
Drexel University College of Medicine

Pharmacology & Physiology Graduate Program

POLICIES AND PROCEDURES

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PROGRAM OF STUDY FOR Ph.D. IN PHARMACOLOGY & PHYSIOLOGY

A. Course Requirements

The curriculum includes two semesters of a “Core Curriculum” that is shared by all of the biomedical graduate programs and a series of programmatic courses specific for Pharmacology and Physiology students. All students in the Pharmacology and Physiology Program must take Core Curriculum including Scientific Integrity and Ethics and Biostatistics OR Statistics for Neuro/Pharm Research (except M.D./Ph.D. students and students who may have had comparable courses elsewhere). All students in the Pharmacology and Physiology Program are required to take the following programmatic courses in the first year: Graduate Physiology, and Advanced Topics in Physiology. In the second year, students must take Graduate Pharmacology, Advanced Topics in Pharmacology, and Principles of Neuropharmacology. Students are required to take 2 graduate level elective courses chosen with advice from the Program Director and/or the Research Advisor. All students must register and participate in the seminar/discussion course (Journal Club) Current Topics in Pharmacology and Physiology every semester while in the program up until registering for Thesis Defense. It is expected that each student will complete three research rotations prior to selecting a thesis research laboratory. Starting with their third year, students are required to register for Teaching Practicum which involves participating in a choice of teaching experiences. It is required that thesis research result in at least one published co-author manuscript and one submitted first author manuscript. The Pharmacology and Physiology Steering Committee and Program Director will advise each student on the selection of the flexible aspects of the curriculum.

B. Curriculum

First Year Fall Semester

Molecular Structure and Metabolism	6 credits	IDPT-521-05
Graduate Physiology	4 credits	PHGY-503-05
Advanced Topics in Physiology	1 credits	PHRM-516-05
Pharmacology & Physiology 1 st Lab Rotation	4 credits	PHRM-503-05
Current Topics in Pharmacology & Physiology	1 credit	PHRM-502-05
Total credits:	16 credits	

First Year Spring Semester

Cells to Systems	6 credits	IDPT-526-05
Biostatistics*	2 credits	IDPT-501-05
Pharmacology & Physiology 2 nd Lab Rotation	4 credits	PHRM-504-05
Current Topics in Pharmacology & Physiology	1 credit	PHRM-502-05
Total credits:	13 credits	

First Year Summer

Pharmacology & Physiology 3rd Lab Rotation

*Statistics requirement may be satisfied by taking either Biostatistics (IDPT-501-05) OR Statistics for Neuro/Pharm Research (NEUR-500-05).

The Pharmacology & Physiology Program Director will serve as Advisor to New Graduate Students and meet with each graduate student once during the Fall and Spring semesters of the first year of study.

Second Year Fall Semester

Graduate Pharmacology	3 credits	PHRM-512-05
Advanced Topics in Pharmacology	1 credits	PHRM-516-05
Pharmacology & Physiology 3 rd Lab Rotation	4 credits	PHRM-505-05
Current Topics in Pharmacology & Physiology	1 credit	PHRM-502-05
Electives	credit(s)	
Total credits:	9 + credits	

Second Year Spring Semester

Principles of Neuropharmacology	3 credits	PHRM-507-05
Pharmacology & Physiology Thesis Research	9 credits	PHRM-600-05
Scientific Integrity and Ethics	3 credits	IDPT-500-05
Current Topics in Pharmacology & Physiology	1 credit	PHRM-502-05
Electives	credit(s)	
Total credits:	16 + credits	

Preliminary Exam January of 2nd year

Written and oral segments must be passed.

Qualifying Exam - Mock R21 NIH Grant Proposal started no later than August between the second and third year of study. Written and oral segments must be passed.

Third Year Semesters and Beyond

Current Topics in Pharmacology & Physiology	1 credit	PHRM-502-05
Pharmacology & Physiology Thesis Research	9 credits	PHRM-600-05
OR Thesis Defense		
Teaching Practicum I, II or III	credit(s)	
Total credits:	10 + credits	

The Office of Biomedical Education has established criteria by which all students in all graduate programs will be uniformly evaluated regarding the Core Curriculum. Students must achieve a score of 80 in each semester of the Core in order to pass, and must achieve an overall average of 80 for both semesters of the Core. Students who do not achieve an average of 80 in the first semester of Core will be put on probation until after the second semester at which time the Core Curriculum Committee and the Program Steering Committee will determine if the student may retake the first semester Core in the Second Year. Failed courses must be repeated. Regarding the Programmatic courses, a grade of B must be earned in each course. Programmatic courses must be repeated if the student earns a grade below a B in that particular course. Programmatic courses in which a student has earned a grade of B- can be remediated to a B.

Unsatisfactory Performance in Current Topics in Pharmacology & Physiology

Three unexcused absences are allowed per year for journal clubs. More than three absences will result in a grade of Unsatisfactory (U). The “U” must be remediated to the satisfaction of the course director.

Laboratory Rotations

A minimum of three rotations must be arranged during the first year in consultation with the Program Director and faculty of the Pharmacology & Physiology Program. The research areas may be chosen to complement the student's long-term research interests. Research rotations should provide an opportunity to:

- Practice scientific logic and experimental design
- Acquire useful technical expertise
- Extend scientific and personal interactions within and between labs
- Explore the possibility for a future Thesis research topic
- Develop presentation skills

At least 20 hours per week (minimum) for a three-month period are required for each rotation. The first rotation must begin no later than mid-August of the first year, and students must satisfactorily complete all rotations no later than Fall semester of second year. An oral presentation of the research experience is prepared by the student at the end of each rotation, presented to the department and evaluated by the faculty and the student. Students must complete a rotation evaluation form with their mentor upon completion of their rotation which must be filed with the Program Director and the Biomedical Graduate Studies office. Upon completion of the final rotation, a student must immediately choose and enter a research lab to start Thesis research.

Students in good academic standing (GPA 3.0 and above), who have extensive previous academic lab research experience (1 year minimum, full time), have already identified/selected a specific Thesis laboratory for their Thesis work, and/or have a Master of Science in a field related to biomedical research may petition the Program Director to opt out of the third rotation. The students must provide a letter from their chosen Thesis Advisor to verify that the student has been accepted in that lab for Thesis work. The Program Director will forward the student's request to the Pharmacology & Physiology Steering Committee for consideration. If approved, students must immediately start their Thesis research.

Unsatisfactory Performance in Laboratory Rotations

Laboratory rotations are graded on a Satisfactory (S) or Unsatisfactory (U) basis. Students receiving an "S" are rated on a performance scale ranging from Outstanding (1) to Poor (5). A "U" for a lab rotation is reserved for students that do not meet performance requirements, including attendance, of the rotation as stipulated by the program.

Advanced Elective Courses

In consultation with the Advisory Committee or a student's mentor and according to the area of selected research, the student is required to select and pass a minimum of 2 advanced elective courses from a diverse range of topics that complement the core curriculum and provide relevant, in-depth knowledge. The 2 elective courses can be taken as appropriate throughout the student's training. A list of potential electives is provided below. This is a representative list, you are not limited to selecting from this list of electives. It is recommended that you consult with the course director for each course to receive approval to register for the course and to discern if there are prerequisites or class limitations.

Advanced Elective Courses by Program

Pharmacology and Physiology -

- Drug Discovery and Development I (McGonigle & Clark)
PHRM-525S-05 (Spring)

- Drug Discovery & Development II (McGonigle & Clark)
PHRM-526S-05 (Fall)
- New Frontiers in Therapy (Ajit)
PHRM-581S-05 (Fall)
- Methods in Biomedical Research (Campbell)
PHRM-519S-05 (Spring)

Neuroscience -

- Advanced Cellular & Developmental Neuroscience (Baas)
NEUR-511-05 (Spring)
- Advanced Cellular & Systems Neurophysiology (Clark)
NEUR-512-05 (Spring)
- Graduate Neuroscience I (Gallo & Tom)
NEUR-508-05 (Fall)

Microbiology & Immunology -

- Advanced Molecular Biology (Bergman & Vaidya)
MIIM-630-05 (Spring)
- Emerging Infectious Diseases (Norton)
MIIM-613-05 (Spring)
- Vaccines & Vaccine Development (Kutzler)
MIIM-524-05 (Spring)
- Immunology (Blankenhorn)
MIIM-508-05 (Fall)
- Molecular Pathogenesis I (Krebs)
MIIM-512-05 (Fall)

Molecular Cell Biology and Genetics -

- Advanced Cell Biology (Bouchard)
MCBG-506-05 (Spring)
- Cell Cycle & Apoptosis (Noguchi)
MCBG-514-05 (Spring)
- Macromolecular Structure & Function (Jorns)
MCBG-507-05 (Spring)

Biochemistry

- Writing for Researchers: Grants and Papers (Loll)
BIOC-511-05 (Spring)
- Biochemistry Experimental Approaches (Loll)
BIOC-508-05 (Fall)
- Cancer Biology (Clifford)
BIOC-510-05 (Fall)

Molecular Pathobiology

- Cell & Molecular Biology of Cancer (Stearns)
PATH-601-05 (Spring)

Teaching

On a yearly basis starting in the third year of study, Ph.D. students will be required to participate in at least one of the following teaching experiences: Medical Pharmacology WebDog lab; Medical Pharmacology small-group conference; Lecturing in Graduate Physiology, or tutoring of students taking Graduate Pharmacology, Medical Pharmacology or Graduate Physiology; Physiology & Pharmacology SIM Center activities. Students will receive credit for their teaching/tutoring through registration for Teaching Practicum each year that they teach and in so doing a student's teaching experience will appear on their transcripts. Teaching Practicum information can be obtained from the Course Director (Shumsky).

Committee Meetings and Program Documentation

It is the student's responsibility to assure that the appropriate paperwork is completed for Lab Rotation Evaluations, Preliminary Exams, Qualifying Exams, Thesis Committee Formation, Thesis Proposal Evaluation and Thesis Defense. Completed forms should be submitted to the Program Administrator and the Program Director. Forms may be found online at:

<http://www.drexelmed.edu/Home/AcademicPrograms/BiomedicalGraduateStudies/OnlineResources/DoctoralForms.aspx>

Meetings between the student and his/her Thesis Committee serve to provide an objective, supportive and critical feedback evaluation of academic and scientific progress throughout Graduate School training. They are an essential part of the mentoring process. Committee meetings must be held every six months or more frequently if deemed necessary by the research advisor, student, or Thesis Committee. **It is the responsibility of each student to convene committee meetings** at a mutually convenient time and to provide evidence of such meetings in writing to the Program Director and the Biomedical Graduate Studies office.

M.D./Ph.D. Students

Due to their two years of medical school preparation prior to the start of their graduate training, students in the combined program are excused from the Core Curriculum, Graduate Pharmacology, Advanced Topics in Pharmacology, Graduate Physiology, Advanced Topics in Physiology, Biostatistics and Scientific Integrity and Ethics. Due to the time restrictions on their course of study, they must complete all course requirements during their first year of graduate training. Typically, an MD/PhD student will have selected a thesis laboratory by the start of their graduate training, but if not, the student must do so by the end of the first semester of graduate training. Therefore, the three-rotation requirement is waived, and M.D./Ph.D. students must register for Thesis Research starting in their first Spring semester at the latest. They are required to take Principles of Neuropharmacology, two advanced graduate electives and Current Topics in Pharmacology & Physiology. M.D./Ph.D. students must take the Preliminary Exam and the Qualifying Examination by the end of the summer of their first year of graduate training.

C. Preliminary Exam

The purpose of the Preliminary Exam is to assess the student's ability to integrate, process and utilize knowledge gained prior to and during the first three semesters of Graduate School. Students in good standing who have completed their course work will be required to sit for a Preliminary Examination.

Format: All primary department faculty will contribute one question to the Preliminary Exam from which the students will be required to answer three. The answers will be in the form of twelve pages double spaced, 12 pt font and 0.5" margins, not including adequate references to support the answers. The students will be allowed 3 weeks to complete the exam. Each question will be graded only by the faculty member who

constructs the question, although any member of the Exam committee may review any of the answers. Answers will be graded on a scale of 100 points each. Passing will require a grade of 80 or better on all three answers. Students should begin preparing for the oral part of the exam upon submitting their written answers. Approximately two weeks after completion of the written portion of the Preliminary Exam, the students will orally defend their answers in a sixty minute block of time. The oral examination committee will be composed of the faculty whose questions were answered for the written portion of the exam as well as a member of the Program Steering Committee. The format of the oral exam is as follows: the faculty member who wrote a question to be defended will begin with a general question about the answer; the other faculty on the committee can then ask follow-up questions if they wish. The oral questions will target the student's answers to the written portion, but may include general and specific physiological and pharmacological principles that underlie the answers. A passing grade for the written and oral portion of the exam is required before a student may advance in the program.

The Preliminary Exam will be administered by a Committee which is composed of the faculty whose questions were answered for the written portion of the exam as well as a member of the Program Steering Committee. Students will not be allowed to read from their written exam during the oral portion of the exam except when clarifying a statement that they have written. The results of the exam are included in the student's permanent file. Students may request written feedback from the Committee on the written portion of the exam once the exam is over. **The Preliminary Exam is taken in January of the second year.**

D. Qualifying Exam

This is a mock NIH grant proposal in the R21 format that is defended orally. The purpose of the examination is to assess the students' scientific creativity, ability to design a research project, and oral and written communication skills. A **Qualifying Exam Committee** will be formed, consisting of the student's advisor, three other faculty members from the program and one faculty member from outside the program who is a member of the Graduate Faculty of Drexel University College of Medicine. The Chair of the Examination Committee will be any of the faculty members in the program other than the advisor, and will be identified based on discussions between the student and advisor. **The Qualifying Exam is started no later than August between the second and third year of study.**

Written Part (A): The Chair will solicit from the prospective candidate a Specific Aims page describing research of a current problem in experimental pharmacology and/or physiology that will serve as the focus for the Qualifying Exam. As stated in the Guidelines for preparing NIH grants (SF424_RR):

The Specific Aims should concisely state "the goals of the proposed research and summarize the expected outcome(s), including the impact that the results of the proposed research will exert on the research field(s) involved." The Specific Aims should "List succinctly the specific objectives of the research proposed, e.g., to test a stated hypothesis, create a novel design, solve a specific problem, challenge an existing paradigm or clinical practice, address a critical barrier to progress in the field, or develop new technology." The Specific Aims page should be limited to a single page, single spaced, 12 pt font and 0.5" margins.

Please go to the following URL for examples:

<http://www.niaid.nih.gov/researchfunding/grant/pages/appsamples.aspx>

The topic may be that which the student is planning for a Thesis project, or a closely related topic. The Exam committee will either accept the problem as stated or recommend that the Chair and Advisor meet with the student in order to modify the problem or come up with an alternative. **Once the topic is approved, the student will have one month to write and submit to each member of the Exam committee a detailed**

Research Strategy written in the R21 NIH grant proposal format. The document should be limited to twelve pages double spaced, 12 pt font and 0.5” margins, not including adequate references to support your Research Strategy. The Research Strategy should be organized and written according to the Guidelines for preparing NIH grants (SF424_RR) as stated below:

“Organize the Research Strategy in the specified order and using the instructions provided below. Start each section with the appropriate section heading – Significance, Innovation, Approach. Cite published experimental details in the Research Strategy section and provide the full reference in the Bibliography and References Cited section (Part I Section 4.4.9).

(a) Significance

- Explain the importance of the problem or critical barrier to progress in the field that the proposed project addresses.
- Explain how the proposed project will improve scientific knowledge, technical capability, and/or clinical practice in one or more broad fields.
- Describe how the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field will be changed if the proposed aims are achieved.

(b) Innovation

- Explain how the application challenges and seeks to shift current research or clinical practice paradigms.
- Describe any novel theoretical concepts, approaches or methodologies, instrumentation or interventions to be developed or used, and any advantage over existing methodologies, instrumentation, or interventions.
- Explain any refinements, improvements, or new applications of theoretical concepts, approaches or methodologies, instrumentation, or interventions.

(c) Approach

- Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project. Unless addressed separately in Item 15 (Resource Sharing Plan), include how the data will be collected, analyzed, and interpreted as well as any resource sharing plans as appropriate.
- Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims.
- If the project is in the early stages of development, describe any strategy to establish feasibility, and address the management of any high risk aspects of the proposed work.
- Point out any procedures, situations, or materials that may be hazardous to personnel and precautions to be exercised. A full discussion on the use of select agents should appear in Item 11, below.

If an applicant has multiple Specific Aims, then the applicant may address Significance, Innovation and Approach for each Specific Aim individually, or may address Significance, Innovation and Approach for all of the Specific Aims collectively.

As applicable, also include the following information as part of the Research Strategy, keeping within the three sections listed above: Significance, Innovation, and Approach.”

Preliminary Studies: You may include information on Preliminary Studies. Discuss preliminary studies, data, and or experience pertinent to this application.

Oral Part (B): An oral defense of the student’s grant proposal will be conducted between one and two weeks after submitting the proposal, barring any scheduling problems. Only the Exam committee will

be in attendance. The exam will last approximately 60 min. The student will present a synopsis of the Research Strategy. The Exam committee may question the student about both the specifics of the proposal and any other issues in experimental pharmacology and/or physiology deemed pertinent to the topic at hand. Questioning may begin during the student's presentation. The Exam committee will meet in closed session immediately after the defense in order to render a decision. A student fails the oral exam if two or more members of the committee give failing grades.

The Chair of the Exam committee will report the decision (pass/fail) to the student. If the student passes, the Exam committee will instruct the Director of the Graduate Program to notify the Office of Biomedical Graduate Studies that the program has advanced the student to candidacy. If the student fails, the committee will recommend either: a) the student be offered the opportunity for reexamination, b) the student be offered the opportunity to transfer into the Master program and allowed to complete the Master's degree, or c) the student be dropped from the program completely. Only one reexamination will be allowed. The Exam committee can determine, at its discretion, the form of the reexamination, but typically it will be an oral examination of the same written grant proposal.

Recommendations to drop a student from the program completely or transfer into the Master's program must be reviewed and approved at a meeting of the Pharmacology and Physiology Steering Committee. The Director of the Graduate Program will submit any recommendations concerning the student (transfer to the Master's program or dismissal) for approval in accordance with the Biomedical Graduate Student Handbook Policies.

E. Thesis Advisory Committee

1. By six months after passing the Qualifying Exam, the student will work with the Thesis Advisor to select members of the faculty to serve on the Thesis Advisory Committee. Once formed, this committee will meet every six months to review the student's progress.

- a. At least three of the five voting members of the Committee must be Graduate School faculty from the Pharmacology and Physiology Graduate Program. To complete the five member Committee the student may select individuals who are members of the Graduate School faculty but not members of the Pharmacology and Physiology Graduate Program or individuals who are specialists in the field but from outside the university (as approved by the Biomedical Graduate Education Committee).
- b. The student's thesis advisor is a voting member of the Committee but cannot chair the Committee.
- c. The Chair of the Committee must not be a collaborator on the student's research project and must not have any apparent conflicts of interest related to the publication or funding of the student's project. It is also the responsibility of the Chair to ensure that there is sufficient balance on the committee to ensure a rigorous and unbiased critique of the student's project and progress.

2. Following each Committee meeting, a brief statement of the student's progress must be prepared by the Committee chair and signed by each Committee member and submitted to the Steering Committee.

F. Thesis Proposal

1. The Thesis Proposal document must be submitted by PhD candidates within 9 months of passing the Qualifying Exam or by May of the third year. In the case of MD/PhD candidates, the document must be submitted within 6 months of passing the Qualifying Exam. Under special circumstances this can be extended via written request to, and approval from, the Steering Committee. The Thesis Proposal must be written in the style and within the page limitations of an NIH R21 grant application and handed in 10 working days prior to formal presentation of the Thesis Proposal to his/her Thesis Advisory Committee. Page limits, font size, and

other matters of format are precisely what are advised in the most up-to-date NIH R21 instructions (outlined in the section “**Qualifying Exam**”). Upon approval of the Thesis Proposal the student will continue with his/her thesis research, culminating in the preparation of the Ph.D. dissertation for defense.

2. At the time of the proposal the student must present a brief (10-15 minute) oral summary of his/her intended research project followed by a detailed question and answer session.

4. The Thesis Advisory Committee will reach a decision on the student’s performance. If the decision is positive, the student may continue with his/her thesis research. If the decision is negative, the student can re-submit a revised or new proposal in three months and the process will be repeated. If the decision is negative a second time, the student may either be dismissed from the program or recommended for a terminal Master’s degree. Recommendations to drop a student from the program completely or transfer into the Master’s program must be reviewed and approved at a meeting of the Pharmacology and Physiology Steering Committee. The Director of the Graduate Program will submit any recommendations concerning the student (transfer to the Master’s program or dismissal) for approval in accordance with the Biomedical Graduate Student Handbook Policies.

G. Thesis Writing

When all program requirements have been completed, including all necessary research activity for generating the required publications, a student may register for “Thesis Writing.” The student’s Thesis Committee, research advisor, and the program director must approve registration for “Thesis Writing”. A thesis based on original research is requisite in partial fulfillment of requirements for the Ph.D. degree. The format of the thesis has been described in detail by the Office of Biomedical Graduate Studies (<http://www.drexelmed.edu/documents/biograd/preparingdissertation.pdf>), and this format must be followed precisely.

H. Thesis Defense

1. A candidate may not present him/herself for the final thesis defense until he or she has completed at least 24 calendar weeks of residence after satisfactory completion of the Thesis Proposal, and has the approval of his/her thesis advisor. ***In conjunction with the Dissertation, the student must have one published co-author manuscript and one submitted first-author manuscript.***

2. At least four weeks prior to the date of the commencement at which the degree is to be conferred, printed or photocopied versions of the thesis must be distributed to each member of the advisory-examination committee. Also at this time, the Chair of the Committee, or the Program Coordinator must notify the Office of Biomedical Graduate Studies, the Registrar’s Office and all departments involved in graduate education of the scheduled date of the thesis defense.

3. The thesis defense will take place no less than two weeks and no more than four weeks after the thesis has been distributed to the members of the examination committee, except under written direction of the Steering Committee.

4. The thesis defense will be public. The candidate will be formally introduced by his/her advisor or the Chair of the Committee. The candidate will present a 45-minute seminar on his/her research, followed by questions from the Examination Committee and the general audience. After this initial question and answer period, the chair will dismiss the audience. The Examination Committee will meet in private with the candidate to complete the examination process.

5. The Thesis Examination Committee shall decide upon the merits of the candidate’s performance on the thesis defense. To be recommended for a doctoral degree, the candidate must receive approval of the Committee with no more than one dissenting vote. By permission of the Committee a candidate who has failed the final thesis defense may present him or herself for re-examination after three, but not more than

twelve months. This re-examination must be taken within a calendar year of failure to pass the first examination. A report on each final thesis defense whether passed, failed, or recommended for re-examination must be filed by the Committee in the Office of Biomedical Graduate Studies.

6. At least four weeks prior to the commencement at which the degree is to be conferred, three copies of the completed thesis suitable for binding and bearing the approval of the advisory-examination Committee must be deposited in the Office of Biomedical Graduate Studies. One of these copies is to be placed on file in the COM Library, Graduate Office and the Pharmacology & Physiology Main Office. An unbound copy of the thesis must also be presented to the Office of Biomedical Graduate Studies for microfilming by University Microfilms, Ann Arbor Michigan. The abstract will be published in Dissertation Abstract by University Microfilms. The cost of preparation, reproduction and personal binding copies are the candidate's responsibility.

PROGRAM OF STUDY FOR M.S. IN Pharmacology & Physiology (Thesis track)

A. Course Requirements

Identical to the doctoral program except that the research project need not be as extensive, and hence the total number of research credits will typically be fewer. There is no teaching requirement or preliminary exam for M.S. students.

B. Thesis Requirement

The laboratory for the thesis project must be selected by June of the first year. The thesis project need not be independent but can be at the suggestion and guidance of the thesis advisor. The research project must be appropriate for completion and thesis defense between the third and fourth year. Laboratory work begins during summer after the first year and continue through the second year.

C. Thesis Advisory Committee

Before the end of the third semester (December 31), the student will propose members of the faculty to serve on the Thesis Advisory Committee subject to approval by the Steering Committee. Once formed this committee will meet at least every 2 months to review the student's progress. The committee consists of at least three voting members of the Committee who must be Graduate School faculty from the Pharmacology & Physiology Graduate Program. The student's major advisor is a voting member of the Committee but cannot chair the Committee. The Chair of the Committee must not be a collaborator on the student's research project and must not have any apparent conflicts of interest related to the publication or funding of the student's project. It is also the responsibility of the Chair to ensure that there is sufficient balance on the committee to ensure a rigorous and unbiased critique of the student's project and progress. Following the bi-annual Committee meeting, a brief statement of the student's progress must be prepared by the Committee chair and signed by each Committee member and submitted to the Steering Committee.

D. Thesis Proposal

1. In lieu of the Qualifying Exam, Master's degree students will defend their thesis proposal to their thesis advisory committee. The Thesis Proposal document will be submitted by the student before completion of the Spring semester courses of the 2nd year of study (i.e., by May of the second year). Under special circumstances this can be extended (but all proposals for extensions will be given due consideration; approval must be obtained through written request to the Steering Committee). The Thesis Proposal must be written in the style and within the page limitations of an NIH R21 grant application and handed in 10 working days prior to formal presentation of the Thesis Proposal to his/her Thesis Advisory Committee. The proposal should include

a Specific Aims page and a Research Strategy with a limit of a single page for the Aims and 12 double-spaced pages for the Strategy using 12 pt font and 0.5" margins. Upon approval of the Thesis Proposal the student will continue with his/her thesis research, culminating on the presentation of the M.S. thesis for defense.

2. At the time of the proposal the student will present an oral summary of his/her intended research project followed by a detailed question and answer session with the Thesis Advisory Committee. The proposal will last approximately 60 min.

3. The Thesis Advisory Committee will meet immediately following the defense and reach a decision. If the decision is positive, the student may continue with his/her thesis research. If the decision is negative, the student can re-submit a revised or new proposal in three months. If the Thesis Proposal is rejected a second time, the student will be either dismissed from the program or recommended for a non-thesis Master's degree. Recommendations to drop a student from the program completely or transfer into the Master's program must be reviewed and approved at a meeting of the Pharmacology and Physiology Steering Committee. The Director of the Graduate Program will submit any recommendations concerning the student (transfer to the Master's program or dismissal) for approval in accordance with the Biomedical Graduate Student Handbook Policies.

E. Thesis Defense

1. A written thesis is required with an oral defense before the thesis advisory committee. A candidate may not present him/herself for the final thesis defense until he or she has completed at least 18 calendar weeks of residence after satisfactory completion of the Thesis Proposal, and has the approval of his/her thesis advisor.

2. At least four weeks prior to the date of the commencement at which the degree is to be conferred, printed or photocopied versions of the thesis must be distributed to each member of the advisory-examination committee. Also at this time, the Chair of the Committee, or the Program Coordinator must notify the Office of Biomedical Graduate Studies, the Registrar's Office and all departments involved in graduate education of the scheduled date of the thesis defense.

3. The thesis defense will take place no less than two weeks and no more than four weeks after the thesis has been distributed to the members of the examination committee, except under written direction of the Steering Committee.

4. The thesis defense will be public. The candidate will be formally introduced by his/her advisor or the Chair of the Committee. The candidate will present a 45-minute seminar on his/her research, followed by questions from the Examination Committee and the general audience. After this initial question and answer period, the chair will dismiss the audience. The Examination Committee will meet in private with the candidate to complete the examination process.

5. The Thesis Examination Committee shall decide upon the merits of the candidate's performance on the thesis defense. To be recommended for a Master's degree, the candidate must receive unanimous approval of the Committee. By permission of the Committee a candidate who has failed the final thesis defense may present him or herself for re-examination after three, but not more than twelve months. This re-examination must be taken within a calendar year of failure to pass the first examination. A report on each final thesis defense whether passed, failed, or recommended for re-examination must be filed by the Committee in the Office of Biomedical Graduate Studies.

6. At least four weeks prior to the commencement at which the degree is to be conferred, three copies of the completed thesis suitable for binding and bearing the approval of the advisory-examination Committee must be deposited in the Office of Biomedical Graduate Studies. One of these copies is to be placed on file in the COM Library, Graduate Office and the Pharmacology & Physiology Main Office. An unbound copy of the thesis must also be presented to the Office of Biomedical Graduate Studies for microfilming by University Microfilms, Ann Arbor Michigan. The abstract will be published in Dissertation Abstract by University

Microfilms. The cost of preparation, reproduction and personal binding copies are the candidate's responsibility.

PROGRAM OF STUDY FOR M.S. IN PHARMACOLOGY & PHYSIOLOGY (Non-Thesis track)

A. Course Requirements

The Pharmacology & Physiology Program offers a non-thesis MS degree in which students can earn the degree by taking graduate classes and writing a literature review paper as opposed to conducting original laboratory research. The requirements for a M.S. degree without thesis as mandated by the Biomedical Graduate Program Committee of the COM are a minimum of 36 credit hours of course work (with a 3.0 or higher GPA) consisting of the Core Curriculum, Biostatistics, Scientific Integrity and Ethics (17 credit hours), required Pharmacology & Physiology program courses (at least 16 credit hours, listed on pages 2-3 of this document), and preparation of a scholarly paper (Literature Review, 4 credit hours). Neither lab rotations nor thesis research credits count toward this degree.

Courses outside of the Pharmacology & Physiology program may be taken on the advice and discretion of the Program Director and the faculty mentor. Credit for a graduate course requires a minimum grade of "B." The student must choose a faculty mentor in the first year, no later than June 30. The role of the mentor is to provide guidance in selecting the topic for the scholarly paper, and in helping the student perform the literature search, and, in writing the document. The selected topic must be approved by Steering Committee of the Pharmacology & Physiology Program.

B. Scholarly Paper Review

The scholarly paper reviews a topic in detail based on the primary research literature. The body of the paper must be 35-50 double spaced pages (12 pt font). This page number does not include citations but citations must be provided as well. The following format must be followed:

- Abstract (250 words)
- Body of Paper
- Introduction – what is the purpose and scope of the review
- Literature review – review and contrast findings in the field; identify unresolved issues and shortcomings of technical approaches
- Summary – what are the key findings of the review
- Conclusion- what gaps in our knowledge or unanswered questions emerge from the review; what are potential future directions for research in this area.

Successful completion of the literature review will be subject to the approval of the mentor/advisor and the Steering Committee.

TRANSFERING BETWEEN DOCTORAL AND M.S. PROGRAMS

Under certain circumstances, the faculty may recommend that a student be transferred from the M.S. program to the Ph.D. program, transferred from the Ph.D. program to the M.S. program, or transferred from the Ph.D. program or the thesis-oriented M.S. program to the non-thesis M.S. option. Students may elect to apply for program transfers with the approval of the Program Director. Requests for M.S. student transfer to the Ph.D. program can be made at completion of the 2nd year of study and require a letter of request from the student and the program director and must first be approved by the Program Steering Committee followed by approval from the Biomedical Graduate Education Committee.

CODE OF BEHAVIOR

The Graduate Program in Pharmacology & Physiology subscribes to the **Code of Professionalism** (<http://www.drexelmed.edu/Portals/0/BiomedicalGraduateStudies/StudentHandbook2010.pdf>) for all of its members. This policy states that professional behavior appropriate to a faculty and students in an academic research setting is expected and required at all times. Admission to and continued participation in the Graduate Program is therefore contingent upon the student's understanding of this policy, and his/her agreement to adhere to its guidelines.

CODE OF ETHICS

The Graduate Program in Pharmacology & Physiology subscribes to the **Code of Academic Integrity** (presented in its complete form in the Student Handbook, (<http://www.drexelmed.edu/Portals/0/BiomedicalGraduateStudies/StudentHandbook2010.pdf>) for all its members. This policy states that cheating, plagiarism, forgery, or other forms of academic misconduct are not tolerated at our institution. Admission to and continued participation in the Graduate Program is therefore contingent upon the student's understanding of this policy, and his/her agreement to adhere to its guidelines.