

**Handbook for
Graduate Students
In
Biomedical Sciences
at Meharry Medical
College**

**For Students
Entering
Fall 2009**

The Ph.D. Graduate Program in Biomedical Sciences

Meharry Medical College, Nashville Tennessee

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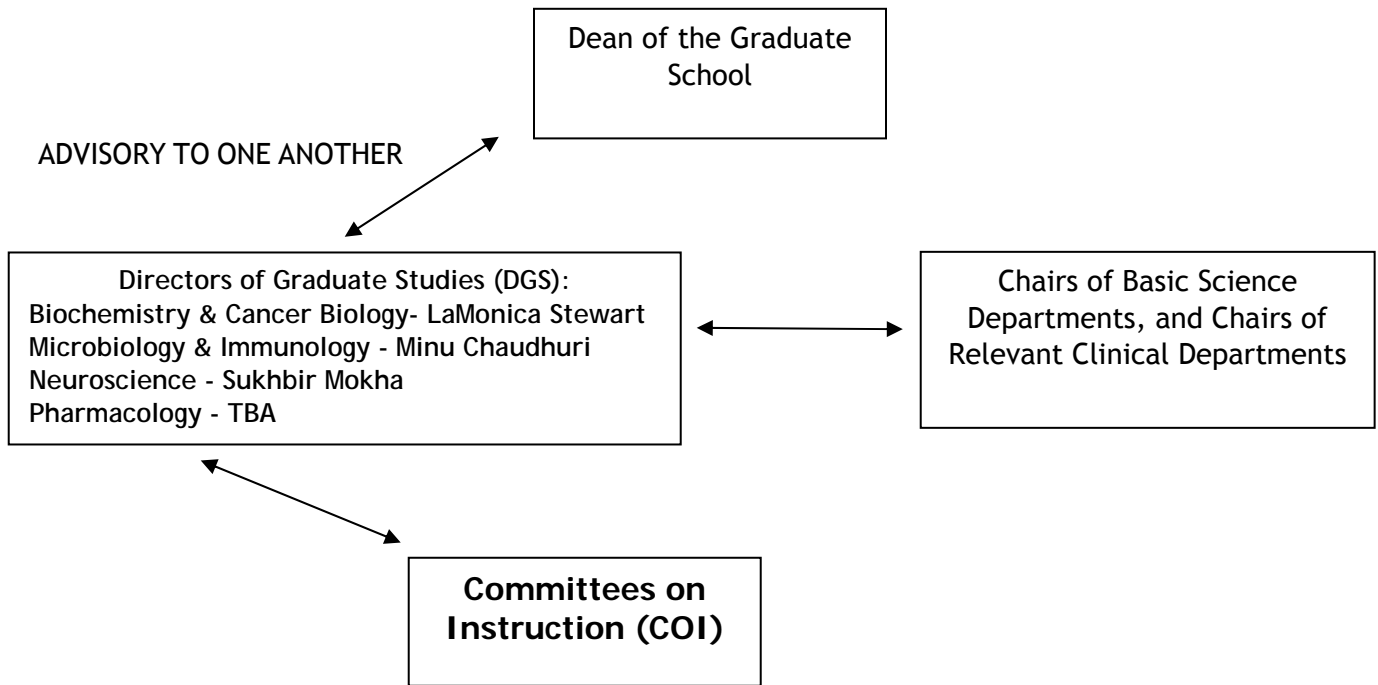
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This Handbook applies to students entering the Ph.D. Graduate Program in 2008 and 2009.

ADMINISTRATIVE STRUCTURE OF THE PHD PROGRAM IN BIOMEDICAL SCIENCES



THE DEAN OF THE GRADUATE SCHOOL is responsible for overseeing all aspects of the Ph.D. Program in Biomedical Sciences, with the assistance of the DGS leadership for each emphasis area. The Dean is the official spokesperson for the Biomedical Sciences Graduate Program and serves as representative in matters related to Meharry Medical College policy and programs. The Dean is responsible for assuring high standards in the academic program, including continually evaluating the quality of the required courses, the qualifications and diversity of the training faculty, and the performance and diversity of the students. The Associate Dean of Graduate Studies, in behalf of the Dean, initiates and coordinates student recruitment activities and also is responsible for identifying and assisting others in applying for internal and external support for graduate training.

The Director of Graduate Studies (DGS) is responsible for monitoring the progress of students' course work and general performance throughout their training, and has the most frequent and direct contact with the students and is responsible for explaining the requirements and expectations to the students. The DGS also serves as a student advocate when personal problems arise and in cases of possible faculty irresponsibility or misconduct. In addition, the DGS will meet periodically with new faculty to review program structure and advise them on special needs of developing trainees.

The Committee on Instruction (COI) is individualized, overseeing the research and development of an individual student. The activities and responsibilities of the COI are outlined in later sections of this Handbook.

How to Use this handbook

The purpose of this Graduate Student Handbook is to help trainees make optimal use of the time invested in their graduate training. Thus, this Handbook outlines Program requirements that are currently in place so that students have an understanding of the pivotal events and achievements associated with successful completion of training Meharry Medical College's Ph.D. Program in Biomedical Sciences, and provides students with an estimate of the timing of these events.

How NOT to use this handbook

This Graduate Student Handbook should not be used as an official and immutable statement of the requirements and timetables for Meharry Medical College's Ph.D. Program in Biomedical Sciences.

The Training Program will be modified over time according to the evolving needs of trainees and to keep the Program at the leading edge of training innovation and excellence. Because the Graduate Student Handbook will be continually updated to reflect Program modifications, the Handbook should be used as a preliminary first step for information about the requirements of the Biomedical Sciences Graduate Training Program.

Always confirm Program requirements with the Director of Graduate Studies (DGS) for each program emphasis area, the Dean or the Associate Dean of the Graduate School, and consult the Policies and Procedures Manual of the Graduate School.

Responsibility, Ethics, and Honor Code

Responsibility: The faculty and staff of the Graduate School and the Biomedical Sciences Training Programs are eager to assist you through the rigors of the Ph.D. Program, to let you know how you are progressing, and to keep you abreast of important deadlines. We will do our best to communicate with you in a timely and accurate manner. Please remember that it is ultimately the graduate student's responsibility to know, understand, and meet the requirements established by the Graduate School and the Biomedical Sciences Training Program. Make it your business to be "in the know"!

Ethics: Our Training Program is designed to provide you with numerous opportunities to learn, ponder, and discuss the many ethical issues that underlie proper scientific conduct. We take very seriously not only that you are educated in ethics, but also that the practices of all scientists, faculty, staff, and trainees strive for and attain the highest ethical standards. If you have concerns about proper conduct issues, do not hesitate to discuss these with your mentor, your DGS, or with the Associate Dean or the Dean of the Graduate School.

Statement of Professional Integrity: Simply stated, we are honest and trust one another. Faculty members trust that your work is your own. Students make sure that all their work is their own. If your work - be it course work, manuscripts, or research - is the result of a collaboration or utilization of ideas or labor of others, this must be acknowledged. All faculty and students agree to uphold the Honor Code. Violations are taken seriously. If you ever have doubt about your behavior or the behavior of others in upholding the Honor Code, talk to the people mentioned above.

GOALS AND PHILOSOPHY OF THE PHD PROGRAM IN BIOMEDICAL SCIENCES

There are several inter-related goals in our Training Program. At the scientific level, we seek to provide a didactic curriculum that assures each student has an understanding of the core knowledge in their area of research and training emphasis. In addition to this core body of knowledge (which will be discussed in more detail later), we expect that students become scholars in at least one particular area of biomedical science, likely an area that directly relates to their dissertation research activity. In this way, students learn the rigors as well as the intellectual satisfaction of scholarship. Additional goals in our training program are to:

- 1) Show, by example, how to construct a rational hypothesis;
- 2) Teach, again by example, how to apply the scientific method to test a hypothesis;
- 3) Provide a basic understanding of a broad range of techniques;
- 4) Provide more in-depth training in those techniques that are particularly germane to a chosen research area of a particular student;
- 5) Teach how to communicate effectively their research findings to the scientific community; and
- 6) Instill a scientific ethic and respect for the pursuit of knowledge.

Other aspirations of the Program are:

- 1) To foster the ability of students to learn how to learn on their own for the rest of their lives, a skill critical for continued excellence in scientific inquiry;
- 2) To free students from the fear of failure; and
- 3) To impart to students an appreciation for diversity.

Each of these latter goals is essential for sustained contributions and leadership in any career, and particularly in biomedical research.

Considering that all of goals must be achieved before a student is adequately prepared for an independent career as a research scientist, only a well-balanced, multifaceted approach to graduate education can achieve the desired end. According to this philosophy, our Training Program employs several methods to ensure the successful education of its trainees. In addition, faculty within the program, and its component emphasis areas, continuously monitor the effectiveness of the various components of the training program and make adjustments when deemed necessary, to achieve an optimal balance among the Program's many educational components. Consequently, the training program continuously evolves.

Emphasis areas in the Training Program In Biomedical Sciences

The Graduate Program in Biomedical Sciences, and the office of the Dean for Graduate studies, organizes the first year training of graduate students who are interested in basic biological and biomedical research. Subsequently, interested students select one of our four current areas of program emphasis:

Biochemistry and Cancer Biology
Microbiology and Immunology
Neuroscience
Pharmacology

We also have research faculty in the area of physiology and cardiovascular biology. However, a formal graduate program in this area does not exist at this time. Since student must commit to one of the current programs, they will be allowed to cross-train with faculty in this area as well as any other research area as part of our interdisciplinary approach to training.

Graduate students are admitted, uncommitted to a specific Ph.D. program, and take a two-semester Core Curriculum (outlined in more detail later). During the first year of study, students also engage in rotations in three laboratories chosen by the student. At the end of two semesters of coursework and laboratory rotations, first-year graduate students declare their intent to pursue a Ph.D. in a particular emphasis area and choose the laboratory in which they will conduct their dissertation research. Students enter their selected laboratory the summer after their first year of study.

Graduate Study Focus Areas for the PhD in Biomedical Sciences

Biochemistry and Cancer Biology: DGS, LaMonica Stewart, PhD
Phone: 327-6749
Email: lstewart@mmc.edu
Office Location: West Basic Science Building, Room 2118.

Faculty mentors in the Biochemistry and Cancer Biology graduate program study the biochemical and molecular bases of cancer and other human diseases. Translational research (i.e. from the bench to the bedside) is highly emphasized. Diseases and tumor sites which disproportionately affect African Americans (such as breast, lung, prostate, and colon cancer) are of particular interest. Faculty members focus on endogenous mediators of the balance between cell proliferation and programmed cell death (apoptosis) as well as environmental agents that influence disease development and progression. Their studies are conducted using *in vitro* as well as *in vivo* models of human disease.

Microbiology and Immunology: DGS, Minu Chaudhuri, PhD
Phone: (615) 327-5726
Email: mchaudhuri@mmc.edu
Office Location: West Basic Science Building, Room 4105

Faculty mentors in Microbiology and Immunology graduate program are involved in the study of the molecular bases for pathogenesis in response to viral or bacterial infection, or in response to parasitic invasion, and the immune response of host cells to these infections. One research strength is

parasitology, focusing on pathogens that previously ravaged third world countries but now are also appearing in our country as opportunistic infections of HIV/AIDS. Faculty participating in the Center of Excellence for Health Disparities in HIV/AIDS also serve as mentors for this graduate program, and address bases for HIV entry, replication, and propagated infection, as well as the factors that modulate the immune response to this infection and the efficacy of therapeutic interventions.

Neuroscience: DGS, Sukhbir Mokha, PhD

Phone: (615) 327-6394

Email: smokha@mmc.edu

Office Location: Biomedical Sciences Building, Room B

Neuroscience represents the broad study of the brain and behavior. The areas of particular emphasis in the research laboratories of faculty mentors in this program are degenerative diseases, such as Parkinson's and Alzheimer's Disease; neuronal plasticity, such as occurs in learning and memory as well as in disease, including addictions; and fundamental mechanisms controlling brain signaling, such as neurotransmitter transporters that regulate transmitter availability and neurotransmitter receptors that initiate chemical and electrical signaling mechanisms. Studies range from quantitative observations on the electrical activity of single molecules to the in vivo behavior in animal model systems and in human beings.

Pharmacology: DGS, TBA

Phone:

Email:

Office Location:

Pharmacology is the study of how chemical agents affect living processes; the chemicals involved include agents such as endogenous hormones, neurotransmitters, and/or growth factors; toxic substances in our environment; or pharmaceutically developed drugs. Faculty mentors in this program are interested in the impact of toxicological agents on normal processes and their role in disease initiation as well as the molecular bases for the action of endogenous substances, with the intent of identifying novel therapeutic targets by revealing new insights into critical regulatory steps in signaling pathways that go awry in disease.

Summary of Overall Requirements

A minimum of 40 didactic hours of graduate credit are required for a Ph.D. degree in Biomedical Sciences. In most cases, course work will be completed during the first and second years. At the end of the second year, a Qualifying Examination must be satisfactorily completed before the student can be admitted to candidacy for a Ph.D. degree in Biomedical Sciences in their emphasis area of choice. This exam must be satisfactorily completed by the end of the third year in the graduate school. If needed, remaining course electives may be taken following the Qualifying Examination, with the permission of the DGS and the Dean of Graduate Studies. After a student completes the qualifying process, the student's efforts are largely directed towards completion of a dissertation project.

First Year Core Curriculum

	<u>Course Name</u>	<u>Credit Hours</u>
Fall:	Biomedical Sciences IA	4
	Scientific Communications (Part I)	0
	Introduction to Laboratory Research	3 (2 in 2008)
	Molecular Methods	6
	Research Laboratory Rotation (I)	0
Spring:	Biomedical Sciences IIA	4
	Scientific Communications (Part II)	3
	Research Laboratory Rotations (II, III)	6
	Introduction to Biostatistics	2

Course Descriptions for the Core Curriculum for the PhD Program in Biomedical Sciences

ASGS 700. SCIENTIFIC COMMUNICATIONS. This course introduces students to the health sciences library, to scientific literature, to scientific writing and to oral presentation of scientific information. The course provides weekly practice in reading and writing about papers in scientific journals and in discussion of papers before an audience. 3 credit hours, Fall & SPRING.

ASGS 701. BIOMEDICAL SCIENCES I (Biochemistry). Lectures, problem-solving sessions, and demonstrations designed to give the student mastery of the organization, composition, and function of the cell at the molecular level; the properties and biological functions of carbohydrates, lipids, nucleic acids, and proteins will be covered. Enzymes, metabolic pathways and their regulation, protein synthesis and biochemical genetics will be introduced. The goal is to give the students a full appreciation of the fundamentals of enzymology and biochemical genetics. 4 credit hours, FALL.

ASGS 703. BIOMEDICAL SCIENCES IIA (Cell Biology I). This course provides lectures, problem solving sessions and discussion designed to give the student an understanding of the organization, origin, function and regulation of the cell and its organelles at the molecular level. Major topics covered include the energetics and thermodynamics of life processes; metabolic pathways and their control; membrane structure and function, protein trafficking, the cytoskeleton, signal transduction and the cell cycle. The goal is to provide sufficient comprehension of molecular cell biology to enable the student to follow current developments in this fundamental and rapidly expanding area of research. 4 credit hours, SPRING.

ASGS 706. BIOMEDICAL SCIENCES IIIB (Laboratory Rotations). The purpose of this laboratory rotations course is to acquaint first-year graduate students with research in progress in the laboratory of three different faculty. The student is supposed to be a participant in the research and will be exposed to scientific knowledge and techniques at a greater depth than is possible in formal laboratory

courses and will participate in the kind of informal discussions which will take place in research laboratories among faculty, students and staff. The first rotation takes place in the fall semester and is ten (10) weeks long. The second and third rotations take place in the spring semester for eight (8) weeks each. It is not intended for students to complete a research project. 2 credit hours per rotation, 3 rotations (total 6 credit hours).

ASGS 723. MOLECULAR METHODS. The module consists of experiments designed to teach students important recombinant DNA techniques, including isolation of plasmids DNA, use of restriction enzymes, cloning of restriction fragments, nick translation, southern and northern hybridizations, DNA sequencing and other important techniques. 6 credit hours, FALL.

ASGS 725. INTRODUCTION TO LABORATORY RESEARCH. The goal of this course is to teach the first-year students basic techniques commonly used in the laboratory and the underlying concepts for each technique. In addition, students will be exposed to key concepts related to scientific ethics and responsible conduct of research. 3 credit hours, FALL.

ASGS 730. INTRODUCTION TO BIostatISTICS. This course intends to review basic principles of data analysis to familiarize students with the terminology and principles that can be found in texts or used in consultation with statisticians. 2 credit hours, SPRING.

ADDITIONAL DETAILS ABOUT THE PROGRAM OF STUDY THAT ARE RELEVANT FOR ALL EMPHASIS AREAS

SELECTION OF FACULTY PRECEPTOR (RESEARCH ADVISOR):

A key element in any graduate program is laboratory research. Everything possible is done to speed up the process of choosing a preceptor and getting research projects off to a fast start. To that end, students begin doing rotations in three laboratories of their choice during the fall and spring semesters of the first year. The rotations provide a short laboratory experience, access to a potential faculty preceptor, and the ability to interact with senior (advanced) students to begin to learn the process of balancing class work with lab work. The purpose of the rotations is for the students to sample different research areas and experience the excitement of working in a particular laboratory.

By June of the first year, students will choose a mentor, enter one of the participating graduate programs, and begin thesis research. The selection of a Faculty Preceptor must be discussed with the DGS for that graduate program, but also is subject for review by the Chairman of the Department for the primary appointment of the mentor and by the Dean of Graduate Studies. Upon selection of a preceptor the student will inform the DGS and work with the preceptor and DGS to select members of the student's Committee on Instruction (COI). The student must submit a COI form with the appropriate signatures from the committee members, mentor, and Chair of the Department of primary appointment of the faculty mentor to the Dean of the Graduate School for approval.

THE FACULTY PRECEPTOR ROLE:

The Faculty Preceptor has the primary responsibility for academically guiding the student through all phases of graduate study. Normally, the student will pursue a research project in an area where the

Faculty Preceptor has expertise. A student may elect to change their Faculty Preceptor, provided that the student can find another faculty member in the Graduate Program Faculty to assume that role. Changing Faculty Preceptors will not only entail changing research projects and most probably beginning anew, but will likely involve changes in the membership of the COI (see below) and may involve changes in source of financial support as well.

SELECTION OF THE COMMITTEE ON INSTRUCTION (COI: THESIS ADVISORY COMMITTEE):

The Faculty Preceptor, in collaboration with the student, designates the proposed members of the COI. The COI must be composed of at least five members. The composition of the COI should be as follows:

- 1) The thesis advisor/preceptor
- 2) At least three members from the graduate program (and this can include the preceptor)
- 3) A faculty member representing another graduate program emphasis area at MMC
- 4) One member from another institution. This member should be a leader in the area of the student's research.

Formation of the COI must be completed during the summer of the first year of study.

RESPONSIBILITIES AND AUTHORITY OF THE COI:

The COI has broad responsibility to oversee the student's graduate studies, and to aid the Faculty Preceptor in assuring the student's progress. Specifically, the COI monitors the student's progress, provides advice on course selection and research, certifies the student's eligibility to take the comprehensive preliminary examination, certifies to the Graduate School (with a copy to the relevant academic Chair) the student's fulfillment of program requirements for admission to candidacy (course work and preliminary examination) requirements, comprehensive preliminary examination, grant application ...etc.) approves the outline for the student's dissertation, approves the completed dissertation, administers the final oral thesis defense and presents a summary of their evaluation to the DGS of the student's program who then recommends the approved dissertation to the Graduate School.

The COI must meet at least once a semester, starting at the time it is first formed. It is the responsibility of the student to make sure that these meetings occur!!! At the first meeting of the COI, the Faculty Preceptor and the student must submit a plan of study for approval by the COI. This plan should include all the required and elective courses planned for the student. At subsequent meetings the Faculty Preceptor will report to the COI on the student's academic progress. The student must submit a plan of research to the COI for its approval, within the first year of its formation. At least once a semester the student must give a presentation to the COI of his/her research progress; even when there are no new advances in the research project, the COI must meet, as often it is just in these periods of frustration and apparent lack of progress that the advice of the COI can be most helpful.

A written summarized report of each COI meeting must be communicated by the Faculty Preceptor to the DGS, with a copy to the relevant academic Chair and to the Graduate School within two weeks after the meeting. Each COI member also receives a copy of each report.

REQUIREMENTS FOR THE PH.D. DEGREE

1. Academic Standing

To remain in good standing, a student must maintain a B grade average in graduate course work. For students who have passed the graduate core curriculum, good standing in the graduate program also includes satisfactory performance in thesis research.

Transfer of Credit: Graduate courses taken at other institutions may be evaluated for transfer of credit by the COI, in accordance with Graduate School policies. Courses taken at Vanderbilt University will automatically be accepted due to the existing cross registration between Meharry and Vanderbilt.

2. Journal Clubs, Works-in-Progress

All graduate students are required to attend journal clubs and works-in-progress in the area related to their research. Occasionally, the research of a student will align with the intellectual activity of more than one Department. In that instance, the DGS will work with the student and their mentor to establish which works-in-progress and which journal clubs are required.

3. Basic Science Research Department Seminars.

Attendance at Departmental seminars is required of all graduate students. The Department invites a number of scientists from universities throughout the United States, and occasional visiting international scientists, as speakers at the seminar series. Seminars on wide-ranging topics by visiting faculty help affirm for students the realization that bodies of knowledge are accrued through incremental additions to our understanding that result from well-defined experiments testing hypotheses that are critically developed. Students will be invited to lunch with the visiting speakers based on their areas of research interest. However, these lunches also provide an opportunity to query the visiting scientists about issues other than science, including how they made career decisions, how they chose the research problems that have engaged them for so many years, how they know when to change directions in their research activities, how they maintain a high level of information and scholarship in their area, and how they integrate career with other aspects their lives. Graduate students in the Ph.D. Program are encouraged to recommend speakers to their mentor or the DGS of their program for these seminars.

4. Teaching

All graduate students are expected to obtain at least one semester's experience in teaching. This expectation may be satisfied by participation in teaching in Medical, Dental, or Graduate courses offered at Meharry Medical College or tutoring at the Center for Educational Development and Support Services (CEDSS), which is highly recommended. The Graduate Program may waive this expectation in special circumstances, with the approval of the Dean of the Graduate School.

5. The Preliminary Examination Requirements.

The preliminary examination will consist of the preparation of a research proposal that conforms to the NIH format for pre-doctoral NRSA fellowship applications. The research proposal should be on a

topic approved by the student's COI, and may be identical to the thesis project of the student. The identification of potential topics is the responsibility of the student; the student is expected to work in consultation with his/her mentor to identify potential topics. The members of the COI may provide guidance to the student in the preparation of the written proposal. This may involve asking the student to modify their central hypothesis or simply explain to him or her, the difference between central hypothesis and working hypotheses which normally accompany the specific aims. The extent of the guidance is left to the discretion of the COI. Obviously too much help would be counterproductive.

After the written proposal is developed, the student must publicly defend the proposal, as adjudicated by the COI who will examine the scientific merits of the written proposal and ask appropriate questions during the defense. These questions will examine the candidate's scientific development and overall knowledge related to the proposal and also knowledge of the course material and scientific knowledge in general. At the end of the presentation, members of the COI will provide the candidate with an assessment of his/her performance.

Students who fail the preliminary examination at this point will be allowed to retake the examination within 60 days. If they are unable to pass the examination the second time, they will be expected to proceed to a terminal M.S. degree.

Guidelines for the Ph.D. Candidacy Examination.

1. Students will be required to take the Ph.D. candidacy examination between the end of the spring semester completing the student's second academic year and the end of the spring semester of the third academic year. The examination may be scheduled outside this time period because of extenuating circumstances if such a variation is recommended by the DGS of the program and approved by the Dean of the Graduate School.
2. The prerequisite for taking the Ph.D. candidacy examination is that the student has an overall GPA of at least 3.0 with at least a B in Biomedical Sciences I, Biomedical Sciences II, Molecular Methods and Introduction to Laboratory Research.
3. The Ph.D. candidacy examination will consist of two parts: written and oral. The examination will be based on the student's proposed dissertation research project, which must be approved by the student's preceptor and the COI in a formal COI meeting.
4. The Examination Committee will be formed at the end of the student's second year and will meet with the student to setup a timeline for completion of the exam within the time frame established in point 1. This committee will be set up for each student by the DGS of the program in which the student is enrolled and by the Chair of the respective department. The committee will be composed of five faculty members. Three members will be selected from the student's COI and two will be faculty members who do not serve on the student's COI. These two members of the Examination Committee may be from institutions other than Meharry Medical College. The DGS and Chair will determine which member will serve as Chair of the Examination Committee. The Chair of the Examination Committee will be responsible for scheduling meetings between the student and the Examination Committee.

5. The format of the written exam will be as follows:
 - a. The student will write a research proposal on their proposed dissertation research. This proposal will be written based on the instructions for section A-D of a NIH F31 fellowship application.
 - b. The student will engage in scholarly dialogue with his/her faculty preceptor and reach agreement on the Research Hypothesis and Specific aims, but the faculty preceptor is to provide NO assistance in the actual writing of this document except for minor editing.
 - c. When the proposal has been written, the student will distribute it to the faculty members of the Examination Committee, four weeks prior to the scheduled oral exam. Each member of the Examination Committee will read the proposal and provide comments to the student within two weeks after receipt of the proposal (i.e. two weeks before the scheduled oral exam). The student will revise the proposal in accordance with these comments prior to the oral exam or be prepared to rebut the recommendations during the oral exam. The revised proposal should be distributed to each member of the Examination Committee at least 48 hours prior to the exam.
6. The oral part of the exam will consist of a closed defense of the research proposal to the members of the Examination Committee. The objectives of the examination are to:
 - a. Evaluate the student's knowledge in his/her general area of interest, to test the student's ability to integrate didactic information into research design, to test the student's understanding of experimental design and the student's ability to connect related concepts.
 - b. Evaluate the student's ability to think creatively and clearly.
 - c. Evaluate the student's ability to effectively communicate the project to the members of the Examination Committee.

Each Examination committee member will provide the Chair of the Examination Committee with three questions at least 24 hours prior to the exam. The examination committee will convene ~30 minutes prior to the start of the exam to discuss the questions.
7. The exam will be graded as follows: Each member of the Examination Committee will grade both parts of the exam and their scores will be averaged for each part. In order to pass, a student must obtain an average score of at least 35 out of a maximum of 50 points on each part of the exam. If a student does not pass the exam, he/she must repeat the part that they did not pass. The student will be informed of the outcome of the exam immediately after the grade has been tabulated at the end of the exam.

The written grade will be based on the following:

- a. Hypothesis/Specific aim—15 points
 - i. Do the aims test the hypothesis?—5 points
 - ii. Do the aims test a causal relationship (not descriptive)?—5 points
 - iii. Why test this hypothesis?—5 points
- b. Background and Significance—15 points
 - i. How will the work advance the field?—5 points
 - ii. Are the preliminary data/information relevant?—5 points

- iii. Are the references from primary literature or mostly from review articles?—5 points
- c. Experimental design—20 points
 - i. Is the rationale for each aim provided and is it based on valid reasoning?—5 points
 - ii. Are expected results provided and are they based on valid reasoning?—4 points
 - iii. Are potential limitations and alternate experiments adequately discussed for each aim?—4 points
 - iv. Are techniques explained?—4 points
 - v. Specific aim 1 will be emphasized more than subsequent aims as it is the one in which the student will be addressing first. However, questions appropriate for other aims are expected.
 - vi. Are statistical analyses described and are they appropriate?—3 point

The oral grade will be based on the following:

- a. In the introduction, how well did the student present background material?
- b. How clearly did the student convey the originality or novelty and significance of the proposed research?
- c. How well were the preliminary data/information presented?
- d. What was the quality of the slide design and organization?
- e. How well did the student “make and keep contact” with the audience?
- f. How well did the student field questions and answer them clearly and informatively?
- g. How was the student’s overall knowledge base regarding the subject matter?
- h. How was the student’s overall knowledge base regarding understanding theory of experimental techniques?
- i. How well did the student integrate his/her basic science knowledge into his/her project?
- j. Did the student speak clearly and in a confident, professional manner? (e.g. did he/she speak loudly enough, were hands in pockets, was jargon used, did he/she lean on podium)

The point value for each question above will range from 1 to 5 for a maximum of 50 points.

1=Completely unacceptable

2= Noticeably worse than average

3= Average, strengths and weaknesses are equal

4= Very good

5= Excellent

8. Within one week after the exam, the Chair of the Examination Committee will inform the DGS of the program in which the student is enrolled, the Chair of the respective department, and the Graduate School Dean of the outcome of the exam in writing.
9. If a student's performance on the qualifying examination is NOT satisfactory, the Chair of the Examination Committee will meet with the student within one week after the exam and advise the student on how to prepare to retake the exam. If a student fails only the written part of the exam, he/she must rewrite and submit the document within 60 days of the exam. If a student fails only the oral part of the exam, he/she must retake the oral portion within 60 days of the first attempt. If a student fails both written and oral parts, he/she must retake the whole exam within 60 days of the first attempt. A student is permitted only one re-examination.
10. If a student is unable to pass the candidacy exam after the second attempt, yet has maintained a B course average, the student's COI will establish conditions for awarding a terminal Master's Degree. The conditions must be submitted to the DGS of the program in which the student is enrolled. The DGS will present the conditions to the Chair of the respective department and the SOGSR Dean. Both the Chair of the respective department and the Dean of the SOGSR must approve the conditions.
11. If a student fails to follow these guidelines, including adherence to the time frame established for taking the exam, the student will be referred to the Evaluation Committee of the SOGSR for appropriate action.

6. Thesis Research

Upon successful completion of the preliminary examination, the student will be admitted into candidacy for the Ph.D. degree. A Ph.D. candidate is essentially involved in research that will culminate in the completion of a dissertation research that is acceptable to the COI. The data obtained should be deemed sufficient to advance the field of endeavor, and to be publishable in a peer-review journal. The final defense is in the form of a public seminar, immediately followed by oral examination administered by the COI, followed by questions from the audience.

To allow for adequate review, a draft of the thesis must be submitted to members of the COI at least two weeks before the proposed public defense. Prior to scheduling the public defense, the COI must certify (to the Department or DGS and the Graduate School) the candidate's eligibility to proceed with the thesis defense. If the student is successful in the dissertation defense, the COI then makes recommendation to the Department Chair or DGS to accept the approved dissertation and to request the School of Graduate Studies to confer the doctor of philosophy degree on the student, at the earliest possible date. Every student is required to have one first author manuscript of their dissertation research either published or accepted for publication in a peer-reviewed journal before scheduling their PhD thesis defense. There is no EXCEPTION TO THIS RULE.

OTHER ELEMENTS OF THE GRADUATE PROGRAM

Throughout graduate training, students are expected to engage in scholarly activities, such as studying the scientific literature with the goal of integrating this new information into their own research questions, and attending lectures, journal clubs, and scientific meetings in order to keep abreast of the most recent scientific achievements. Meeting these and other expectations will foster a student's professional development, establishing a scientific life-style of learning that will persist throughout the professional career.

OTHER ISSUES

Length of Training

Students and advisors should aim for completion of graduate studies within a period of five to six years of uninterrupted participation in the curriculum. Most students will be able to graduate within this period. All students are expected to graduate within four years of passing the Qualifying Examination. Prior to the seventh year of study, the student can **MUST** submit a formal petition to request an extension of the doctoral training period to the Dean of Graduate Studies, via the DGS, with an explanation for the inability to complete training within the allotted time an outline of the remaining and a projected timeline and a date for the Dissertation defense.

Extended Absence from Meharry Medical College

The PhD Program in Biomedical Sciences requires continuous registration. It is required that any absence of 2 weeks or longer at anytime during the calendar year be reported. Students who wish to interrupt their graduate study must inform the DGS of their emphasis program, and be approved by the Dean of Graduate Studies, for an authorized Leave of Absence. Those without authorized leave who do not register for one semester are dropped from the rolls of the Graduate School and are not considered students. A student who withdraws from graduate school without an authorized leave and later wants to resume graduate study at Meharry Medical College must submit a formal application to the Graduate School Dean. However, there is a time limit associated with resuming graduate study. See the *Student Academic Policy and Procedures Manual* for rules on *Leave of Absence*.

Candidates who have passed the qualifying examination or completed 72 or more hours of credit toward the Doctor of Philosophy degree are not usually granted leaves of absence, except in special circumstances (e.g., maternity or medical leave).

Under some other circumstances, Graduate Students may spend extended periods of time performing experiments or undergoing specialized training at sites distant from their mentor's laboratory or the immediate confines of Meharry Medical College. If this is required of a particular Graduate Student, it is essential that the DGS and the Graduate School be notified as soon as such an undertaking is planned. It is the responsibility of both the mentor and the student to ensure that the DGS and the Graduate School are informed of this proposed research leave of absence. A form is provided in this Graduate Student Handbook that outlines the proposed period of absence, mechanism for support of the student during this time, and the goals to be obtained during this absence. In addition, the student must complete the official *Leave of Absence* Form from the College and secure

all signatures. This information must be provided at least 1 month prior to the beginning of the student's absence. If for any reason the research leave of absence extends beyond the limit originally reported, it is the responsibility of both the mentor and the student to inform the DGS and the graduate school of this change.

What follows are the specific expectations for each emphasis area that go beyond the above general guidelines.

Graduate Program in Biochemistry and Cancer Biology

ADMISSION OF STUDENTS TO THE PROGRAM IN BIOCHEMISTRY AND CANCER BIOLOGY:

In addition to the requirements of the Graduate School, participants in the Graduate Program in Biochemistry and Cancer Biology are recommended to also have taken the following undergraduate courses:

- General Chemistry, one year
- Analytical Chemistry, one semester
- Organic Chemistry, one year
- Physical Chemistry, one year
- Physics, one year
- Biology, two years
- Mathematics through Integral Calculus

Course Requirements for the Program in Biochemistry and Cancer Biology

DR: Departmental Required Course

DE: Departmental Elective Course

First Year: Core Curriculum

Second Year:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Cancer Biology I (DR)	3
	Membrane Biochemistry (DR)	3
	Biochemical Basis of Human Disease (DR)	3
	Directed Studies in Cytokines (DR)	2
	Advanced Topics in Biochemistry (DR)	3
	Directed Studies [Faculty] (DE)	1- 3
	Research (DR)	4-12
	Seminar Course (DR)	1
Spring Semester		
	Molecular Genetics (DR)	3

Metabolic and Cellular Regulation (DR)	3
Research (DR)	4-12
Seminar Course (DR)	1
Directed Studies - Cancer Biology II (DE)	2
Radiation Biology (DE) Vanderbilt Grad. School	2
Molecular Bioimaging (DE) Vanderbilt Grad. School	3
Advanced Cell Signaling (DE)	3
Other Elective Courses (MMC or Vanderbilt)	varies
Summer Semester	
Research (DR)	6

Third Year:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Research (DR)	4-12
	Preparation of PhD Candidacy Proposal	
	Seminar	1
Spring Semester		
	Research	4-12
	PhD Candidacy Exam	
	Seminar	1
Summer Semester		
	Research (DR)	6
	PhD Candidacy Exam	

Subsequent Years:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Research (DR)	4-12
	Seminar	1
Spring Semester		
	Research	4-12
	Seminar	1
Summer Semester		
	Research (DR)	6

Total Required Hours: At least 40 credit hours of didactic courses

Core Curriculum: 26 credit hours

Biochemistry and Cancer Biology Required Courses: 20 credit hours

Elective Courses: As recommended by student's COI

Expected Graduation: 5 - 6 years

COURSE DESCRIPTIONS FOR THE PROGRAM IN BIOCHEMISTRY AND CANCER BIOLOGY

BICH 703. MOLECULAR GENETICS (SPRING)

An advanced course on the biochemistry and molecular genetics of gene expression, gene regulation and mutation. Current advances in prokaryotic and eukaryotic systems are discussed. 3 credit hours. Prerequisite: Core Curriculum.

BICH 706. MEMBRANE BIOCHEMISTRY (FALL)

This course discusses basic and contemporary literature on the structure and functions of biological membranes and includes topics on membrane dynamics, biogenesis and transport by or through membrane components. The cytoskeleton and the extracellular matrix are also discussed. 3 credit hours. Prerequisite: Background in cell physiology and/or molecular biology.

BICH 710. SEMINAR IN BIOCHEMISTRY AND CANCER BIOLOGY (FALL & SPRING)

Discussion of contemporary topics in cancer biology, carcinogenesis, biochemistry, cell and molecular biology. 1 credit hour.

BICH 712. DIRECTED STUDIES (Faculty) (FALL & SPRING)

Individual instruction designed to meet the specific academic needs of the student. This course may be research or didactic instruction. Up to 3 credit hours. Prerequisite: Consent of the instructor. The grade awarded in this course is S or U if a research course.

BICH 713. ADVANCED CELL SIGNALING (SPRING)

A lecture course covering specialized and contemporary areas of inquiry in cell signaling and molecular biology, consisting of one of three such areas per semester. This course may be taken more than once. 3 credit hours. Prerequisite: Consent of the instructor.

BICH 704. TOPICS IN CELLULAR AND METABOLIC REGULATION (SPRING)

An advanced course on the regulatory mechanisms controlling major metabolic and cellular physiological processes in eukaryotes. 3 credit hours.

BICH 730. CANCER BIOLOGY I (FALL)

A multidisciplinary course designed to expose students to the latest and promising areas of basic and translational research. Molecular mechanisms underlying carcinogenesis and tumor progression and their relationship to clinical aspects of the disease are discussed. Students will be

required to take a Keystone course in the pathobiology of cancer as an additional requirement for the course. 3 credit hours. Prerequisite: Consent of the instructor.

SELECTED TOPICS IN MOLECULAR VIROLOGY GENE THERAPY AND TRANSGENICS. Cross-listed in Microbiology and Immunology

MECHANISMS OF CANCER THERAPEUTICS. Cross-listed in Pharmacology

CANB 344. INTEGRATED BIOLOGY OF CANCER (VUMC) (SPRING)

BICH 769. MOLECULAR BIOIMAGING (VUMC) (SPRING)

SPECIAL PROGRAMMATIC FEATURES OF THE GRADAUTE PROGRAM IN CANCER BIOLOGY

Cancer Biology Retreat. Preceptors and trainees in the Cancer Biology program participate in the annual Cancer Biology Retreat hosted jointly by Meharry Medical College and the Vanderbilt Ingram Cancer Center. This is an outstanding opportunity to learn of advances in cancer research from bench to bedside to behavioral research and community-based research. Participants also have the opportunity to obtain constructive feedback from a broad audience on each individual's research program.

Graduate Program in Microbiology and Immunology

COURSE REQUIREMENTS FOR THE PROGRAM in MICROBIOLOGY AND IMMUNOLOGY

DR: Departmental Required Course

DE: Departmental Elective Course

First Year: Core Curriculum

Second Year:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Foundations in Research (DR)	3
	Fundamentals in Immunology (DR)	2
	Seminal Papers on the Foundations of Modern Microbiology (DR)	2
	Seminars/Journal Club (DR)	1
	Dissertation Research(DR)	1-12
	General Electives (DE)	
Spring Semester		
	Roles of Microorganisms in the	2

	Living World (DR)	
	Host-Pathogen Relationships (DR)	5
	Seminars/ Journal Club (DR)	1
	Dissertation Research (DR)	1-12
	General Electives (DE)	
Summer Semester		
	Research (DR)	6

Third Year:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Research (DR)	1-12
	Preparation of PhD Candidacy Proposal Seminar	1
Spring Semester		
	Research	1-12
	PhD Candidacy Exam Seminar / Journal Club (DR)	1
Summer Semester		
	Research (DR)	6
	PhD Candidacy Exam	

Subsequent Years:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Research (DR)	1-12
	Seminar/ Journal Club (DR)	1
Spring Semester		
	Research (DR)	1-12
	Seminar / Journal Club (DR)	1
Summer Semester		
	Research (DR)	6

Students are expected to complete the requirements for the Ph.D. degree in 5-6 years.

Elective Courses Taught at Meharry Medical College

- Perspectives in Immunology (MICR 702)
- Gene Transcription and Regulation (BSCI 719)
- Directed Studies (BSCI 736)

Advanced Seminar and Special Topics (MICR 901)
Advanced Virology (MICR 713)

Elective Courses Taught at Vanderbilt

Cellular and Molecular Basis of Vascular Disease
Microbial Genetics
Molecular Virology
Cellular Microbiology of the Pathogen-Host Interaction
Human Genetics

COURSE DESCRIPTIONS FOR THE PROGRAM IN MICROBIOLOGY AND IMMUNOLOGY

MICR 702. PERSPECTIVES IN IMMUNOLOGY. This course consists of a series of seminars on recent research advances in immunology. Topics covered include immunochemistry, immunogenetics, cellular immunity, tumor and transplantation immunology, immunopathology and the complement system. Prerequisite: Medical Microbiology or equivalent preparation in immunology. 3 credit hours. SPRING, even years. Coordinator, Dr. M. F. Lima.

MICR 703. SEMINAL PAPERS ON THE FOUNDATIONS OF MODERN MICROBIOLOGY. Students present and discuss papers describing fundamental discoveries in areas related to microbiology. The goal is to familiarize students with the process of scientific discovery, and with the history of major developments in the field. Topics include important discoveries involving major human pathogens, fundamental processes in molecular biology, and the development of technology that has a major impact on current biomedical research. 2 credit hours. FALL every year. Coordinator, Dr. M. Chaudhuri.

MICR 708. FOUNDATIONS IN RESEARCH. The goal of this course is for the student to critically review the literature relevant to his/her proposed thesis research. The outcome of the course will be a student-prepared paper that provides a thoroughly documented background that supports the rationale for the proposed research project. The choice of the research problem should be determined by the student in consultation with the preceptor. Each student will be guided by a committee of three faculty members that will include the student's preceptor. 3 credit hours. SPRING, every year. Coordinator, Dr. R. Holt.

MICR 709. HOST-PATHOGEN RELATIONSHIPS. The course is designed primarily for advanced graduate students. Instruction consists of lectures, informal discussions, and guest speakers. Emphasis is directed to examining the theoretical, molecular, ultrastructural and physiological elements which characterize hosts and parasites in the broad sense (bacteria, viruses and parasites). Prerequisites: MICR-710 or equivalent preparation in immunology. 5 credit hours. SPRING, odd years. Coordinator, Dr. M.F. Lima.

MICR 710. FUNDAMENTALS IN IMMUNOLOGY. This course reviews the basic concepts in immunology. It consists of the immunology lecture and laboratory component of Medical Microbiology and seminar/discussions focused on selected topics in immunology. This course may serve as a pre-

requisite for advanced immunology courses offered by the Department of Microbiology. 3 credit hours. SPRING, every year. Coordinator, Dr. M. F. Lima.

MICR 713. **Molecular Biology of Animal Viruses.** Lecture course with emphasis on mechanisms of viral replication, oncogenic transformation, and virus-host cell interactions. 3 credit hours. SPRING, alternate years. Coordinators, Drs. Waldemar Popoik and B. Liu.

MICR 714. **ROLE OF MICROORGANISMS IN THE LIVING WORLD.** A topical course exploring the biology of microorganisms. Emphasis on mechanisms underlying microbial adaptations and how they influence biological systems. 2 credit hours. SPRING, every year. Coordinator, Dr. Raju Ramasamy.

BSCI 719. **GENE TRANSCRIPTION AND REGULATION.** Structure and function of different RNA polymerases (RNAPs). Role of CTD (C-terminal domain) of RNAP II. Basic aspects of initiation of transcription by RNAP I, II and III. Molecular mechanisms of transcription activation. Regulation of basic transcription initiation, elongation and termination in bacterial system. Regulation of transcription initiation, elongation and termination in eukaryotic system. Chromatin and regulation of transcription. DNA topology and gene expression. Structural studies (X-ray crystallography and NMR) of transcription factors. Nucleic acid-protein interactions. Regulation of expression of tumor suppressor genes and human tumor virus genes. Methods involved in transcription research. 3 credit hours. SPRING, even years. Coordinator, Dr. G. Chaudhuri.

BSCI 736. **READINGS IN BIOMEDICAL SCIENCES (Directed Studies).** Intensive reading under the guidance of a faculty member in an area selected by the student. The student and faculty member meet weekly to discuss the readings; the student may be required to write a paper on the semester's reading. 1-3 credits. FALL and SPRING, every year. Faculty.

MICR 850. **MICROBIOLOGY RESEARCH.** Ph.D. Dissertation Research. Required of students who are candidates for the doctoral degree. 1-12 credit hours. FALL and SPRING, every year. Faculty.

MICR 900. **MICROBIOLOGY SEMINAR.** Weekly discussion of current topics in microbiological research and of research within the department. 0-1 credit hour. FALL and SPRING, every year.

MICR 901. **ADVANCED SEMINAR AND SPECIAL TOPICS.** This course is a discussion by advanced graduate students and a faculty discussion leader who will make assignments from the current literature on a specific subspecialty. The course will examine experimental design, laboratory techniques used, validity of conclusions and contributions to the knowledge of the field under consideration. 1-3 credit hours. FALL and SPRING, every year.

Courses taught at Vanderbilt University that are permitted as electives in this program

Cellular and Molecular Pathology 337. **CELLULAR AND MOLECULAR BASIS OF VASCULAR DISEASE.** Lectures on contemporary research in cell biology, protein and lipid biochemistry, and molecular biology of the vascular system. 3 credit hours. SPRING

Microbiology and Immunology 328 1. **MICROBIAL GENETICS.** The genetics of bacteria and yeast and their use in molecular biology as an experimental tool. 2 credit hours. FALL.

Microbiology and Immunology 328 2. MOLECULAR VIROLOGY.. The interaction of animal viruses with their host cells, discussed at the molecular and cellular level as model systems. Special emphasis on current literature and methodology. 3 credit hours. FALL.

Microbiology and Immunology 350. CELLULAR MICROBIOLOGY OF THE PATHOGEN-HOST INTERACTION. An interdisciplinary course designed to train students in the field of molecular microbiology and/or cell biology. Model organisms or their products will be analyzed in the context of molecular cell microbiology. Students will be challenged to utilize new information from microbial genome sequencing to understand host cell Subcellular compartments and signaling pathways. 3 credit hours. SPRING.

Molecular Physiology and Biophysics 340. HUMAN GENETICS. Designed to cover background and latest advances in human genetics. Topics will include an overview of mutational mechanisms, cytogenetics (detection and description of chromosomal abnormalities), biochemical genetics (gene defects in biochemical pathways), molecular genetics (gene structure, function, and expression), population genetics (heritability, quantitative traits, variance analysis), gene mapping (positional cloning, statistical and molecular techniques), and genetic epidemiology (genetic linkage analysis, design of gene mapping studies, gene-environment interaction). Topics will be discussed with reference to specific human genetic diseases. 3 credit hours. SPRING.

SPECIAL PROGRAMMATIC FEATURES OF THE GRADAUTE PROGRAM IN MICROBIOLOGY AND IMMUNOLOGY

Microbiology Retreat. The Microbiology Retreat is a weekday program of informal research talks and discussions. Faculty, students and fellows attend this function. This Retreat provides an outstanding opportunity to keep up to date with the diverse research underway in the program and to participate in vigorous scientific discussions. Students are expected to attend the Retreat, and are encouraged to present their research either as a formal talk or a poster.

Graduate Program in Neuroscience

Course Requirements for the Program in Neuroscience

DR: Departmental Required Course

DE: Departmental Elective Course

First Year: Core Curriculum

Second Year:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Graduate Neuroscience (DR)	5
	Neuropharmacology (DR)	3

	Research in Physiology (DR)	1-12
	Seminar in Physiology (DR)	1
Spring Semester		
	Toxicology (DE)	3
	Neurobiology of Disease (DE)	1-5
	Research in Physiology (DR)	1-12
	Seminar in Physiology (DR)	1
Summer Semester		
	Research in Physiology (DR)	6

Third Year:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Advanced Neurophysiology (DE)	3
	Neurobiology of Disease (DE)	1-5
	Research in Physiology (DR)	1-12
	Seminar in Physiology (DR)	1
	Preparation of PhD Candidacy Proposal	
Spring Semester	General Electives	
	Research in Physiology (DR)	1-12
	Seminar	1
	PhD Candidacy Exam	
Summer Semester		
	Research (DR)	6
	PhD Candidacy Exam	

Subsequent Years:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Research (DR)	1-12
	Seminar	1
Spring Semester		
	Research (Dissertation Research)	1-12 (1-3)
	Seminar	1
Summer Semester		
	Research (DR)	6

Students are expected to complete the requirements for the Ph.D. degree in 5-6 years.

Neuroscience Electives

(a) Meharry Medical College

NSC1 70001 Neurobiology of Disease (1-5 credits)

PHAR 723 Toxicology (3 credits)

PHY720 Readings in Physiology (3 credits)

(b) Vanderbilt Courses

NURO 325 (MMC: PHYS 724) Neuroscience Foundations (2 credit)

NURO 345 (MMC: 73701) Cellular and Molecular Neuroscience (4 credits)

NURO 340 (MMC: PHYS 70901) Systems Neuroscience (4 credits)

COURSE DESCRIPTIONS FOR THE PROGRAM IN NEUROSCIENCE

NSC1 700. NEUROBIOLOGY OF DISEASE. The course has five modules (1 credit hour each). Five modules are: Parkinson's Disease and Movement Disorders; Alzheimer's Disease and Dementias; Chronic Pain; Addictions; Depression and Mood Disorders. The importance of this course, and the rationale for its development, is to foster preparedness for interdependent collaborative research that spans from bench to bedside, and also allows laboratory investigators to exploit clinical insights to inform basic science inquiries. The goal is to train scholars for participation in interdependent research across the molecular and cellular to integrative and clinical continuum. The course will foster this interdependence by both the content of the courses as well as the participation in these courses by graduate, medical, postgraduate (MD and PhD) fellows. The selection of the disease themes of this course reflect areas of research interest and strength at both Meharry and Vanderbilt, and also- in their didactic content- will allow students to become familiar with the breadth of experimental strategies and areas of scholarship (including genetics and imaging, for example) that converge to facilitate discovery to translation to clinical diagnosis and intervention. Prerequisite: Graduate Neuroscience. 1-5 credits. Fall & Spring.

PHYS 709. ADVANCED NEUROPHYSIOLOGY. A functional approach to nervous system mechanisms. Topics include sensory and motor mechanisms, sensory motor integration and higher functions.

The course will include lectures, selected literature discussions and essay examinations. 3 credits. Prerequisite: Human Physiology. (Substitute for Systems Neuroscience)

PHYS 712. SEMINAR IN PHYSIOLOGY. Weekly discussion of current topics in neuroscience research and of research within the Department of Neuroscience and Pharmacology.

PHYS 714. RESEARCH IN PHYSIOLOGY. Participation and credit in this course are arranged by the COI of students working on their PhD thesis research. Required of all students who are candidates for the doctoral degree.

PHYS 721. DISSERTATION RESEARCH. This is a practical course in assembling, analyzing, and presenting large quantities of experimental data. Students are required to register for this course in their last semester of residence. Course is completed with the approval of the written dissertation by the COI. PhD thesis research. Required of all students who are candidates for the doctoral degree.

PHYS 724. NEURONAL PHYSIOLOGY. Advanced study of cellular processes related to nervous system functions will include aspects of neurophysiology, neurochemistry and neuroanatomy. Format will be primarily lectures and selected literature readings. Prerequisite: core curriculum. 3 credit hours
(Substitute for NURO 325. Neuroscience Foundations- 2 credit hours)

PHYS 735. GRADUATE NEUROSCIENCE. The goal of this course is to help students achieve an integrated and correlated understanding of nervous system structure, function, dysfunction and therapeutics. The course covers the following major topics: 1) excitable cells and synapses; 2) anatomy of the nervous system, meninges and neuron-vasculature; 3) sensory systems; 4) motor system; and 5) higher functions. Graduate student exams in this course are essay type, and test critical thinking skills. (Drs. Ansah, Mokha and Staff).

PHARM 722. NEUROPHARMACOLOGY. This course presents an overview of neuropharmacology, including fundamentals of receptor theory, Neurotoxicology, neurophysiology and drug abuse. Mechanisms and problems concerned with neurotransmission will be discussed. Emphasis is given to the neurochemical basis of CNS disorders and drug intervention. Lecturers, current literature, discussions are included. 3 credit hours (Dr. Charlton & Staff)

PHARM 723. TOXICOLOGY. Principles involved in toxicity of drug and chemical agents will be presented. Topics include xenobiotic biotransformation, toxicokinetics, chemical carcinogenesis, neurotoxicology, metal toxicity, toxic response of skin & respiratory system & occupational toxicology. Toxicological mechanisms of action, rationale for therapeutic measures against effects of toxic chemical agents, and the basis for toxicological pathology, Current issues in toxicology (Toxicogenomics) will also be covered. Course format includes lectures, and student involvement in critical review of current literature. 3 credit hours (Dr. Hood & Staff)

PHYS720. Readings in Physiology. Student should complete a comprehensive reading list of topics specifically associated with his/her area of research. There will be no formal meetings or exam. This course may be taken only once for credit. 3 credit hours

Courses at Vanderbilt that may be taken as Electives in the Neuroscience emphasis program

NURO 325. NEUROSCIENCE FOUNDATIONS. This course discusses historical concepts and individuals in neuroscience, so that students develop an appreciation for the history of their discipline.

FUNDAMENTAL NEUROSCIENCE. This comprehensive course covers the fundamentals of the nervous system, from molecules to networks and systems. The lectures are designed to move from the pioneering work that established a research area to the recent advances in neuroscience. In addition to the didactic content of this course, the intent is to foster the discovery paradigm-breaking thinking that parallels major advances in a field.

NURO 340. Systems Neuroscience (description pending)

(NURO 345.) PHAR 345. CELLULAR AND MOLECULAR NEUROSCIENCE. An overview of major neural networks, including examples from motor and sensory systems, as well as higher cognitive and affective functions. Studies of neural development move from an examination of neurogenesis, cell fate, and phenotype development to an analysis of invertebrate models and how they have advanced our understanding of mechanisms involved in axonal guidance, synapse formation and apoptosis. Additional lectures covering synaptic and systems plasticity, and models of neural networks and learning and memory will also be provided. Emphasis is placed on the integration of anatomical, biochemical and physiological information. (Blakely)

(NURO 346.) PHAR 346. MOLECULAR NEUROBIOLOGY. Molecular components and interactions that regulate neuronal development, signaling and disease. Classic molecular analysis of neurobiological processes will be coupled with detailed studies of contemporary literature to provide students with a sound foundation for understanding the molecular bases underlying the development and function of the nervous system. Topics to be covered include: development of neuronal identity, axonal transport, growth factors and cell death, axon guidance and synapse formation, electrical and chemical neurotransmission, regulation of neuronal excitability, and genetic analysis of signaling and neural disorders. (Emeson)

SPECIAL PROGRAMMATIC FEATURES of the Neuroscience Graduate Program

Neuroscience Retreat. In order to enhance the cohesiveness and visibility of the neuroscience program, a one-day Meharry-Vanderbilt Neuroscience Retreat is organized to focus on an emerging area of neuroscience. The central theme is developed by three to four faculty research presentations that move from molecules to neural systems to behavior or disease. A nationally recognized neuroscientist is invited to present a plenary lecture that relates to the central theme. The one-day program includes poster presentations by graduate students (second year and beyond) in the program, thus giving students an opportunity to get constructive input about their ongoing projects from the visiting as well as local scientists outside the program. Thus, the Spring Retreat serves as a venue for highlighting students in our program and providing valuable contacts for future career opportunities. In addition to the educational benefits, this experience will serve as a confidence builder for the students and provide time for informal scientific and social interactions. An added benefit of the Retreat is that advice is sought from the invited speaker on improvements in our training program.

The Neuroscience Student Organization (NSO). This was established by graduate students in 1998, and membership includes any interested graduate student doing neuroscience-related work in any department or program at Meharry or Vanderbilt. The NSO is run by students and has its own infrastructure, including a President and advisory council. The NSO organizes a biweekly Summer Seminar Series to which only students are invited. Individual students make research presentations providing an opportunity for them to discuss their research in a relaxed environment and get input from students of diverse backgrounds and interests. The NSO also coordinates an annual Spring Neuroscience Seminar with students selecting the topic and speaker, making travel and itinerary arrangements, and setting up and advertising the seminar. One of the goals of the Spring Neuroscience Seminar is to allow trainees to develop a professional network in the at-large community that will serve as a foundation for future professional endeavors. Finally, the NSO is instrumental in helping coordinate aspects of the annual Neuroscience Retreat and Brainstorm Brain Awareness Program, making this organization a dynamic and enriching component of the Neuroscience Graduate Program.

Graduate Program in Pharmacology

Course Requirements for the Program in Biochemistry and Cancer Biology

DR: Departmental Required Course

DE: Departmental Elective Course

First Year: Core Curriculum

Second Year:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	General Pharmacology (DR)	5
	Neuropharmacology (DE)	3
	Research in Pharmacology (DR)	1-12
	Pharmacology Seminar (DR)	2
	Carcinogenesis & Cancer Therapeutics (DE)	3
Spring Semester		
	Cell Surface Receptors (DR)	2
	Drug Metabolism (DR)	2
	Pharmacokinetics (DR)	2
	Research in Pharmacology (DR)	1-12
	Pharmacology Seminar Course (DR)	2
	Cardiovascular Pharmacology (DE)	2
Summer Semester		2

Third Year:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Research in Pharmacology (DR)	1-12
	Pharmacology Seminar (DR)	2
	Preparation of PhD Candidacy Proposal	
	General Electives	
Spring Semester		
	Research in Pharmacology (DR)	1-12
	Pharmacology Seminar (DR)	2
	PhD Candidacy Exam	
Summer Semester		
	Research in Pharmacology (DR)	6
	PhD Candidacy Exam	

Subsequent Years:

Semester	Name of Course	Number of Credit Hours
Fall Semester		
	Research in Pharmacology (DR)	1-12
	Pharmacology Seminar (DR)	2
Spring Semester		
	Research in Pharmacology (DR)	1-12
	Pharmacology Seminar (DR)	2
Summer Semester		
	Research in Pharmacology(DR)	6

Students are expected to complete the requirements for the Ph.D. degree in 5-6 years.

COURSE REQUIREMENTS FOR THE PROGRAM in PHARMACOLOGY

Elective Pharmacology Courses

Courses offered at Meharry Medical College:

PHARM 705	Cardiovascular Pharmacology
PHARM 722	Neuropharmacology
PHARM 723	Toxicology
PHARM 735	Research Problems in Pharmacology
PHARM 736	Current Topics in Pharmacology
PHARM 738	Carcinogenesis & Cancer Therapeutics

Courses offered at Vanderbilt University

PHAR 324	Receptor Theory, Cell-Surface Receptors and Signal Transduction Pathways
PHAR 320	Pharmacological Targets and Mechanisms
PHAR 322	Scientific Communication Skills
PHAR 321	Principles of Drug Action
PHAR 325	Cardiovascular Pharmacology
PHAR 329	Pharmacology of Psychotropic Drugs
PHAR 345	Cellular and Molecular Neuroscience
PHAR 346	Molecular Neurobiology

COURSE DESCRIPTIONS FOR COURSES IN THE PHARMACOLOGY EMPHASIS AREA

PHARM 705. CARDIOVASCULAR PHARMACOLOGY. The pharmacology of drug agents exerting major effects on the cardiovascular system will be presented in lectures, discussions, and demonstrations. Mechanism of action, basis for therapeutic application and limiting side effects of the drug agents will be discussed. Research methodology utilized in studying these agents will also be covered. 3 credit hours (Drs. Maleque & Barnett)

PHARM 706. GENERAL PHARMACOLOGY. The pharmacological basis of therapeutics is presented by means of lectures, conferences and demonstrations. Emphasis is placed on the factors governing drug action, dose-response relationships, the relationship between chemical structure and pharmacological action, the problems associated with absorption, distribution metabolism and elimination, and the mechanism of action of the common classes of drugs. Attention is also given to contra-indications, side effects and toxic effects of these compounds. 5 credit hours (Staff)

FUNDAMENTALS OF PHARMACOLOGY (3 modules). General principles and introductory considerations of the pharmacological basis of therapeutics will be presented in this course. Course will be offered in modular format, consisting of three modules: Receptor Theory (Dr. Limbird), Drug Metabolism (Dr. Eltom), Pharmacokinetics (Dr. Nyanda). Areas to be covered include: receptor theory & kinetics, dose-response relationships, and mechanism of drug action; Phase I and phase II of drug metabolism, diversity of cytochromes P450(CYPs), CYP polymorphism (SNPs) & drug efficacy; pharmacokinetics concepts, Pharmacodynamic-Pharmacokinetic modeling, therapeutic drug monitoring, clinical correlates. 6 credit hours (2h for each module) (Drs. Limbird, Eltom & Nyanda)

PHARM 710. CELL SURFACE RECEPTORS. The course consists of interactive but lecture-like sessions. Exams are take home, open book, and focus on critical thinking and using what is taught in a new experimental setting. The course will begin with studies of receptor identification and characterization in simple cellular settings, and then extend those studies to *in vivo* formats, using classical methodology. 2 credits hours (Dr. Limbird)

PHARM 715. DRUG METABOLISM. This course will cover in depth the concepts involved in metabolism of lipophilic molecules - identifying Phase I & Phase II enzymes; their location, mechanism, typical substrates, genetic variation, species variation, inhibition and drug interaction and drug design. 2 credit hours (Dr. Eltom)

PHARM 722. NEUROPHARMACOLOGY. This course presents an overview of neuropharmacology, including fundamentals of receptor theory, Neurotoxicology, neurophysiology and drug abuse. Mechanisms and problems concerned with neurotransmission will be discussed. Emphasis is given to the neurochemical basis of CNS disorders and drug intervention. Lecturers, current literature, discussions are included. 3 credit hours (Dr. Charlton & Staff)

PHARM 723. TOXICOLOGY. Principles involved in toxicity of drug and chemical agents will be presented. Topics include xenobiotic biotransformation, toxicokinetics, chemical carcinogenesis, neurotoxicology, metal toxicity, toxic response of skin & respiratory system & occupational toxicology. Toxicological mechanisms of action, rationale for therapeutic measures against effects of toxic chemical agents, and the basis for toxicological pathology, Current issues in toxicology (Toxicogenomics) will also be covered. Course format includes lectures, and student involvement in critical review of current literature. 3 credit hours (Dr. Hood & Staff).

PHARM 735. RESEARCH PROBLEMS IN PHARMACOLOGY. This is essentially an independent study, qualified students work with individual staff members in areas not covered in other available courses. 1-6 credit hours (Staff)

PHARM 736. CURRENT TOPICS IN PHARMACOLOGY. By means of lectures and/or discussion sessions, this course will offer opportunity to evaluate current advances in the field of pharmacology. Each

student enrolled will be required to write and submit a critical evaluation of an assigned, current, published research article. 3 credit hours (Staff)

PHARM 737. PHARMACOKINETICS. Offered as a module in Fundamentals of Pharmacology. This course module is designed to understand the pharmacokinetics principles that govern the absorption, distribution, metabolism, and elimination of drugs. Basic pharmacokinetics parameters are examined using one- and two-compartment modeling. In addition, applications of pharmacokinetics are examined with respect to clinical situations, and students will be introduced to the use of computer programs in pharmacokinetics. 2 credit hours (Dr. Nyanda & Staff)

PHARM 738. CARCINOGENESIS & CANCER THERAPEUTICS (cross-listing with Cancer biology). This course will cover the mechanisms underlying the carcinogenic process induced by chemical, viral or physical agents. Major emphasis will be focused on the mechanisms exploited in developing therapeutic targets for cancer treatment. Lectures on clinical correlates will be presented by clinical oncologists. 3 credit hours (Drs. Eltom& Ochieng)

Courses at Vanderbilt University that may be taken as electives in the Pharmacology emphasis program

PHAR 324. RECEPTOR THEORY, CELL-SURFACE RECEPTORS AND SIGNAL TRANSDUCTION PATHWAYS. Course covering structure and function of cell-surface receptors and the molecular bases by which they activate cellular function. Topics include receptor identification; quantitation of simple and complex binding phenomena; molecular bases for receptor coupling to GTP-binding proteins; the structure and function of ligand-operated ion channels, receptor tyrosine kinases and receptor-induced signal transduction cascades receptors as oncogenes and proto-oncogenes. (Summer)

PHAR 320. PHARMACOLOGICAL TARGETS AND MECHANISMS. Introduction to *in vivo* physiological mechanisms, anatomical structure of organ systems, and regulatory feedback pathways responsible for drug metabolism and physiological homeostasis. Classical studies that shifted the paradigm in a particular area and contemporary research will be discussed to demonstrate clarity of thinking, focused experimental strategies leading to genuine discovery, as well as potential difficulties in interpretation of results of experiments. (Fall)

PHAR 321. PRINCIPLES OF DRUG ACTION. The mechanisms of drug action are taken up in a systematic manner. Course includes didactic lectures and parallel, guided readings on drug discovery and design, based on current advances in basic science and clinical research. (Spring)

PHAR 322. SCIENTIFIC COMMUNICATION SKILLS. Techniques in effective oral communication of scientific research as well as practical experience in research and literature presentation and in the preparation of grant proposals. (Fall)

PHAR 323. EXCITABLE MEMBRANES IN NERVE AND MUSCLE. Recent findings concerning the structure, function, and pharmacology of ion channels. Topics will include the relationship between amino acid sequence, protein subunit structure, and function of both voltage- and ligand-gated channels; the relationship between channel structure and pharmacology; the interaction of drugs with channels and receptor/channel proteins, with special emphasis on the

interaction of compounds with different functional channel states; indirect coupling between ion channels and neurotransmitter and hormone receptors. Classes will include both presentations by the instructors and discussion of recent publications by students. (Dr. DeFelice)

PHAR 325. CARDIOVASCULAR PHARMACOLOGY. Cardiovascular physiology and pharmacology from the molecular to the organismal level. Classic experimental studies, molecular studies, and clinical observations will be presented to demonstrate the power of interdisciplinary approaches in answering complex questions in biology. Students will have the opportunity to identify specific areas or pathophysiologic states for emphasis. Topics covered: development of the cardiovascular system, regulation of cardiac contractility and electrophysiology, blood pressure regulation, coagulation, and select cardiovascular pathophysiologies. (Dr. Barnett)

PHAR 329. PHARMACOLOGY OF PSYCHOTROPIC DRUGS. An advanced course that focuses on the mechanism of action of CNS-active drugs, with extensive literature reading and student presentations. (Dr. Sanders-Bush)

PHAR 345. CELLULAR AND MOLECULAR NEUROSCIENCE. An overview of major neural networks, including examples from motor and sensory systems, as well as higher cognitive and affective functions. Studies of neural development move from an examination of neurogenesis, cell fate, and phenotype development to an analysis of invertebrate models and how they have advanced our understanding of mechanisms involved in axonal guidance, synapse formation and apoptosis. Additional lectures covering synaptic and systems plasticity, and models of neural networks and learning and memory will also be provided. Emphasis is placed on the integration of anatomical, biochemical and physiological information. (Dr. Blakely)

PHAR 346. MOLECULAR NEUROBIOLOGY. Molecular components and interactions that regulate neuronal development, signaling and disease. Classic molecular analysis of neurobiological processes will be coupled with detailed studies of contemporary literature to provide students with a sound foundation for understanding the molecular bases underlying the development and function of the nervous system. Topics to be covered include: development of neuronal identity, axonal transport, growth factors and cell death, axon guidance and synapse formation, electrical and chemical neurotransmission, regulation of neuronal excitability, and genetic analysis of signaling and neural disorders. (Dr. Emeson)

Special Programmatic Features of the Pharmacology Program

Pharmacology Retreat

Each fall, the Department of Pharmacology at Vanderbilt University holds a retreat in conjunction with the Pharmacology graduate program at Meharry Medical College at a nearby state park. Attendance at and full participation in the Retreat is required for all graduate students who are in the Pharmacology program at Meharry Medical College. The speakers at the retreat are students and postdoctoral fellows. Each of the talks by the students is ten minutes in length, and focuses on future research plans rather than past accomplishments. Although a few minutes of the presentation are used to explain the research problem under study, its importance, and what has been learned to date, the students are expected to spend the majority of the ten minute presentation explaining what they want

to accomplish or learn in the coming year and what strategies they will employ to do so. This emphasis on the future tense encourages a great deal of input, discussion, and critical consideration of the project at a level of intensity that would not necessarily occur following presentations of already-completed work. Furthermore, by learning the methodologies being established in different laboratories, participants in the training program can more readily learn from one another, rather than "reinventing the wheel." Important collaboration and "crash courses" in different technologies have emerged because of this retreat, and this mode of scientific exchange has fostered an acceleration of the productivity of graduate students and participating mentors alike.

Pharmacology Graduate Students Enrichment Club

This club is run by Meharry Medical College students, mentored by Dr. Eltom, and meets every two weeks in the West Basic Science Building 3rd floor conference room. The major activity of the club involves reading of books or articles and their thorough discussion to lead to an in depth understanding of concepts in pharmacological sciences or relevant biological sciences. In the past, books have included a Textbook of Receptor Pharmacology; a Workshop for Reference Manager and its application in citation management for writing fellowships, thesis and manuscripts: PowerPoint Presentation Skills; Ask The Expert sessions, to discuss a technique by somebody who does the assay routinely, either graduate student or invited guest; and other topics. As some of these topics and workshops are integrated into required elements of the Core Curriculum for the PhD, graduate students in the Pharmacology program will identify the needs to be addressed in this enrichment club, on an annual basis.

APPENDICES

Self-Tracking Summary Progress Checklist for the Overall Program
Self-Tracking Qualifying Exam/COI Checklist
Self-Tracking Final THESIS Defense Checklist
Committee Meeting Information Form

Self-Tracking Progress Checklist

Summary Progress in the PhD Program in Biomedical Sciences
At Meharry Medical College

Year Entered Program: _____

Preceptor/Dissertation
Advisor: _____
Graduate Program: _____
Emphasis _____

Lab Rotations (faculty member name):

Lab #1: _____

Lab #2: _____

Lab #3: _____

Required Courses Completed (record semester and year completed and grade earned):

Biomedical Sciences IA _____

Biomedical Sciences IIA _____

Introduction to Research _____

Research Laboratory Rotations (I, II, III) _____

Introduction to Biostatistics _____

Molecular Methods _____

Scientific Communications (I & II) _____

Elective Courses Completed (course name & number, date completed, credit hours, & grade)

Self-Tracking Progress Checklist (continued)

Dissertation/COI Committee -at least five members; please give names of committee members and their affiliations; at least one member of the committee should come from outside MMC

1. Committee

Chairperson _____

2. Dissertation

Advisor/Mentor _____

3. Outside MMC

Member _____

4. _____

5. _____

6. _____

Date Passed Qualifying Exam _____

Dissertation Title: _____

Defense Date: _____

Abstracts, Publications, and Honors (use continuation pages if necessary):

Self-Tracking Dissertation FINAL THESIS Defense Checklist

STEP I: Pre-Defense COI Committee Meetings:
Between the time you successfully complete your Dissertation Defense Proposal and defend your Dissertation, you must meet with your COI each semester, in order for the Committee to monitor your progress and make suggestions, as well as for you to have the opportunity to solicit input and advice

a. Dates of Dissertation Committee Meetings:

b. Date Dissertation Committee granted permission to write:

STEP II: Before You Begin Writing Your Final Draft
Please obtain and examine a copy of Meharry Medical College’s official **Guidelines for Writing Dissertations from the Graduate School Office** prior to writing your dissertation.

STEP III: While Writing Your Dissertation
a. After you have the main components of your dissertation written (e.g., cover page, table of contents, a figure, a table, a page of standard text), **MAKE AN APPOINTMENT WITH THE STUDENT OFFICER IN THE GRADUATE SCHOOL** to review the samples for formatting requirements. They can be reached at 327- 6533.

Self-Tracking Dissertation Defense Checklist (continued)

- b. The Graduate School ultimately determines if you have completed all the necessary requirements for the Ph.D. degree in Biomedical Sciences and confers your degree. You must file an Intent to Graduate form with the Graduate School by the appropriate deadline, which is relatively early in the semester in which you intend to graduate. These dates can be obtained from the Graduate School (327-6533).

The latest approximate dates to file the Intent to Graduate form to the Educational Programs Coordinator are as follows:

For December graduation	by August 1 st
For May graduation	by February 1 st
For October graduation	by May 1 st

Your intent to graduate form must include either published work with you as first author in a peer-reviewed journal OR indication from a journal of ACCEPTANCE of your first-authored manuscript.

Self-Tracking Dissertation Defense Checklist (continued)

STEP V: Dissertation Submission and Defense

a. Scheduling your oral defense:

Once your dissertation is written or nearly completed, set a COI meeting to be granted approval for an oral defense date. As it is often difficult to schedule a time for your defense that is convenient for all of the members of your COI, it is suggested that you begin your scheduling well in advance of your anticipated defense meeting. ALL DISSERTATION COMMITTEE MEMBERS MUST ATTEND. You must notify the DGS of the date, time and place of your defense, as well as your dissertation title AT LEAST 3 WEEKS BEFORE THE DATE OF YOUR DEFENSE MEETING so this information can be approved and received by the Graduate School 2 weeks prior to your defense.

Scheduled Date of Dissertation Defense: _____

Date Notification Submitted to DGS: _____

The reservation of a room for the Dissertation Defense should be done by calling the Graduate School Office 327-6533. Your reservation will not be complete until the DGS or the Department Chair receives a letter from your COI chair indicating that you are approved to defend. The Chair of the Division or the DGS of your program will then write a letter to the Dean of the Graduate School indicating that you are recommended to defend your dissertation.

b. Submitting your dissertation

Your Committee should receive a copy of your dissertation at least two weeks prior to your oral defense. Your dissertation should have been carefully critiqued by, and be acceptable to, you and your dissertation advisor prior to its submission to the Dissertation Committee.

Date Dissertation Submitted to Committee Members:

c. Defending your dissertation:

Prepare a 40-50 minute oral summary

You must bring at least five title pages on bonded paper from your dissertation to your Defense and get ORIGINAL Committee signatures on each. Original signatures are required for all final copies of your dissertation submitted to the Graduate School.

Once you have completed your dissertation defense, the form that is signed by your Committee indicating either a Pass or Fail should be submitted to the Dean of the Graduate School.

Remember, even if your oral defense is successful and your dissertation is accepted by your Dissertation Committee, there are still almost always minor corrections and revisions required by each Committee member.

d. Dissertation binding:

Once you have successfully completed your Dissertation Defense, and made any corrections required by your Committee, you must provide five final copies of your dissertation to the Graduate School for binding. The Dissertation binding fee is paid by your graduation fee.

Self-Tracking Dissertation Defense Checklist (continued)

Final submission of the Dissertation to the Graduate School is required on these dates:

May graduation	Last Friday in April
June graduation	Last Friday in May
October graduation	Last Friday in July
December graduation	Last Friday in October

Committee Meeting Information Sheet

Student's Name: _____

Student ID # _____

Date of Meeting: _____

Time of Meeting: _____

Location: _____

The purpose of this meeting is (please check one):

- Dissertation Proposal Committee Meeting Dissertation Defense

If this is your dissertation defense, what is the title of your dissertation?

Committee Members:

At least ONE member must be from an academic institution other than MMC

STUDENT'S MENTOR

Chair of Committee _____
(if different from mentor) _____

