



VANDERBILT
UNIVERSITY

Graduate Student Handbook

2017-2018 Edition

Department of Pharmacology

Table of Contents

The Graduate Program in Pharmacological Sciences Vanderbilt University Medical Center, Nashville, Tennessee

Christine Konradi, Ph.D.

Director of Graduate Studies
Professor of Psychiatry and Pharmacology
Office Location: MRB3, Room 8160

Karen Gieg

Graduate Education Program Coordinator
Department of Pharmacology
Office Location: 507E Light Hall

Contents

About Pharmacology

How to use this handbook

Responsibility, Ethics, and Honor code

GOALS AND PHILOSOPHY OF THE GRADUATE PROGRAM IN PHARMACOLOGY

ADMISSION TO THE TRAINING PROGRAM IN PHARMACOLOGICAL SCIENCES

PROGRAM OF STUDY

Summary of Requirements

Choosing a Preceptor/Mentor in the Pharmacology Department

Length of Training

Extended Absence from Vanderbilt University

Parental Leave Policy

Ideal Program of Study

IGP Required Curriculum

CPB Program Requirements

Pharmacology Training Program Required Coursework

Elective Coursework

Grades and Additional Expectations

Financial Support

Policy Regarding Outside Employment

PROGRAM OF STUDY FOR ENTERING MEDICAL SCIENTIST TRAINING PROGRAM (MSTP) STUDENTS

PROGRAM OF STUDY FOR ENTERING LIPSCOMB/VANDERBILT DUAL DEGREE PARTNERSHIP PROGRAM STUDENTS

Table of Contents

ADDITIONAL TRAINING REQUIREMENTS

- Department of Pharmacology Seminars
- Works In Progress Seminars
- Graduate Student Journal Club
- Joel G. Hardman Student-Invited Pharmacology Forum
- Department of Pharmacology Annual Retreat

ADDITIONAL TRAINING OPPORTUNITIES

- Other Seminars/Lectures/Symposia
- Informal Meetings with Faculty Members
- Extended Leave Policy
- Student Travel

QUALIFYING EXAMINATIONS FOR ADMISSION TO CANDIDACY

- Qualifying Exam Part I: The Preliminary Examination
- Qualifying Exam Part II: The Dissertation Proposal Defense

DISSERTATION RESEARCH

DEFENDING THE DISSERTATION (AND BEYOND)

- Life After Degree Completion
- VUconnect

PHARMACOLOGY TRAINING FACULTY ROSTER

ADMINISTRATIVE STRUCTURE

About Pharmacology's Training Program

Pharmacology can be broadly defined as the study of *how chemical agents affect living processes*. These agents include natural substances, such as hormones, neurotransmitters, growth factors, and local autocrine factors, as well as drugs and toxic agents in the environment. Thus, by definition, pharmacology is a very broad-based discipline. The Dept. of Pharmacology at Vanderbilt University Medical Center embraces this broad definition. The breadth of our scientific environment is manifest by faculty who study the fate of drugs once ingested and the variability of drug response in varying patient populations (*pharmacokinetics*), as well as faculty who study the mechanisms by which drugs as well as endogenous agents work (*pharmacodynamics*), with the intention that detailed molecular insights concerning the mechanism of action of endogenous hormones, neurotransmitters, growth factors or autocoids ultimately will lead to the discovery of novel drug targets. A longstanding strength in our research and training environment is the world-acclaimed Div. of Clinical Pharmacology that links the Depts. of Medicine and Pharmacology. Faculty in the Div. of Clinical Pharmacology focus on human disease and clinical enigmas as the origin of their questions for research. Basic scientists who pursue inquiries in this environment are continually informed of the pathophysiological and potential therapeutic relevance that can be achieved by appropriate focus of their efforts. More recently, the Vanderbilt Institute of Chemical Biology, which links the College of Arts and Sciences with the School of Medicine has evolved into an additional strength in our research and training environment. The Institute links the chemical and physical sciences with the biomedical sciences in areas such as drug design, synthetic chemistry, and high throughput screening (HTS). From this investment has grown the Program in Drug Discovery, which chooses targets that are highly validated in human disease settings, and locks in to full-blown discovery of novel small molecules that work in novel ways, often as allosteric modulators, inhibitors of protein-protein interaction, or molecules which display functional selectivity. Such small molecule discovery leads are subjected to intensive medicinal chemistry for optimization of lead compounds, and *in vitro* ADME (absorption, distribution, metabolism, excretion) studies. Potent and efficacious compounds are tested in animal studies to show proof of concept. Our HTS and chemical synthesis cores allow any pharmacologist with a valid target to discover small molecule probes to test their hypothesis in *in vivo* settings. These investigators share a common research goal of developing new therapeutic and investigational agents as the desired product of their research endeavors. Since the inception of the Institute, participating investigators have been well represented as mentors in our training program.

Pharmacology is a hybrid discipline, with considerable overlap with aspects of physiology, biochemistry, immunology, cell biology, molecular biology, neurobiology, psychology, microbiology, chemistry, and medicine. Pharmacology is more than just combined components of several disciplines. It has its own paradigms which, in conjunction with concepts borrowed from other fields, explain drug action. The broad scope of concepts and methods central to pharmacological research presents an educational challenge which, in our view, is best met through predoctoral training in the pharmacological sciences. The intention of our graduate program is, and has been for more than 30 years, to provide a broad understanding of all of the elements of biomedical research with particular attention to the precepts, scientific questions and experimental strategies central to pharmacological research. With our recent recruitments, the Dept. has reinforced its strengths in its traditional areas of strength in signal transduction and neuroscience, and expanded into drug discovery, membrane protein structural biology and systems biology.

About Pharmacology's Training Program

How to use this handbook

The purpose of the Pharmacology Graduate Student Handbook is to help trainees make optimal use of the time they will invest in their graduate training in pharmacology. Thus, the Handbook provides information about the goals and global structure of the Training Program in Pharmacological Sciences to assist students in ascertaining if these features of the Program are compatible with training and career goals. Additionally, 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 in Vanderbilt's Training Program in Pharmacological Sciences, and provides students with an estimate of the timing of these events.

How not to use this handbook

The Pharmacology Graduate Student Handbook should not be used as an official and immutable statement of the requirements and timetables for Vanderbilt's Training Program in Pharmacological Sciences.

The Training Program in Pharmacological Sciences 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 Pharmacology Graduate Training Program.

Always confirm Pharmacology Program requirements with the Director of Graduate Studies (DGS), the Education Coordinator, or other Program officials. Always confirm Graduate School requirements with the appropriate Graduate School official. Who these individuals are, and how to contact them, are found in the Appendix section of this Handbook, as well as in the Graduate School Bulletin.

About Pharmacology's Training Program

Responsibility, Ethics, and Honor Code

Responsibility: The faculty and staff of the Training Program in Pharmacological Sciences 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 Pharmacology Training Program. Make it your business to be "in the know"!

Ethics: The Training Program in Pharmacological Sciences 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 Training Program in Pharmacological Sciences officers, particularly the DGS.

Honor Code: The Vanderbilt Honor Code was explained during Graduate Student Orientation and is also found in The Graduate School Bulletin and on the Graduate School web site, <http://www.vanderbilt.edu/gradschool/>.

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 one of the Training Program in Pharmacological Sciences officers.

About Pharmacology's Training Program

GOALS AND PHILOSOPHY OF THE PROGRAM

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 pharmacology and related physiology, including the molecular, cellular and integrated understanding of drug action, receptor theory, pathways of drug metabolism, pharmacokinetics, and rational drug design. 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 Pharmacological Sciences Training 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 these specific aims 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 department 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.

Admission to Pharmacology Training Program

Most students enter our program through the Interdisciplinary Graduate Program (IGP), the Quantitative & Chemical Biology (QCB) Program, or the Medical Scientist Training Program (MSTP). Vanderbilt University's Interdisciplinary Graduate Program in Biomedical Sciences (IGP) organizes first year training of most graduate students who are interested in basic biological and biomedical research. Subsequently, interested students apply to the Training Program in Pharmacological Sciences.

IGP students are admitted to Vanderbilt University uncommitted to a specific department or Ph.D. program and take a two-semester IGP course: Bioregulation I and II. During the first year of study, students also engage in rotations in three laboratories chosen by the student. Students who know or expect that they will apply to the Training Program in Pharmacological Sciences should conduct laboratory rotations in approved pharmacology laboratories and take pharmacology courses as electives. At the end of two semesters of coursework and laboratory rotations, IGP students declare their intent to pursue a Ph.D. in pharmacology 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.

Coursework is designed to impart to students a common framework of basic principles in Pharmacology and related disciplines. This framework is supplemented by exercises that allow students to use and integrate basic principles. An overview of the Program, including the IGP or CPB year, is presented below.

Year	Fall	Spring	Summer
1-IGP	IGP Core Course-Bioregulation I (IGP 8300A) Visit with Departments First and Second Rotations	IGP Core Course-Bioregulation II (IGP 8300B) - <i>Receptors Module required of Pharmacology Students</i> Third and Fourth Rotations At least one Elective Course	Fundamentals of Pharmacology (PHAR 8324) Begin Ph.D. Research
1-CPB	CPB Program students take a curriculum custom tailored to meet the needs of each student. Often this is mathematics and physics for biologists and biology for physicists and mathematicians. Laboratory Rotations.		
2	Drug Metabolism & Pharmacokinetics (PHAR 8326) Targets, Systems, and Drug Action, Part I (PHAR 8320) Scientific Communication Skills, Part I, Oral (PHAR 8322) Hypothesis Testing (PHAR8350-06) - counted toward Elective Credit requirement Present at Department Retreat Continue Ph.D. Research	Targets, Systems, and Drug Action, Part II (PHAR 8321) Scientific Communication Skills, Part II, Written (PHAR 8323) Experimental Design (PHAR 8328) - counted toward Elective Credit requirement Graduate Student Seminar Student-Invited Forum Meetings with Faculty Continue Ph.D. Research	Qualifying Examination, Part I Continue Ph.D. Research
3-6	Qualifying Examination, Part II Continue Ph.D. Research Continued participation in departmental requirements: presentation at Department Retreat, Student-Invited Forum, presentation and attendance at Journal Club or Works in Progress, attendance at Department Seminars, meetings with faculty members, and meetings with Dissertation Committee.		

Program of Study: Incoming IGP/QCB Students

Summary of Requirements

A total of 72 hours of graduate credit are required for a Ph.D. degree in Pharmacology, 32 of which must be obtained from didactic course work (including 16 from the IGP year). 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 Pharmacology. If needed, remaining course electives may be taken following Part I of the Qualifying Examination. After a student completes the qualifying process, the student's efforts are largely directed towards completion of a dissertation project.

Choosing a Preceptor/Mentor in the Pharmacology Department

During the four IGP rotations students are expected to find a suitable laboratory to carry out their thesis research. If a mentor in the Pharmacology department is chosen, the student can be accepted into the Pharmacology Graduate Program. Under rare and special circumstances, a student, in consultation with the mentor and DGS, might decide to leave the dissertation research laboratory. The decision to change laboratories is not to be taken lightly and requires both the student and mentor to communicate this intent and reasons to the Chair and the training program leadership. Prior to any formal declaration concerning a wish to change laboratories, the student must consult with the DGS and Chair of the department about their options, which include a Leave of Absence or a single laboratory rotation of no more than 8 weeks to find an alternative lab.

Length of Training

Students and advisors should aim for completion of graduate studies within a period of five years. Most students will be able to graduate within this period. All students are expected to graduate within four years of passing Part II of the Qualifying Examination. If necessary, the student can submit a formal petition to request an extension of the doctoral training period to the Graduate Education Committee for Students, via the DGS, with an explanation for the inability to complete training within the allotted time and a projected date for the Dissertation defense. If an extension is recommended by the Graduate Education Committee, the DGS will petition the Dean of the Graduate School for an extension.

Ideal Programs of Study

Coursework is designed to impart to students a common framework of basic principles in Pharmacology and related disciplines. This framework is supplemented by exercises that allow students to use and integrate basic principles. An overview of the IGP or QCB year, is presented below.

Year	Fall	Spring
1-IGP	IGP Core Course-Bioregulation I (IGP 8300A) Visit with Departments First and Second Rotations	IGP Core Course-Bioregulation II (IGP 8300B) - <i>Receptors Module required for Pharmacology students</i> Third and Fourth Rotations At least one Elective Course
1-QCB	QCB Program students take a curriculum custom tailored to meet the needs of each student. Often this is mathematics and physics for biologists and biology for physicists and mathematicians. Laboratory Rotations.	

Program of Study: Incoming IGP/QCB Students

IGP Required Curriculum. Pharmacology participates in the IGP, which is a common recruiting and basic training program shared by Ph.D. programs in the biomedical sciences. During their first year, Students entering the IGP take two semesters of core coursework and rotate through four laboratories of their choice. The main goal of the IGP year is not to absorb vast quantities of facts, but to learn how to be a creative and analytical thinker who can gain information as needed from the scientific literature. At the end of the IGP year, students select a training program in one of the participating departments or programs, which include Biochemistry, Biological Sciences, Cancer Biology, Cell & Developmental Biology, Cellular and Molecular Pathology, Chemical and Physical Biology, Human Genetics, Microbiology & Immunology, Molecular Physiology & Biophysics, Neuroscience, and Pharmacology.

One of the greatest benefits of the IGP is the flexibility it offers. New graduate students have nine months to explore their interests in multiple areas before selecting a thesis advisor. The comprehensive nature of the IGP training sometimes leads students to explore departments they hadn't considered previously. Moreover, research faculty often have appointments in more than one department, and students can use the entire IGP year to determine which department most suits their individual interests and career goals.

Coursework

During the IGP year, students take a two semester course entitled Bioregulation. This course surveys key biological processes and principles. The first semester focuses on biological processes within a cell, from macromolecular structure and function to cell biology and the regulation of cell growth. In the Spring session of the Bioregulation course, students tailor their coursework to their individual research interests through the selection of mini-electives. All students will take a total of six modules that serve as these mini-electives in the Spring semester. Students will be required to take one **Quantitative module** and it is recommended that they take a second **Quantitative module** if possible. Each module lasts about 5 weeks. Pharmacology students are required to take the Receptors module in the Bioregulation class, either during their IGP year, or the subsequent year.

FOCUS

One of the key objectives in the first year graduate program is for our students to become proficient in reading and critically analyzing the primary scientific literature. As a method for instruction in developing these skills, students in the Bioregulation course are divided into small groups each with a faculty, postdoc and graduate student leaders to facilitate discussion of seminal papers in the field of biomedical sciences. Discussions are centered around identifying the central hypothesis being tested, various experimental methods and technologies used, key experimental controls, analyzing the authors' interpretations of the data, and using this discussion as a springboard to identify future directions.

Advising-IMPACT

Students are organized into small groups for mentoring during the first year through the IMPACT (Intensive Mentoring Program to Accelerate Career Transitions) program. IMPACT is designed to give students and faculty the opportunity to interact in a smaller setting. Groups are comprised of about 10 students to 1 faculty mentor. Discussion topics range from students concerns during the first year, managing coursework, and effective student-faculty communication to funding and careers in the biomedical sciences. Students meet with their IMPACT mentors weekly during the fall semester in the first year and biweekly in the spring.

Program of Study: Incoming IGP/QCB Students

Electives

In the spring semester, students take elective courses as they begin to extend their knowledge into a specialty area of interest. These electives typically fulfill required credit hours in the department that the student chooses to join after their IGP year.

Responsible Conduct of Research

In August, students in the IGP attend a session where they have an introduction to “Responsible Conduct of Research.” In May, students in the IGP attend a one-day “Responsible Conduct of Research” workshop. The workshop is designed to help scientists identify and deal with ethical issues and dilemmas. Formal lectures, small group discussions and study analyses address topics such as institutional and NIH policies regarding scientific misconduct and conflicts of interest, ethical use of human and animal subjects in research, and data management and intellectual property.

Laboratory Research

A key element of the IGP year is laboratory research, and every effort is made to speed up the process of choosing a preceptor.

At the beginning of the first year, students begin the first of four sequential eight week rotations in the lab of their choice. Students can sample different research areas and experience the excitement of working in a particular laboratory. By May of the IGP year, students will choose a mentor, enter one of the participating departments, and begin their thesis research.

Quantitative and Chemical Biology (QCB) Program Requirements. QCB is a second inter-departmental umbrella program for students with undergraduate degrees in the quantitative or physical sciences (e.g. chemistry, computer science, engineering, mathematics, or physics), or occasionally biology, who wish to pursue a degree at the interface of the chemical, physical, and biological sciences. The curriculum prepares students for research careers at the chemistry-biology interface in structural biology, molecular biophysics, and computational biology. CPB students may explore their research interests in 12 participating Depts. and programs, including Pharmacology, prior to choosing a laboratory for their dissertation research.

The only required courses for QCB students are 2 seminar series, one in each semester during the first year, that host internal and external speakers with research programs that span the Chemistry-Physics-Biology interface. They are chosen to provide students with a broad view of contemporary research. Students may elect to enroll in a specialized course that gives an accelerated introduction to biological aspects of modern research at the Chemistry-Physics-Biology interface. The remaining didactic hours are selected from graduate course offerings in an individualized manner taking into account the students' undergraduate training, career goals, and the departmental program that the student elects to enter for their dissertation research. Elective courses may be selected from the course offerings of any of the 12 participating Depts. Students complete 3, sequential 8 week rotations designed to allow the students to sample specific laboratories. Students may rotate in laboratories from any of the participating Depts. As with IGP students, the final preceptor decision is made by the end of May.

Program of Study: Pharmacology Students

Pharmacology Training Program Required Coursework. In addition to the IGP or CPB core, there is a core curriculum for graduate students in the Pharmacological Sciences Training Program that includes seven (7) required courses, complemented by several available elective courses. The required courses are Fundamentals of Pharmacology (PHAR 8324); Scientific Communication Skills (PHAR 8322); Scientific Communication Skills II (PHAR 8323); Targets, Systems, and Drug Action (PHAR 8320 and PHAR 8321); Drug Metabolism & Pharmacokinetics (PHAR 8326); and Experimental Design.

The overall coursework plan for a graduate student who selects a participating mentor in the Pharmacological Sciences Training Program and intends to graduate from Vanderbilt with a Ph.D. in Pharmacology is outlined below:

Pharmacology, Year 1 - Summer

3 Credit Hours – PHAR 8324 Fundamentals of Pharmacology: Receptor Theory & Cell Signaling

Course Description: 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. Prerequisite: Enrollment in the Ph.D. program or consent of faculty.

Pharmacology, Year 1 - Fall

2 Credit Hours – PHAR 8326 Drug Metabolism & Pharmacokinetics (DMPK)

Course Description: The course will provide an introduction and overview of drug metabolism and pharmacokinetics (DMPK). Focus will be on drug distribution and drug elimination concepts, drug absorption, bioavailability, and multiple dosing, and clearing concepts, as well as various case studies.

3 Credit Hours – PHAR 8320 Targets, Systems & Drug Action, Part 1

Course Description: Introduction to human physiology is integrated with the pathophysiology, pathological manifestations, and therapeutic interventions. Lectures and laboratories emphasize the molecular and cellular underpinnings of normal organ function and disease. Mechanisms of drug action are discussed in a systemic fashion and supported by guided readings on drug discovery and design. Paradigm shifting experiments will be discussed to illustrate clarity of thinking, how focused experimental strategies lead to discovery, and potential difficulties in interpretation of experimental results.

1 Credit Hour – PHAR 8322 Scientific Communications I (Oral Communications; in preparation of Departmental Retreat and Journal Club presentations)

Course Description: 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. During the fall course, a draft Specific Aims page is written and critiqued and will be used in the spring course PHAR-GS 8323. Pre-requisite: Enrollment in the Ph.D. program or consent of faculty.

Elective Credit (must accumulate 6 credit hours total, including the elective the student took during the spring of IGP/QCB year)

Credit Hours of **Non-Candidate Research** (to total 12 for the semester)

Pharmacology, Year 1 - Spring

5 Credit Hours – PHAR 8321 Targets, Systems & Drug Action, Part 2

Course Description: Introduction to human physiology is integrated with the pathophysiology, pathological manifestations, and therapeutic interventions. Lectures and laboratories emphasize the molecular and cellular underpinnings of normal organ function and disease. Mechanisms of drug action are discussed in a systemic fashion and supported by guided readings on drug discovery and design. Paradigm shifting experiments will be discussed to illustrate clarity of thinking, how focused experimental strategies lead to discovery, and potential difficulties in interpretation of experimental results.

1 Credit Hour – Receptor Theory & Enzyme Kinetics (module of IGP Bioregulation class, *only if you didn't already take it during your IGP/QCB year*)

1 Credit Hour – PHAR 8323 Scientific Communications II (Written Communications; electronic course, minimal classroom hours, counts toward Elective Credit requirement)

Course Description: This course will leverage the writing assignments of the fall Scientific Communications course (8322) to accelerate preparation of a draft NRSA fellowship (or equivalent such as AHA) application. During the fall course, a draft Specific Aims page is written and critiqued. In this spring course, students will write the next two sections of their application and have it peer-reviewed. These writing

Program of Study: Pharmacology Students

assignments are intended to be self-guided with significant support by the student's mentor. The applications will subsequently be submitted for funding to the proper agency. Pre-requisite: Completion of PHAR-GS 8322 and Enrollment in the Ph.D. program.

2 Credit Hours – **PHAR 8328 Experimental Design for the Biomedical Sciences** (counts toward Elective Credit requirement)

Course Description: The overall goal of this course is to provide comprehensive instruction in the theory and practice of rigorous and reproducible scientific methods. It combines traditional didactic presentations, small group discussions, and practical exercises. The practical exercises include the use of REDCap and Labnodes; attendance at a biostatistics clinic; in-class data analysis exercises; and a capstone exercise in which groups of students designed a hypothetical experiment.

Elective Credit (must accumulate 6 credit hours total, including the elective the student took during the spring of IGP/QCB year)

Credit Hours of **Non-Candidate Research** (to total 12 for the semester)

In addition to required coursework, each student must take a minimum of 6 credit hours of elective coursework distributed over at least 2 elective courses.

Summary of Required Coursework Expectations. The overall goal of the Program is that each student graduating with a degree in Pharmacology will have a shared body of knowledge of cellular and integrated physiology; therapeutic agents, how they are handled by the body, how they work and how they affect diverse patient populations; and the molecular basis by which drugs, endogenous hormones, neurotransmitters, and autocrine agents regulate cellular pathways via diverse signaling pathways. The students also will have refined their ability to communicate scientific knowledge they have read or obtained in their own research activities. This shared body of knowledge obtained by all participates in the Pharmacological Sciences Training Program is complemented by an area of distinct scholarship by each student, provided in part by the elective coursework described below.

Program of Study: Pharmacology Students

Elective coursework. In addition to the above required coursework, each student must take a minimum of six credit hours of elective coursework distributed over at least two elective courses. A large number of electives are available and a partial listing of acceptable elective courses is presented below:

Modern Drug Discovery (PHAR 8327); The course will provide an introduction and overview to the drug discovery process. Focus will be on target selection, target validation, and the process of discovery early drug leads and optimization of those leads into compounds suitable for clinical development. This will include approaches used to transition from discovery to the early clinical development phase of a program as well as medical and market considerations that impact launching and progress of a drug discovery program. (Jones)

Cellular and Molecular Neurosciences (PHAR 8345; also NURO 8345): 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)

Advanced Molecular Neurobiology (PHAR 8346; also NURO 8346): 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)

Independent Study (PHAR 8350)*: Qualified students work with individual staff members in areas not covered in other available courses. (Staff)

Current Topics in Pharmacology (PHAR 8360): Presentation of current advances, paradigm shifts, and problems in Pharmacology with an emphasis on experimental approaches and their interpretations. (Staff)

Summary of Elective Coursework Expectations. The elective curriculum listed above represent those courses specifically sponsored by the Department of Pharmacology and does not include the myriad courses offered by other departments at Vanderbilt University. When in line with the research interests of a particular student, they are encouraged to explore other elective courses available to them within the University; approval for such course selections is made in consultation with the DGS.

*When available courses do not meet the needs of a particular student, students may work with individual faculty in an Independent Study Course. Once a syllabus for the independent study is developed in conjunction with the teaching faculty involved, an **Independent Study Request Form** must be prepared and signed by faculty involved and approved by the DGS. The form, which requests a one page summary of independent study objectives, a plan for scientific learning and information on how the student will be evaluated, may be obtained from the Education Coordinator. Typically, independent study courses are for one (1) credit only and cannot be under the direction of a student's mentor or co-mentor.

Additional graduate courses, across multiple disciplines, that might be selected as elective credit can be found online via the Programs & Departments websites:

http://gradschool.vanderbilt.edu/academics/programs_and_departments.php

Program of Study: Pharmacology Students

GRADES AND ADDITIONAL EXPECTATIONS

Student academic performance will be monitored by the DGS, who will meet with each student at least once per semester. The scale of grades in the Graduate School ranges from A (4.0) to C (2.0) to F (0.0). A single grade of C or two grades of B-, in either required or elective courses, will result in a student being placed on academic probation. The placement of a student on academic probation serves to officially inform the student that their academic performance is deemed to be unacceptable. If a student has received a grade of C, the course must be repeated and the student must earn a grade of B or better. Under some circumstances, repeating a course may not be necessary and the course material may be mastered by independent study or other arrangements approved by the DGS. Once placed on academic probation, a student will remain on probation until successfully completing Part I of the Qualifying Examination. If a third B- is received, the student will not be allowed to take Part I of the Qualifying Examination until the academic deficiencies have been remedied to the satisfaction of the DGS.

Receiving two grades of C, in either required or elective courses, is grounds for dismissal from the graduate program, unless compelling circumstances dictate otherwise. The decision to dismiss a student for unsatisfactory academic performance will be made by the DGS in consultation with the Graduate Education Committee.

★★ **A special note concerning grades:** Earning a “B” in a didactic course is considered respectable, but earning a B for the research grade is considered a “flag” that a student is not performing up to the expectations of his or her Mentor. Thus, if a student earns a B in research, the student should speak with his or her mentor to discover where research performance is not meeting expectations. If Mentor expectations seem unclear or unrealistic, the student should make an appointment with the DGS to discuss this matter. ★★

In addition to earning 72 coursework and research hours and maintaining at least a B average, there are **additional Program requirements**: such as attending the weekly Department of Pharmacology seminars and meeting with at least one invited speaker from outside Vanderbilt, the Joint Meharry-Vanderbilt Research Seminars, the annual Student-Invited Pharmacology Forum, the Earl W. Sutherland, Jr. Symposium, as well as attendance at and participation in the weekly Graduate Student Journal Club and the annual Pharmacology Retreat. Details of these additional requirements are described in the section entitled “Additional Training Requirements and Opportunities”.

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.

Program of Study: Pharmacology Students

Financial Support

Stipends and tuition allowances are awarded to students on the basis of academic merit. Levels for stipends are set by a Steering Committee in consultation with the department chairs.

The first two semesters of support are provided by institutional sources through the IGP or CPB. Students are then eligible to compete for positions on various training grants and positions supported by the Department of Pharmacology. Other competitive funding opportunities include the Harold Sterling Vanderbilt Graduate Scholarships and the Vanderbilt's Dean's Fellows Program. The latter provides competitive fellowships targeted to individuals underrepresented in the basic sciences (visit the following link for further information: http://www.vanderbilt.edu/gradschool/fees_and_financial_support.html).

Additional sources of support include faculty research grants and individual fellowships from extramural sources, such as federal agencies (i.e., National Institutes of Health ~ see <http://www.nih.gov>) and private foundations (i.e., Howard Hughes Medical Institute ~ see <http://www.hhmi.org>).

Financial support from year four to completion of the Ph.D. is the responsibility of the Dissertation advisor. However, once a student has completed both Phase I and Phase II of his or her Qualifying Exams, it is expected that the student will submit an individual grant proposal to support the remainder of his or her research project as a graduate student.

Support may be withdrawn from students whose performance is deemed unsatisfactory.

Policy Regarding Outside Employment

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

If additional income is necessary, students are encouraged to consider the possibility of low-interest student loans. Advice about such loans may be obtained from the Vanderbilt University Financial Aid Office (listed in the Appendix section). If a student feels strongly that outside employment is necessary while in the Training Program, this must be discussed with the student's Dissertation advisor and a formal request must be submitted to the Graduate Education Committee through the DGS. Students should be aware that such requests will rarely, if ever, be granted. However, if outside employment is necessary and is approved by the Committee, the student must not allow it to interfere with high standards of performance and the timely completion of graduate education and research training.

Program of Study: Incoming MSTP Students

New students enroll in the MSTP in late June, approximately 4 weeks before the start of the first-year Medical School curriculum. New students, along with current MSTP students, members of the Faculty Advisory Committee, Departmental Chairs and Directors of Graduate Study, and faculty preceptors, attend the **MSTP Retreat** held the weekend after orientation. All MSTP students in the graduate phase of training present their research at the retreat. The forum serves as an opportunity for scientific interactions among colleagues as well as an orientation for new students.

	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY
YEAR 1	LAB ROTN 1		FOUNDATIONS OF MEDICAL KNOWLEDGE (YEAR 1)											
	MSTP SEMINAR SERIES/FOUNDATIONS OF BIOMEDICAL RESEARCH I													
YEAR 2		LAB ROTN 2		FOUNDATIONS OF CLINICAL CARE (YEAR 2)										
	MSTP SEMINAR SERIES/FOUNDATIONS OF BIOMEDICAL RESEARCH II													
YEARS 3-6	STUDY & BOARD EXAM		GRADUATE RESEARCH (YEARS 3-6)											
	MSTP SEMINAR SERIES/CLINICAL PRECEPTORSHIP PROGRAM/DATA CLUB													
YEAR 7	CLINICAL IMMERSION YEAR (YEAR 7)											GRADUATE		
	MSTP SEMINAR SERIES													

The graduate phase of training for MSTP students is equivalent to that of our conventional Ph.D. students, who complete 72 credit hours of graduate work; 32 of which are derived from formal coursework. Where appropriate, departments may use medical school courses for didactic credit. Students must maintain a "B" average and pass a qualifying exam following the completion of coursework. Although the composition of the qualifying exam varies by department, it serves to test the trainee's knowledge of skills necessary for a career in scholarly research.

In addition to spending the first Graduate School year (G1) taking required courses and preparing for the Ph.D. qualifying exam, MSTP students continue their dissertation research. Full-time research is initiated in the spring or summer semester of the first graduate year and continues for a total of 3 to 4 years in most cases.

The culmination of graduate training is the defense of a dissertation describing original research that significantly advances knowledge in the field. The dissertation must be successfully defended before the student resumes medical training.

The successful completion of the first two years' Medical School courses counts toward the core curriculum in Pharmacology and are substituted for PHAR 8320 (Targets, Systems and Drug Action), with the exception of the Drug Metabolism & Pharmacokinetics (DMPK) section. After the successful completion of Year 2 of Medical School, students generally sit for Part I of the Medical Boards.

Program of Study: Incoming MSTP Students

The curriculum for the Pharmacology MSTP students is as follows:

Summer, Grad School Year 1

0 Hours PHAR 8379 Non-Candidate Research

Fall, Grad School Year 1

1 Hour PHAR 832 Drug Metabolism & Pharmacokinetics
1 Hour PHAR 8322 Scientific Communications Skills I, Oral Presentations
1 Hour PHAR 8350-06 Independent Study: Hypothesis Testing
1 Hour IGP 8300A Bioregulation - Biostatistics module ONLY
1 Hour MSTP 8310 MSTP Seminar Series
7 Hours PHAR 8999 Non-Candidate Research

Spring, Grad School Year 1

1 Hour PHAR 8322 Scientific Communications Skills II, Grant Writing
2 Hours PHAR 8328 Experimental Design for the Biomedical Sciences
1 Hour IGP 8300B Bioregulation - Receptors module ONLY
5 Hours PHAR 8999 Non-Candidate Research

Summer, Grad School Year 2

0 Hours PHAR 8999 Non-Candidate Research
3 Hours PHAR 8324 Fundamentals of Pharmacology: Receptor Theory & Cell Signaling

MSTP students may be required to take a Graduate School elective after consultation with the Director of Graduate Studies. **Although not required, MSTP students are strongly encouraged to sit in on the Targets course, in preparation for the Qualifying Examinations.**

At the end of the Summer semester GY2, MSTP students will be required to sit for Part I of the Qualifying Examination. The requirements for the Qualifying Examinations for MSTP students are identical to those outlined in the Graduate Student Handbook.

The above sequence of courses and examinations assures student entry into the laboratory two and a half years after beginning the Program. It is anticipated that MSTP students will spend approximately three years in the laboratory completing their dissertation studies before reentering Medical School. During this time in the laboratory, MSTP students are required to attend seminar series, journal clubs, retreats, etc. as outlined in other sections of this handbook.

All other aspects of the Training Program in Pharmacological Sciences are outlined in the Graduate Student Handbook.

If you require additional, detailed information about customizing the curriculum to meet the needs of our Training Program, please contact the Director of Graduate Studies.

Program of Study: Incoming Dual Degree Lipscomb Students

Students accepted into the Lipscomb/Vanderbilt Dual Degree Partnership Program may formally enter the Pharmacology Ph.D. Training Program at Vanderbilt after the second, third, or fourth year of the professional Pharm.D. Program at Lipscomb. Students entering the the Ph.D. Training Program after their second or third year of the Pharm.D. Program will take a leave of absence from Lipscomb University to complete additional required coursework and their research dissertation project full-time. It is anticipated that the Ph.D. portion will be completed within 4 years. After completion of the Ph.D. Program, students will reenter the Pharm.D. Program and complete the remaining pharmacy training requirements. Students entering the Ph.D. Training Program after the fourth year of the professional pharmacy program will complete all Pharm.D. degree requirements prior to entering into the Pharmacology Ph.D. Training Program.

Students in the Pharm.D. program will have the opportunity to rotate in research laboratories by spending 2 or 3 summers in Vanderbilt laboratories and will be counseled to identify a mentor.

Appropriate coursework hours from the Pharm.D. program will be transferred with additional specialized coursework completed in the first year of the Ph.D. portion. In all cases, rotations and classroom performance will be monitored by an oversight committee. Coursework hours from Pharmacy school will be transferred in as described below. Students will enter the Ph.D. program in June, complete the summer receptor theory course, the fall communications course, and electives in the spring and fall as needed. Students will take Qualifying Examinations in July (13 months after entering the program). The requirements for the Qualifying Examinations for Dual Degree Partnership Program students are identical to those outlined in the Graduate Student Handbook.

It is anticipated that students will complete the Ph.D. within 4 years total. Student progress will be monitored by both the thesis committee (which will meet every 6 months) and oversight committees as described below.

Summary of proposed course transfers The courses chosen for transfer are those that provide basic instruction in the biomedical sciences, convey the principles of human physiology and pathophysiology, and provide the basis for and mechanisms of drug therapy. These are key concepts that are presented to Vanderbilt Ph.D. students in the first two years of graduate school. The anticipated course transfer requests are provided below.

Program of Study: Incoming Dual Degree Lipscomb Students

<u>Vanderbilt Courses</u>	<u>(Hours)</u>	<u>Lipscomb Course Equivalents</u>
Bioregulation-fall	(6)	Biomolecular Chemistry (3) Microbiology & Immunology (3)
Bioregulation-spring	(6)	Physiological Basis of Therapeutics 1 (3) Pharmaceutics (3)
Techniques and Preparation	(5)	Integrated Biomedical Sciences Laboratory 1, 2 (4) Interpreting Laboratory Data (1)
Targets, Systems, and Drugs	(10)	Physiological Basis of Therapeutics 2 (3); Pharmacological Basis of Therapeutics 1, 2, 3 (9)
Current Topics in Pharmacology	(3)	Biopharmaceutics (3)
Current Topics in Pharmacology	(3)	Advanced Biopharmaceutics and Pharmacokinetics (3)
Total hours transferred in	(33)	(plus the possible addition of hours from elective courses)

Courses in Residence at Vanderbilt

	<u>(Hours)</u>	
Receptor Theory & Enzyme Kinetics (IGP Bioregulation II, IGP 8302)	(1)	Spring Semester
Fundamentals of Pharmacology: Receptor Theory & Cell Signaling (PHAR 8324)	(3)	Summer Semester
Scientific Communications I (PHAR 8322)	(1)	Fall Semester
Scientific Communications II (PHAR 8323)	(1)	Spring Semester
Independent Study: Hypothesis Testing (PHAR 8350-06)**	(1)	Fall Semester
Experimental Design for the Biomedical (Sciences PHAR 8328)**	(2)	Spring Semester
Electives (**Counts toward elective credit requirement)	(6)	
Responsible Conduct in Research	(0)	
Experimental Statistics (IGP Bioregulation, IGP 8300)	(1)	Fall Semester
This leaves a maximum of 26 hours of research		

During the time in the laboratory, dual degree students are required to attend seminar series, journal clubs, retreats, etc. as outlined in other sections of this handbook. **Dual Degree students may also be required to attend a short course in Biostatistics, if this is deemed necessary by the Director of Graduate Studies. Although not required, Pharm.D./Ph.D. students are strongly encouraged to sit in on the DMPK course and the Targets course, in preparation for the Qualifying Examinations.**

All other aspects of the Training Program in Pharmacological Sciences are outlined in the Graduate Student Handbook.

If you require additional, detailed information about customizing the curriculum to meet the needs of our Training Program, please contact the Director of Graduate Studies.

Additional Training Requirements, All Students

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 are required to attend lectures, journal clubs, and scientific meetings in order to keep abreast of the most recent scientific achievements.

Attendance at these mandatory seminars is required of ALL graduate students in all years of the Pharmacological Sciences Training Program. To that end, there will be a sign-in sheet every week at Journal Club, Pharmacology Seminars, Dissertation Defenses, and other special events as required by the Director of Graduate Studies. Attendance expectations are outlined below:

Students will be allowed two unexcused absences per academic year. An unexcused absence is defined as a failure to email the DGS and/or Education Coordinator prior to a mandatory event (Departmental Seminar, Works In Progress Seminar, Graduate Student Journal Club, Dissertation Defense, etc.) when you are prevented from attending said event. Attendance will be taken at all events and records will be kept.

A third unexcused absence will result in a mandatory meeting with the DGS or Associate DGS, during which extra work will be assigned at the discretion of the DGS/Assoc. DGS.

A fourth unexcused absence will result in a mandatory meeting with the Chair of the department.

Continued violations can result in a "Lack of Progress toward Degree Completion" Report to the Graduate School, which could result in academic probation for the offender.

Department of Pharmacology seminars. The Department of Pharmacology has a weekly 8:30 am seminar on Tuesdays sponsored by the Division of Clinical Pharmacology and a weekly 9:00 am seminar on Wednesdays sponsored by the Department of Pharmacology. **Attendance at the Wednesday 9:00 AM seminar is required of all graduate students**, and attendance at the Tuesday 8:30 am seminar is strongly encouraged. Because of the generosity of faculty in contributing some consultation fees to a seminar program, the Department of Pharmacology invites a number of scientists from universities throughout the United States, and an occasional visiting international scientist, 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.

Visiting speakers for Wednesday seminars meet with graduate students, who have specifically identified an interest, during a lunch meeting following the seminar. This provides an opportunity for students to ask additional questions about the science that was discussed in the seminar. However, students also exploit this opportunity to query the visiting scientists about other issues, 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. **Each graduate student in the Training Program is required to select at least one speaker per year from outside Vanderbilt to meet with in the above manner.**

Additional Training Requirements, All Students

Works in Progress Seminars. Senior students, postdoctoral fellows, and faculty elect to participate in this Wednesday morning series (intertwined with the Department of Pharmacology seminars, see above), and present a seminar describing their work. This provides an opportunity for students to have their data and presentation examined by an audience composed of faculty, fellows, and students. This allows students to polish presentations targeted to potential postdoctoral mentors and employers. This series was reviewed in 2006 by a committee of faculty and students. Given the increase in the number of trainees over the past few years, and the concomitant increase in the number of trainees who wish to participate, the committee implemented several format changes. These include offering the option of presenting a 50 minute lecture or being part of a “double bill” where 2 trainees each give a 30 minute presentation. These seminars are no longer referred to as “Works in Progress” but fall under the heading of “Dept. of Pharmacology seminars”. This series will continue to provide an important venue for fostering presentation skills and for providing an opportunity for constructive criticism. **Attendance at the Wednesday 9:00 AM seminar is required** (and monitored) **of all graduate students.**

Graduate Student Journal Club. After completion of Scientific Communication Skills (PHAR 322), students in the Program participate as speakers in an ongoing seminar series. Currently, the student seminars are held at 4:00 PM on Mondays. The quality of these seminars is outstanding. **Attendance is required** (and monitored) **of all students in all years of the Program.** No academic credit is given, as we think it is essential to groom students to continue their education on the own initiative to successfully participate in a career in science. Meharry students in Vanderbilt laboratories participate in this seminar series as part of an overall effort to provide numerous and diverse opportunities for Vanderbilt and Meharry students to interact.

Students are able to choose any published paper that is as closely related to their research as they like just as long as it is not a paper from their lab or one that they have co-authored. This should result in better journal clubs because the presenter will be more interested in the topic and will have a better background knowledge to more critically talk about the research and answer questions that may arise during the presentation. **Presentations must be longer than 30 minutes, or will have to be repeated.** Faculty members will be chosen to serve as the faculty advisor throughout the year and will be announced as soon as possible. Once the schedule is finalized each academic year, no Journal Club presentation can be canceled or rescheduled without the prior approval of the DGS. However, if you find you need to do so and can find someone to switch with you, you are welcome to. The Program Coordinator must be notified in advance of any switches in presentation dates.

Joel G. Hardman Student-Invited Pharmacology Forum. As the pace at which we acquire new knowledge in scientific disciplines is ever accelerating, students quickly understand that material covered in coursework in their first two years of training cannot include an introduction to all areas of biomedical research. Thus, our training program gives students the opportunity to pursue areas in which they would like further instruction. For the Joel G. Hardman Student-Invited Pharmacology Forum, students identify emerging areas of research that they think are important for understanding as trainees in pharmacological sciences, and invite three nationally or internationally recognized scientists to participate in an annual symposium. **Attendance at the one-day Forum is required for all graduate students and includes a required poster presentation by all students,** thus giving our students the opportunity to get constructive input about their ongoing projects from the visiting scientists as well as scientific colleagues at Vanderbilt.

The past topics of the Forum held in the spring can be found at:

<https://medschool.vanderbilt.edu/pharmacology/joel-g-hardman-student-invited-pharmacology-forum>

Additional Training Requirements, All Students

Students also use the occasion of the Forum to present the Pharmacology Teaching Award to a faculty mentor of their choosing who, in their estimation, has contributed significantly to their education. The plaque, given each year to a selected faculty member, reads "With special recognition for excellence in lecturing and willing assistance in the design and execution of experiments". The students nominate faculty, select the annual recipient, and the results of their vote are revealed in an institution-wide presentation as a prelude to the Forum Symposium. A list of the past recipients for this award can also be found at Forum's website, link listed above.

Department of Pharmacology Annual Retreat. Each fall, the Department of Pharmacology holds a retreat at a nearby state park. **Attendance at the Retreat is required for all graduate students.** The speakers at the retreat are students and postdoctoral fellows, and the retreat is considered an important component of the Pharmacological Sciences Training Program. 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.

Additional Training Opportunities

Other Seminars/Lectures/Symposia and training opportunities that graduate students are strongly encouraged to attend throughout their training include (but are not limited to) the following:

The Flexner Discovery Lecture Series. Vanderbilt Medical Center has launched the Discovery Lecture Series featuring the nation's most eminent scientists, who will speak on the highest-impact research and policy issues in science and medicine today. There are two lectures scheduled monthly.

Clinical Pharmacology Grand Rounds. Sponsored by the Division of Clinical Pharmacology, these weekly Grand Rounds are offered on Tuesdays at 8:30 am in 512 Light Hall.

Paul D. Lamson and Allan D. Bass Lecture Series. This annually alternating series of lectures held in the fall of each year are sponsored by the Department of Pharmacology to honor Dr. Paul D. Lamson, organizer of the Department of Pharmacology and served as its first Chair from 1925 to 1952, and Dr. Allan Bass, who succeeded Dr. Lamson as Chairman of the Department of Pharmacology and served as such for two decades.

Grant R. Wilkinson Distinguished Lectureship in Clinical Pharmacology. This annual lectureship, held in the spring, honors the late Dr. Wilkinson's seminal contributions in the field of pharmacokinetics.

John A. Oates and Meredith S. Oates Lectureship in Clinical Pharmacology. Vanderbilt's Division of Clinical Pharmacology's fame is credited largely to the efforts of Dr. John Oates, who started the division in 1964 and set the scientific standards in the division. This lectureship in his and his wife's honor is presented annually in the fall.

Elaine Sanders-Bush Lecture. Dr. Sanders-Bush is internationally recognized for her contributions to understanding the brain chemical serotonin and its receptors, as well as mentoring young scientists. The symposium and lectureship was created to celebrate her career and is held every other year in the spring.

Dr. Dolores C. Shockley Lecture and Partnership Award. The Dr. Dolores C. Shockley Lectureship and Partnership Award is a bi-yearly lectureship, co-hosted with Meharry Medical College, held in early May to honor Dr. Shockley, Professor Emeritus, Meharry Medical College.

Student-Invited Special Seminars. This venue is an integral part of our program. It provides a unique opportunity for students to develop leadership skills and be an active partner in their education. Once a year we plan to host a high profile visiting scientist whose work is highly relevant to the fusion of clinical and basic research. Students will choose both the area of interest and the speaker. They extend the invitation to the speaker, organize the schedule, host dinners and lunches, and are responsible for assuring a successful program and visit. This Lecture is advertised widely to Vanderbilt University and Meharry Medical College and provides critical contact for students to explore research and/or career options.

Meetings with the Faculty. Students have monthly meetings with various faculty mentors during their graduate training. These meetings are held from September through May. Students scheduled to meet with a faculty member gather in one of the Dept. conference rooms. These meetings are not information-gathering sessions, but are the beginnings of conversations that will continue and mature during graduate training.

There are in-depth discussions of issues related to the maturation of a scientist: responsible conduct in research; what constitutes a scientific question; scientific ethics, both in publication and collaboration; what determines when a project is appropriate for publication; how the thinking pattern and intellectual premises used by scientists differ from those of lawyers or clinician/diagnosticians and what impact this has on research strategies and choices; what constitutes a quality publication; sources of research support for sustaining future scientific careers, etc. Also feedback on the training program is often provided by the students. These meetings also take the form of lunches that serve as a format where invited guests discuss the diversity of career options available. Several prominent visitors and alumni of the program have participated in this venue during visits to the program.

Extended Leave/Absence Policies

The Program in Pharmacological Sciences requires continuous registration. Students who wish to interrupt their graduate study must apply to the Director of Graduate Studies for an authorized Leave of Absence. The DGS will then petition the Dean of the Graduate School for a maximum leave of absence of one year. Those without authorized leave who do not register are dropped from the rolls of the Graduate School and are not considered students. If such a student wants to resume graduate study at Vanderbilt, he/she must apply for reinstatement by contacting the DGS.

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 Vanderbilt University. If this is required of a particular Graduate Student, it is essential that the DGS 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 is informed of the proposed leave of absence. A form is provided in the 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. This information must be provided to the DGS at least 1 month prior to the beginning of the student's absence. If for any reason the absence extends beyond the limit originally reported, it is the responsibility of both the mentor and the student to inform the DGS of this change. It is required that any such absence of 2 weeks or longer at anytime during the calendar year be reported.

Parental Leave

The Chairs of the basic science departments support that Graduate Students continue the current approach of being allocated 12 days of sick leave and three weeks (15 calendar days) of vacation leave annually. It was also agreed that this leave allotment should continue to be on an honor system where the graduate student should determine with their respective mentors the accumulation, accounting and use of these leaves.

The Family and Medical Leave Act (FMLA) **DOES NOT** apply to graduate students. However, it has been agreed that following childbirth or adoption of an infant, the primary care giver (whether female or male) would be allowed to take 30 work days (equivalent to 6 work weeks) of parental leave with full stipend and continued health insurance coverage. This leave can be viewed as composed of the 30 calendar days allowed by NIH training grant policy together with two weeks of vacation or sick leave time. Graduate students may then elect to use any residual sick or vacation time to extend the period of paid leave. Graduate student health insurance is purchased in academic year increments so they would not need to make extra payments for continued health insurance during an extended leave.

In sum, the approved parental leave policy for graduate students grants up to 12 weeks of leave to a primary care giver, of which 6 weeks would be paid, for care of a newborn or newly adopted infant.

For students supported by a Ruth L. Kirschstein National Research Service Award (NRSA): Current NRSA policy allows trainees on institutional research training grants (T32, T34, T35, and the NRSA component of T90), and fellows on individual research training fellowships (F30, F31, F32, and F33) to receive stipends for up to 60 calendar days (equivalent to 8 work weeks) of parental leave per year for the adoption or the birth of a child when those in comparable training positions at the grantee organization have access to this level of paid leave for this purpose. Either parent is eligible for parental leave. The use of parental leave must be approved by the training Program Director.

NATIONAL OR INTERNATIONAL GRADUATE STUDENT TRAVEL

- All Graduate Student travel (including authorization and expenses) is to be processed through the BRET Office. The current contact person is:

Aaron Howard
350 Light Hall
Office Phone: 615.875-9050
Email: aaron.w.howard@vanderbilt.edu

- PRIOR TO TRAVEL, students must fill out a travel authorization form and travel liability waiver. These forms are available from the Department Student Travel Representative in 350 LH. **These forms must be filled out regardless of reimbursable expenses** (e.g. all expenses were paid with a Vanderbilt Procurement Card).
- Students have several options for non-mentor funding for travel including:
 1. Travel Award from the Graduate School (see below for further information)
 2. Some training grants allow for travel (ask your Program Coordinator)
 3. Pharmacology Departmental awards (see the Department Chair or Director of Graduate Studies)
 4. Travel budgeted in to pre-doctoral fellowships (see your Financial Manager in the BRET Office)

Apart from this, the mentor is responsible for covering the expenses of the travel.

- Meeting must be a major regional, national, or international conference.
- International - if travel is to be done outside the country (including Canada and Mexico - yes, we have found it necessary to stipulate this) and the expenses are to be charged to a federal grant, we need at least 1 month notice in order to request approval from Grants and Contracts.
- Grad School award applications are to be submitted at *least* two weeks prior to the travel for review and approval. ***They will be denied if not received in the Graduate School in this timely manner.*** The letter of approval should be taken to the student's home department administrative office to be placed with their travel authorization form.

The policy (as of July 1, 2015) for Travel Awards from the Graduate School are:

- 1) Student must have completed at least one academic year in the Vanderbilt Graduate School;
- 2) Student must be the sole presenter of the research conducted at Vanderbilt
- 3) Meetings must be a major regional, national, or international conference
- 4) Grants are limited to up to \$500 for either domestic and international travel
- 5) Grants are limited to a maximum of one award per budget year (July 1-June 30)
- 6) Students are allowed a total of **three (3)** travel grants for their entire tenure at Vanderbilt.

Student Travel Policies

Grandfathering in present students (for the 2015-2016 academic year), the following will apply to the rest of their tenure at Vanderbilt:

- All current students starting their 2nd year will be allowed to apply for three travel grants
- All current students starting their 3rd year will be allowed to apply for two travel grants
- All current students starting their 4th year and beyond will be allowed to apply for one grant

Please see http://gradschool.vanderbilt.edu/funding/university_scholarships.php for the required form (which must be approved by the DGS prior to submission).

- Transportation, registration, hotel and airfare are the only allowable expenses on the Grad School travel grants and most training grants. Food expenses are paid by the mentor on unrestricted funds. The reimbursement of alcohol is generally discouraged and it is suggested that these expenses be charged separately. Alcohol **CANNOT** be reimbursed from a federal grant.
- Any reimbursable receipts must be submitted to the home department administrative **office within 7 days of travel**. Purchases made with a p-card need copies of receipts submitted as well for documentation. Students may be penalized by Finance for extremely late receipts and treated as taxable income. Expenses in excess of \$25 that do not have an itemized receipt will not be reimbursed by Finance. You may contact the vendor for a copy of the itemized receipt if you have lost yours.
- Travel advances may be obtained if necessary to cover expenses such as airfare and registration. Please see the Department Student Travel Representative in 476 RRB for further information.

Qualifying Examinations

The admission to candidacy for a Ph.D. in the Pharmacological Sciences requires successful completion of a two-part examination that serves to insure that students have mastered all of the information that has been conveyed in the required coursework (Part I). Equally important, is that the students **must be able to use these insights** in new experimental settings; otherwise the information learned in coursework is not useful for their maturation as independent investigators. The major objective of Part II of the Qualifying Examination is to evaluate the ability of the student to pose a scientific question, state a hypothesis, develop reasonable strategies to test the hypothesis, anticipate possible outcomes and forecast reasonable interpretations of those outcomes. Acquisition of such skills is a crucial prerequisite for success in any scientific environment and therefore must be developed and evaluated.

Qualifying Exam Part I: The Preliminary Examination

For Part I of the Qualifying Examination, students will be examined orally. Twenty-four hours prior to their examination, the student will pick up the written examination consisting of seven questions primarily based upon the didactic material covered in their required courses [Targets, Systems & Drug Action (PHAR 8320 and 8321); Receptor Theory (PHAR 8324)]. These questions will be developed by all of the faculty serving as course directors or as section lecturers in these required courses. Students will pick up their exam from a previously designated location 24 hours in advance of their scheduled oral examination. During the 24 hours following the exam pickup and the start of the oral examination, no written materials may be consulted, however students may choose to prepare diagrams or other aids that would be effective in conveying an answer to the examination committee. Students will be examined for no less than one, but for no more than two hours on four of the seven questions chosen by the student.

In most instances, qualifying examination questions will provide raw data to the student and they will be asked for possible interpretations. During the oral examination, the interpretation of the data will be expanded to demonstrate whether a student not only has a knowledge of the specific details posed in the questions, but also can relate that understanding to issues related to receptor theory, drug metabolism and disposition, molecular signaling pathways, and other topics felt to be relevant to training in pharmacological sciences and introduced to the students during the required coursework. All faculty members who submit questions will submit both the specific question to be given to the students as well as additional discussion points to be probed by the Examination Committee. This latter input will guide the questioning and make the examination both uniform and broad-based for all students. There will be four faculty each year on the Examination Committee. Two will rotate each year, so there will always be two faculty in year (02) of their assignment, thus providing a "program perspective" on the level of performance expected in this examination, as well as two faculty who have just begun in year (01) of their assignment.

The students will be evaluated for their performance on the examination as pass/fail. A written summary of their examination will detail strengths as well as deficiencies that were noted during the examination. This written summary is given to the student and a copy maintained in the student's file. If there are deficiencies noted during the oral examination which are not sufficient to require re-examination, but which do represent areas where strengthened insights need to be achieved, these also will be noted in the formal summary. This summary will be made available to the student's Dissertation Committee, so that these areas of concern can be probed during the oral examination of the proposal for the Ph.D. (discussion of that examination follows). If a student fails this first oral qualifying examination, they must retake the examination within *six months*. If they do not pass the second time, they will be dismissed from the program.

Qualifying Exam Part II: The Dissertation Proposal Defense

Part II of the qualifying examination is taken after passing Part I and should be **scheduled to occur within 120 days of completion of Part I**. One purpose of Part II of the qualifying examination is to ensure that the student, advisor and Dissertation Committee have a general concept of what the dissertation project will entail and how it will be conducted. This should prevent such unfortunate situations as: 1) the student "floating" from project to project for several months or years with only a foggy notion of his or her objectives, and 2) the Dissertation Committee belatedly recommending major changes in Dissertation direction after one or two years of work by the student. Steps to completing Part II of the Qualifying Examination are outlined below. As always, if you have any questions or need additional information, please contact first the Education Coordinator.

Step 1: Meet with your Mentor

Before beginning work on Part II of the qualifying examination, the student and advisor should discuss together the direction that the Dissertation work will probably take and how the stated objectives will be achieved. The involvement of the advisor at this planning phase is essential, as it represents a critical component of the mentor-junior scientist dialogue that should continue throughout the dissertation research. The importance of close interaction between the student and advisor during the development of strategy cannot be overemphasized.

Although a cooperative effort between student and advisor is strongly encouraged during the development of ideas and, while permissible to obtain feedback from others during the writing process, it is the responsibility of the student to compile and defend the written proposal himself.

Step 2: Select your Dissertation Committee

The Dissertation Committee is formed prior to Part II of the Qualifying Examination. While the student is preparing the proposal (or even earlier), he or she should select a Dissertation Committee consisting of **at least five graduate faculty, four with primary or secondary appointments in the Department of Pharmacology** (including the student's advisor) **and one with an appointment in some other basic science department** (Biochemistry, Molecular Physiology and Biophysics, Cell Biology, Molecular Biology, Microbiology & Immunology, Pathology) **but without any appointment in Pharmacology**. The DGS will serve in an *ex officio* capacity, unless chosen as an official committee member, in which case the Associate Director of Graduate Studies would serve as *ex officio* on the committee.

The student and dissertation advisor propose the composition of the Dissertation Committee to the DGS, who then evaluates it and, if approved, sends it to the Dean of the Graduate School for final approval. The Dissertation Committee is crucial to the trainee's research progress and professional advancement, and thus its composition should be based on sound scholarship and service to the student.

From the four Pharmacology faculty members, you will need to **select a Chairperson** of your Committee (he or she must have an appointment in Pharmacology and **CANNOT** be your Mentor). The chairperson will be responsible for providing written feedback to the student (with a copy for the student's file in the Education Coordinator's Office) after each Dissertation Committee meeting and to serve as an additional contact. **Please discuss your selection in advance with**

Qualifying Examinations

your Chairperson and ask him/her to provide you with written acceptance of this position. This will avoid much confusion later!

The Dissertation Committee serves as a working team to help the student in any number of ways, including participating in the Qualifying Examination evaluation process, offering suggestions about experimental technique and design, and providing continual encouragement to be innovative and take risks, characteristics that are crucial to long-term success in research. Therefore, **it is important that the Dissertation Committee be carefully selected**, with consideration of the scientific training, intellectual interests, and research activities in the laboratory of each Committee member. The diversity of intellectual activity that will be present in a student's research project should be reflected in the composition of the Dissertation Committee.

Step 3: Schedule a Date to Meet with your Committee

Once the committee is approved by the DGS, the student should immediately inform the Program Coordinator of the committee's composition (see attached Committee Meeting Information Sheet form that **MUST** be completed prior to any and all committee meetings) **at least three weeks in advance**. The Program Coordinator will then set a date to meet with the Dissertation Committee to conduct the oral examination. After the date for the oral examination is set, the Program Coordinator will then notify the student, the committee, and the Graduate School of the date of the oral examination.

Step 4: Write your Proposal

The written proposal should be **according to NIH guidelines for Individual NRSA grant proposals**. The formatting of the document should be according to the following guidelines (as stipulated in the Instructions for NIH Individual NRSA applications)

Font

Use an Arial, Helvetica, Palatino Linotype, or Georgia typeface, a black font color, and a font size of 11 points or larger. (A Symbol font may be used to insert Greek letters or special characters; the font size requirement still applies.)

Paper Size and Page Margins

Use *standard paper size* (8 1/2" x 11).

Use at least one-half inch margins (top, bottom, left, and right) for all pages. No information should appear in the margins.

Figures, Graphs, Diagrams, Charts, Tables, Figure Legends, and Footnotes

You may use a smaller type size but it must be in a black font color, readily legible, and follow the font typeface requirement. Color can be used in figures; however, all text must be in a black font color, clear and legible.

Grantsmanship

Use English and avoid jargon.

If terms are not universally known, spell out the term the first time it is used and note the appropriate abbreviation in parentheses. The abbreviation may be used thereafter.

Page Limits

Observe the page number limits give in the following section.

The written proposal should consist of the following parts:

1) **Specific Aims** (Page Limit: 1):

State concisely 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.

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.

2) **Research Strategy** (Page Limit: 6):

Organize the Research Strategy in the specified order 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.

1. 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.

2. Innovation

Fellowship applications should not include an Innovation section unless specified in the funding Opportunity Announcement (FOA).

3. Approach

- Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project. Include how the data will be collected, analyzed, and interpreted 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.
- Include any courses that you plan to take to support the research training experience.

Qualifying Examinations

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 for New Applications.

For new applications, include information on preliminary studies, if any. Discuss the applicant's preliminary studies, data and/or experience pertinent to this application.

When applicable, provide a succinct account of published and unpublished results, indicating progress toward their achievement.

3. Bibliography & References Cited (no page limitation):

Provide a bibliography of any references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations.

The references should be limited to relevant and current literature. While there is not a page limitation, it is important to be concise and to select only those literature references pertinent to the proposed research.

Step 5: Copies of Proposal to Committee Members

A copy of the proposal (either electron or hard copy) must be given to each member of the committee **at least one week in advance** of the scheduled meeting. If, for any reason, a copy of the proposal is not given to committee members at least one week prior to the scheduled examination, the student will be required to reschedule the meeting.

Step 6: The Oral Presentation

During the meeting with the committee, the student is expected to give a brief (approximately 20 minutes) oral presentation of the proposal and then to answer specific questions about background, strategy, protocol design, methods, etc. If the committee approves the proposal and finds the performance of the student laudable in answering questions, outlining strategies appropriate for addressing the questions and anticipating outcomes/interpretations, the student is officially designated a Ph.D. candidate.

The oral defense of the dissertation proposal is not a perfunctory exam. It represents the formal examination of whether a student can go beyond satisfactory performance in didactic coursework and exam-taking and truly articulate questions and strategies as a scientist. Until the committee is convinced of the certainty of this aspiration, candidacy will not be granted. The outcome of the examination is followed up by a written summary of the evaluation of the student's performance by the Dissertation Committee chairperson, which summarizes areas of strength and identified areas of focus for continued growth, such as increased scholarship in certain areas in the scientific literature, improved focus on discriminating experiments, etc. This written summary is approved for faithfulness to the discussion by the faculty on the Dissertation Committee following the oral

Qualifying Examinations

examination by each committee member and is then provided to the student for constructive criticism and as a guideline for effort before the next meeting of the committee.

Along with this letter, the student receives an evaluation form with numerical scores for several important aspects of the progress in research project and the level of student's professional development. These scores are reached by a consensus of the committee. Students are encouraged to further discuss the recommendations of the committee and this evaluation with committee members, if necessary.

Disapproval of the proposal or of the student's performance in outlining and defending the proposal will necessitate a redrafting and re-defense of the proposal. Students are permitted to be examined twice. A second unsatisfactory performance results in dismissal from the graduate program.

Step 7: Relax and Research!

After the successful completion of both parts of the qualifying examination, the Graduate School must be notified (see the Education Coordinator for the appropriate form), so that official designation as a Ph.D. Candidate occurs.

Dissertation Research & Defense

After a student completes both parts of the qualifying exam, all of the student's efforts are to be directed towards completing the Dissertation project. Each Dissertation Committee must be convened periodically, so that the committee can monitor the student's progress and make timely, constructive suggestions. The Program Coordinator will schedule these meetings and confirm the date, time, and location with the student and the committee.

A student is expected to meet with the Dissertation Committee a minimum of every 9 months. However, the student and advisor always have the right to call a meeting at any time (please contact the Program Coordinator to schedule a meeting). The Chair of the Dissertation Committee will document in writing to the student, the committee's comments and recommendations regarding the student's progress in the program and dissertation project. A copy of that documentation is to be sent to the Program Coordinator for the student's file. **At each meeting, the committee will specify whether it will reconvene in 3, 6 or 9 months.**

At least one week prior to each committee meeting, graduate students are to prepare a brief Progress Report and submit it to his or her Dissertation Committee, in either paper or electronic format. The Progress Report should be a brief (1-2 page) summary of your progress since your last committee meeting. Also, it should include any manuscripts or abstracts generated since the last meeting.

Also, at least one week prior to the committee meeting, the Program Coordinator will send to the student and the student's mentor a **Pre-Meeting Evaluation form** for each to independently complete and send to the rest of the members of the committee at least one day before the scheduled meeting (with a copy to the Program Coordinator for the student's file).

The day before the scheduled committee meeting, the Program Coordinator will send to the Chair of the Committee a Student Progress Committee Meeting Form. The Chair will be asked to print the form and take it with him/her to the meeting and complete the form (in conjunction with the entire committee), then send the completed form back to the Program Coordinator for the student's file.

The date for the next meeting will be scheduled by the Program Coordinator within two (2) weeks following a committee meeting. Committee Meeting dates are absolute and cannot be canceled or changed without the prior approval of the Director of Graduate Studies. This guideline is necessary to prevent committee meeting dates from creeping past the time frame dictated by the student's committee.

Also, it is appropriate to convene a penultimate meeting of the Dissertation Committee several months before the final defense date (again, please contact the Program Coordinator to schedule this meeting). This meeting is intended to resolve any major stumbling blocks that might preclude committee approval before the final defense.

Defending the Dissertation (and beyond)

PLEASE NOTE: EACH STUDENT'S DISSERTATION COMMITTEE COLLABORATES WITH THE STUDENT AND MENTOR TO DEFINE THE BODY OF WORK REQUIRED TO COMPLETE THE RESEARCH PORTION OF THE DEGREE. THIS INCLUDES COOPERATING WITH THE MENTOR AND THE STUDENT TO REFINE THE EXPERIMENTAL PLAN AND PRESENTATION OF RESULTS. THE DISSERTATION COMMITTEE MAY REQUIRE THE SUBMISSION AND PUBLICATION OF ANY OR ALL PORTIONS OF THE WORK AS A PREREQUISITE PRIOR TO SCHEDULING A DEFENSE. HOWEVER, THE PROGRAM REQUIRES THAT ONE FIRST AUTHOR PUBLICATION BY THE STUDENTS IN A PEER-REVIEWED JOURNAL MUST BE ACCEPTED PRIOR TO OBTAINING PERMISSION TO SCHEDULE THE DEFENSE. IN RARE CIRCUMSTANCES, CO-FIRST AUTHOR PAPERS MAY BE USED TO MEET THIS REQUIREMENT AFTER REVIEW BY THE CHAIR OF PHARMACOLOGY AND THE PHARMACOLOGY DIRECTOR OF GRADUATE STUDIES. METHODS OR REVIEW PAPERS WILL NOT MEET THIS REQUIREMENT. A STUDENT WILL NOT BE ALLOWED TO DEFEND HIS OR HER DISSERTATION UNTIL SUCH PUBLICATION, AS APPROVED BY THE PROGRAM, IS IN PRESS.

During a student's penultimate meeting of the Dissertation Committee, the student is given permission to write his or her dissertation (providing that the publication conditions above have been met) and schedule the dissertation defense date.

Before the student begins writing the dissertation, it is necessary to **obtain a copy of the Graduate School's official instructions** for preparing dissertations, **available in 117 Alumni Hall (2-3934)** or on the Graduate School's website at http://www.vanderbilt.edu/gradschool/current_students.html. During the development of the text of the dissertation, mentor and student should review and edit the text together on a chapter-by-chapter basis. After both the mentor and the student concur that the dissertation is completed, a copy of the dissertation should be provided to each member of the Dissertation Committee. It is important to stress that Dissertation Committee members should be asked to evaluate only what the Dissertation advisor and student concur is the final draft. **This final draft should be distributed to the committee at least two weeks before the final defense.** Also, the Graduate School should be notified of the date, time and place two weeks in advance, using the appropriate form and submitted to the Education Coordinator.

As there are many forms and procedures required for graduation, the **best approach is to contact the Education Coordinator well in advance of your anticipated defense date.** The Education Coordinator will be able to guide you through the forms and processes that are required for graduation by the Graduate School. A few guidelines for these procedures are indicated in the Appendix Section.

Life after degree completion

Deciding what direction your career will take following completion of the Training Program in Pharmacological Sciences should arise early and become increasingly important as your training progresses. It is never too early to consider career options and plan a curriculum accordingly. To prepare further for a career of independent research in academic biomedical research, it is essential that students take a postdoctoral position, in order to pursue a specific research interest and acquire additional technical skills and expertise. Some students may take permanent positions in industrial or government research laboratories or at teaching-oriented colleges immediately after receiving their degree. Your career objectives can best be realized through the careful planning of your graduate training program. Your Dissertation advisor, Dissertation Committee, DGS, and members of the Pharmacology Ph.D. faculty and Program staff stand ready to advise you on career options. In addition, Vanderbilt's Career Center offers a variety of services including resume and interview assistance, on-campus employer interviews, and individual career counseling. For more information, call 615-322-2750.

VUconnect

We encourage all students to continue their Vanderbilt email relationship. Once a student graduates with their Ph.D. and leaves Vanderbilt to pursue their career, in whatever form that may take, we encourage them to continue their Vanderbilt email relationship via VUconnect, a worldwide network of Vanderbilt alumni. Access to VUconnect requires registration and is only open to Vanderbilt University alumni and students.

Visit the website at: <http://www.vuconnect.com/>.

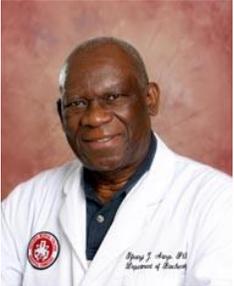
To register, you'll need to identify yourself, and you'll need to provide your four-digit code. You can find this code in the VUconnect card or email you will receive from Vanderbilt, on the mailing label of Vanderbilt Magazine or other Vanderbilt magazines you receive; your code is the last four digits of the long number above your name on the label.) If you need help getting your code, email vuconnect@vanderbilt.edu or call the Help Desk at (615) 322-5578. Help is available weekdays 8:30 a.m. - 5 p.m. CST.

Then you'll choose your user ID and password, and you're connected. You'll only need your code to register on your first visit to VUconnect. On future visits, all you'll need to enter is your user name and password.

Vanderbilt is committed to your privacy and the privacy of your info, which is password-protected to allow access by registered users only. VUconnect's online directory is a secure area that can only be accessed by registered alumni and students. It is not made public. The information resides on a secure server (the URL switches to https: from http: when this feature is accessed). You have complete control over the information displayed, and you can update or hide your profile information (or any elements of it) at any time.

Vanderbilt does not and will not sell, provide or share alumni, student or friend information to any third party. All information is strictly reserved for use by individual alumni, students or friends for personal use and by Vanderbilt for university-related purposes only.

Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
Adj	<p>W. Scott Akers, Pharm.D./Ph.D. Chair, Department of Pharmaceutical Sciences Associate Professor of Pharmaceutical Sciences College of Pharmacy David Lipscomb University One University Park Drive Nashville, TN 37204 Tel: 615-966-7171 scott.akers@lipscomb.edu</p>	<p>Affiliated faculty member representing Lipscomb University for the Pharm.D./Ph.D. Program.</p>	
	<p>Ifeanyi Arinze, Ph.D. (Meharry Medical College) Professor Dept. of Cardiovascular Biology and Biomedical Sciences WBS, Room 2103 1005 Dr. D.B. Todd, Jr. Blvd. Nashville, TN 37208 Tel.: 615-327-6586 iarinze@mmc.edu</p>	<p>Signal transduction mechanisms by which hormones regulate a variety of metabolic processes. Current studies are focused on the ontogeny and regulation of the developmental expression of G-proteins using cultured hematopoietic cells to study molecular mechanisms regulating expression of G-proteins</p>	
Pri	<p>Joey V. Barnett, Ph.D. Acting Chair of Pharmacology Director of Graduate Studies in Pharmacology Professor of Pharmacology, Medicine, Pediatrics and Microbiology & Immunology 460B PRB Tel.: 615-936-1722 joey.barnett@vanderbilt.edu</p>	<p>Peptide growth factors and receptors in development; cardiac development</p>	
Pri	<p>Randy D. Blakely, Ph.D. Director, Center for Molecular Neuroscience Allan D. Bass Professor of Pharmacology 6133 Medical Research Bldg III Suite 7140A Tel: 615-936-3705 Fax: 615-936-3040 randy.blakely@vanderbilt.edu</p>	<p>Neurotransmitter transporter genes and proteins; transporter dysfunction in autonomic, neurologic and psychiatric disorders</p>	
Pri	<p>Alan R. Brash, Ph.D. Professor of Pharmacology 510A RRB Tel.: 615-343-4495 alan.brash@vanderbilt.edu</p>	<p>Biosynthesis and metabolism of prostaglandins</p>	

Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
Sec	<p>Richard M. Breyer, Ph.D. Professor of Medicine and Pharmacology S3223 MCN Tel.: 615-343-0257 rich.breyer@vanderbilt.edu</p>	<p>Structure, function, and regulation of prostanoid receptors</p>	
	<p>Kendal S. Broadie, Ph.D. Eldon Stevenson Jr. Professor of Neurobiology 1210 MRB3 Tel.: 615-936-3937 kendal.broadie@vanderbilt.edu</p>	<p>The genetic mechanisms underlying coordinated movement, behavior and cognition. How does nervous system circuitry underlying behavior develop? How are nervous system circuits modified by experience? How do these mechanisms go awry in inherited neurological diseases and age-related neurological decline? These questions center around the common themes of information transfer and information storage in cells of the nervous system. My long-term focus has been on the intercellular synapses that establish and provide communication between nerve cells.</p>	
Pri	<p>H. Alex Brown, Ph.D. Ingram Associate Professor of Cancer Research in the Department of Pharmacology 412B PRB Tel.: 615-936-3888 alex.brown@vanderbilt.edu</p>	<p>Lipid signaling pathways and cellular signal transduction</p>	
Sec	<p>Nancy J. Brown, M.D. Robert H. Williams Professor of Medicine 560 RRB Tel.: 615-343-7345 Nancy.j.brown@vanderbilt.edu</p>	<p>Cardioprotective effects of bradykinin and on the interaction of the renin-angiotensin-aldosterone and fibrinolytic systems in humans</p>	
	<p>David J. Calkins, Ph.D. Professor of Ophthalmology and Visual Sciences 11435 MRB4 Tel: 615-936-6412 David.j.calkins@vanderbilt.edu</p>	<p>The laboratory focuses in the molecular mechanisms of neurodegeneration in the visual pathways in health, aging and disease.</p>	
Pri	<p>Ana M. Carneiro, Ph.D. Assistant Professor of Pharmacology 7144 MRBIII Tel: 615-936-1699 ana.carneiro@vanderbilt.edu</p>	<p>Understanding how conserved protein interactions influence homeostasis of different cells and tissues</p>	

Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
	<p>Roger J. Colbran, Ph.D. Professor of Molecular Physiology & Biophysics 724 RRB Tel.: 615-936-1630 Fax: 615-322-7236 roger.colbran@vanderbilt.edu</p>	<p>Mechanisms of subcellular targeting and role in regulating protein phosphorylation/dephosphorylation</p>	
Pri	<p>P. Jeffrey Conn, Ph.D. Professor of Pharmacology and Director of Program in Translational Neuropharmacology 417D PRB Tel: 615-936-2478 jeff.conn@vanderbilt.edu</p>	<p>Cellular/molecular mechanisms of regulation of neuronal function. Novel treatments for CNS disorders.</p>	
Sec	<p>Kevin P. M. Currie, Ph.D. Associate Professor of Anesthesiology and Pharmacology B4225 MCN Tel: 615-322-8514 kevin.currie@vanderbilt.edu</p>	<p>Regulation of voltage-gated calcium channels and neurotransmitter release</p>	
Pri	<p>J. Scott Daniels, Ph.D. Assistant Professor of Pharmacology Tel: 615-322-8299 scott.daniels@vanderbilt.edu</p>	<p>Understanding how drug metabolism and pharmacokinetic (DMPK) mechanisms impact the pharmacodynamics of small molecule allosteric modulators of metabotropic glutamate receptors (mGluRs) and muscarinic receptors (mAChRs)</p>	
Pri	<p>Sean S. Davies, Ph.D. Assistant Professor of Pharmacology 506A RRB Tel: 615-322-5049 sean.davies@vanderbilt.edu</p>	<p>Treatment of chronic disease by modulating oxidative stress</p>	

Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
Sec	<p>Jerod S. Denton, Ph.D. Assistant Professor of Anesthesiology and Pharmacology B4229 MCN Tel: 615-343-7385 jerod.denton@vanderbilt.edu</p>	<p>Molecular mechanisms and signaling pathways that regulate potassium channel biosynthesis, trafficking, function and degradation.</p>	
Sec	<p>Ariel Y. Deutch, Ph.D. Professor of Psychiatry and Pharmacology Investigator, John F. Kennedy Center for Research on Human Development Director, National Parkinson Foundation Center of Excellence at Vanderbilt Psychiatric Hosp. at Vanderbilt, Suite 313 Tel: 615-327-7080 ariel.deutch@vanderbilt.edu</p>	<p>Prefrontal and striatal dopaminergic and serotonergic systems</p>	
Sec	<p>Florent Elefteriou, Ph.D. Associate Professor Clinical Pharmacology/Medicine 1235 MRB IV Tel: 615-322-7975 Fax: 615-343-2611 Florent.elefteriou@vanderbilt.edu</p>	<p>Regulation of bone remodeling by the central and peripheral nervous systems.</p>	
Pri	<p>Ronald B. Emeson, Ph.D. Joel G. Hardman Chair in Pharmacology Professor of Pharmacology and Molecular Physiology & Biophysics 8160B MRB III Tel: 615-936-1688 ron.emeson@vanderbilt.edu</p>	<p>Cell-specific regulation of neuroendocrine gene expression; RNA processing</p>	
Sec	<p>Stephen W. Fesik, Ph.D. Professor of Biochemistry & Pharmacology Ingram Professor in Cancer Drug Discovery 634 RRB / 802 RRB Tel: 615-322-6306 stephen.fesik@vanderbilt.edu</p>	<p>Cancer drug discovery using fragment-based approaches and structure-based drug design</p>	

Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
Sec	<p>Joshua P. Fessel, M.D., Ph.D. Assistant Professor of Medicine, Division of Allergy, Pulmonary and Critical Care Medicine Assistant Professor of Pharmacology Tel.: 615-936-2187 joshua.p.fessel@vanderbilt.edu</p>	<p>My lab has two broad areas of focus, one that is disease-specific and one that is more fundamental biology. My disease interest focuses on disorders affecting the vasculature in the lung - specifically, pulmonary arterial hypertension. My lab also studies more fundamental biology related to molecular metabolism, carbon source utilization, mitochondrial physiology, and mechanisms of molecular metabolic control.</p>	
	<p>Thomas Force, M.D. Professor of Medicine Professor of Pharmacology Dorothy and Laurence Grossman Chair in Cardiology Thomas.l.force@vanderbilt.edu</p>		
	<p>Martin J. Gallagher, M.D., Ph.D. Associate Professor of Neurology 6140 MRB3 Tel.: 615-322-5979 martin.j.gallagher@vanderbilt.edu</p>	<p>The effects of monogenic epilepsy mutations on protein expression and electrophysiology in both cultured cells as well as genetically modified mice. In addition, we study the effects of these mutations on the development of seizures and neurobehavioral abnormalities in genetically modified mice</p>	
Sec	<p>Aurelio Galli, Ph.D. Professor of Molecular Physiology & Biophysics and Pharmacology 7124 MRBIII Tel: 615-936-3891 aurelio.galli@vanderbilt.edu</p>	<p>Trafficking and biophysics of Neurotransmitter Transporters</p>	
	<p>Brad Grueter, Ph.D. Assistant Professor Division of Research Department of Anesthesiology P435G MRB4 Tel.: 615-936-1684 brad.grueter@vanderbilt.edu</p>	<p>Elucidating the molecular constituents in the NAc that are necessary and sufficient to drive complex motivated behaviors</p>	

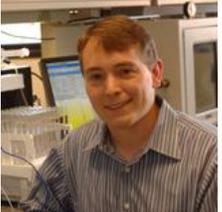
Pharmacology Training Faculty

Apt.	Faculty Member	Research Interests	Photo and Link to Webpage
Sec	Richard J. Gumina, M.D., Ph.D. Assistant Professor of Medicine, Division of Cardiovascular Medicine 383 PRB Tel.: 615-936-1720 richard.gumina@vanderbilt.edu	Regulation of extracellular nucleotide/nucleosides in cardiovascular health and disease	
Pri	Vsevolod Gurevich, Ph.D. Professor of Pharmacology 418 PRB Tel.: 615-322-7070 vsevolod.gurevich@vanderbilt.edu	Molecular mechanism of arrestin function	
Pri	Heidi E. Hamm, Ph.D. Earl W. Sutherland, Jr. Professor of Pharmacology 442 RRB Tel: 615-343-3533 heidi.hamm@vanderbilt.edu	G-proteins and intracellular signaling	
Sec	David Harrison, M.D. Chief, Division of Clinical Pharmacology Betty and Jack Bailey Professor of Medicine 536 RRB Tel: 615-875-3049 David.g.harrison@vanderbilt.edu	Inflammation; Endothelial cell metabolism of tetrahydrobiopterin.	
Sec	Eva Marie Harth, Ph.D. Associate Professor of Chemistry and Pharmacology 7619 Stevenson Center Tel: 615-343-3405 Eva.harth@vanderbilt.edu	Development of bioinspired nanoscopic polymeric materials establishing and implementing new achievements in targeted drug delivery and imaging	
	Alyssa Hasty, Ph.D. Associate Professor of Molecular Physiology & Biophysics 813 Light Hall Tel: 615-322-5177 Alyssa.hasty@vanderbilt.edu	Obesity-related increases in adipose tissue macrophages leading to inflammation and insulin resistance	

Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
	<p>Antonis K. Hatzopoulos, Ph.D. Associate Professor of Medicine, Cell & Developmental Biology and Pharmacology P425C MRB4 Tel: 615-936-5529 Antonis.hatzopoulos@vanderbilt.edu</p>	<p>Molecular and cellular mechanisms of cardiac development and regeneration, with emphasis on the role of endothelial progenitor cells to promote regeneration of injured organs, or to eradicate unwanted tissue growth</p>	
Sec	<p>Charles C. Hong, M.D., Ph.D. Assistant Professor of Medicine, Pharmacology and Cell & Developmental Biology 1155A Light Hall 2215 Garland Ave. Tel.: 615-936-7032 charles.c.hong@vanderbilt.edu</p>	<p>Chemical biology of embryonic development and stem cell differentiation</p>	
	<p>Billy G. Hudson, Ph.D. Professor of Medicine Professor of Pathology, Microbiology and Immunology Elliott V. Newman Professor of Medicine Professor of Biochemistry B-3102 Medical Center North Tel.: 615-322-7298 billy.hudson@vanderbilt.edu</p>	<p>The structure and function of type IV collagen, the major constituent of basement membranes (BMs)</p>	
Pri	<p>Tina Iverson, Ph.D. Associate Professor of Pharmacology 460 RRB Tel: 615-322-7817 tina.iverson@vanderbilt.edu</p>	<p>X-ray crystallography of integral membrane protein complexes</p>	
Pri	<p>Carrie K. Jones, Ph.D. Assistant Professor of Pharmacology 12478B MRB IV Tel: 615-343-4337 Fax: 615-343-3088 carrie.jones@vanderbilt.edu</p>	<p>Exploring the underlying mechanisms of novel ligands targeting different G protein-coupled receptors (GPCR) and transporters within the CNS and the implications of these effects on different disease states, most notably schizophrenia</p>	
Sec	<p>Bjorn C. Knollman, MD/Ph.D. Professor of Medicine and Pharmacology 1265 MRB IV Tel.: 615-343-6493 bjorn.knollman@vanderbilt.edu</p>	<p>Cardiac electrophysiology, calcium signaling, excitation-contraction coupling, ion channels, drug-induced arrhythmias</p>	

Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
Pri	<p>Christine Konradi, Ph.D. Professor of Pharmacology and Psychiatry 7158 MRB III Tel.: 615-936-1021 christine.konradi@vanderbilt.edu</p>	Gene Expression in the Brain	
	<p>Andre H. Lagrange, M.D., Ph.D. Associate Professor of Neurology 6140 MRB III Tel: 615-322-5979 Andre.h.lagrange@vanderbilt.edu</p>	Using electrophysiological techniques with brain slices and immortalized cultured cells to study the tuning of inhibitory neurotransmission during normal brain function and in disease states, including epilepsy	
Pri	<p>Craig W. Lindsley, Ph.D. Professor of Pharmacology 804A RRB Tel: 615-322-8700 Craig.lindsley@vanderbilt.edu</p>	Medicinal chemistry efforts to validate novel targets/mechanisms	
Sec	<p>MacRae Linton, M.D. Professor of Medicine and Pharmacology 315 PRB Tel.: 615-936-1656 macrae.linton@vanderbilt.edu</p>	Lipoprotein metabolism and atherosclerosis	
	<p>Oliver McDonald, M.D., Ph.D. Assistant Professor of Pathology, Microbiology and Immunology CC2201A MCN Tel.: 615-343-1101 oliver.g.mcdonald@vanderbilt.edu</p>	Epigenetic reprogramming of chromatin structure during neoplastic transformation and malignant progression	
Sec	<p>BethAnn McLaughlin, Ph.D. Assistant Professor of Neurology and Pharmacology 8110A MRB III Tel: 615-936-3847 bethann.mclaughlin@vanderbilt.edu</p>	Neurodegenerative and neuroprotective cell signaling pathways	

Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
Sec	<p>Jens Meiler, Ph.D. Associate Professor of Chemistry and Pharmacology 5144B MRB III Tel.: 615-936-5662 jens@jens-meiler.de</p>	Computational Structural Biochemistry	
Sec	<p>Katherine T. Murray, M.D. Assoc. Professor of Medicine and Pharmacology 559 PRB Tel: 615-322-3304 kathy.murray@vanderbilt.edu</p>	Metabolic regulation of Na ⁺ channel activity in cardiac cells; mechanisms of antiarrhythmic drug action	
	<p>Young-Jae Nam, M.D., Ph.D. Assistant Professor of Cardiovascular Medicine 1155C Light Hall Tel: 615-936-5436 Young-Jae.nam@vanderbilt.edu</p>	Their research goals are 1) to develop an entirely new heart repair strategy targeting specific heart disease by generation of individual subtypes of cardiomyocytes including atrial, ventricular, and pacemaker cardiomyocytes and 2) to understand the mechanistic basis of cardiac cell fate specification during direct cardiac reprogramming and pluripotent stem cell differentiation.	
	<p>Gregor Neuert, Ph.D. Assistant Professor of Molecular Physiology & Biophysics 813C Light Hall Tel.: 615-343-6404 gregor.neuert@vanderbilt.edu</p>	To study and predict dynamic spatial-temporal processes in signal transduction and gene regulation by quantifying individual cells with single-molecule resolution	
	<p>Neil Osheroff Professor of Biochemistry Professor of Medicine John G. Coniglio Chair in Biochemistry 654 RRB Tel.: 615-322-4338 neil.osheroff@vanderbilt.edu</p>	Function and biology of DNA topoisomerases	

Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
	<p>John S. Penn, Ph.D. Professor of Ophthalmology & Visual Sciences, Cell & Developmental Biology, and Pharmacology 8016 MCE Tel: 615-936-1485 John.penn@vanderbilt.edu</p>	A Molecular and Cellular Characterization of Ocular Angiogenesis	
Sec	<p>Elizabeth Phillips, M.D. Professor of Medicine and Pharmacology John A. Oates Chair in Clinical Research Tel: Elizabeth.j.phillips@vanderbilt.edu</p>		
	<p>Matthias Riess, M.D., Ph.D. Professor of Medicine Division of Multispecialty Adult Anesthesiology Tel: 615-322-9044 Matthias.riess@vanderbilt.edu</p>		
Pri	<p>L. Jackson Roberts, II, M.D. Professor of Pharmacology and Medicine 522A RRB Tel: 615-322-3203 jack.roberts@vanderbilt.edu</p>	Prostaglandins; oxidative injury	
Sec	<p>David H. Robertson, M.D. Elton Yates Professor of Medicine, Pharmacology and Neurology AA3228 MCN Tel: 615-343-6499 david.robertson@vanderbilt.edu</p>	Pharmacology and molecular genetics of the adrenergic nervous system; aerospace medicine and physiology	
Sec	<p>Dan M. Roden, MD Professor of Medicine and Pharmacology Director, Division of Clinical Pharmacology 532C RRB Tel.: 615-322-0067 Fax: 615-343-4522 Pager: 615-835-7513 dan.roden@vanderbilt.edu</p>	Pharmacology of antiarrhythmic drugs	

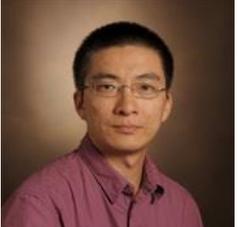
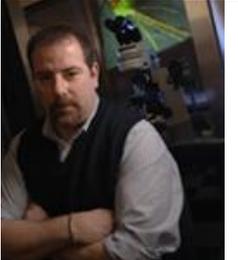
Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
	<p>Rebecca M. Sappington, Ph.D. Assistant Professor Department of Ophthalmology and Visual Sciences Department of Pharmacology 11445E MRB4 Tel.: 615-322-0790 Rebecca.m.sappington@vanderbilt.edu</p>	<p>The role of neuroinflammation in aging and neurodegeneration of the retina, specifically glaucoma. Using a broad approach that encompasses behavioral, cellular and molecular neuroscience, they investigate the impact of glial cells and neuroinflammation, i.e. cytokine and chemokine production, on function and survival of retinal ganglion cells, whose axons form the optic nerve. Their goal is to identify potential targets for retinal therapeutics by understanding primary mechanisms of neuroinflammation.</p>	
Sec	<p>Douglas B. Sawyer, M.D./Ph.D. Professor of Medicine and Pharmacology 383 PRB Tel.: 615-936-1717 Fax: 615-936-2029 Douglas.b.sawyer@vanderbilt.edu</p>	<p>Role of the cardiac growth factor neuregulin in cardioprotection, repair and regeneration</p>	
Pri	<p>Claus Schneider, Ph.D. Assistant Professor of Pharmacology 572 RRB Tel.: 615-343-9539 Fax: 615-322-4707 Claus.schneider@vanderbilt.edu</p>	<p>Biochemistry of lipid signaling</p>	
Sec	<p>Jonathan G. Schoenecker, M.D., Ph.D. Assistant Professor of Orthopedic Surgery and Rehabilitation Assistant Professor of Pediatrics Assistant Professor of Pathology, Microbiology & Immunology Assistant Professor of Pharmacology 454 RRB Tel.: 615-9363080 jon.schoenecker@vanderbilt.edu</p>	<p>The role of Coagulation in Normal and Pathologic Orthopaedic Related Wounds</p>	
Pri	<p>Bih-Hwa Shieh, Ph.D. Assoc. Professor of Pharmacology 402B RRB Tel: 615-343-0441 bih-hwa.shieh@vanderbilt.edu</p>	<p>Visual transduction in <i>Drosophila</i>; <i>Drosophila</i> genetics</p>	

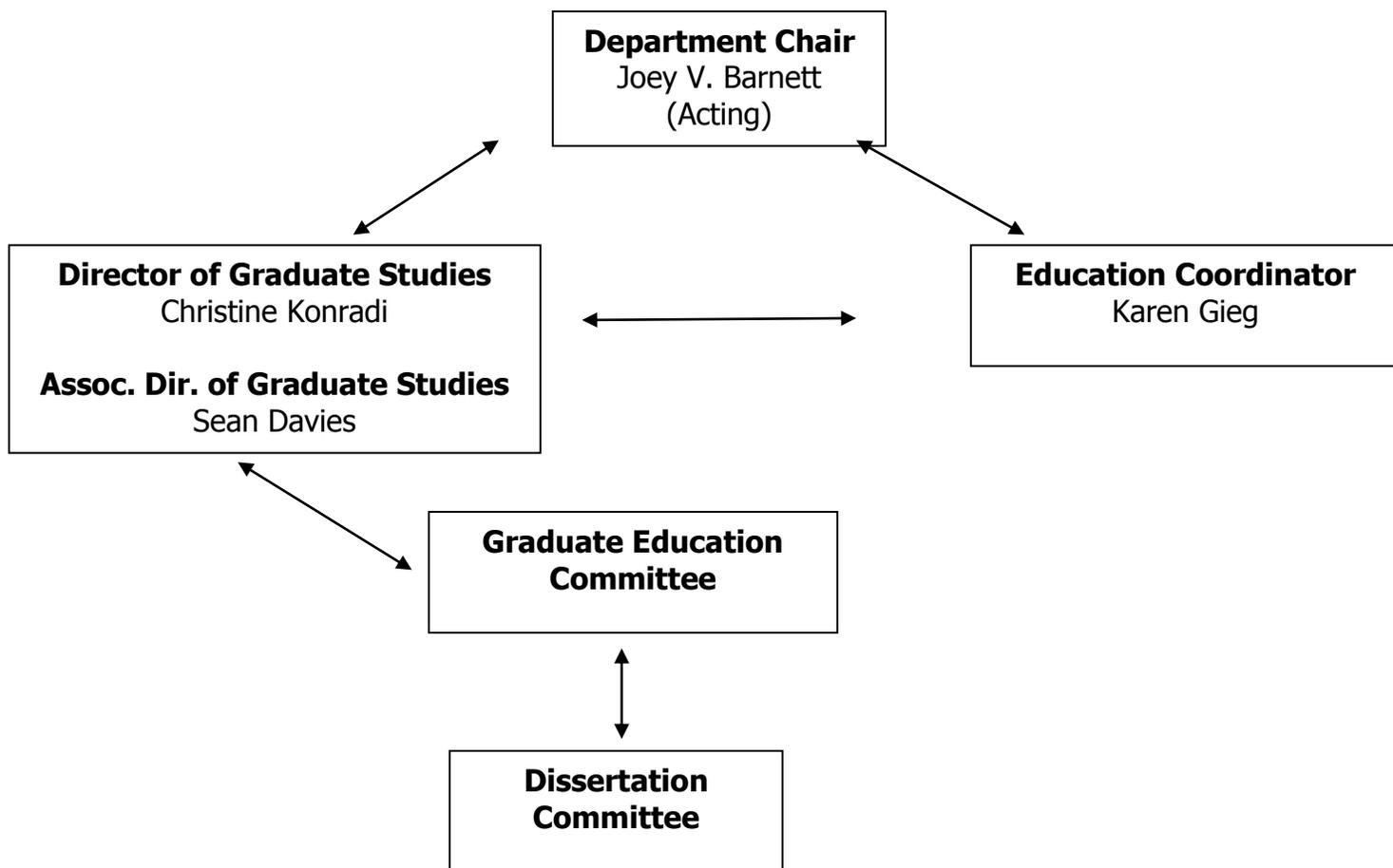
Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
Pri	<p>Benjamin Spiller, Ph.D. Assistant Professor of Pharmacology 5154B MRB III Tel: 615-322-6766 Benjamin.spiller@vanderbilt.edu</p>	Structural Biology of Ion Channels	
	<p>John M. Stafford, M.D./Ph.D. Assistant Professor of Medicine and Molecular Physiology & Biophysics 7445 MRB4 Tel: 615-936-6113 Fax: 615-936-1667 John.stafford@vanderbilt.edu</p>	Diabetes, Obesity and Lipid Metabolism and Atherosclerosis	
	<p>LaMonica V. Stewart, Ph.D. (Meharry Medical College) Assistant Professor of Cancer Biology Assistant Professor of Biomedical Sciences West Basic Science Bldg., Rooms 2118/2120 1005 Dr. D.B. Todd, Jr. Blvd. Nashville, TN Tel: 615-327-6749 lstewart@mmc.edu</p>	Regulation of prostate cancer growth and progression by the peroxisome proliferator activated receptor gamma (PPAR gamma) and other nuclear receptors	
Sec	<p>Jeremy Veenstra-VanderWeele, M.D. Assistant Professor of Psychiatry, Pediatrics & Pharmacology 465 MRB3 Tel: 615-936-1701 j.vvw@vanderbilt.edu</p>	This lab is focused on mouse models related to autism spectrum disorders.	
Pri	<p>Brian E. Wadzinski, Ph.D. Assoc. Professor of Pharmacology 424 RRB Tel: 615-343-2080 brian.wadzinski@vanderbilt.edu</p>	Novel protein phosphatases and control of gene transcription	
	<p>Jialiang Wang, Ph.D. Asst Professor of Neurological Surgery T4224 MCN Tel: 615-936-6421 jjialiang.wang@vanderbilt.edu</p>	Translational medicine in brain tumors and other human cancers, in particularly malignant glioma	

Pharmacology Training Faculty

Appt.	Faculty Member	Research Interests	Photo and Link to Webpage
	<p>C. David Weaver, Ph.D. Asst Professor of Pharmacology 461 PRB Tel: 615-936-6461 David.weaver@vanderbilt.edu</p>	<p>The discovery and characterization of novel chemical tools for studying ion channel structure, function, and therapeutic potential.</p>	
Sec	<p>Matthew H. Wilson, M.D., Ph.D. Assoc. Professor of Medicine Division of Nephrology and Hypertension Tel: 615-873-6842 matthew.wilson@vanderbilt.edu</p>	<p>Engineering cell and gene therapies for kidney diseases</p>	
	<p>Danny G. Winder, Ph.D. Professor of Molecular Physiology & Biophysics & Psychiatry 750A RRB Tel: 615-322-1144 Dany.winder@vanderbilt.edu</p>	<p>Glutamatergic synaptic transmission is the primary means of fast excitatory neural communication in the brain. Modulation of this transmission serves an important role in brain function.</p>	
Pri	<p>Qi Zhang, Ph.D. Assistant Professor of Pharmacology 410 RRB Tel: 615-875-7620 Qi.zhang@vanderbilt.edu</p>	<p>Inventing interdisciplinary methods to study molecular mechanisms governing cellular communication</p>	
Sec	<p>Laurence J. Zwiebel, Ph.D. Professor of Biological Sciences 6260 MRB3 Tel: 615-343-3718 Fax: 615-936-0129 l.zwiebel@vanderbilt.edu</p>	<p>Characterization of several genes and their products that together control important behavioral processes in the life cycle of insects that act as disease vectors</p>	

ADMINISTRATIVE STRUCTURE



THE DEPARTMENT CHAIR, as Program Director, is responsible for overseeing all aspects of the Ph.D. Program, with the assistance of the DGS, the Graduate Education Committee, and the Educational Coordinator. The Program Director is the official spokesperson for the Pharmacology Graduate Program and serves as representative in matters related to University policy and programs. The Program Director 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 Program Director initiates and coordinates recruitment activities and is also responsible for identifying and assisting others in applying for internal and external support for graduate training in pharmacology.

The Director of Graduate Studies, who is responsible for monitoring the progress of students' course work and general performance throughout their training, 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 Education Coordinator is the *first person to contact* with questions about specific program requirements or with whom to discuss personal problems. The Coordinator is available in this capacity to pharmacology graduate students and prospective students of the Pharmacology Graduate Program. Key responsibilities of the Educational Coordinator are to answer student questions, direct students to appropriate sources of information, alert students to resources such as funding opportunities, and to assist students in any necessary problem-solving. The Coordinator also provides ongoing infrastructure support to the Department Chair and DGS by tracking each student's progress, ensuring that critical deadlines are met and that all requirements for completion of the Pharmacology Ph.D. degree are accomplished. The Educational Coordinator also develops and implements programs, such as the Pharmacology Retreat.

A Graduate Education Committee, chaired by the Director of Graduate Studies, will assist in student-related areas such as monitoring progress, performance, and welfare of students. The Education Committee will evaluate each student's progress at the end of the second year of training and determine whether that student should continue the program. The Education Committee also evaluates student progress periodically.

Whereas the Graduate Education Committee oversees the progress of every student in the Pharmacology Graduate Program, **the Dissertation Committee** is individualized, overseeing the research and development of an individual student. The activities and responsibilities of the Dissertation Committee are outlined in earlier sections of this Handbook.