

UPSTATE
MEDICAL UNIVERSITY

2023-2024
Course Selection Book



College of Graduate Studies

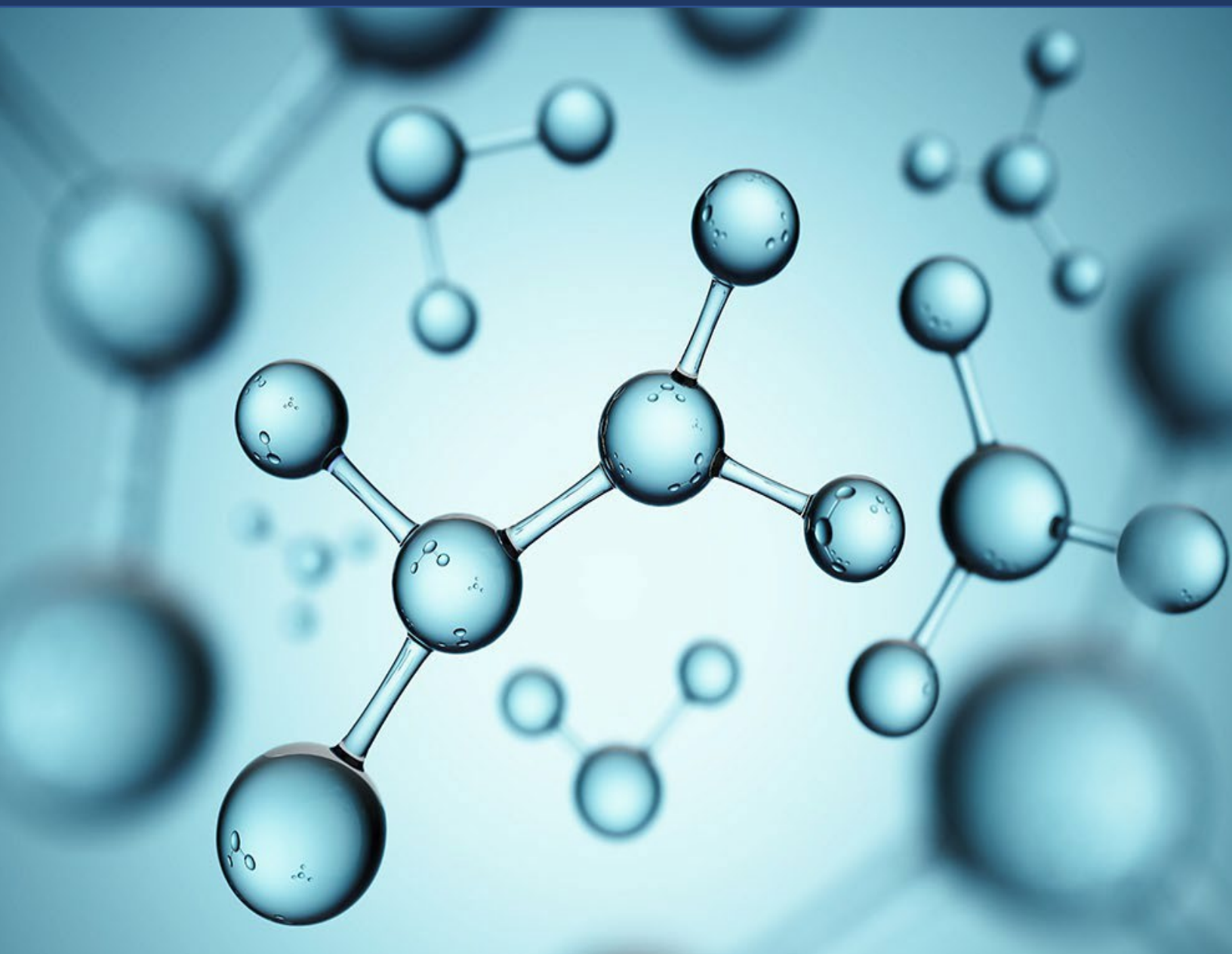


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SUNY UPSTATE MEDICAL UNIVERSITY ACADEMIC CALENDAR 2023-2024

		College/Program					
FALL 2023 - COGS	FALL 2023 CHP, CON, COM Public Health	FALL 2023 - COM MD program	All	Sat	April	22	Eid al-Fitr - contact faculty if unable to attend due to religious observance
			COM	Mon	May	15	Deadline to Sit for USMLE Step 1 (Class of 2025)
			COM	May 22-26			MS III Transition to Clerkships (Required)
			COM	Mon	May	29	Memorial Day - No Classes
			COM	Tues	May	30	MS III & MS IV Fall Semester Begins
			CHP	Mon	June	12	Summer Semester Begins DPT (All) PA (Incoming)
			COM	Mon	June	19	Juneteenth Observed - No Classes
			All	Thurs	June	29	Eid al-Adha - contact faculty if unable to attend due to religious observance
			COM	Tues	July	4	Independence Day Observed - No Classes
			COM	Mon	July	24	MSI Fall Semester Begins
			COM	Mon	Aug	14	MSII Fall Semester Begins
			All (except MD)	Aug 8-26			Fall Semester Nonmatriculated Student Registration
			All	Aug 24-25			New Student Orientation (as assigned)
			All (except MD)	Mon	Aug	28	FALL SEMESTER Begins (unless otherwise noted)
			All	Mon	Sept	4	Labor Day - No Classes
			All	Fri	Sept	8	Last Day to Add or Drop courses without a late fee (except MD)
			CHP/CON/PH	Fri	Sept	8	Last Day to Drop a full semester course without a grade
			All	Sept 15 - 17			Rosh Hashanah - contact faculty if unable to attend due to religious observance
			All	Sept		25	Yom Kippur - contact faculty if unable to attend due to religious observance
			COM/COGS	Mon	Oct	9	Fall Break - No Classes
			CHP/CON	Oct 9-10			Fall Break - No Classes (Except PA students)
			CHP/CON	Fri	Oct	20	Mid-Semester Grades Due for Full Semester courses
			All (except MD)	Oct 23 - Jan 12			Spring Semester Open Enrollment-Matriculated Students
			CHP/CON	Fri	Nov	10	75% of the Semester Completed (WP/WF grades assigned full semester courses)
			All	Thurs	Nov	23	Thanksgiving Break Begins
			All	Mon	Nov	27	Classes Resume
			COM	Fri	Dec	1	Deadline to Sit for USMLE Step II CK (Class of 2024)
			CHP/CON/PH	Mon	Dec	11	Last Day of Classes
			CHP/CON/PH	Tues	Dec	12	Study Day
			CHP/CON/PH	Dec 13-18			Final Exams (No exams on Sunday)
			All	Dec 12 - Jan 13			Spring Semester Nonmatriculated Student Registration (except MD)
			All	Fri	Dec	22	Fall Semester Ends
All	Sat	Dec	30	Degree Conferral for Fall Graduates			

SPRING 2024 COGS	SPRING 2024 CHP, CON, COM Public Health	SPRING 2024 COM MD program	All	Mon	Jan	8	SPRING SEMESTER Begins
			All	Mon	Jan	15	Martin Luther King Day - No Classes
			All	Fri	Jan	19	Last Day to Add or Drop courses without a late fee (except MD) Last Day to Drop a full semester course without a grade
			CHP/CON/PH	Fri	Jan	19	Spring Vacation Begins Year 2 Perfusion and Radiation Therapy Sr Students Mid-Semester Grades Due for Full Semester courses
			CHP	Sat	Feb	24	Spring Vacation Begins (except PT Yr 3, PA Yr 1, Perfusion Yr 2 & Radiation Therapy Sr) Classes Resume Year 2 Perfusion and Radiation Therapy Sr Students
			CHP/CON	Fri	Mar	1	Spring Vacation Begins - PH
			CHP/CON	Sat	Mar	2	Classes Resume (except PT Yr 3, PA Yr 1, Perfusion Yr 2 and Radiation Therapy Sr)
			CHP	Mon	Mar	4	Summer Semester Open Enrollment - Matriculated Students
			PH	Sat	Mar	9	Spring Vacation Begins PA Year 1, all Graduate Studies Students and MSI Classes Resume - PH
			CHP/CON	Mon	Mar	11	Fall Semester Open Enrollment - Matriculated Students
			CHP/CON/PH	Mar	11 - May	10	Classes Resume PA Year 1, all Graduate Studies Students and MSI
			COGS/CHP/COM	Sat	Mar	16	75% of the Semester Completed (WP/WF grades assigned full semester courses) Last Day of Classes MSII
			PH	Mon	Mar	18	Passover - contact faculty if unable to attend due to religious observance Good Friday - contact faculty if unable to attend due to religious observance Last Day of Classes (except PT Year 3)
			All (except MD)	Mar	25 - Aug	30	Summer Semester Nonmatriculated Student Registration Study Day
			COGS/CHP/COM	Mon	Mar	25	Final Exams (No exams on Sunday)
			CHP/CON	Wed	Mar	27	Spring Semester Ends - MSIV, CHP (except PT Year 3), CON & Public Health
			COM	Fri	Mar	29	
			All	April	22 - 30		
			All	Fri	March	29	
			CHP/CON/PH	Mon	April	22	
			CHP/CON/PH	Apr	22 - May	10	
			CHP/CON	Tues	April	23	
			CHP/CON	Apr	24 - Apr	29	
			CON/CHP/COM	Fri	May	3	
			All	Sun	May	5	COMMENCEMENT Ceremony
			All	Sun	May	5	Degree Conferral for Spring Graduates
			CHP/CON	Mon	May	6	SUMMER SEMESTER Begins (except as otherwise noted)
			CHP/CON	Fri	May	10	Last Day to Add or Drop courses without a late fee Last Day to Drop a full semester course without a grade Deadline to Sit for USMLE Step 1 (Class of 2026)
			CHP/CON	Fri	May	10	Spring Semester Ends MSII
			COM	Mon	May	13	
			COM	Fri	May	17	
			CHP/CON	Mon	May	20	50% Tuition Liability for full semester courses
			COM	Fri	May	24	Spring Semester Ends MSI and MSIII
			All	Mon	May	27	Memorial Day - No Classes
			CHP	June 6-7			New Student Orientation (as assigned)
			COGS/CHP	Fri	June	7	Semester Ends Graduate Studies, PT Year 3
			All	Mon	June	10	Alternate Degree Conferral for Spring Graduates
			CHP/PH	Mon	June	10	PA & PT Incoming Students and PH SUMMER SEMESTER Begins
			All	Wed	June	19	Juneteenth Observed - No Classes Perfusion vacation begins
			CHP	Sat	June	22	
			CHP	Wed	June	26	Last Day of Arts and Sciences Classes
			CHP	Mon	July	1	Perfusion Classes Resume
			CHP/CON	Thurs	July	4	Independence Day Observed - No Classes
			CHP	Fri	July	12	Last Day of Classes for Medical Imaging BPS
			CHP	Fri	July	26	Last Day of Classes for Med Tech Jr, Medical Imaging Jr and Radiation Therapy Jr
			CHP	Fri	Aug	2	Last Day of Classes for PA, Medical Imaging BS Sr
			CHP/PH	Fri	Aug	9	Last Day of Classes for Behavioral Analysis, PH and PT
			CHP/CON	Fri	Aug	16	Last Day of Classes for Nursing, Perfusion and Respiratory Care
			CHP/CON/PH	Tues	Aug	20	Summer Semester Ends
			All	Fri	Aug	30	Degree Conferral for Summer Graduates

New York State Law - Section 224A

Students Unable to Attend Classes on Certain Days

1. No person shall be expelled or be refused admission as a student to an institution of higher education for the reason that he/she is unable, because of his/her religious beliefs, to attend classes or to participate in any examination, study or work requirements on a particular day or days.
2. Any student in an institution of higher education who is unable, because of his/her religious beliefs, to attend classes on a particular day or days shall, because of such absence on the particular day or days, be excused from any examination or any study or work requirements.
3. It shall be the responsibility of the faculty and of the administrative officials of each institution of higher education to make available to each student who is absent from school, because of religious beliefs, an equivalent opportunity to make up any examination, study, or work requirements which he may have missed because of such absence on any particular day or days. No fees of any kind shall be charged by the institution for making available to the said students such equivalent opportunity.
4. If classes, examinations, study or work requirements are held on Friday after four o'clock post meridian or on Saturday, similar or makeup classes, examinations, study, or work requirements shall be made available on other days, where it is possible and practicable to do so. No special fees shall be charged to the student or these classes, examinations, study, or work requirements held on other days.
5. If effectuating the provisions of this section, it shall be the duty of the faculty and of the administrative officials of each institution of higher education to exercise the fullest measure of good faith. No adverse or prejudicial effects shall result to any student because of his availing himself/herself of the provisions of this section.
6. A copy of this section shall be published by each institution of higher education in the catalog of such institution containing the listing of available courses. It shall be the responsibility of the administrative officials of each institution of higher education to give written notice to students of their rights under this section, informing them that each student who is absent from school, because of his/her religious beliefs, must be given an equivalent opportunity to register for classes or make-up any examination, study or work requirements which he/she may have missed because of such absence on any particular day or days. No fees of any kind shall be charged by the institution for making available to such student such equivalent opportunity.
7. As used in this section, the term "institution of higher education" shall mean schools under the control of the board of trustees of the State University of New York or the board of higher education of the city of New York or any community college.

Registration Information & Instructions

1. **Check your account for holds:** [Log into MyUpstate](#) > Select “Student Academic Information” tab at the top > Select “Student Academic Information” > Select “View Holds on Your Student Record.” If you have holds on your account, you must clear them with the appropriate office before you will be allowed to register – so check early!
2. **Students will be automatically enrolled for all required core courses (i.e. variable credit research, seminar, grant writing, ethics, foundations, etc.) for the upcoming semester.** Block registration occurs twice each year – fall registration will begin in July & spring registration will begin in November. Please note that students who maintain holds on their account at the time of registration will not be enrolled.
3. **Review Your Schedule in MyUpstate:** To view your schedule log onto [MyUpstate](#), go to the “Student Academic Information” tab, then click on “Course Enrollment” link. Click on “Student Detail Schedule” and select the desired term and push submit.
4. **Run Your Online Degree Audit:** To run your online degree audit, log into [Degree Works](#). Please make note of any outstanding requirements to be completed – paying special attention to advanced courses or elective credits you may need to satisfy the degree/program requirements – you will need to manually add these to your enrollment in MyUpstate. *If you would like to discuss, please feel free to [Schedule a Course Registration & Enrollment Appointment](#) with the CGS Program Coordinator. You may also consider reaching out to your Program Director.*
5. **Review the [Course Schedule](#) for the upcoming term (as applicable):** If you have outstanding requirements to be met or if you just want to take some exploratory electives, you can review the course schedule in MyUpstate to identify what advances courses and electives are running this term.
6. **Make Additional Changes to Your Enrollment in MyUpstate (as applicable):** If you would like to add additional courses to your enrollment, you may do so now in MyUpstate - no Alt PIN Number is required. *Please note that students should be registered for 12 credits. If you are adding credits, you may need to decrease your variable credit research by the respective amount.*

Fall 2023: Deadline to Register – Friday, August 18, 2023

Spring 2023: Deadline to Register – December 1, 2023

Registration Policies & Procedures

- Students with holds on their account may register with an Add/Drop Form once their hold is cleared.
- Students not registered before the end of open enrollment will be required to pay a late fee.
- To receive graduate credit for a course, you must formally enroll each semester.
- Students can make changes to their course enrollment online during registration. After that, students may enroll or make changes to their enrollment with an [Add/Drop Form](#) during Open Enrollment.
- If you intend to audit a course, you must complete a [Course Audit Form](#) prior to the first day of class.
- Changes to your course enrollment after open enrollment will incur a late fee.
- A course cannot be added after 20% of the course has been completed.
- A course dropped before one-third of the course, will not be recorded on your transcript. However, a course dropped after the one-third mark will be reflected on the transcript.
- The decision to change the credit status of a course (from credit to audit or vice versa) must be made before 20% of the course is completed. This change is reflected on an Add/Drop Form and must be approved by the student's advisor, course instructor, Program Director and the College of Graduate Studies.
- To receive a tuition waiver, PhD students must be registered full time each semester. PhD students in their first year must be registered for nine (9) credits or more. PhD students in and beyond year two must be enrolled for 12 credits.

The course registration form should be completed by you and signed by your advisor. Indicate number(s) and title(s) of course(s), where taken (SUNY, SU, SUNYESF). Graduate students who intend to register for classes at SU and/or the SUNY ESF are also required to register there. Special registration packets for these schools are available in the Graduate Studies Office, Weiskotten Hall, Room 3114.

Add/Drop actions for SUNY Upstate Medical University must be channeled through the SUNY Upstate Medical University College of Graduate Studies. [Please note add/drop dates on academic calendar in front of book]

ID Cards

ID cards are issued or validated in the PAYROLL OFFICE located in Jacobsen Hall, Room 100, on the day of registration. Proof of tuition payment is required.

Car Registration and Parking

Car registration and the issuance of parking permits is completed at the Parking Office which is located in the University Hospital, Room 1801. Car registration and ID cards will be required for verification. The Parking Office is open Monday through Friday, from 7AM to 4PM.

Student Health

The college has a student health service which is located on the fourth floor of Jacobson Hall. A description of the services available through Student Health is in the ***Student Handbook*** which is available online: www.upstate.edu/currentstudents/support.

Health Insurance

Health Insurance coverage is mandatory for all students.

Veteran's Educational Benefits

Students eligible for VA benefits should contact Ms. Jennifer Martin-Tse, Registrar, SUNY Upstate Medical University at Syracuse, 155 Elizabeth Blackwell Street, Room 203, Syracuse, NY 13210 (315-464-4604).

Special Students (Non-matriculated)

To be eligible for registration in a graduate course as a "special" or "non-matriculated" student, the student should be employed at the Upstate Medical University or be a student in one of the Center's academic programs (approval of program director or supervisor is required) or obtain permission by the Course Director.

Agreement between United University Professions and the State of New York 1982- 85: Article 36.1 Program for Tuition Assistance

The State agrees to continue the existing Tuition Assistance Program using a “space available” concept. When space is available, employees may enroll in a course on a tuition free basis, subject to the following requirements:

1. The University determines when space is available, recognizing that such determination must be made in sufficient time to permit enrollment by employees.
2. Employees must meet course prerequisites.
3. All fees other than tuition shall be paid by employees.
4. Employees may enroll in a MAXIMUM of one course per semester in special session, for example, summer session and intersession.
5. Minimum enrollment requirements established by the university as a necessary condition for offering a course shall not be affected by students interested in enrolling in a course on a space available basis.
6. The program shall continue for the term of the agreement.

Syracuse University (SU) and SUNY ESF Students

Permission is required of your home college advisor(s) and the course instructor(s) of the College of Graduate Studies, SUNY Upstate Medical University.

Prior to registering at your home college, appropriate SUNY registration forms need to be completed. They are available at the Office of Graduate Studies, 766 Irving Avenue, Room 3114, Syracuse, NY 13210.

Instructions concerning payment of tuition for SUNY Upstate Medical University courses are listed in the Syracuse University Registration Booklet.

ADD/DROP actions for Syracuse University must be channeled through the SUNY Office of Graduate Studies.

Family Educational Rights and Privacy Act

The Family Educational Rights and Privacy Act of 1974 requires us to make provisions for complying with Section 99.5, “Directory Information.” Directory information is defined as information which may be released to the public. If a student wishes to restrict the release of directory information, s/he should indicate any restrictions at the time of registration. Directory information includes all of the following:

Name

Address

Telephone Number

Date/Place of Birth

Program of Study Dates

of Attendance

Degrees/Awards Received from the most recent previous educational agency or institution attended

The enclosed registration form (computer data sheet) complies with the above Family Educational Rights and Privacy Act. Please present your registration form along with the (multi-part) course registration form and biographical data sheet (incoming or special, non- matriculated students only) when you come to the Registration Desk.

The College of Graduate Studies educates students to be biomedical research scientists, preparing them for careers in academic medical centers, colleges and universities, biomedical research institutes, the biotechnology industry, and government agencies. The College educates graduate students through its six biomedical science programs, awarding PhD degrees and MS degrees as noted:

- Anatomy: MS
- Anatomy and Cell Biology: PhD
- Biochemistry: MS
- Biochemistry and Molecular Biology: PhD
- Microbiology: MS
- Microbiology and Immunology: PhD
- Neuroscience: PhD
- Pharmacology: MS and PhD
- Physiology: MS and PhD*

**Not accepting students at this time.*

The MD/PhD program at SUNY Upstate Medical University is designed for college graduates who seek the medical training and advanced research skills required for careers in academic medicine and medical research. This eight-year, dual - degree program combines our medical school (College of Medicine) with our graduate school in biomedical sciences (College of Graduate Studies).

Degree and Program Overview

Doctoral Degree

www.upstate.edu/grad/curriculum/phd_degrees.php

The PhD degree – including research, didactic course work and successful defense of a dissertation – is intended to be completed in four to six years.

First Year: All first-year students participate in three lab rotations of their choosing. Lab rotations give students exposure to diverse research environments and help them select a mentor with whom to do their dissertation research. To help students select their rotation labs, the college offers the Graduate Student Research Opportunities course during the first three weeks. In this course, representatives from each of the six biomedical sciences programs describe the research interests of their faculty members. A faculty advisor also helps students select their rotation labs. All first-year students also participate in a core curriculum designed to provide a broad-based education in the biomedical sciences. The first-year core curriculum courses are: Foundations of Molecular and Cellular Biology, covering fundamental and advanced topics in biochemistry, molecular biology and cell biology; experimental design and analysis, introducing the basic principles of biostats for research; and Journal Club where students practice analyzing papers and giving oral presentations. Beginning in January, students take electives. By the end of the spring semester, students begin focusing on research. Students select a mentor and become affiliated with their mentor's degree granting program at the end of the first year.

Second Year: By the start of the second year, most PhD students have begun work on the research project that will lead to their dissertation. During this year, students take the Responsible Conduct of Scientific Research course, which examines research ethics and the moral and philosophical issues confronting scientists and continue to take electives based on their research interests as well as courses required by their program. All students take a program specific grant writing course. Students pass a qualifying exam to become candidates for the doctoral degree. This exam is scheduled by the end of the second year.

Later Years: In their second year, students put together a dissertation advisory committee, comprised of three to six faculty members from different departments. The committee meets every six months to review the student's progress, make suggestions and provide direction. To assist in the guidance of a student's career planning, the student and advisor develop a career development plan which is updated and shared annually with the advisory committee to help a student meet their planned goal. After completing their research projects, students write a dissertation and defend it before a dissertation defense committee.

Master's Degree

www.upstate.edu/grad/curriculum/masters.php

The master's degree program typically takes two to three years to complete. Master's students participate in selected parts of the core curriculum along with PhD students. However, unlike PhD students who usually affiliate with a degree-granting program at the end of their first year, master's students join a degree-granting program from the start. Master's students write and defend a thesis, but they do not take a qualifying exam.

Additional required courses are determined by degree granting program and the advisor.

MD/PhD Program

www.upstate.edu/mdphd/curriculum/index.php

Upstate Medical University's MD/PhD Program is designed for individuals interested in pursuing a career as physician-scientists in academic medicine. During the students first two years of training students complete required courses in the College of Medicine curriculum (see College of Medicine section of the Academic Catalogue). They then advance into the laboratory where they spend three to four years completing additional coursework and dissertation research under the guidance of one of the faculty members in College of Graduate Studies. The time in the laboratory culminates with the defense of the doctoral dissertation, after which students re-enter the College of Medicine to complete their training in the required clinical clerkships and electives. The total time spent in the program should be no more than eight years. Throughout the training students will also participate in MD/PhD specific coursework and activities.

Annual stipends and tuition scholarships are provided for students during enrollment in the MD/PhD program.

MD/PhD students may receive up to but no more than 12 elective credits in the College of Medicine (COM) for research which will count toward fulfilling the COM graduation requirement of 25 elective credits. MD/PhD students must apply for this research credit; please see the Student Handbook for details. Alternatively, MD/PhD students are eligible to apply up to 9 credits from the Grand Rounds Course towards College of Medicine elective credits (see above).

There can be 24 credits transferred from the COM to the College of Graduate Studies (CGS). These credits are based on criteria set forth by the Graduate Programs, the Dean of College of Graduate Studies, and the MD/PhD Program Co-directors. The courses transferred are those that fulfill the CGS core curriculum and correlate with the degree-granting program in which the student is enrolled.

The MD/PhD Grand Rounds course is a required course for all students in all years of the program. MD/PhD students in the first year of their PhD are required to take the MD/PhD grant writing course.

For MD/PhD course descriptions, see page 39.

Prior to graduation from the program each student must have at least one accepted first-author publication of experimental data from their dissertation work in a peer-reviewed journal.

GRADUATE STUDIES CORE CURRICULUM COURSE DESCRIPTIONS

GS604 Graduate Student Research Opportunities

1 Credit Hours

Course Coordinator(s):

Dean, College of Graduate Studies

Semester Offered: Fall

Course Description: With one full afternoon per program, each of the six PhD training programs will describe its currently active research projects. This description will be presented in a format which the program's faculty feels best displays all its research activities. Two major goals of these presentations are to: 1) acquaint the incoming graduate students with the breadth of research being pursued within each graduate program, and 2) to thereby give the incoming graduate students further information upon which to base their own choice of research area and advisor for their dissertations.

Prerequisites: None.

Textbook(s): None.

GS612 Biomedical Sciences Laboratory Rotations

2 Credit Hours/Rotation

Course Coordinator(s):

Dean, College of Graduate Studies

Semester Offered: Year-round

Course Description: The purpose of the rotation is to learn new research skills and more about the research of a potential dissertation advisor, and to potentially lay the groundwork for a future dissertation. Biomedical Sciences PhD students are required to do three laboratory rotations, taken consecutively, in the first year. Rotations begin approximately September, January and March. An optional fourth rotation in the summer may be taken. MD/PhD students are required to do two laboratory rotations, one each summer prior to their medical school years one and two (an optional third rotation may be taken). Written report due to Advisor at the end of each rotation.

Prerequisites: None.

Textbook(s): None.

GS616 Foundations of Molecular and Cellular Biology

3 Credit Hours

Course Coordinator(s):

Dr. Stephan Wilkens Dr.
Brian Howell

Dr. Jeffrey Amack

Semester Offered: Fall

Course Description: This course provides a comprehensive background for students in the Biomedical Sciences Program. It covers fundamental and advanced topics in biochemistry, molecular biology, and cell biology. Lectures and discussions are based on primary research articles, reference books, and lecture notes. Major divisions of the course are 1) properties of biomolecules, 2) cell organization and regulation, and 3) cell function.

Prerequisites: None.

Textbook(s): None.

GS637 Responsible Conduct of Scientific Research (Research Ethics)

2 Credit Hours

Course Coordinator(s):

Sarah Reckess, JD

Dr. Jennifer Moffat

Semester Offered: Fall

Course Description: The faculty instructors participate in lecture and discussion with the students. The lecture topics include Authorship, Peer Review and Plagiarism, Conflicts of Interest, Policies on Research Misconduct, Human Subjects, Animal Subjects, and Intellectual Property.

Prerequisites: None.

Textbook(s): Francis L. Macrina, *Scientific Integrity*, 4th edition

GS690 Experimental Design and Analysis

2 Credit Hours

Course Coordinator(s):

Dr. Michael Zuber

Semester Offered: Fall

Course Description: Principles of experimental design and analysis using a mixed approach of online and in person instruction. The course would use examples from literature and faculty labs. Statistical methodology used in biomedical research using GraphPad Prism and Minitab will be covered. During the last 3 weeks students would prepare and present a project about the skills learned in the course.

Prerequisites: None.

Textbook(s): None.

GS892 Introduction to the Presentation and Analysis of Scientific Literature: Journal Club

1 Credit Hour

Course Coordinator(s):

Dr. Samuel Herberg

Semester Offered: Fall

Course Description: This course gives students the opportunity to read, critically evaluate, and present research articles in a variety of fields. During this course, students are expected to develop a high standard of scientific analysis and good public presentation skills. At the beginning of the semester, students will be assigned to one of four subgroups according to their preference and available space. The topic areas are determined by the instructors and each subgroup will operate independently. Students will be required to present one assigned research paper. When not presenting, students will be expected to critically read the paper and submit questions in advance, and to actively participate in class discussions. Students will also gain experience in peer-review by submitting comments to the presenter on strengths and weaknesses of each presentation. This course is required for all first year graduate students in the fall semester, but, if space is available, it is also offered as an elective for advanced students.

Prerequisites: None.

Textbook(s): None.

**For additional Graduate Studies general electives, see course descriptions listed on page 38-40.*

BIOCHEMISTRY AND MOLECULAR BIOLOGY PROGRAM AND DEGREE REQUIREMENTS

CIP Code: 26.0202

This program awards:

- PhD in Biochemistry and Molecular Biology
- MS in Biochemistry

Faculty researchers in Biochemistry and Molecular Biology seek to understand the molecular and cellular bases of human health and disease. They apply a broad range of tools ranging from those of structural biology and biophysics to cell biology and genetics. Faculty with expertise in X-ray crystallography, single-molecule electron microscopy, and spectroscopy investigate protein structure, folding, and interactions at the atomic level. Other faculty members employ modern genetics and genomic technologies to integrate the above information with in vivo studies to generate a broader understanding of cellular pathways and systems biology. This comprehensive strategy is reflected by the diverse approaches that our researchers take, from high-resolution structural and single-molecule studies to the use of animals and single-celled organisms to model disease processes and development. Areas of focus in the Department of Biochemistry and Molecular Biology include membrane and transport protein structure and function, DNA replication and transcription, cellular responses to stress, epigenetics and energy metabolism. These studies impact disorders from cancer to neurodegenerative diseases to pathogenic infections. Our program boasts a robust and long-standing record of extramural funding, particularly from the National Institutes of Health.

PhD Degree Requirements:

Required Graduate Courses:

GS604	Graduate Student Research Opportunities
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
GS637	Responsible Conduct of Scientific Research
GS612	Biomedical Sciences Laboratory Rotations (x3)
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club
B617	Methods of Biochemistry and Molecular Biology Research
B620	Biochemistry Seminar
B648	Research Design in Biochemistry and Molecular Biology
B650	Scientific Writing in Biochemistry

Electives: At least 6 credits of Advanced Biochemistry and Molecular Biology elective courses are required. (Note: GS628 Systems Biology of Genetics, Genomics, and Proteomics and PHA615 Apoptosis and Cancer Pharmacology are considered advanced Biochemistry and Molecular Biology courses for this purpose).

- Total 90 credit hours (a minimum of 30 Didactic Graduate Course credit hours and a minimum of 30 Research Graduate Course credit hours).
- Qualifying Examination (to be scheduled before or during the summer following the student's second year)
- Dissertation Advisory Committee Meetings and Department Research Talk (minimum of one meeting every six months)
- Successful Dissertation Defense

MS Degree Requirements:

Required Graduate Courses:

GS604	Graduate Student Research Opportunities
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
GS637	Responsible Conduct of Scientific Research
B609	Biochemistry & Molecular Biology Rotations
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club
B620	Biochemistry Seminar

Electives: At least 3 credits of Advanced Biochemistry and Molecular Biology elective courses are required.

- Total 30 credit hours (a minimum of 20 Didactic Graduate Course credit hours and a minimum of 10 Research Graduate Course credit hours).
- MS Thesis Committee Meetings (minimum of two meetings per year)
- Successful Thesis Defense

BIOCHEMISTRY AND MOLECULAR BIOLOGY COURSE DESCRIPTIONS

B617 Methods of Biochemistry and Molecular Biology Research

Variable Credit Hours

Course Coordinator(s):

Dr. Patricia Kane

Semester Offered: By arrangement only

Course Description: Course provides an individualized laboratory experience for students who have not yet completed their qualifying exam. Topics are determined by student and faculty sponsor. Generally taken between rotations and qualifying exam to fulfill credit requirements.

Prerequisites: GS612.

Textbook(s): None.

B620 Biochemistry Seminar

0 Credit Hours

Course Coordinator(s):

Dr. Xin Jie Chen

Semester Offered: Year-round

Course Description: Presentations of recent research activities by invited speakers and department members.

Prerequisites: None.

Textbook(s): None.

B638 Independent Study in Biochemistry and Molecular Biology

1 – 2 Variable Credit Hours

Course Coordinator(s):

Dr. Patricia Kane

Semester Offered: Year-round

Course Description: A tutorial course designed for graduate students in biochemistry, or related disciplines that will involve in-depth review of recent developments in biochemical research. May include 1) literature searches, 2) seminar and/or lectures, 3) hands on experience with new techniques available in the department, and 4) a written report. The purpose of the course is to develop a broad knowledge of the biochemical literature as the student advances in his/her more defined research goals.

Prerequisites: General biochemistry or equivalent.

Textbook(s): None.

B647 Gene Expression and Epigenetic Regulation

2 Credit Hours

Course Coordinator(s):

Dr. Michael Cosgrove

Dr. Bruce Knutson

Semester Offered: Spring, even years

Course Description: Gene expression is a fundamental process in all living organisms. Regulation of gene expression determines cell type during development and is required for cells to carry out their functions in response to nutritional, hormonal and environmental signals. At the heart of gene expression is the process of transcribing DNA into RNA. In this course, we will discuss the detailed mechanisms of transcription with a particular emphasis on the role of epigenetic modifications of chromatin in the regulation of transcription. We will use knowledge obtained from the study of a variety of model organisms to illustrate the basic concepts that are conserved throughout evolution, including (but not limited to) the role of histone modifications, chromatin remodeling, the CTD code, non-coding regulatory RNAs, and mechanisms of cell memory. In addition, we will discuss the role of epigenetic mechanisms in imprinting, iPS cell reprogramming, and human disease. The course is organized into both lecture and discussion groups, with opportunities for student participation and presentations. Readings will include contemporary studies from the published literature.

Prerequisites: None.

Textbook(s): None.

B648 Research Design in Biochemistry and Molecular Biology

3 Credit Hours

Course Coordinator(s):

Dr. Patricia Kane

Semester Offered: Spring

Course Description: This course promotes the development of critical thinking, experimental design and scientific writing important to the students' future career as scientists. The students will develop an original dissertation research project, present their project aims in a "chalk talk", and prepare the plan in a formal hypothesis-based research proposal. Students will learn the essential features of grant writing, with the emphasis on developing skills necessary for effectively designing communicating their research.

Prerequisites: General biochemistry or equivalent and with course coordinator approval.

Textbook(s): None.

B650 Scientific Writing in Biochemistry

1 Credit Hour

Course Coordinator(s):

Dr. Stewart Loh

Semester Offered: Fall

Course Description: This course is required in the second year for all students performing their thesis research in the Department of Biochemistry and Molecular Biology. The purpose is to prepare students for writing scientific papers, grant proposals, peer reviews, and written components of qualifying exams. Each of the 4-6 program instructors will assign the student a writing task that emphasizes an aspect of composition, e.g., critical evaluation of scientific literature, ability to summarize scientific concepts clearly and succinctly, sentence and paragraph structure, or other elements of style. Students will have 10 days to write the first draft, meet with the instructor one-on-one, and submit the final draft. Grading is satisfactory/unsatisfactory.

Prerequisites: First year core curriculum.

Textbook(s): None.

B664 Protein Sorting & Vesicular Trafficking

1 Credit Hour

Course Coordinator(s):

Dr. Patricia Kane

Semester Offered: Spring, even years

Course Description: The current literature is used to analyze recent discoveries and controversies in protein sorting and trafficking. After an initial review of core material related to the topic, students are assigned papers to read in advance of each class along with questions to think about in relation to the reading assignment. Each class consists of a student presentation(s) of the assigned paper(s) and class discussion of the readings. Grading is based on presentation and class participation.

Prerequisites: GS616 or permission of instructor.

Textbook(s): None.

B665 Bioenergetics and Metabolism

1 Credit Hours

Course Coordinator(s):

Dr. Xin Jie Chen

Semester Offered: Spring, odd years

Course Description: This course is taught by Biochemistry and affiliated faculty specialized in bioenergetics, metabolism and metabolic signaling. Using both lecture and student-driven discussions, basic principles of metabolism will be discussed and applied in a variety of disease states. The course covers topics including mitochondrial signaling, energy metabolism, nutrient and energy sensing, pH

homeostasis, cell signaling in cancer, hypoxia signaling, and oncometabolites in epigenetic regulation.

Prerequisites: None.

Textbook(s): None.

B666 Protein Structure Determination

2 Credit Hours

Course Coordinator(s):

Dr. Stephan Wilkens

Semester Offered: Fall, even years

Course Description: The primary literature and lecture handouts will be used to cover advanced topics in structure determination and dynamics of biological macromolecules. Topics include structure and dynamics by X-ray crystallography, nuclear magnetic resonance (NMR) spectroscopy, cryo electron microscopy, optical super resolution microscopy, fluorescence and circular dichroism spectroscopy, mass spectrometry, analytical ultracentrifugation, and computational methods. Emphasis is placed on how structure and dynamics of proteins relates to their function and mechanism. Grading is based on homework assignments, paper presentation, and class participation.

Prerequisites: None.

Textbook(s): None.

B669 FIJI Bootcamp: What you can and cannot do in quantitative image analysis

1 Credit Hour

Course Coordinator(s):

Dr. Jessica Ridilla

Semester Offered: Fall

Course Description: The objective of this course is to develop skills for critically evaluating scientific images and to when and why to perform several basic analyses for movies and images collected on light microscopes. This course uses the powerful (open source) image analysis program FIJI (Fiji is just ImageJ) to apply basic image acquisition and quantification principles to scientific data (digital images).

Prerequisites: None.

Textbook(s): None

B700 Research in Biochemistry

Variable Credit Hours

Course Coordinator(s):

Dr. Patricia Kane

Semester Offered: Year-round

Course Description: Original thesis research in the field of Biochemistry under the supervision of a member of the staff.

Prerequisites: None.

Textbook(s): None.

CELL AND DEVELOPMENTAL BIOLOGY PROGRAM AND DEGREE REQUIREMENTS

CIP Code: 26.0601

This program awards:

- PhD in Anatomy and Cell Biology
- MS in Anatomy

Research in the Department of Cell and Developmental Biology explores the molecular and biochemical mechanisms of cellular function and development. Faculty researchers in the department have funding for fundamental studies of: proteins and structures responsible for the assembly and dynamics of myofibrils; the genetics and cell biology of heart formation; the role of class I myosins in kidney functions; the mechanisms of actin assembly during endocytosis; the role of cell adhesion in regulating the cytoskeleton and cell motility in normal and cancerous cells; integrin regulation of the actin cytoskeleton; research on neural plasticity and spinal cord injury; the role of formins in the assembly of the actin cytoskeleton; the identification of genes important for the assembly and motility of cilia; the interface between cytoskeletal dynamics, mitotic signaling, and membrane transport during cell division. Models used in the research include: zebrafish, avian embryos, the alga *C. reinhardtii*, cell culture lines, *C. elegans*, the yeast *S. pombe*, rats and mice. Students and faculty use a variety of research methods including sophisticated light microscopy (laser scanning confocal microscopy, spinning disc confocal microscopy, wide field deconvolution imaging, real-time fluorescence microscopy, TIRF microscopy), high-sensitivity digital cameras and image processing, electron microscopy, tissue culture, stereotactic surgery, and a complete range of molecular and biochemical techniques.

PhD Degree Requirements:

Required Graduate Courses:

GS604	Graduate Student Research Opportunities
A617	Methods of Cell and Developmental Research Biology
A624	Seminar in Cell and Developmental Biology
GS612	Biomedical Sciences Lab Rotations (x3)
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
GS637	Responsible Conduct of Scientific Research
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club

Electives:

GS628	Systems Biology of Genetics, Genomics, Proteomics
A613	Graduate Cellular Anatomy
A614	Contemporary Cellular, Molecular, and Developmental Biology
A615.5	Teaching in Graduate Cellular Anatomy
A621	Neuroanatomy Lab
A622	Developmental Biology
B647	Gene Expression and Epigenetic Regulation
B664	Protein Sorting and Vesicular Trafficking
B666	Protein Structure Determination
N620	Advanced Topics in Receptors and Cell Signaling
N623	Systems Neuroscience
PHA615	Apoptosis and Cancer Pharmacology

- Total 90 credit hours (a minimum of 30 Didactic Graduate Course credit hours and a minimum of 30 Research Graduate Course credit hours).
- Qualifying Examination (to be completed by the end of the second year)
- 30 min Departmental Seminar (to be presented within 6 mos. of qualifying exam)
- Department Seminar Series (attendance required at all seminars)
- Dissertation Advisory Committee Meetings (minimum of one meeting every six months)
- Successful Dissertation Defense

MS Degree Requirements:

Required Graduate Courses:

GS604	Graduate Student Research Opportunities
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
A624	Seminar in Cell and Developmental Biology
GS637	Responsible Conduct of Scientific Research
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club

Electives:

GS628	Systems Biology of Genetics, Genomics Proteomics
A613	Graduate Cellular Anatomy
A614	Contemporary Cellular, Molecular, and Developmental Biology
A617	Methods of Cell and Developmental Research
A621	Neuroanatomy Lab
A622	Developmental Biology
B664	Protein Sorting and Vesicular Trafficking
B666	Protein Structure Determination
N620	Advanced Topics in Receptors and Cell Signaling
N623	Systems Neuroscience
PHA615	Apoptosis and Cancer Pharmacology

- Total 30 credit hours (a minimum of 20 Didactic Graduate Course credit hours and a minimum of 10 Research Graduate Course credit hours).
- Department Seminar Series
- Successful Thesis Defense

CELL AND DEVELOPMENTAL BIOLOGY COURSE DESCRIPTIONS

A613 Graduate Cellular Anatomy

2 Credit Hours

Course Coordinator(s):

Dr. Vladimir Sirotkin

Semester Offered: Spring, even years

Course Description: Graduate Cellular Anatomy provides an opportunity for graduate students to independently visualize cells, tissues, and organs of the human body by direct light-microscopic observation of prepared histologic specimens and develop their teaching and presentation skills. Introductory lectures on the histology of the basic tissue types will be followed by a guided laboratory session where each student will use their own university microscope to explore these tissue types. Course participants will select organ systems of interest and prepare presentations on the histology of those organ systems and present it to the class. Student presentations will also be followed by a laboratory session for students to explore that organ system.

Prerequisites: First year core curriculum.

Textbook(s): A combined text and color atlas of histology (examples Junquiera, Ross, Wheater, or Kerr).

A614 Contemporary Cellular, Molecular and Developmental Biology

2 Credit Hours

Course Coordinator(s):

Dr. Jeffrey Amack

Semester Offered: Fall, odd years

Course Description: Lectures, student presentations, and discussions dealing with cellular and molecular mechanisms during embryonic development. Classical as well as contemporary concepts will be emphasized.

Prerequisites: A622 or with course coordinator approval.

Textbook(s): None.

A615.5 Teaching in Graduate Cellular Anatomy

2 Credit Hours

Course Coordinator(s):

Dr. Vladimir Sirotkin

Semester Offered: By arrangement only

Course Description: This course will provide an opportunity for graduate students to teach a graduate level course through assisting the faculty instructors of Graduate Cellular Anatomy.

Prerequisites: A517 or A613.

Textbook(s): None.

A617 Methods of Cell and Developmental Research

Variable Credit Hours

Course Coordinator(s):

Dr. Margaret Maimone

Semester Offered: By arrangement only

Course Description: Methods of research used by the faculty are demonstrated. Problem design and research methods emphasized.

Prerequisites: Course coordinator approval.

Textbook(s): None.

A621 Neuroanatomy Lab

2 Credit Hours

Course Coordinator(s):

Dr. Dana Mihaila

Semester Offered: Fall

Course Description: Using a case-based format, this course will provide students an appreciation for the structure and three-dimensional organization of the central nervous system including external and internal anatomy of the central nervous system, functional organization and interconnections of the major brain pathways.

Prerequisites: None.

Textbook(s): *Neuroscience, 6th edition*, Purves et. al, Sinauer Associates, Sunderland, MA, 2018. & *Neuroanatomy in clinical context, 10th edition*, Haines, Duane E., Lippincott Williams & Wilkins, Philadelphia, 2019.

A622 Developmental Biology

2 Credit Hours

Course Coordinator(s):

Dr. Jeffrey Amack

Semester Offered: Spring, odd years

Course Description: This is an introductory graduate course in developmental biology. The course will have two 90-minute sessions per week for 10 weeks. A team of faculty with a broad range of expertise will give lectures that introduce key concepts in developmental biology. In addition, faculty will moderate discussions of primary literature. Each student will give one Journal Club-style presentation of an assigned research article. Grades will be based on effectiveness of the presentation, performance on short quizzes, and participation in class discussions.

Prerequisites: GS616.

Textbook(s): Scott Gilbert, *Developmental Biology*, 10th edition.

A623 Grant Writing in Cell and Developmental Biology

2 Credit Hours

Course Coordinator(s):

Dr. Margaret Maimone

Semester Offered: Spring

Course Description: Faculty will provide an overview of grant writing style and mechanics and provide examples of grants written in common formats for private and government agencies. Students will write their own grants, limited to ten pages, excluding Abstract and Bibliography, and otherwise following the style of the current NIH R01 grant. Each mentor-student pair may follow their own timetable towards completion by semester's end. Students and mentors are encouraged to review writing progress and provide feedback frequently.

Prerequisites: GS616 and with course coordinator approval.

Textbook(s): None.

A624 Seminar in Cell and Developmental Biology

1 Credit Hour

Course Coordinator(s):

Dr. Christopher Turner

Semester Offered: Year-round

Course Description: Graduate students and faculty will meet throughout the year to participate in formal public seminars. Seminars will be given by invited speakers, faculty candidates, department faculty and students. Students are required to present a 30 minute seminar on their research within six months of passing their qualifying exam and at least one, 30 minute research seminar annually thereafter. Students will receive written, constructive feedback on their presentations from both faculty and students. It is recommended that student presentations are coordinated with their thesis advisory committee meetings, when possible. Students are also expected to meet with invited speakers over lunch to discuss their research as well as career development/opportunities.

Prerequisites: None.

Textbook(s): None.

A700 Research in Cell and Developmental Biology

Variable Credit Hours

Course Coordinator(s):

Dr. Margaret Maimone

Semester Offered: Year-round

Course Description: Original dissertation research in cell and developmental biology under faculty supervision.

Prerequisites: None.

Textbook(s): None.

MICROBIOLOGY AND IMMUNOLOGY PROGRAM AND DEGREE REQUIREMENTS

CIP Code: 26.0501

This program awards:

- PhD in Microbiology and Immunology
- MS in Microbiology

Major research areas in the Department of Microbiology and Immunology are in diseases caused by viruses, the host response to infection, and the development and function of the immune system. A range of viruses are studied, including dengue virus, cytomegalovirus, varicella zoster virus, and Zika virus. The focus of virology research is on pathogenesis, gene regulation, molecular interactions between the virus and host cell, and antiviral agents. Immunology research focuses on autoimmune diseases and the role of innate and adaptive immune responses in development, infectious disease and cancer. A major focus of our immunology research is immunoreceptor signaling. Research is conducted at the molecular, biochemical, genetic and population levels with goals of developing vaccines and therapeutics of infectious diseases and cancer.

PhD Requirements:

Required Graduate Courses:

First and Second Years:

GS604	Graduate Student Research Opportunities
GS612	Biomedical Sciences Laboratory Rotations (x3)
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club
GS637	Responsible Conduct of Scientific Research
M627	Introduction to Virology
M628	Introduction to Immunology
M616	Current Concepts in Virology*
M610	Advanced Immunology*
M630	Seminar in Microbiology and Immunology
M623	Directed Individual Study in Microbiological and Immunological Research Methods
M609	Grant Writing in Microbiology and Immunology

Third Year & Following Years:

M700	Research in Microbiology and Immunology
M630	Seminar in Microbiology and Immunology

**Students must take either 6 credits of both M616 and M610 or 3 credits of one of these advanced courses plus 3 credits of another advanced course offered by College of Graduate Studies degree-granting programs.*

- Total 90 credit hours (a minimum of 30 Didactic Graduate Course credit hours and a minimum of 30 Research Graduate Course credit hours).
- Qualifying Examination (to be scheduled by the end of the second year)
- Dissertation Advisory Committee – The committee must meet at least twice per year during the dissertation research period, and committee must sign-off on student's readiness to write & defend dissertation.
- Submission of First-Author (or Co-First-Author) Research Paper – Students in Microbiology and Immunology are required to submit at least one first-author or co-first-author research paper for publication prior to the Dissertation Defense.
- Successful Dissertation Defense

MS Requirements:

Required Graduate Courses:

First and Second Years:

GS604	Graduate Student Research Opportunities
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club
GS637	Responsible Conduct of Scientific Research
M627	Introduction to Virology
M628	Introduction to Immunology
M616	Current Concepts in Virology*
M610	Advanced Immunology*
M630	Seminar in Microbiology and Immunology
M623	Directed Individual Study in Microbiological and Immunological Research Methods

Electives:

M609	Grant Writing in Microbiology and Immunology
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**Either M616 for M610 is required.*

- Total 30 credit hours (a minimum of 20 Didactic Graduate Course credit hours and a minimum of 10 Research Graduate Course credit hours).
- Successful Thesis Defense

MICROBIOLOGY AND IMMUNOLOGY COURSE DESCRIPTIONS

M609 Grant Writing in Microbiology and Immunology

3 Credit Hours

Course Coordinator(s):

Dr. Gary Chan

Semester Offered: Spring

Course Description: Students will learn the essential features of writing research proposals, with an emphasis on the requirements of the NIH. In the first half of the course the principles of clear, unambiguous writing will be presented in lectures, accompanied by analysis of good and bad examples. In the second half of the course the students will meet regularly with the course instructor to review their assignments, which will then be revised as necessary in the final sessions of the course the students will meet as a group to review and discuss each other's proposals.

Prerequisites: Thesis advisor must be chosen.

Textbook(s): None.

M610 Advanced Immunology

3 Credit Hours

Course Coordinator(s):

Dr. Iwona Koenig

Semester Offered: Fall

Course Description: This is an advanced immunology course that will consist of a number of modules on special topics in immunology chosen by the faculty. Typically, the first session of each module will provide an overview of the topic, and the second session will be in the form a discussion of the current literature. Students will be asked to participate during the discussion sections. At the end of the semester, each student will give an oral presentation on a special topic of their choosing. Topics will vary with faculty interests, but have included innate immune, macrophage immunity, immunometabolism, T and B lymphocytes, tumor immunity, and autoimmunity.

Prerequisites: M628.

Textbook(s): Janeway's, *Immunobiology*, 9th edition.

M616 Current Concepts in Virology

3 Credit Hours

Course Coordinator(s):

Dr. Harry Taylor

Semester Offered: Spring

Course Description: The structure, function and replication of important virus groups will be studied. Current research topics and techniques will be reviewed, with an emphasis on molecular biology, viral pathogenesis, and anti-viral therapy.

Prerequisites: M627 or equivalent course of basic virology and GS616.

Textbook(s): None.

M623 Directed Individual Study In Microbiological and Immunological Research Methods

Variable Credit Hours

Course Coordinator(s):

Dr. Jennifer Moffat

Semester Offered: By arrangement only

Course Description: This is a special research training program designed to acquaint students with specific areas of research and/or use of methods, techniques, or instrumentation, as well as to introduce students intensively to the laboratory, and research approaches.

Prerequisites: Declaration in the Microbiology and Immunology program or with program director approval.

Textbook(s): None.

M626 Methods of Microbiology and Immunology Research

Variable Credit Hours

Course Coordinator(s):

Dr. Jennifer Moffat

Semester Offered: By arrangement only

Course Description: Methods of Research used by the faculty are demonstrated. Problem design and research methods are emphasized. Course deals with individualized laboratory experience. Topics agreed upon by student and faculty sponsor.

Prerequisites: GS612 or with course coordinator approval.

Textbook(s): None.

M627 Introduction to Virology

2 Credit Hours

Course Coordinator(s):

Dr. Jennifer Moffat

Semester Offered: Spring

Course Description: This is an introductory course in virology for graduate students. The objectives are to understand the structure and characteristics of viruses, their replication, interactions with the host, and applications in biomedical science. The material will be presented as online lectures viewed outside class time. Students will generate discussion questions that are addressed in class, which meets once for 2 hours weekly. Course grade is based on weekly quizzes and an oral presentation.

Prerequisites: At least one course in Biochemistry and Molecular Biology.

Textbook(s): S.J. Fint, et al., *Principles in Virology: Molecular Biology, Pathogenesis, and Control*, 4th edition (2017).

M628 Introduction to Immunology

2 Credit Hours

Course Coordinator(s):

Dr. Steven Taffet

Semester Offered: Spring

Course Description: This course is intended to be an introductory course in immunology for graduate students. The course goal is to develop a general understanding of immunology including both adaptive and innate immunity.

Prerequisites: At least one course in Biochemistry and Molecular Biology.

Textbook(s): K. Murphy and C. Weaver, Janeway's, *Immunobiology*, 9th edition.

M630 Seminar in Microbiology and Immunology

1 Credit Hour

Course Coordinator(s):

Dr. Eain Murphy

Semester Offered: Year-round

Course Description: Faculty and students will present their research work, in a selected subject area. Meetings will be once a week lasting 60 minutes per session.

Prerequisites: At least one microbiology and immunology course or with course coordinator approval.

Textbook(s): None.

M700 Research in Microbiology

Variable Credit Hours

Course Coordinator(s):

Dr. Jennifer Moffat

Semester Offered: Year-round

Course Description: Original research in microbiology for doctoral dissertation.

Prerequisites: None.

Textbook(s): None.

NEUROSCIENCE PROGRAM AND DEGREE REQUIREMENTS

CIP Code: 26.0608

This program awards:

- PhD in Neuroscience

The Neuroscience Graduate Program is a multidisciplinary program divided into three areas: Cell and Molecular Neuroscience, Development and Regeneration, and Systems Neuroscience. Program research relates to many human diseases and disorders, including fetal alcohol syndrome, retinitis pigmentosa, spinal cord injury, Alzheimer's, multiple sclerosis, cerebral palsy and amyotrophic lateral sclerosis (ALS). Research in Cell and Molecular Neuroscience group the regulation of gene expression in the nervous system, mechanisms of cell signaling and excitability within cells, and the molecular bases of neurological disease and disorders. Research topics in Development and Regeneration include the development of the mammalian cortex, regulation of gene expression during development, neuronal stem cells in the CNS and the eye, and mechanisms of regeneration in the retina, and the spinal cord. Research in Systems Neuroscience focuses on the neural mechanisms that underlie the functions of the olfactory system, the visual system, and motor systems in health and disease. Students can take advantage of a collaborative neuroscience program with neighboring Syracuse University.

PhD Requirements:

Required Didactic Courses (minimum of 30 credits):

The didactic credits requirement is satisfied through 15 credits of required GS coursework and 15 or more credits of Neuroscience courses (up to 2 credits of non-NS courses are accepted without petition).

Required Graduate Courses:

GS604	Graduate Student Research Opportunities
GS612	Biomedical Sciences Laboratory Rotations (x3) OR
N675	Research Rotations in Neuroscience (x3)
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club
N606	Laboratory Research in Neuroscience (Pre-Qual Research)
N701	Neuroscience Seminar
GS637	Responsible Conduct of Scientific Research
N601	Neuroscience
N627	Fundamentals in Grant and Fellowship Applications

Electives:

N605	Welcome to Neuroscience
N610	Topics in Developmental Neurobiology
N616	Topics in Vision I
N617	Methods of Neuroscience Research
N618	Topics in Vision II
N619	Neurobiology of Disease
N620	Advanced Topics in Receptors and Cell Signaling
N621	Neuroanatomy Lab (same as A621)
N623	Systems Neuroscience
N631	Topics in Neuroscience (only open to 1 st Year students)
N653	Topics in Cellular and Molecular Neurobiology

**Continued on next page*

- Total 90 credit hours (a minimum of 30 Didactic Graduate Course credit hours and a minimum of 30 Research Graduate Course credit hours).
- Qualifying Examination – to be completed by the end of the second year.
- Each student in the Neuroscience Graduate Program is required to attend the complete seminar series and to present a seminar to the members of the Program each year.
- Dissertation Advisory Committee Meetings (minimum of one meeting every six months).
- Successful Dissertation Defense

NEUROSCIENCE

COURSE DESCRIPTIONS

N601 Neuroscience

3 Credit Hours

Course Coordinator(s):

Dr. Frank Middleton

Dr. Dana Mihaila

Semester Offered: Spring

Course Description: In-depth exploration of the various components of the nervous system and how it produces behavior. Topics include: human and comparative neuroanatomy, neurons and their electrochemical properties, visual, sensory, and motor systems, homeostasis, and learning and memory.

Prerequisites: None.

Textbook(s): TBD.

N605 Welcome to Neuroscience

1 Credit Hour

Course Coordinator(s):

Dr. Eric Olson

Semester Offered: Spring

Course Description: The course will provide an introduction to cellular and molecular neuroscience, emphasizing concepts and intuitive understanding. The course will start with basic information on the anatomical organization of the nervous system and the structure of neuronal and glial cells. This will be followed with fundamental intuitions in electrophysiology and synaptic function and culminate in neuronal plasticity and synaptic basis of learning and memory. Students will have opportunities to enhance core competencies by presenting and discussing some of the landmark findings in neuroscience. Course performance will be assessed through weekly short quizzes and classroom participation.

Prerequisites: None.

Textbook(s): The Mind's Machine. Foundations of Brain and Behavior, 4th Edition, Watson and Breedlove, Sinauer Associates.

N606 Laboratory Research in Neuroscience

Variable up to 12 Credit Hours

Course Coordinator(s):

Dr. Rick Matthews

Semester Offered: By arrangement only

Course Description: Individualized laboratory experience around topics agreed upon by the student and a faculty sponsor. Emphasis is on experimental approaches and research methods used in the mentor's laboratory. Course applies to students who have joined the Neuroscience PhD Program but have not completed the Qualifying exam.

Prerequisites: GS612 or N675

Textbook(s): None.

N610 Topics in Developmental Neurobiology

2 Credit Hours

Course Coordinator(s):

Dr. Rick Matthews

Dr. Sijun Zhu

Semester Offered: Fall, even years

Course Description: This course will provide extensive, yet selective, exposure to major issues and events in the development of the nervous system. Topics include: Axis determination and early patterning, Developmental signals and gene regulation, Cell generation/proliferation, Cell migration and guidance, Cell death, Synaptogenesis, and Plasticity.

Prerequisites: N601.

Textbook(s): None.

N616 Topics in Vision I

3 Credit Hours

Course Coordinator(s):

Dr. Eduardo Solessio

Dr. William Brunken

Semester Offered: Fall, odd years

Course Description: The course is a comprehensive study of the eye and visual system. We will examine neuroanatomical, electrophysiological, developmental and evolutionary aspects of vision. The course is a combination of didactic lecture and problem-based learning. Course source material is largely from the original scientific literature. It is particularly appropriate for graduate students intending to conduct original research in the visual system.

Prerequisites: N601 Neuroscience is strongly recommended.

Textbook(s): None.

N617 Methods of Neuroscience Research

2 Credit Hours

Course Coordinator(s):

Dr. Peter Calvert

Semester Offered: Spring

Course Description: Survey of research methods in neuroscience. Course will include modules on the study of gene expression, morphology of neurons and glia cells, neuronal and glial function, behavior, networks, inheritance, etc. Emphasis is on experimental design, research protocols and data interpretations. Most modules will include both study of theory and actual hands-on practice through in-lab demonstrations of research methods.

Prerequisites: GS616.

Textbook(s): None.

N618 Topics in Vision II

2 Credit Hours

Course Coordinator(s):

Dr. Daniel Ts'o

Semester Offered: Spring, by arrangement only

Course Description: The course will examine neuroanatomical, electrophysiological, and psychophysical aspects of vision. This is primarily a readings course, with emphasis on original literature. It is particularly appropriate for graduate students intending to conduct original research in the visual system. This second half will focus on visual mechanisms beyond the level of the retina, focusing on the cortical contributions to visual processing and visually-guided behavior.

Prerequisites: N623 strongly encouraged.

Textbook(s): None.

N619 Neurobiology of Disease

2 Credit Hours

Course Coordinator(s):

Dr. Huaiyu Hu

Semester Offered: Fall, odd years

Course Description: This course is focused on the fundamental biological mechanisms of neurological and neuropsychiatric diseases such as Alzheimer's disease and schizophrenia.

Prerequisites: None.

Textbook(s): None

N620 Advanced Topics in Receptors and Cell Signaling

1 Credit Hour

Course Coordinator(s):

Dr. Brian Howell

Semester Offered: Fall

Course Description: This advanced course will cover a topic in receptors and cell signaling; for example, Netrin signaling, integrins and cell adhesion, tyrosine kinase-linked receptors, and scaffolding proteins. Topics will be covered by a combination of graduate student-specific lectures and tutorials, based on current research papers and associated reviews. Each topic will also include a take-home essay-type examination.

Prerequisites: First year core curriculum.

Textbook(s): None.

N621 Neuroanatomy Lab

2 Credit Hours

Course Coordinator(s):

Dr. Dana Mihaila

Semester Offered: Fall

Course Description: Using a case-based format, this course will provide students an appreciation for the structure and three-dimensional organization of the central nervous system including external and internal anatomy of the central nervous system, functional organization and interconnections of the major brain pathways.

Prerequisites: None.

Textbook(s): Neuroscience, 6th edition, Purves et. Al, Sinauer Associates, Sunderland, MA, 2018. & Neuroanatomy in clinical context, 10th edition, Haines, Duane E., Lippincott Williams & Wilkins, Philadelphia, 2019. & Essential Neuroscience, 3rd edition, Siegel A., and Sapru H.N., Lippincott, Williams & Wilkins, Philadelphia, PA, 2015.

N623 Systems Neuroscience

3 Credit Hours

Course Coordinator(s):

Dr. Daniel Ts'o

Semester Offered: Fall

Course Description: An exploration of issues and themes in systems neuroscience, focusing on the cooperativity of neurons in circuits, ensembles, representations and pathways, leading to sensation, perception, information processing, cognition and behavior. Course format includes lectures and discussion. Readings include selected textbook chapters and reviews as well as in-depth analysis of original literature. This is an introductory graduate level course that does not assume prior exposure to systems neuroscience

beyond the level of N507/N601.

Prerequisites: N507 or N601.

Textbook(s): Kandel, Schwartz et al. 5th Ed. "Principles of Neural Science".

N627 Fundamentals in Grant and Fellowship Applications

3 Credit Hours

Course Coordinator(s):

Dr. Mariano Viapiano

Semester Offered: Spring

Course Description: The primary goal of the course is to teach the rationale and preparation of a grant or fellowship application, using the current formats for NIH R-type grants and F-type fellowships. The course is divided into 3 major sections. An introductory section describes the structure of grant and fellowship applications as well as the process of review and discussion. In section 2, the students will prepare their own applications by working with the course coordinator and their own advisors, following an intensive schedule of written assignments that must be completed and reviewed within deadlines. In section 3, the students will learn the major components of an F-type fellowship application and will prepare their NIH-style biosketch. The course requires writing a mock-grant application package to be submitted for external reviews. The students must discuss the resulting reviews and submit a compiled and revised application to achieve a final passing grade. The final mock-grant application will be used by the students to prepare part of the written portion of their qualifying exam.

Prerequisites: Second year standing or equivalent, N601, N629 or equivalent experience in scientific writing.

Textbook(s): None.

N630 Independent Study in Neuroscience

1 – 3 Variable Credit Hours

Course Coordinator(s):

Dr. Francesca Pignoni

Semester Offered: By arrangement only

Course Description: A tutorial course designed for graduate students in neuroscience that provides an in-depth look at a field of neuroscience research.

Course will include: 1.) Literature survey, 2.) Seminar and/or lectures, 3.) In-depth critique of literature and/or experimental techniques. Fulfillment of the course requires a written report. The purpose of the course is to develop in-depth knowledge of a field of neuroscience research as a student continues to make progress towards his/her research goals.

Prerequisites: N601.

Textbook(s): None.

N631 Topics in Neuroscience

1 Credit Hour

Course Coordinator(s):

Dr. Rick Matthews

Semester Offered: Fall

Course Description: For first year students only, this is a survey course of current research in neuroscience. Members of the Neuroscience Faculty will present specific subfields of neuroscience research focusing on major questions and recent progress. Course will combine a basic introductory lecture (focused on major questions and techniques) with a discussion session to go over a recent research paper. Students will be required to submit written questions for, and actively participate in, the discussion session. The purpose of the course is to familiarize incoming students with major research questions and experimental approaches in neuroscience research.

Prerequisites: None.

Textbook(s): None.

N653 Topics in Cellular and Molecular Neurobiology

1 Credit Hours

Course Coordinator(s):

Dr. Brian Howell

Semester Offered: By arrangement only

Course Description: This course will discuss major issues in Molecular and Cellular Neurobiology, emphasizing contemporary approaches.

Prerequisites: First year core curriculum and N601.

Textbook(s): None.

N675 Research Rotations in Neuroscience

1-5 Variable Credit Hours

Course Coordinator(s):

Dr. Yingxi Lin

Semester Offered: By arrangement only

Course Description: Methods of research used by the faculty are demonstrated. Problem design and research methods emphasized. Course deals with individualized laboratory experience. Topics agreed upon by student and faculty sponsor.

Prerequisites: None.

Textbook(s): None.

N700 Research in Neuroscience

Variable Credit Hours

Course Coordinator(s):

Dr. Yingxi Lin

Semester Offered: Year-round

Course Description: Original dissertation research in Neuroscience under supervision of a Neuroscience faculty member and monitored by an advisory committee.

Prerequisites: None.

Textbook(s): None.

N701 Seminar in Neuroscience

1 Credit Hour

Course Coordinator(s):

Dr. Francesca Pignoni

Semester Offered: Year-round

Course Description: Weekly seminars will be given by invited speakers, faculty candidates, program faculty, and students. Students are required to present their first 30-minute seminar during their third year in graduate school (after passing their qualifying exam), and annually thereafter. Students will receive written, constructive feedback on their presentations from program faculty and fellow students. The coordination of the students' presentations with their thesis advisory committee meetings is strongly encouraged. Students are also expected to meet with invited speakers over lunch to discuss research (the speaker's/their own) and/or career-development topics. Grades will be based on attendance, participation (e.g., questions or comments), and performance (as speakers). All students must sign in at the seminar to record their attendance.

Prerequisites: None.

Textbook(s): None.

PHARMACOLOGY PROGRAM AND DEGREE REQUIREMENTS

This program awards:

- PhD in Pharmacology
- MS in Pharmacology

Current research in the Department of Pharmacology focuses on cancer biology, structure-based drug design, cell signaling, cardiovascular disease, neurodegeneration, stem cells, and the discovery, development and testing of novel therapeutics. This work is supported by external funding, particularly from NIH.

To continue this excellent tradition in research and teaching and to keep pace with ongoing changes in pharmacology, our department is enhancing its research strengths and expanding into new research areas.

PhD Requirements:

Required Graduate Courses:

GS604	Graduate Student Research Opportunities
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
GS612	Biomedical Sciences Lab Rotations (x3) OR
PHA653	Pharmacology Laboratory Rotations (x3)
GS637	Responsible Conduct of Scientific Research
PHA623	Grant Writing in Pharmacology
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club
PHA610	Principles of Pharmacology
PHA645	Pharmacology Seminar

Electives:

PHA612	Cardiovascular Physiology and Pharmacology*
PHA615	Apoptosis and Cancer Pharmacology*
PHA618	Current Topics of Pharmacology*
PHA622	Principles and Practices of Drug Discovery and Development*

**All Pharmacology PhD students must take a minimum of 4 advanced Pharmacology course credits (including credit hours for PHA610).*

- Total 90 credit hours (a minimum of 30 Didactic Graduate Course credit hours and a minimum of 30 Research Graduate Course credit hours).
- Qualifying Examination – to be taken late summer of student's second year
- Dissertation Advisory Committee Meetings (minimum of one meeting every six months)
- Successful Dissertation Defense

MS Degree Requirements:

Required Graduate Courses:

GS604	Graduate Student Research Opportunities
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
GS637	Responsible Conduct of Scientific Research
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club
PHA610	Principles of Pharmacology
PHA645	Pharmacology Seminar

Electives:

PHA612	Cardiovascular Physiology and Pharmacology*
PHA615	Apoptosis and Cancer Pharmacology*
PHA618	Current Topics of Pharmacology
PHA622	Principles and Practices of Drug Discovery and Development*
PHA623	Grant Writing in Pharmacology

**All MS students are required to take minimum of 4 advanced Pharmacology course credits (including credit hours for PHA610). Students can take other elective courses offered by the Department of Pharmacology or by other Departments to fulfill the didactic course requirement. Also, it is suggested that students take Methods of Pharmacology Research (PHA617) in the first year (no more than 4 credits).*

- Total 30 credit hours (a minimum of 20 Didactic Graduate Course credit hours and a minimum of 10 Research Graduate Course credit hours).
- Successful Thesis Defense

PHARMACOLOGY

COURSE DESCRIPTIONS

PHA610 Principles of Pharmacology

1 Credit Hour

Course Coordinator(s):

Dr. Hong Lu

Semester Offered: Fall

Course Description: Pharmacology is the study of how drugs react in living organisms, which is consisting of pharmacokinetics (what the body does to a drug) and pharmacodynamics (what the drug does to the body). Pharmacokinetics is the study of absorption, distribution, metabolism, and excretion of drugs (ADME). The physical, chemical and biochemical principles and the dosage (route, dose and frequency) determine the drug concentration at the site of action and the intensity of a drug's effects with time. The formulation of drugs can markedly alter the oral absorption and/or the delivery of drugs to their targeted sites of action. Certain physiological and pathological factors may modify the pharmacokinetics of drugs via altering drug ADME. Pharmacodynamics is the study of the mechanisms of action of drugs and their biochemical and physiological effects, whereas the study of the undesirable adverse effects of drugs is toxicology. In contrast, drug/substance abuse studies how excessive use of psychoactive drugs, such as alcohol, pain medications, or illegal drugs lead to physical, social, or emotional damage. Pharmacogenomics is the study of how acquired and inherited genetic variations affect individual's drug response. Finally, special areas of pharmacology will be introduced to illustrate the application of pharmacology principles in the treatment of diseases. These principles of pharmacology will be taught in twelve 1-hour lectures, complemented by two sections of student presentations on pharmacodynamics and pharmacokinetics. A minimum of two students must register for this course to be offered.

Prerequisites: First year core curriculum.

Textbook(s): None.

PHA612 Cardiovascular Physiology and Pharmacology

2 Credit Hour

Course Coordinator(s):

Dr. Arkadii Perzov

Semester Offered: Year-round

Course Description: This advanced course will

cover cardiac anatomy and physiology, basic mechanisms of cardiac arrhythmias, methods of diagnostics and treatment of cardiac diseases, and the mechanisms of action of antiarrhythmic drugs. The course will be run in a small discussion group format. The group will meet once a week to discuss a set of 4 - 5 topics formulated by the moderator. The students are expected to study the materials independently and be prepared to give a short presentation on any of the topics to the class as well as discuss it with other members of the group.

Prerequisites: First year core curriculum.

Textbook(s): None.

PHA615 Apoptosis and Cancer Pharmacology

2 Credit Hours

Course Coordinator(s):

Dr. M.Saeed Sheikh

Dr. Ying Huang

Semester Offered: Spring

Course Description: This advanced course will cover current concepts in cell death and cancer pharmacology, and will specifically address the molecular actions of anti-cancer agents with emphasis on death ligands/receptors, apoptotic machinery, tumor suppressor genes, oncogenes, molecular mechanisms of chemoprevention and anti-cancer drug resistance, novel anticancer drug targets and emerging anti-cancer therapies. It will consist of a combination of graduate student-specific lectures and tutorials.

Prerequisites: First year core curriculum.

Textbook(s): None.

PHA617 Methods of Pharmacology Research

Variable Credit Hours

Course Coordinator(s):

Dr. Juntao Luo

Semester Offered: By arrangement only

Course Description: Methods of research used by faculty are demonstrated. Problem design and research methods are emphasized.

Prerequisites: GS612.

Textbook(s): None.

PHA618 Current Topics in Pharmacology

1 Credit Hour

Course Coordinator(s):

Dr. Juntao Luo

Semester Offered: By arrangement only

Course Description: The purpose of this tutorial course is to develop a student's knowledge of Pharmacologic research as well as to provide an opportunity for focused study in areas of cell and molecular pharmacology not otherwise covered in the graduate curriculum. The course format may include selected readings, discussions with faculty, seminars, and lectures. Course content should be discussed with the faculty mentor prior to enrollment in the class, and a course outline with possible start and end dates should be prepared and approved by the Pharmacology Program Director.

Prerequisites: PHA610.

Textbook(s): None.

PHA622 Principles and Practices of Drug Discovery and Development

1 Credit Hour

Course Coordinator(s):

Dr. Juntao Luo

Semester Offered: Fall

Course Description: The course objective is to help students understand the overall process of drug discovery and development, structure-based drug design, combinatorial chemistry and high throughput screening in drug discovery, in vitro drug screening – identification and optimization of lead compound, mouse models for drug development, early safety and efficacy assessments, pharmacokinetics/ toxicology (PK/TOX) studies in drug development, and nanotechnology in drug delivery. Students will be expected to read literatures and think critically about the objectives and experimental designs of the various stages of drug development.

Prerequisites: Course coordinator approval.

Textbook(s): None.

PHA623 Grant Writing in Pharmacology

3 Credit Hours

Course Coordinator(s):

Dr. Richard Wojcikiewicz

Semester Offered: Spring

Course Description: The primary goal is to teach critical thinking, organizational skills and proposal writing using the current NIH R21/F31 format. The course will be divided into 4 sections: (I) introductory sessions concerning the peer review process, application materials, the overall organization of the proposal, hypothesis development, and the setting of deadlines, (II) the development of Specific Aims and then the entire proposal in conjunction with thesis advisors (this will involve regular meetings and discussions between the student and advisor), (III) review and critiquing of the proposals by participating faculty and the class, (IV) revision of the proposal on the basis of critiques and completion of final version.

Prerequisites: First year core curriculum and declaration into Pharmacology department.

Textbook(s): None.

PHA645 Pharmacology Seminar

0 Credit Hours

Course Coordinator(s):

Dr. Juntao Luo

Semester Offered: Year-round

Course Description: Graduate students and faculty will meet every week during the academic year to participate in seminars. Seminars will be given by outside speakers and Departmental members, including Graduate Students who, after their first year, will be required to give one presentation per year. Grades will be assigned based on attendance and performance.

Prerequisites: None.

Textbook(s): None.

PHA700 Research in Pharmacology

Variable Credit Hours

Course Coordinator(s):

Dr. Juntao Luo

Semester Offered: Year-round

Course Description: Original dissertation research in Pharmacology under the supervision of a Pharmacology Faculty member and monitored by an advisory committee.

Prerequisites: None.

Textbook(s): None.

PHYSIOLOGY PROGRAM AND DEGREE REQUIREMENTS

CIP Code: 26.0706

This program awards:

- PhD in Physiology*
- MS in Physiology

**Not accepting students at this time.*

The major research in this department includes endocrinology, exercise science, neurophysiology, and pulmonary and sensory physiology.

Since a number of the Physiology faculty hold primary appointments in clinical departments, the Physiology program is an ideal vehicle for students looking to apply basic science research techniques to clinically relevant biomedical problems such as bone tumors, diabetes, osteoporosis, kidney disease and lung disease.

Experimental approaches range from studies on whole animals and isolated tissues to studies of cellular and molecular events.

Scientific inquiry may include the complex interactions of systems in the whole individual, the orchestration of processes integrating organ and cell function, and/or integration of molecular events within individual cells.

PhD Requirements:

Required Graduate Courses:

GS604	Graduate Student Research Opportunities
GS612	Biomedical Sciences Laboratory Rotations (x3)
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club
GS637	Responsible Conduct of Scientific Research
PHY627	Grant Writing Course in Neuroscience and Physiology

- Total 90 credit hours (a minimum of 30 Didactic Graduate Course credit hours and a minimum of 30 Research Graduate Course credit hours).
- Qualifying Examination to be scheduled at the end of the spring of the second year.
- Each student in the Physiology Graduate Program is required to attend the complete seminar series and to present a seminar to the members of the Program each year.
- Dissertation Advisory Committee Meetings (minimum of one meeting every six months).
- Successful Dissertation Defense

MS Requirements:

Required Graduate Courses:

GS604	Graduate Student Research Opportunities
GS616	Foundations of Molecular and Cellular Biology
GS690	Experimental Design and Analysis
GS637	Responsible Conduct of Scientific Research
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club

- Total 30 credit hours (a minimum of 20 Didactic Graduate Course credit hours and a minimum of 10 Research Graduate Course credit hours).
- Successful Thesis Defense

PHYSIOLOGY COURSE DESCRIPTIONS

PHY617 Methods of Physiology Research

Variable Credit Hours

Course Coordinator(s):

Dr. Francesca Pignoni

Semester Offered: By arrangement only

Course Description: Methods of research used by the faculty are demonstrated. Problem design and research methods are emphasized. Course deals with individualized laboratory experience. Topics agreed upon by student and faculty sponsor.

Prerequisites: GS612.

Textbook(s): None.

PHY620 Advanced Topics in Receptors and Cell Signaling

1 Credit Hour

Course Coordinator(s):

Dr. Brian Howell

Semester Offered: Fall

Course Description: Same as N620 above.

PHY627 Fundamentals of Grant and Fellowship Applications

3 Credit Hours

Course Coordinator(s):

Dr. Mariano Viapiano

Semester Offered: Spring

Course Description: Same as N627 above.

PHY654 Proposal Writing for the Physiology Master's Thesis

0.5 Credit Hours

Course Coordinator(s):

Dr. Evelyn Voura

Semester Offered: Fall

Course Description: With help from their Research Advisor, students will select and define a research problem to be studied within the context of the Advisor's scope of ongoing research. Putting together a thoughtful proposal is an important first step in preparing both the student and Advisor for successful thesis research. In addition, this process provides the Research Advisor with an early opportunity to make student aware of fundamental background concepts before the project is underway. The written proposal will

also provide the Program Director with an understanding of the possible scope of the project. The student will be expected to complete the thesis proposal as directed by the Course Coordinator and submit it to the Program Director for review within four weeks of selecting a research laboratory. Prerequisites: None. Textbook(s): None.

PHY659 Physiology Seminar

0 Credit Hour

Course Coordinator(s):

Dr. Evelyn Voura

Semester Offered: Year-round

Course Description: Graduate students and faculty will meet once every other week during the academic year for the purpose of discussing current topics in neuroscience and physiology and departmental research programs. Outside speakers also participate. Each graduate student is required to present a critical review of a topic in biology during a scheduled meeting.

Prerequisites: Declaration in Physiology.

Textbook(s): None.

PHY700 Research in Physiology

Variable Credit Hours

Course Coordinator(s):

Dr. Evelyn Voura

Semester Offered: Year-round

Course Description: Independent research in preparation for dissertation requirement.

Prerequisites: None.

Textbook(s): None.

ADDITIONAL GRADUATE COURSES

GS628 Systems Biology of Genetics, Genomics and Proteomics

4 Credit Hours

Course Coordinator(s):

Dr. Frank Middleton

Semester Offered: Spring

Course Description: The goal of this course is to train graduate students in modern experimental and theoretical methods of performing systems level investigations that address fundamental and clinically-relevant questions in genetics, genomics and proteomics. The course is divided into 4 sections. Section 1 is an examination of the origins of living organisms, basic genome organization, the basis of genetic diversity, mitochondrial and yeast genetics, and genomic instability. Section 2 is an examination of human genetics, including linkage, association of quantitative trait analysis, as well as transcription factor analysis, epigenetics, microRNA analysis, and immunorepertoire analysis. Section 3 provides in-depth exposure in the use of next-generation sequencing and gene network analysis for monitoring gene expression, the fundamentals of proteomics and metabolomics and sequencing by mass spectrometry, as well as mouse genetics, pharmacogenetics, personalized medicine, and microbiome analysis. Section 4 concludes the course with students developing and presenting their own systems biology research project.

Prerequisites: GS616.

Textbook(s): None.

GS632 Biomolecular X-Ray Diffraction: Theoretical Basis and Experimental Procedures

4 Credit Hours

Course Coordinator(s):

Dr. Debashis Ghosh

Semester Offered: By arrangement only

Course Description: An introduction to the theory and practices of X-ray diffraction and crystallographic methods applicable to the elucidation of structure-function relationships of proteins and other biological molecules and interactions thereof. The course is designed to provide a comprehensive understanding of the basic principles through in- depth theoretical discussion, extensive problem solving and hands-on

experimental and computational steps through the biomolecular structure solution process. Prerequisite: undergraduate (senior level) biochemistry, chemistry, physics or physical chemistry or permission of the instructor.

Prerequisites: None.

Textbook(s): None.

GS638 Teaching for the Basic Scientist

2 Credit Hours

Course Coordinator(s):

Dr. Rebecca Greenblatt

Semester Offered: Spring, odd years

Course Description: This course is for graduate students who want to become course directors and explore the teaching track. Enrollees will learn about design, delivery and assessment of any academic course for adult learners. Students will learn to write learning objectives and plan content as well as deliver content with an emphasis on active learning. The student will also learn appropriate assessment methods that fit the delivery and objectives of the course.

Prerequisites: None.

Textbook(s): None.

GS643 Introduction to Quality and Compliance for Biotechnology

3 Credit Hours

Course Coordinator(s):

Mr. Terrence Howell

Ms. Lisa Ware

Semester Offered: Fall, even years

Course Description: This course provides an overview of the skills and knowledge needed to perform and oversee quality and regulatory compliance functions within the biotechnology industry. This introduction in Quality and Compliance for Biotechnology reviews Good Pharmaceuticals Industry Practice (GXP) principles, procedural guidelines, FDA, and other regulations and ethical considerations.

Prerequisites: None.

Textbook(s): None.

GS647 Nanocourses in Biomedical Sciences

0.5 Credit Hours

Course Coordinator(s):

Dean, College of Graduate Studies

Semester Offered: By arrangement only

Course Description: Nanocourses are short courses that meet for a total of ~7-8 hours and typically address a new or evolving area that is not covered by the standard graduate curriculum. The course could be given in a week or two days or even over 7 weeks. Typical nanocourses could involve new methodologies (super-resolution microscopy, microfluidics, proteomics) or could focus on a specific biological entity (exocyst) or could be practical (presenting scientific data using Photoshop and Illustrator). Course could include lecture, discussion, paper presentations, problem solving or other modalities. A full list of courses can be found at <http://upstate.edu/grad/curriculum/nanocourses.php>.

Prerequisites: None.

Textbook(s): None.

GS652 Advanced Dissection I

3 Credit Hours

Course Coordinator(s):

Dr. Jennette Ball

Semester Offered: Fall

Course Description: A practical skill based course in which students will complete specific dissections upon a cadaver under the supervision of the course director. Course director will provide a rubric of standards for documenting the student's skills and competencies. There will also be activities that include demonstrating prosected specimens to the COM students, assisting COM students with their dissections, preparing and presenting teaching content with clinical applications, and conducting small group teaching in person or remotely. Each activity will be evaluated by a member of the anatomy faculty team as well as students based on a feedback form.

Prerequisites: PHYT601 Gross Anatomy

Textbook(s): None.

GS653 Advanced Dissection II

3 Credit Hours

Course Coordinator(s):

Dr. Jennette Ball

Semester Offered: Spring

Course Description: A practical skill based course in which students will complete specific dissections upon a cadaver under the supervision of the course director. Course director will provide a rubric of standards for documenting the student's skills and competencies. There will also be activities that include demonstrating prosected specimens to the COM students, assisting COM students with their dissections, preparing and presenting teaching content with clinical applications, and conducting small group teaching in person or remotely. Each activity will be evaluated by a member of the anatomy faculty team as well as students based on a feedback form.

Prerequisites: PHYT601 Gross Anatomy

Textbook(s): None.

GS660 Discovery Science To Patient Care

1 Credit Hour

Course Coordinator(s):

Dr. Evelyn Voura

Semester Offered: Fall

Course Description: The course will involve discussions on selected topics and a book club. The topics will aim to familiarize the students with the often-serendipitous process through which basic science discoveries lead to medical applications. In addition, it is important that aspiring physicians and biomedical researchers read broadly about the history and progress of medicine as reported by respected scientists, clinicians and historians. To meet this end, students will read two books outside of class – one during the fall semester, and another during the spring semester. Students will demonstrate their engagement by taking an active role in activities and conversations focused on both aspects of the course. Various strategies will be used to encourage student participation and keep the sessions active.

Prerequisites: None.

Textbook(s): TBD.

GS664 Teaching in Human Anatomy

3 Credit Hours

Course Coordinator(s):

Dr. Robert Zajdel

Dr. Jennette Ball

Semester Offered: Fall

Course Description: Students are expected to assist in teaching gross anatomy to first year medical students. Emphasis is placed upon laboratory activities, including helping with daily dissections, working with students in small group sessions to facilitate an understanding of sectional and radiographic anatomy, and providing an opportunity to appreciate the application of gross anatomy to clinical medicine. Students may be asked to assist in the laboratory outside of designated class time and to offer individualized instruction to students experiencing difficulty in the course. Teaching assistants will be required to provide a log of their contact hours to the course director. Credit for the elective will be awarded on a basis of time spent teaching in the laboratory, tutoring, or preparing teaching specimens. Student feedback, direct faculty observation of interactions with students and correct answers to student and faculty questions will be used for assessment.

Prerequisites: PHYT601 Gross Anatomy

Textbook(s): None.

MD/PHD COURSES

(The courses below are unique to the MD/PhD program)

MDPH601 Research Design for Physician-Scientists

3 Credit Hours

Course Coordinator(s):

Dr. Leszek Kotula

Semester Offered: Fall

Course Description: This course promotes the development of critical scientific writing important to the students' future career as physician-scientists. The student will gain experience in grantsmanship by writing and presenting an original hypothesis-based research proposal. Students will learn the essential features of scientific writing, with the emphasis on developing skills necessary for crafting an effective grant proposal.

Prerequisites: None.

Textbook(s): None.

MDPH602 MD/PhD Grand Rounds

Variable Credit Hours

Course Coordinator(s):

Dr. Amit Dhamoon

Semester Offered: Year-round

Course Description: The MD/PhD Grand Rounds course is required for all MD/PhD students. MSI and MSII students attend Grand Rounds, read assigned papers, and participate in discussions. They are also required to present their summer research experiences. Students in their PhD years will present an assigned clinical case or research study. The student presenter is responsible for facilitating discussion surrounding the context of the basic, clinical and translational research issues of the case or study. MSIII and MSIV participation is similar to that of the student's in their PhD years. The exception is that presentations in MSIII and MSIV are based on students' fields of interest and/or personal experiences during their training. Presentation feedback is required after each presentation by all seminar attendees.

Prerequisites: None.

Textbook(s): None.

Student Name: _____ Semester Entered: _____

		Credit Hours	Year Completed	Grade
1. Required Graduate Courses:				
GS616	Foundations of Molecular and Cellular Biology	3	_____	_____
GS637	Responsible Conduct of Scientific Research	2	_____	_____
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club	1	_____	_____
GS690	Experimental Design and Analysis	2	_____	_____
GS604	Graduate Student Research Opportunities	1	_____	_____
B609	Biochemistry and Molecular Biology Rotations	4	_____	_____
B620	Biochemistry Seminar	0	_____	_____

Advanced Courses:

At least 3 credits of Advanced Biochemistry and Molecular Biology are required.

B665	Bioenergetics and Metabolism	2	_____	_____
B647	Gene Expression and Epigenetics	2	_____	_____
B664	Protein Sorting	1	_____	_____
B666	Protein Structure Determination	2	_____	_____
GS628	Systems Biology of Genetics Genomics & Proteomics	4	_____	_____
GS632	Biomolecular X-Ray Diffraction	4	_____	_____
PHA615	Apoptosis and Cancer Pharmacology	2	_____	_____

2. Total Credit Hours (30, including **3.** And **4.**): _____

3. Total Didactic Graduate Course (minimum of 20 credit hours): _____

4. Total Research Graduate Course (minimum of 10 credit hours): _____

5. MS Thesis Committee Meetings (minimum of two meetings per year):

	Meeting Dates
First Year:	_____
Second Year:	_____

6. Thesis Defense:

Date: _____

Committee Approved: _____

Student Name: _____ Semester Entered: _____

			Credit Hours	Year Completed	Grade
1. Required Graduate Courses:					
GS612	Biomedical Sciences Laboratory Rotations		6	_____	_____
GS616	Foundations of Molecular and Cellular Biology		3	_____	_____
GS637	Responsible Conduct of Scientific Research		2	_____	_____
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club		1	_____	_____
B620	Biochemistry Seminars		0	_____	_____
GS690	Experimental Design and Analysis		2	_____	_____
GS604	Graduate Student Research Opportunities		1	_____	_____
B617	Methods of Biochemistry and Molecular Biology Research		Var.	_____	_____
B648	Research Design in Biochemistry & Molecular Biology		3	_____	_____
B650	Scientific Writing		1	_____	_____

Advanced Courses:

At least 6 credits of Advanced Biochemistry & Molecular Biology Courses are required. (Note: GS628 Systems Biology of Genetics, Genomics, and Proteomics, PHA615 Apoptosis and Cancer Pharmacology and GS632 Biomolecular X-ray Diffraction: Theoretical Basis and Experimental Procedures, are considered advanced Biochemistry & Molecular Biology courses for this purpose).

B665	Bioenergetics and Metabolism		2	_____	_____
B647	Gene Expression and Epigenetics		2	_____	_____
B664	Protein Sorting		1	_____	_____
B666	Protein Structure Determination		2	_____	_____
GS628	Systems Biology of Genetics Genomics & Proteomics		4	_____	_____
GS632	Biomolecular X-Ray Diffraction		4	_____	_____
PHA615	Apoptosis and Cancer Pharmacology		2	_____	_____

2. Total Credit Hours (90 including **3.** And **4.**): _____

3. Total Didactic Graduate Course (minimum of 30 credit hours): _____

4. Total Research Graduate Course (minimum of 30 credit hours): _____

5. Qualifying Examination (to be scheduled before or during the summer following the student's second year):

Graduate Program Committee Approval: _____

Examination Date and Results: _____

Continued on next page

6. Dissertation Committee Meetings and Department Research Talk

(minimum of two meetings per year):

	Meeting Dates	Letter Received
Third Year:	<hr/>	<hr/>
	<hr/>	<hr/>
	<hr/>	<hr/>
Fourth Year:	<hr/>	<hr/>
	<hr/>	<hr/>
	<hr/>	<hr/>
Fifth Year:	<hr/>	<hr/>
	<hr/>	<hr/>
	<hr/>	<hr/>

7. Dissertation Defense:

Date:

Committee Approval:

Student Name: _____ Semester Entered: _____

			Credit Hours	Year Completed	Grade
1. Required Graduate Courses:					
GS637	Responsible Conduct of Scientific Research		2	_____	_____
B620	Biochemistry Seminars		0	_____	_____
MDPH601	Research Design for Physician Scientists		3	_____	_____

Advanced Courses:

At least 6 credits of Advanced Biochemistry & Molecular Biology Courses are required. (Note: GS628 Systems Biology of Genetics, Genomics, and Proteomics, PHA615 Apoptosis and Cancer Pharmacology and GS632 Biomolecular X-ray Diffraction: Theoretical Basis and Experimental Procedures, are considered advanced Biochemistry & Molecular Biology courses for this purpose).

B665	Bioenergetics and Metabolism		2	_____	_____
B647	Gene Expression and Epigenetics		2	_____	_____
B664	Protein Sorting		1	_____	_____
B666	Protein Structure Determination		2	_____	_____
GS628	Systems Biol. of Genetics, Genomics & Proteomics		4	_____	_____
GS632	Biomolecular X-Ray Diffraction		4	_____	_____
PHA615	Apoptosis and Cancer Pharmacology		2	_____	_____

2. Qualifying Examination (to be completed at the end of year 1):

Graduate Program Committee Approval: _____

Examination Date and Results: _____

Continued on next page

4. Dissertation Committee Meetings and Department Research Talk

(minimum of two meetings per year):

	Meeting Dates	Letter Received
Third Year:	_____	_____
	_____	_____
	_____	_____
Fourth Year:	_____	_____
	_____	_____
	_____	_____
Fifth Year:	_____	_____
	_____	_____
	_____	_____

5. Dissertation Defense:

Date:	_____
Committee Approval:	_____

Student Name: _____

Semester Entered: _____

1. Required Graduate Courses:		Credit Hours	Year Completed	Grade
GS616	Foundations of Molecular and Cellular Biology	3	_____	_____
GS637	Responsible Conduct of Scientific Research	2	_____	_____
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club	1	_____	_____
GS690	Experimental Design and Analysis	2	_____	_____
GS604	Graduate Student Research Opportunities	1	_____	_____
A624	Seminar in Cell and Developmental Biology	1	_____	_____

Suggested Advanced Courses:

	Systems Biology of Genetics, Genomics & Proteomics	4	_____	_____
GS628				
GS647-002	Nanocourse: Introduction to Flow Cytometry	0.5	_____	_____
GS647-012	Nanocourse: Protein Expression & Purification	0.5	_____	_____
GS647-020	Nanocourse: Introduction to Light Microscopy	0.5	_____	_____
A507	Introduction to Neuroscience	3	_____	_____
A613	Graduate Cellular Anatomy	2	_____	_____
	Contemp. Cellular, Molecular & Developmental Biology	3	_____	_____
A614				
A617	Methods of Cell & Developmental Research	Variable	_____	_____
A622	Developmental Biology	2	_____	_____
B666	Protein Structure Determination	2	_____	_____
PHA615	Apoptosis and Cancer Pharmacology	2	_____	_____

2. Total Credit Hours (30 credit hours, including **3.** And **4.**): _____

3. Total Research Course (minimum of 10 credit hours): _____

4. Total Didactic Graduate Course (minimum of 20 credit hours): _____

3. A624 Department Seminar (attendance required at all seminars and annual 30 min research presentation required, starting in year 2): _____

4. Thesis Committee Meetings (minimum of one meeting per year):

Members: _____ **Sponsor:** _____

Dates: _____

_____ **Chair:** _____

5. Thesis Defense:

Date: _____

Committee Approved: _____

Student Name: _____ Semester Entered: _____

1. Required Graduate Courses:		Credit Hours	Year Completed	Grade
GS604	Graduate Student Research Opportunities	1	_____	_____
GS612	Biomedical Sciences Laboratory Rotations	6	_____	_____
GS616	Foundations of Molecular and Cellular Biology	3	_____	_____
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club	1	_____	_____
GS637	Responsible Conduct of Scientific Research	2	_____	_____
GS690	Experimental Design and Analysis	2	_____	_____
A617	Methods of Cell & Developmental Research	Variable	_____	_____
A623	Grant Writing in Cell and Developmental Biology	2	_____	_____
A624	Seminar in Cell and Developmental Biology	1	_____	_____

Suggested Advanced Courses:

	Systems Biology of Genetics, Genomics & Proteomics	4	_____	_____
GS628				
GS647-002	Nanocourse: Introduction to Flow Cytometry	0.5	_____	_____
GS647-012	Nanocourse: Protein Expression & Purification	0.5	_____	_____
GS647-020	Nanocourse: Introduction to Light Microscopy	0.5	_____	_____
A507	Introduction to Neuroscience	3	_____	_____
A613	Graduate Cellular Anatomy	2	_____	_____
A614	Contemp. Cellular, Molecular & Developmental Biology	3	_____	_____
A622	Developmental Biology	2	_____	_____
B666	Protein Structure Determination	2	_____	_____
PHA615	Apoptosis and Cancer Pharmacology	2	_____	_____

2. Total Credit Hours (minimum of 90, including **3.** and **4.**): _____

3. Total Didactic Graduate Course (minimum of 30 credit hours): _____

4. Total Research Graduate Course (minimum of 30 credit hours): _____

5. A624 Department Seminar (attendance required at all seminars and annual 30 min research presentation starting within 6 m of QE required): _____

6. Qualifying Examination (to be completed by the end of the summer of the second year): _____

Graduate Program Committee Approval: _____

Examination Date and Results: _____

Continued on next page

5. Thesis Advisory Committee Meetings (minimum of one meeting every 6 months):

Members: _____ **Dates:** _____

(minimum 3 faculty members, _____
including sponsor) _____

6. Dissertation Committee (minimum 5 faculty members including Thesis Advisory Committee Members, maximum 3 members from the Department of Cell and Developmental Biology and at least one member from outside SUNY Upstate.

Members: _____

7. Dissertation Defense:

Date: _____
Committee Approval: _____

Student Name: _____ Semester Entered: _____

1. Required Graduate Courses:		Credit Hours	Year Completed	Grade
GS637	Responsible Conduct of Scientific Research	2	_____	_____
A624	Seminar in Cell and Developmental Biology	1	_____	_____
MDPH601	Research Design for Physician Scientists	3	_____	_____

Suggested Advanced Courses:

There are no formal advanced didactic course requirements. Example of relevant courses that can be taken are list below.

GS628	Systems Biology of Genetics, Genomics & Proteomics	4	_____	_____
GS647-002	Nanocourse: Introduction to Flow Cytometry	0.5	_____	_____
GS647-012	Nanocourse: Protein Expression & Purification	0.5	_____	_____
GS647-020	Nanocourse: Introduction to Light Microscopy	0.5	_____	_____
A507	Introduction to Neuroscience	3	_____	_____
A613	Graduate Cellular Anatomy	2	_____	_____
A614	Contemp. Cellular, Molecular & Developmental Biology	3	_____	_____
A617	Methods of Cell & Developmental Research	Variable	_____	_____
A622	Developmental Biology	2	_____	_____
B666	Protein Structure Determination	2	_____	_____
PHA615	Apoptosis and Cancer Pharmacology	2	_____	_____

2. Qualifying Examination (to be completed at the end of year 1):

Graduate Program Committee Approval: _____

Examination Date and Results: _____

3. A624 Departmental Seminar Series (attendance at all seminars and annual 30 min. research presentation, starting within 6 mo of QE required) _____

Continued on next page

4. Thesis Advisory Committee Meetings (minimum of one meeting every 6 months):

Members:	Dates:
(minimum 3 faculty members, including sponsor)	

5. Dissertation Committee (minimum 5 faculty members including Thesis Advisory Committee Members, maximum 3 members from the Department of Cell and Developmental Biology and at least one member from outside SUNY Upstate).

Members:

6. Dissertation Committee Meetings (minimum of two meetings per year):

	Meeting Dates	Letter Received
Third Year:		
Fourth Year:		
Fifth Year:		

7. Dissertation Defense:

Date:	
Committee Approval:	

Student Name: _____

Semester Entered: _____

		Credit Hours	Year Completed	Grade
1. Required Graduate Courses:				
GS604	Graduate Student Research Opportunities	1	_____	_____
GS616	Foundations of Molecular and Cellular Biology	3	_____	_____
GS637	Responsible Conduct of Scientific Research	2	_____	_____
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club	1	_____	_____
GS690	Experimental Design and Analysis	2	_____	_____
M627	Intro to Virology	2	_____	_____
M628	Intro to Immunology	2	_____	_____
*M616	Current Concepts in Virology	3	_____	_____
*M610	Advanced Immunology	3	_____	_____
M630	Seminar in Microbiology & Immunology	1 x 1	_____	_____
M623	Directed Individual Study in Micro. & Immuno. Research	Variable	_____	_____

**Either M616 or M610 is required.*

2. Total Credit Hours (minimum of 30 credit hours, including **3.** and **4.**) _____

3. Total Didactic Graduate Course (minimum of 20 credit hours) _____

4. Total Research Graduate Course (minimum of 10 credit hours) _____

5. Thesis Committee Meetings (minimum of one meeting per year):

Members: _____ **Sponsor:** _____

Dates: _____

_____ **Chair:** _____

6. Thesis Defense:

Date: _____

Committee Approved: _____

Student Name: _____ Semester Entered: _____

			Credit Hours	Year Completed	Grade
1. Required Graduate Courses:					
First and Second Year:					
GS604	Graduate Student Research Opportunities		1	_____	_____
GS612	Biomedical Sciences Laboratory Rotations		6	_____	_____
GS616	Foundations of Molecular and Cellular Biology		3	_____	_____
GS637	Responsible Conduct of Scientific Research		2	_____	_____
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club		1	_____	_____
GS690	Experimental Design and Analysis		2	_____	_____
M627	Intro to Virology		2	_____	_____
M628	Intro to Immunology		2	_____	_____
*M616	Current Concepts in Virology		3	_____	_____
*M610	Advanced Immunology		3	_____	_____
M609	Grant Writing in Microbiology & Immunology		3	_____	_____
M630	Seminar in Microbiology & Immunology		1 x 1	_____	_____
M623	Directed Individual Study in Micro. & Immuno. Research		Variable	_____	_____
Third and Fourth Year:					
M700	Research in Microbiology & Immunology			_____	_____
M630	Seminar in Microbiology & Immunology		1 ea. sem.	_____	_____

Each student will assist in the Medical Microbiology laboratory (second, third, and possibly fourth, not final thesis year).

**Students must take either 6 credits of M616 or M610 or 3 credits of one of these advanced courses, plus 3 credits of another advanced course offered by College of Graduate Studies degree-granting programs.*

2. Total Credit Hours (minimum of 90, including **3.** and **4.**): _____

3. Total Didactic Graduate Course (minimum of 30 credit hours): _____

4. Total Research Graduate Course (minimum of 30 credit hours): _____

5. Qualifying Examination (to be completed by the end of the summer of the second year):

Graduate Program Committee Approval: _____

Examination Date and Results: _____

Committee Members:

Chair _____

Continued on next page.

6. Dissertation Advisory Committee (minimum of one meeting every six months):

Members:	Meeting Dates
5 members, but no more than 3 from the same department	Third Year: _____
_____	Fourth Year: _____
_____	Fifth Year: _____
_____	Sixth Year: _____

7. Submission of First-Author (or Co-First-Author) Research Paper (must be submitted prior to Dissertation Defense):

Journal Submitted to: _____

Date Submitted: _____

Current Status: _____

8. Dissertation Defense Committee:

Members:	
5 members, plus 1 off-campus member	

	Date: _____
	Committee Approval: _____

Student Name: _____ Semester Entered: _____

1. Required Graduate Courses:		Credit Hours	Year Completed	Grade
GS637	Responsible Conduct of Scientific Research	2	_____	_____
GS690	Experimental Design and Analysis	2	_____	_____
*M616	Current Concepts in Virology	3	_____	_____
*M610	Problems in Cell & Molecular Immunology	3	_____	_____
M630	Seminar in Microbiology & Immunology	2 x 1	_____	_____
M700	Research in Microbiology & Immunology	Variable	_____	_____

**Students must take either 6 credits of M616 or M610 or 3 credits of one of these advanced courses, plus 3 credits of another advanced course offered by College of Graduate Studies degree-granting programs.*

2. Qualifying Examination (to be completed by the end of the summer of the second year):

Graduate Program Committee Approval: _____

Examination Date and Results: _____

Committee Members:

Chair _____

Continued on next page.

3. Dissertation Advisory Committee (minimum of one meeting every six months):

Members:	Meeting Dates
5 members, but no more than 3 from the same department	Third Year: _____
	Fourth Year: _____
	Fifth Year: _____
	Sixth Year: _____

4. Submission of First-Author (or Co-First-Author) Research Paper (must be submitted prior to Dissertation Defense):

Journal Submitted to: _____

Date Submitted: _____

Current Status: _____

5. Dissertation Defense Committee:

Members:
5 members, plus 1 off-campus member

Date: _____

Committee Approval: _____

**Neuroscience Program
PhD Degree Requirements Checklist**

Student Name: _____ Semester Entered: _____

1. Required Graduate Courses:		Credit Hours	Year Completed	Grade
GS612	Biomedical Sciences Laboratory Rotations	6	_____	_____
GS604	Graduate Student Research Opportunities	1	_____	_____
GS690	Experimental Design and Analysis	2	_____	_____
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club	1	_____	_____
GS637	Responsible Conduct of Scientific Research	2	_____	_____
GS616	Foundations of Molecular and Cellular Biology	3	_____	_____
*N601	Neuroscience	3	_____	_____
N606	Laboratory Research in Neuroscience	Variable	_____	_____
N627	Fundamentals of Grant and Fellowship Applications	3	_____	_____
N701	Seminar in Neuroscience	1	_____	_____

Elective Courses:

N605	Welcome to Neuroscience	1		
N610	Topics in Developmental Neurobiology	2	_____	_____
N616	Topics in Vision Research I	3	_____	_____
N617	Methods in Neuroscience Research	2	_____	_____
N618	Topics in Vision Research II	3	_____	_____
N620	Advanced Topics in Receptors & Cell Signaling	1	_____	_____
N621	Neuroanatomy Lab	2	_____	_____
N623	Systems Neuroscience	3	_____	_____
N629	Scientific Writing in Neuroscience	1	_____	_____
N630	Independent Studies in Neuroscience (1-3 credits)	Variable	_____	_____
*N631	Topics in Neuroscience	1	_____	_____
N653	Topics in Cellular and Molecular Neurobiology	2	_____	_____

**Only open to 1st year students-Fall, Weeks 8-14.*

- 2. Total Credits** (90, including **3.** and **4.**): _____
- 3. Total Didactic Graduate Course** (minimum of 30 credit hours): _____
- 4. Total Research Graduate Course** (minimum of 30 credit hours): _____
- 5. Department Seminar Series** (attendance required at all seminars): _____
- 6. Presentations** (students are required to present once a year): _____

*Continued on next page.

7. Qualifying Examination (to be completed by the end of the summer of the second year):

Graduate Program Committee Approval: _____

Examination Date and Results: _____

8. Dissertation Advisory Committee Meetings (minimum of one meeting every 6 months):

Members: _____ **Dates:** _____

(minimum 3 faculty members, including
sponsor)

9. Dissertation Defense:

Date: _____

Committee Approval: _____

Student Name: _____ Semester Entered: _____

1. Required Graduate Courses:		Credit Hours	Year Completed	Grade
MDPH601	Research Design for Physician Scientists	3	_____	_____
GS637	Responsible Conduct of Scientific Research	2	_____	_____

Elective Courses:

N605	Welcome to Neuroscience	1		
N610	Topics in Developmental Neurobiology	2	_____	_____
N616	Topics in Vision Research I	3	_____	_____
N617	Methods in Neuroscience Research	2	_____	_____
N618	Topics in Vision Research II	3	_____	_____
N619	Neurobiology of Disease	2	_____	_____
N620	Advanced Topics in Receptors & Cell Signaling	1	_____	_____
N621	Neuroanatomy Lab	2	_____	_____
N623	Systems Neuroscience	3	_____	_____
N629	Scientific Writing in Neuroscience	1	_____	_____
N630	Independent Studies in Neuroscience (1-3 credits)	Variable	_____	_____
*N631	Topics in Neuroscience	1	_____	_____
N653	Topics in Cellular and Molecular Neurobiology	2	_____	_____

**Only open to 1st year students-Fall, Weeks 8-14.*

- 2. Total Didactic Graduate Course** (minimum of 30 credit hours): _____
- 3. Department Seminar Series** (attendance required at all seminars): _____
- 4. Presentations** (students are required to present once a year): _____

5. Qualifying Examination (to be completed by the end of the first year):

Graduate Program Committee Approval: _____

Examination Date and Results: _____

6. Dissertation Advisory Committee Meetings (minimum of one meeting every 6 months):

Members: _____

Dates: _____

(minimum 3 faculty members, including
sponsor)

7. Dissertation Defense:

Date: _____

Committee Approval: _____

Student Name: _____ Semester Entered: _____

		Credit Hours	Year Completed	Grade
1. Required Graduate Courses:				
GS604	Graduate Student Research Opportunities	1	_____	_____
GS616	Foundations of Molecular and Cellular Biology	3	_____	_____
GS637	Responsible Conduct of Scientific Research	2	_____	_____
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club	1	_____	_____
GS690	Experimental Design and Analysis	2	_____	_____
PHA610	Principles of Pharmacology	1	_____	_____
PHA645	Pharmacology Seminar (one/academic year)	0	_____	_____

Elective Courses:

*PHA612	Cardiovascular Physiology and Pharmacology	1	_____	_____
*PHA615	Apoptosis and Cancer Pharmacology	2	_____	_____
*PHA618	Current Topics in Pharmacology	1	_____	_____
*PHA622	Principles and Practices of Drug Discovery and Dev.	1	_____	_____
PHA623	Grant Writing in Pharmacology	3	_____	_____

**Students are required to take a minimum of 4 Advanced Pharmacology course credits (including PHA610).*

2. Total Credit Hours (minimum of 30, including **3.** and **4.**) _____

3. Total Didactic Graduate Course (minimum of 20 credits): _____

4. Research Credits (minimum of 10 research credits):

PHA700	Research in Pharmacology	_____	_____	_____
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4. Thesis Committee Meetings (minimum of one meeting per year):

Members: _____ **Sponsor:** _____ **Dates:** _____
 _____ **Chair:** _____

5. Thesis Defense:

Date: _____

Committee Approved: _____

Student Name: _____ Semester Entered: _____

		Credit Hours	Year Completed	Grade
1. Required Graduate Courses:				
GS616	Foundations of Molecular and Cellular Biology	3	_____	_____
GS637	Responsible Conduct of Scientific Research	2	_____	_____
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club	1	_____	_____
GS690	Experimental Design and Analysis	2	_____	_____
GS612	Biomedical Sciences Lab Rotations	6	_____	_____
GS604	Graduate Student Research Opportunities	1	_____	_____
PHA610	Principles of Pharmacology	1	_____	_____
PHA645	Pharmacology Seminar (one/academic year)	0	_____	_____
PHA623	Grant Writing in Pharmacology	3	_____	_____

Elective Courses:

*PHA612	Cardiovascular Physiology and Pharmacology	1	_____	_____
*PHA615	Apoptosis and Cancer Pharmacology	2	_____	_____
PHA617	Methods of Pharmacology Research	2	_____	_____
*PHA618	Current Topics in Pharmacology	1	_____	_____
*PHA622	Principles and Practices of Drug Discovery and Development	1	_____	_____

**Students are required to take a minimum of 4 Advanced Pharmacology course credits (including PHA610).*

2. Total Credit Hours (minimum of 90 credits, including **3.** and **4.**): _____

3. Total Didactic Graduate Courses (minimum of 30 credits): _____

4. Total Didactic Graduate Courses (minimum of 30 credits): _____

5. Qualifying Examination (to be scheduled before or during the summer following the student's second year):

Graduate Program Committee Approval: _____

Examination Date and Results: _____

Continue on next page.

6. Dissertation Committee Meetings
(minimum of one meeting per year):

	Meeting Dates	Letter Received
Third Year:	_____	_____
	_____	_____
	_____	_____
Fourth Year:	_____	_____
	_____	_____
	_____	_____
Fifth Year:	_____	_____
	_____	_____
	_____	_____
	_____	_____

7. Dissertation Defense:

Date:	_____
Committee Approval:	_____

Student Name: _____ Semester Entered: _____

1. Required Graduate Courses:		Credit Hours	Year Completed	Grade
GS637	Responsible Conduct of Scientific Research	2	_____	_____
PHA645	Pharmacology Seminar	0	_____	_____
MDPH601	Research Design for Physician Scientists	3	_____	_____

Advanced Courses:

PHA610	Principles of Pharmacology	1	_____	_____
PHA612	Cardiovascular Physiology and Pharmacology	1	_____	_____
PHA615	Apoptosis and Cancer Pharmacology	2	_____	_____
PHA618	Current Topics in Pharmacology	1	_____	_____
PHA622	Principles and Practices of Drug Discovery and Development	1	_____	_____

All Pharmacology MD/PhD students must take a minimum of 6 credits of advanced courses chosen from the Pharmacology Program or other Graduate Programs or Nanocourses in College of Graduate Studies

2. Qualifying Examination (to be completed at the end of year 1):

Graduate Program Committee Approval: _____

Examination Date and Results: _____

Continued on next page

4. Dissertation Committee Meetings and Department Research Talk

(minimum of two meetings per year):

	Meeting Dates	Letter Received
Third Year:	_____	_____
	_____	_____
	_____	_____
Fourth Year:	_____	_____
	_____	_____
	_____	_____
Fifth Year:	_____	_____
	_____	_____
	_____	_____

5. Dissertation Defense:

Date:	_____
Committee Approval:	_____

Student Name: _____ Semester Entered: _____

1. Required Graduate Courses:		Credit Hours	Year Completed	Grade
GS616	Foundations of Molecular and Cellular Biology	3	_____	_____
GS690	Experimental Design and Analysis	2	_____	_____
GS604	Graduate Student Research Opportunities	1	_____	_____
GS637	Responsible Conduct of Scientific Research	2	_____	_____
PHY654	Master's Thesis Proposal	.5	_____	_____
PHY659	Physiology Seminar	0	_____	_____
*GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club	1	_____	_____
*GS660	Discovery Science to Patient Care	1	_____	_____
<i>*Students must take either GS660 or GS892.</i>				

Other Advanced Courses:

Specialty courses selected to support and enrich the student's research area.

_____	_____	_____
_____	_____	_____
_____	_____	_____

2. Total Credit Hours (minimum of 30 credits, including **3.** and **4.**):

3. Total Didactic Credits (minimum of 20 credit hours):

4. Total Research Credits (minimum of 10 credit hours):

5. MS Thesis Committee Meetings (minimum of two meetings per year):

Meeting Dates

First Year: _____

Second Year: _____

6. Thesis Defense:

Date: _____

Committee Approved: _____

Student Name: _____ Semester Entered: _____

1. Required Graduate Courses:		Credit Hours	Year Completed	Grade
GS616	Foundations of Molecular and Cellular Biology	3	_____	_____
GS690	Experimental Design and Analysis	2	_____	_____
GS604	Graduate Student Research Opportunities	1	_____	_____
GS892	Introduction to the Presentation and Analysis of Scientific Literature: Journal Club	1	_____	_____
GS637	Responsible Conduct of Scientific Research	2	_____	_____
GS612	Biomedical Sciences Laboratory Rotations	6	_____	_____
PHY627	Grant Writing in Neuroscience and Physiology	3	_____	_____
PHY659	Physiology Seminar	1	_____	_____

2. Advanced Courses:

Specialty courses selected to support and enrich the student's research area.

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

2. Total Credit Hours (minimum of 90 credits, including **3.** and **4.**): _____

3. Total Didactic Graduate Courses (minimum of 30 credits): _____

4. Total Research Graduate Courses (minimum of 30 credits): _____

5. Qualifying Examination (to be scheduled before or during the summer following the student's second year):

Graduate Program Committee Approval: _____

Examination Date and Results: _____

6. Department Seminar Series (present each year and at oral defense): _____

Continue on next page.

7. Dissertation Committee Meetings
(minimum of one meeting per year):

	Meeting Dates	Letter Received
Third Year:	_____	_____
	_____	_____
	_____	_____

Fourth Year:	_____	_____
	_____	_____
	_____	_____

Fifth Year:	_____	_____
	_____	_____
	_____	_____

8. Dissertation Defense:

Date: _____

Committee Approval: _____

Student Name: __

Semester Entered: _____

		Credit Hours	Year Completed	Grade
1. Required Graduate Courses:				
PHYT601	Gross Anatomy	6	_____	_____
GS652	Advanced Dissection I	3	_____	_____
GS653	Advanced Dissection II	3	_____	_____
ANAT0405	Teaching in Human Anatomy	6	_____	_____
*GS638	Teaching for the Basic Scientist	2	_____	_____

**2 modules of COM Faculty Development Course can be substituted for GS638*

2. Additional Program Requirements: Teaching Capstone & COM Embryology, Microscopic Anatomy, Radiology and Neuroanatomy classes

College of Graduate Studies

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