sciences.

If the student fails the examination, the student might be allowed to take a second examination. The format and composition of the second exam will reflect the student's performance on the initial exam, but will most likely consist of 6-7 questions from which the student can choose 5. However, it is within the discretion of the faculty to conduct an oral examination. Again, the student must obtain an 80% to pass. If the student does not pass the second examination, the student can be dismissed from the program.

DOCTORAL REQUIREMENTS

After admittance to candidacy for the degree of Doctor of Philosophy, the student (candidate) will focus on research leading to a dissertation. Requirements for this to occur are:

- (1) selection of a faculty mentor from among the graduate faculty in the Program of Pharmacology and Toxicology. It is expected that this will have occurred earlier in graduate training, preferably by the end of the first year. If not, the student needs to do so as early as possible.
- (2) definition, with assistance from the mentor, of a research project on which to develop a dissertation.
- (3) selection, with advice from the mentor, of a Research Advisory Committee consisting of at least five members: the mentor who will be the primary research advisor and chair, three members of the graduate faculty from the Pharmacology and Toxicology program, and one outside examiner who is a member of the graduate faculty from another department of UMMC or another accredited institution.

Once the committee is identified and approved by the Dean of the Graduate School, the student must prepare and formally present a research proposal to the committee for its approval. This process: choosing an advisor, choosing an advisory committee and writing a research proposal, should be completed within six months of admittance to candidacy for the doctoral degree. Failure to comply with this requirement is grounds for loss of stipend support or dismissal from the program.

Research Proposal

The proposal is to include

- (1) a short introduction containing the pertinent background material,
- (2) a rationale, hypothesis and specific aims,
- (3) the experiments proposed to test the hypothesis including a brief description of design and proposed methods,
- (4) preliminary results, if there are any, or a description of expected results,
- (5) a discussion that includes interpretation of expected results, and
- (6) a bibliography or pertinent references.

Proposals must be typed and of appropriate length to allow the committee to adequately evaluate the premise, aims, experimental design, and duration of the proposed research.

The written proposal is to be distributed to the committee members a minimum of two weeks prior to the scheduled presentation and committee meeting. The student should be prepared to discuss the proposal, including the experimental design, general feasibility and technical limitations, and time anticipated for completion of the proposed experiments. The student – and the primary advisor - should also be open to recommendations from the committee.

Progress Reports

Students are required to provide at least one progress report to their Research Advisory Committee per year. This progress report must be presented publicly to all faculty as a departmental seminar. The committee also might require a written report. The student will meet with the advisory committee afterward to discuss progress, problems or other aspects of the student's research.

Dissertation

When the research outlined in the proposal has been completed and a dissertation has been written, the student will schedule an oral presentation for public defense of the dissertation. [NOTE: The announcement for the public presentation and defense must be made through the Graduate School.] The oral presentation can be scheduled no sooner than two weeks following receipt of the dissertation by the Research Advisory Committee.

The public presentation and defense will be followed by a private defense of the dissertation to the Research Advisory Committee. Immediately afterward, the Research Advisory Committee will meet to determine whether the:

- (1) candidate has fulfilled all research requirements for the Ph.D. degree,
- (2) dissertation is complete and appropriately structured, and
- (3) defense of the dissertation is adequate.

The committee can require satisfactory correction of any deficiencies noted in the performance of the candidate. These requirements can include, but are not limited to, further experimentation and revision of the dissertation. After the candidate satisfactorily completes all requirements, members of the Research Advisory Committee will sign the appropriate forms that authorize awarding of the Ph.D. degree. If requirements are not satisfactorily addressed, the Research Advisory Committee can recommend that the candidate not be awarded the Ph.D.

1st Author Publication

Each doctoral candidate must have at least one peer reviewed, 1st author manuscript related to his/her dissertation published or accepted for publication in a peer-reviewed scientific journal in order to receive the Ph.D. It is expected that the publication requirement will be fulfilled well before defense of the dissertation. Students should strive to have their 1st author publication submitted during their 4th year in the program, if not sooner. In addition, students should strive to make enough of a contribution to the overall research in the laboratory in which they are working to warrant co-authorship on at least one paper.

Completion of All Required Courses

Any course required by the School of Graduate Studies or the Medical Pharmacology program that was not completed at the time of the qualifying examination must be satisfactorily completed prior to application for the Ph.D. Courses that might specifically apply include advanced pharmacology courses and Professional Skills for Graduate Students and Postdoctoral Fellows (ID 714).

REGISTRATION REQUIREMENTS

Prior to candidacy, a graduate student must be registered for a minimum of 9 semester hours to be considered full time during the fall and spring semesters: Full time status is required for receipt of a stipend. During the summer semester, a student must be registered for at least 1 semester hour. Tuition for full time graduate students is charged at a flat fee per semester; No additional tuition is charged for hours in excess of the minimum required for full time status.

After admittance to candidacy, students register each term for Dissertation and Dissertation Research (PHARM798) while preparing a research proposal, doing dissertation research, and writing the dissertation. To maintain full time status, a student must register for a minimum of 1 semester hour of dissertation research/dissertation. Registration for a minimum of 1 semester hour is also required in the semester in which the candidate graduates in order for a diploma to be awarded. Any exception to that requirement must be approved by the Dean of the Graduate School.

DESCRIPTIONS OF GRADUATE COURSES IN PHARMACOLOGY & TOXICOLOGY

A prerequisite for all courses is approval by the course director and the graduate director of the Department of Pharmacology and Toxicology. Graduate students outside the pharmacology program must also have approval of the graduate director of the program in which they are enrolled. Courses are offered annually unless indicated otherwise. Students can assess the syllabi for all pharmacology courses through the department's web site (<http://pharmacology.umc.edu>) or the student's Graduate Medical Pharmacology site on Blackboard.

PHARM. 701. SEMINAR. Students are required to (1) attend presentations by others (both faculty and students) participating in the course and (2) make an oral presentation related to their own research or an assigned topic. Students in the pharmacology program participate in seminar as partial requirement for PHARM 702 (Required, 1 semester hour (pass:fail); Fall, R Duhe, director)

PHARM. 702. RECENT ADVANCES IN PHARMACOLOGY AND TOXICOLOGY. This course comprises reading, informal presentation and discussion of topics in pharmacology, toxicology and related disciplines from the current scientific literature. Critical evaluation of experimental design, data analysis and interpretation are emphasized. For students in the pharmacology program, participation in departmental seminar is a requirement for this course. (Required; 1 semester hour (pass:fail); Spring; RE Kramer, director)

PHARM. 722. PHARMACOLOGY AND THERAPEUTICS. Students are introduced to the principles underlying the use of pharmacological agents in medical practice. Concepts related to drug distribution, drug-receptor interaction and drug metabolism are considered. In addition, the mechanism of action, therapeutic effects, adverse side effects and common clinical applications of various drugs and drug classes are presented through a combination of lectures and clinical correlations. (Elective, 12 semester hours, 6-6; Fall, Spring; RE Kramer, director)

PHARM. 723. MECHANISMS OF DRUG ACTION. This course comprises assigned readings, in-class discussions, written assignments and student presentations. Selected aspects of pharmacology are presented, with emphasis on the mechanisms of drug action. (Required; 8 semester hours, 4-4; Fall, Spring; JA Love, director)

PHARM 726. FUNDAMENTAL PHARMACOLOGY. A basic pharmacology course in which principles underlying the actions of drugs are presented, including pharmacokinetics, drug-receptor interactions, and drug metabolism. In addition, mechanisms of action, therapeutic effects, adverse

effects and therapeutic indications are noted for major classes of drugs and for commonly used drugs within each class. (Required; 6 semester hours; Spring; S Smith, director) (also listed as Dental 626).

PHARM. 785. PRINCIPLES OF MODERN DRUG DESIGN. This course addresses the basic principles of the modern drug discovery and validation process, with emphasis on applications in cancer therapy. The course begins with the identification and characterization of disease-specific molecular targets using genetic and biochemical techniques. The second section describes the selection of lead drugs through high-throughput screening assays, combinatorial chemistry, and computer-assisted rational drug design. The final section covers preclinical and clinical trials and the potential use of database analysis to ensure that the drugs are safe and effective, and that the chosen therapeutic regimen will yield the best outcome for any given patient. (Elective; 2 semester hours; Spring; offered biennially [even years]; RJ Duhe, director)

PHARM. 790. SPECIAL TOPICS IN PHARMACOLOGY AND TOXICOLOGY. This course may cover any area of interest to at least one student and one faculty member. (Elective; Hours/credit TBA)

PHARM. 792. RESEARCH IN PHARMACOLOGY AND TOXICOLOGY. Students perform research in the laboratory of a faculty member. Students are also required to submit a brief written report and make a presentation concerning the rotation [including the general premise, experimental approach and results; the latter two may be actual or anticipated] to the general departmental faculty at the completion of the rotation. (Required; 3 semester hours unless otherwise arranged; Summer, Fall, Spring)

PHARM. 798. DISSERTATION AND DISSERTATION RESEARCH (Hours/credit TBA)

PHARM. 799. THESIS AND THESIS RESEARCH. (Hours/credit TBA; maximum of 6 semester hours)

DESCRIPTIONS OF REQUIRED SUPPORT AND INTERDISCIPLINARY COURSES

BIOCH. 704. FUNDAMENTAL BIOCHEMISTRY. Fundamental course that presents a broad survey of biochemistry that is suitable for students whose major area of study is outside the discipline. Topics include the chemistry of amino acids and proteins, nucleic acids, carbohydrates and lipids; enzymology; metabolism and metabolic regulation; membrane structure and function; oxidative phosphorylation; hormonal control mechanisms; molecular biology and protein synthesis as well as aspects of oral biology and dental biochemistry. (Fall, 7 semester hours) (also listed as Dental 604)

PHYSIOL 725. FUNDAMENTAL PHYSIOLOGY A fundamental course designed to provide students for whom physiology is not their primary area of study with knowledge of the basic functions of the cells, tissues, organs and organ systems, and how they interrelate to accomplish the many and diverse functions of the human body. (9 semester hours) (also listed as Dental 625).

ID 709. RESEARCH ETHICS. An interactive lecture course designed to provide an understanding of ethics in scientific research and the basic skills important for both oral and written scientific communication. (1 semester hour; Fall or Spring semester; Course Coordinator, Dr. I Paul).

ID 710/BIOCH 742. RESEARCH TOOLS IN MOLECULAR BIOLOGY. A course designed to introduce students to contemporary methods in molecular biology including cloning, mutagenesis,

transgenic animals, genomics, proteomics, and gene expression. (2 semester hours; Spring semester; Dr. D Sittman, Course Coordinator).

ID 714. PROFESSIONAL SKILLS FOR GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS. A course designed for early to late graduate students and postdoctoral fellows to acquire skills needed to be successful in a scientific work environment, with special emphasis on oral and written communication skills, grantsmanship, career choices, laboratory management, and academic teaching skills. (3 semester hours; Spring semester, Dr. J. Reckelhoff, Course Coordinator).

ID 727. CURRENT ISSUES IN BIOMEDICAL RESEARCH AND TRANSLATIONAL MEDICINE. This course focuses on current issues in biomedical research and involves a mixture of didactic lectures coupled with discussion of primary research papers.

ID 740. STATISTICAL METHODS IN RESEARCH 1. An introduction to basic experimental statistics. Application of statistical techniques such as estimation and confidence limits, tests of significance, correlation and regression, sampling, analysis of variance and covariance to experimental data. Fundamental principles of design. (Fall, 3 semester hours).

DESCRIPTIONS OF ELECTIVE ANCILLARY COURSES

ANAT 713. HISTOLOGY AND CELL BIOLOGY. A study of the structure and function of cells, tissues and organs. (6 semester hours, 3-3)

BIOCH 743. CELLULAR BIOCHEMISTRY I (Fall semester, 4 credit hours) and **BIOCH 744. CELLULAR BIOCHEMISTRY II** (Spring semester, 4 credit hours). These courses cover the structure and function of eukaryotic cells. Topics covered include: gene expression and its regulation, cell cycle, organelle function, signal transduction, intracellular transport, bioenergetics, and model genetic systems. The courses are organized into “modules” which can be taken individually as special topics, so students may take topics of interest rather than a whole course.

ID 704. AN INTRODUCTION TO ANIMAL RESEARCH. The use of animals as research tools, including characteristics of commonly used species, anesthesia and surgical techniques. (Elective, Lecture; 2 semester hours; optional laboratory 2 semester hours; Spring Semester; Dr. Andrew Grady, Jr., Course Coordinator)

ID715. TEACHING IN HIGHER EDUCATION. This course is designed to provide practical and theoretical foundations for teaching in higher education. The course will offer experiences to explore and develop skills that promote learning as well as apply strategies for effective course design and assessment. The intended audience is graduate students and postdoctoral fellows. (Elective; 3 semester hours; Spring, L. Spence, I. Paul and R. Kramer, co-directors)

NSCI 701. FUNDAMENTAL NEUROSCIENCE. Course provides an intensive overview of the topics and terminology of neuroscience. It outlines the main areas of study in the Program in Neuroscience core course sequence, namely: 1) cells and synapses; 2) neurophysiology; 3) developmental neuroscience; 4) neuroanatomy and; 5) behavior. Consists of didactic and laboratory presentations as well an overview of the research of the faculty of the Program in Neuroscience. First course in the Program in Neuroscience graduate course sequence, however open to all interested students with sufficient background. No prerequisite however students outside of Program in Neuroscience must obtain permission of course director. (8 semester hours).

NSCI 706. CNS PHARMACOLOGY. Drug actions at neuronal targets, the blood-brain barrier and special pharmacokinetics of centrally acting drugs as well as the pharmacotherapy of the CNS and neurological disorders are among the topics covered. (Elective; 3 semester hours; Fall; W. Woolverton, director)

PHYSIO. 704. MOLECULAR PHYSIOLOGY. A course designed to teach how state of the art approaches in molecular biology can be applied to cardiovascular and renal physiology. This course is structured as a laboratory format with some reading and lecture. (2 semester hours)

PHYSIO. 717. CIRCULATORY PHYSIOLOGY. A reading and conference course that emphasizes regulation of cardiac output, body fluid volumes and arterial pressures. (7 semester hours)

PHYSIO. 731. RENAL AND BODY FLUID PHYSIOLOGY. A seminar course that includes critical study of research methods, comparative renal physiology and literature on classical and contemporary principles of renal physiology and pathophysiology. (7 semester hours)

FACULTY

Primary

Rodney C. Baker, Ph.D.
George Booz, Ph.D.
Jian-Xiong Chen, M.D.
Sean P. Didion, Ph.D.
Roy J. Duhe, Ph.D.
Jerry M. Farley, Ph.D.
Michael R. Garrett, Ph.D.
Robert E. Kramer, Ph.D.
Jeffrey Alan Love, Ph.D.
Lucio Miele, Ph.D.
Yin-Yuan Mo, Ph.D.
M. Reddy Pabbidi, Ph.D.
Robin W. Rockhold, Ph.D.
Richard J. Roman, Ph.D.
Jennifer Sasser, Ph.D.
Stanley Smith, Ph.D.
Jan M. Williams, Ph.D.
Jia Long Zhuo, M.D., Ph.D.

Adjunct/Affiliate

Robert D. Cox, M.D., Ph.D.
Ian A. Paul, Ph.D.
Elise Gomez-Sanchez, Ph.D., D.V.M.
Mazen Kurdi, Ph.D.
Anait S. Levenson, Ph.D.
Junming Wang, Ph.D.

Emeritus

Susan E. Wellman, Ph.D.