SIU Southern Illinois University
CARBONDALE

Table of Contents

Multidisciplinary Biomedical and Biological Sciences

The Multidisciplinary Biomedical and Biological Sciences (MBBS) Graduate Program offers Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees in a variety of disciplines at Southern Illinois University. This umbrella graduate program is designed to provide flexibility for students to choose research advisors and elective courses. Advanced training (via lecture, discussion and laboratory research) is led by faculty located on 3 campuses (Carbondale, Edwardsville and Springfield) in 9 areas of study or Concentrations. Select students can enter the MBBS program through the Interdisciplinary Rotation mechanism, which provides laboratory rotation experience in multiple areas of research before a Concentration is chosen. Thesis M.S. and Ph.D. degrees, which require laboratory research, are available in the following Concentrations:

- Anatomy & Neurobiology
- Biochemistry & Molecular Biology
- Cell Biology, Immunology & Cancer Biology
- Medicinal Chemistry (Ph.D. only)
- Microbiology
- Molecular & Integrative Physiology
- Pharmacology & Neuroscience

Non-thesis M.S. degrees are also available in Biomedical Science, Pharmacology & Neuroscience and Public Health Lab Science. The non-thesis M.S. degrees in Biomedical Science and Pharmacology & Neuroscience are designed for students to improve their academic credentials in preparation for health professional school applications or to enhance their knowledge for a professional, teaching or research career. The Biomedical Science M.S. is taught in person with a broad-based curriculum. The Pharmacology & Neuroscience M.S. is designed for completion online with a more focused curriculum. Students participating in SIU's MEDPREP program can also obtain a non-thesis M.S. degree in Biomedical Science. The non-thesis M.S. in Public Health Lab Science is designed to prepare students for a career in public health laboratory science and requires substantial training in relevant laboratory settings.

The MBBS Program also offers a post-baccalaureate certificate in Anatomy that provides students an opportunity to become proficient in anatomy teaching to be more competitive in the job market for this field.

Interdisciplinary Rotation Students

The Interdisciplinary Rotation mechanism is designed for students to explore multiple areas of research before choosing a Concentration to pursue a thesis M.S. or Ph.D. degree. In the application, students will identify their interest in Interdisciplinary Rotations and then select either the Carbondale or Springfield campus. Students admitted as Interdisciplinary will select three rotations with participating faculty from any of the Concentrations on their respective campus. The curriculum in the first semester of study will include MBBS 500 (Introduction to Scientific Communication), MBBS 502 (Research Experience through Laboratory Rotations), MBBS 504 (Fundamentals of Graduate Research) and 1-3 elective courses. Students should declare their chosen Concentrations before the second semester of study.

Admission and Application

The minimum requirement for admission to the MBBS Program is an undergraduate degree in one of the biological, chemical or physical sciences. However, each Concentration may have additional

requirements for prerequisite courses. The minimum GPA requirement varies depending on the degree and the Concentration. Concentrations allow students to directly enter the Ph.D. program with a bachelor or master's degree. Many Concentrations also have an accelerated entry program where students in a M.S. program can transfer to the Ph.D. degree; however, the requirements for accelerated entry vary by Concentration.

Each applicant must submit an online application at gradschool.siu.edu/apply that contains the following:

1. A non-refundable $65 application fee, which must be pacid by credit card.
2. Choose the degree of interest (M.S. or Ph.D.).
3. For thesis M.S. and Ph.D., students may select Interdisciplinary Rotations and rank up to 3 Concentrations.
4. Unofficial transcripts for all undergraduate and graduate coursework.
5. A resume or curriculum vitae.
6. At least 2 letters of recommendation.
7. A personal statement (1-2 pages) describing the applicant's motivation for graduate work, any research experience, and goals and ambitions for the future. Thesis M.S. and Ph.D. applicants must also identify 2-3 faculty members with whom their research interests align, with specific reasons for this selection.

While not required, applicants are strongly encouraged to submit Graduate Record Examination (GRE) general test scores. International students whose native language is not English will be required to take an English proficiency exam using TOEFL, IELTS, or Duolingo unless exemptions apply.

Financial Assistance

The MBBS Graduate Program offers financial assistance to graduate students through assistantships that include a stipend and a tuition waiver. Research assistantships are the most common, but some Concentrations offer Teaching assistantships. SIU also awards Fellowships on a competitive basis. Financial assistance depends on availability, the student's qualifications and their academic status. Continued financial support is contingent upon the student's satisfactory progress toward the degree and good academic standing.

The non-thesis M.S. degrees in Biomedical Science and Pharmacology & Neuroscience do not provide financial support to students. Students in these programs must pay standard tuition rates for graduate programs.

Performance Requirements to Maintain Good Academic Standing

A cumulative GPA of 3.0 (A = 4.0) in all graduate coursework is required to remain in the MBBS graduate program. However, some Concentrations may have additional requirements. In accordance with the graduate school policy, if the cumulative GPA falls below 3.0, the student is placed on academic probation. If the cumulative GPA remains below 3.0 for two consecutive semesters (excluding summer), the student will be suspended from the program and the SIU Graduate School.

Master's Degree Requirements

Students must complete at least 30 credit hours of graduate courses to obtain a M.S. degree, where at least 21 credit hours are graded (A-F scale). All thesis M.S. students in the MBBS program must take the following courses: MBBS 500 (Introduction to Scientific Communication), MBBS 501 (Advanced Scientific Communication), MBBS 504 (Fundamentals for Graduate Research) and MBBS 540 (Responsible Conduct of Research). Additional required courses are specified by each Concentration. The curriculum for the non-thesis M.S. degrees vary by Concentration.

While most non-thesis M.S. degrees are coursework only, the non-thesis M.S. degree in Pharmacology & Neuroscience requires a capstone project. Students pursuing a thesis M.S. degree should take at least 3 credit hours of MBBS 599 (Thesis Research) and should create a written or oral research proposal that is approved by their research advisor and the majority of their thesis committee. Once thesis research is complete, the student will present their work as a public seminar and should pass the oral thesis defense examination in a closed session with their committee. The majority of the thesis committee must approve

the written thesis as well as the oral defense for completion of the degree. Some Concentrations may have additional requirements for thesis M.S. degree completion.

Doctoral Degree Requirements

The Ph.D. degree in the MBBS program is awarded for high achievement in one of our Concentrations as measured by the student's ability to pass the preliminary exam and to create an original research project for their dissertation. Twenty-four credit hours of graduate coursework is needed to complete the residency requirement which must include the following courses: MBBS 500 (Introduction to Scientific Communication) and MBBS 501 (Advanced Scientific Communication), as well as the two Research Tool courses. Additional required courses are specified by each Concentration.

Research Tools

All Ph.D. students must acquire competence in two Research Tools. Students may fulfill this requirement by taking MBBS 504 (Fundamentals of Graduate Research) and MBBS 540 (Responsible Conduct of Research). Students in the Medicinal Chemistry Concentration may substitute CHEM 531 (Advanced Analytical Chemistry) or CHEM 561 (Advanced Physical Chemistry) for MBBS 504. Students may also complete the Research Tool requirement by taking a different course that is approved by the Director of their Concentration.

Residency

The residency requirement for Ph.D. students is satisfied by the completion of 24 credit hours of SIU graduate coursework as a doctoral student within a period not to exceed four calendar years. For students enrolled in the Medicinal Chemistry Concentration or the Pharmacology & Neuroscience Co-Op Ph.D. program, graduate credit at SIUE will count toward residency. No more than six hours of MBBS 600 (Dissertation Research) may be applied toward the fulfillment of the residency requirement.

Preliminary Exam and Research Proposal

After completion of the required courses, Ph.D. students must pass a preliminary exam, whose format will vary depending on the Concentration. In addition, students should create a written research proposal that is presented as a seminar and is approved by their research advisor and the majority of their dissertation committee.

Admission to Candidacy

Once Ph.D. students have fulfilled the residency requirement, passed the preliminary exam, and met the Research Tool requirement, the Director of the student's Concentration will recommend their admission to candidacy for approval by the Dean of the Graduate School.

Dissertation Defense

After admission to candidacy, Ph.D. students must complete 24 credit hours of MBBS 600 (Dissertation Research) and meet with their committee at least once a year. Once dissertation research is complete, the student will present their work as a public seminar and should pass the oral defense examination in a closed session with their committee. The majority of the dissertation committee must approve the written dissertation, as well as the oral defense for completion of the degree. Some Concentrations may have additional requirements for Ph.D. degree completion.

Anatomy and Neurobiology Concentration

The Anatomy & Neurobiology Concentration offers opportunities to study a wide array of topics within its fields and to earn the M.S. or Ph.D. degree. A degree from the Anatomy & Neurobiology Concentration prepares students for careers in education and academic or health industry research or for further education in a health professional program. The Anatomy & Neurobiology Concentration faculty cover a broad variety of research areas so that the program offers opportunities for advanced training in human

anatomy, histology, cell biology, neuroscience and neuroanatomy, and neurophysiology of human and animal behavior. Thus, students are advised to develop a plan of coursework which will allow them to acquire a broad knowledge of the field prior to focusing on a more precise research area. Each semester, students are expected to be engaged in a training assignment which supplements formal coursework and will consist of research or teaching or both. A committee will be developed for each student to guide them with development of a coursework program of study and to advise them on their research plan and its execution. All graduate training plans are subject to approval by the Anatomy & Neurobiology faculty.

Admission Criteria

Applicants to the Anatomy & Neurobiology Concentration must have earned a B.S. or B.A. degree with a major or minor in a life, chemical, or physical science from an accredited institution of higher learning. They must have taken basic biology and chemistry courses and it is recommended that they have taken cellular biology, physiology, and biochemistry courses. Strong applicants with deficiencies in an area may be admitted, but there may be requirements for additional coursework during graduate study and/or the research areas available to them may be limited. It is preferred, but not required, that the applicants to the Ph.D. degree have a M.S. degree in one of these areas. Applicants may be admitted to the doctoral program with a B.S. degree only, however, only very strong applicants (see below) will be considered.

For admission to the M.S. program, the Anatomy & Neurobiology Concentration requires a cumulative undergraduate grade point average (GPA) of 2.7 (using a grading scale where A=4.0). For students with an undergraduate degree only, direct admission into the Anatomy & Neurobiology Ph.D. program requires a cumulative GPA of 3.0 and evidence of the potential for excellent performance. Additional course work may be required by the advisory committee to rectify any noted deficits. A cumulative GPA of 3.0 in any graduate level work is required for admission to either the M.S. and Ph.D program. Students may also enter the Ph.D. degree from the M.S. program without completing a thesis in a process called Accelerated Entry which requires a cumulative GPA of 3.0 in graduate coursework.

Financial Assistance

Fellowships or research assistantships may be available through the Anatomy & Neurobiology Concentration for qualified thesis M.S. and Ph.D. applicants. Student performance is evaluated annually by the student's advisor and the Graduate Program Committee and is documented in an annual report. The evaluation assesses any assigned duties which are relevant to the graduate assistantship as well as coursework and research performance. The Graduate School requires that students maintain an overall "B" average (3.0) in graduate coursework to remain in good academic standing. Research assistantships or fellowship are renewed only when performance evaluations are satisfactory. If it is determined that satisfactory progress towards the degree has NOT been made, as documented in the annual progress report, financial support may be terminated.

Degrees and Requirements

M.S. MBBS Anatomy & Neurobiology Concentration

All M.S. students in the Anatomy & Neurobiology Concentration will choose a faculty member as their Research Advisor and together they will develop a Thesis Committee to advise the student throughout their degree. The committee must consist of at least three graduate faculty members, two of whom must be from the Anatomy & Neurobiology Concentration. A committee approval form must be completed at this time and filed with the departmental administrative assistant. Members of the Thesis Committee will provide expertise in or complementary to the student’s research area and offer guidance in the development of a course work plan and the student’s research. Each thesis M.S. student is required to complete core coursework, that is supplemented with relevant electives. The student should meet with the committee yearly, or more often if needed, to discuss student progress. Failure to make adequate progress may result in dismissal from the program.

The Anatomy & Neurobiology Concentration thesis MS degree requires the completion of a total of 30 credit hours at the 400- or 500-level. Of these total credit hours, at least 21 hours must be graded (*A*, *B*, or *C*). At least 15 of the total 30 credit hours must be 500-level courses taken at SIU. Of these 15, a minimum of 3 credit hours of MBBS 599A (Thesis Research - Anatomy & Neurobiology) is required. More than three credit hours of MBBS 599A may be taken, however, only six hours may be applied toward

the 500-level course requirement. All thesis MS students should take at least 1 credit hour of MBBS 500 (Introduction to Scientific Communication) and MBBS 501 (Advanced Scientific Communication), as well as MBBS 504 (Fundamentals of Graduate Research) and MBBS 540 (Responsible Conduct of Research). Note: Coursework hours listed are minimum requirements. Additional courses may be added at the discretion of the student's Thesis Committee.

Preliminary Exam

Upon completion of coursework, there will be a preliminary exam to consist of a written research proposal that is presented to and defended before the Thesis Committee.

Thesis M.S. MBBS Anatomy & Neurobiology Concentration

The thesis should be a written document describing original research concerning a specific neurological or anatomical problem or concerning an issue related to the Research Advisor's expertise. The work should be completed under the research advisor's supervision and have the Thesis Committee's approval. The thesis should include: a literature review, a statement of the hypothesis, a description of the set of experiments which test the hypothesis by appropriate methods, appropriate analyses of the results, and a discussion which interprets the work and relays its significance. Once completed, the student will present their work as a public seminar which will be followed by a closed oral examination by the Thesis Committee. The examination will cover the thesis and other relevant issues related to the discipline of the work.

Non-Thesis M.S. MBBSAnatomy & Neurobiology Concentration

A non-thesis M.S. degree may be conferred under extenuating circumstances as decided and recommended by the student's Thesis Committee. Details of requirements will be determined by the committee based upon the student's situation.

Ph.D. MBBS Anatomy & Neurobiology Concentration

As established by the Graduate School, the base requirements for the Ph.D. degree in the Anatomy & Neurobiology Concentration are 24 credit hours of SIU graduate coursework to meet the residency requirement, completion of Research Tool courses, and 24 hours of MBBS 600A (Dissertation Research - Anatomy & Neurobiology). Of the total credit hours completed, at least 10 of these must be graded (*A*, *B*, *C*) hours. Each student is required to complete at least 1 credit hour of MBBS 500 (Introduction to Scientific Communication) and MBBS 501 (Advanced Scientific Communication), and the Research Tool requirement [MBBS 504 (Fundamentals of Graduate Research) and MBBS 540 (Responsible Conduct of Research)]. The remaining credit hours can be selected from relevant electives. For completion of the Ph.D. degree, any additional requirements are determined by the student's Dissertation Committee. The student should meet with the committee yearly, or more often if needed, to discuss student progress. Failure to make adequate progress may result in dismissal from the program.

Dissertation Committee

All Ph.D. students in the Anatomy & Neurobiology Concentration will choose a faculty member as a Research Advisor and together they will develop a Dissertation Committee which will advise them throughout their degree. Members of the Dissertation Committee will provide expertise in or complementary to the student's research area and offer guidance in the development of a course work plan and their research. The Dissertation Committee will consist of at least 5 members of the SIU graduate faculty, one of whom is from outside the student's Concentration.

Preliminary Exam

After completion of all coursework, the preliminary examination for doctoral students is to be a written document in the format of an NIH F31 training grant, related to the student's research and approved by their Dissertation Committee. Development of an application for submission to a specific granting agency is strongly encouraged and MAY be required by the student's Research Advisor. Approval of the document by the Dissertation Committee is to be followed by a presentation of the proposal and then an oral examination of the student in a closed session by the Dissertation Committee.

Dissertation

The dissertation should be a written document describing original research concerning a specific neurological or anatomical problem or concerning an issue related to the advising Research Advisor's expertise. The work should be completed under the Research Advisor's supervision and have the Dissertation Committee's approval. The dissertation should include: a literature review, a statement of the hypothesis, a description of the set of experiments which test the hypothesis by appropriate methods, appropriate analyses of the results, and a discussion which interprets the work and relays its significance. Once completed, the student will present a final public seminar which will be followed by a closed oral examination of the student by the Dissertation Committee. The examination will cover the dissertation and other issues related to the discipline of the work.

Biochemistry and Molecular Biology Concentration

The Biochemistry and Molecular Biology Concentration offers both M.S. and Ph.D. degrees. The faculty that participate in this Concentration are in the Division of Biochemistry and Molecular Biology in the Department of Biomedical Sciences (School of Medicine) on the Carbondale campus. The program is designed to offer advanced training (via lecture, discussion and laboratory) in biochemistry, molecular biology, cell biology, and structural biology.

Admission Criteria

Prospective graduate students should have an undergraduate degree in any of the biological, chemical or physical sciences. The applicants are recommended to have completed courses in biology, chemistry, physics and mathematics. Strong candidates with deficiencies in any area may be admitted, but such deficiencies may restrict the research areas available to the student and may lead to requirements for additional courses during graduate study. An advisory system in the program (see below) will help students in planning their course of study. Prospective students for the thesis M.S. degree and the Ph.D. degree in the Biochemistry and Molecular Biology Concentration are encouraged to contact program faculty in areas of their research interest. Students may be admitted to the Ph.D. program with a bachelor's or master's degree. Students pursuing a thesis M.S. degree in the Biochemistry and Molecular Biology Concentration can be admitted to the Ph.D. program via accelerated entry or the master's equivalency option by the recommendation of the faculty and approval of the Graduate School.

Financial Assistance

Fellowships and assistantships are available through the Biochemistry and Molecular Biology Concentration for qualified applicants.

Advisement and General Requirements

For thesis M.S. and Ph.D. students in the Biochemistry and Molecular Biology Concentration, the Director of Graduate Studies for the Concentration will assist each incoming student with the initial planning of a program of study and will advise the student until a Research Advisor is chosen.

Research Director and Graduate Committee Selection

Each student in the Ph.D. or thesis M.S. in the Biochemistry and Molecular Biology Concentration should select a Research Advisor as soon as possible during the first year. The graduate committee for thesis M.S. students shall consist of the Research Advisor (committee chair), and two additional graduate faculty members, including at least one from the Biochemistry and Molecular Biology Concentration. The graduate committee for Ph.D. students shall consist of at least five graduate faculty members to include the Research Advisor (committee chair), three faculty members from the Program with at least one from the Biochemistry and Molecular Biology Concentration and one member from outside the Concentration.

Graduate Committee Functions

For the thesis M.S. and Ph.D. degrees in the Biochemistry and Molecular Biology Concentration, the graduate committee will:

1. plan and approve the student's program of study.
2. review the student's progress in courses and suggest and approve changes in the program of study.
3. evaluate the student's progress in research and make appropriate recommendations.
4. meet and determine, on a yearly basis, whether a student is making satisfactory progress and may continue toward a degree. If continuation is denied, the committee must notify the Director of Graduate Studies for the Biochemistry and Molecular Biology Concentration, in writing, of the reasons for this denial.
5. administer written and oral preliminary examinations to the Ph.D. student.
6. read and evaluate the student's thesis or dissertation.
7. conduct the required oral examinations for MS and Ph.D. defenses.

Formal Course Requirements

The formal core course requirement for both the thesis M.S. and Ph.D. degrees can be met by taking a minimum of one credit hour of MBBS 500 (Introduction to Scientific Communication), one credit hour of MBBS 501 (Advanced Scientific Communication), MBBS 504 (Fundamentals of Graduate Research), MBBS 540 (Responsible Conduct of Research), MBBS 554A (Biochemistry I) and MBMB 554B (Biochemistry II) or their equivalent. All course requirements are minimum requirements. Additional courses may be required by the student's graduate committee to meet any deficiencies or to provide proficiency in a specialized area. The Director of Graduate Studies for the Biochemistry and Molecular Biology Concentration, with the advice of the student's graduate committee may designate other courses within or outside of the Concentration to fulfill formal course requirements. Any course (or its equivalent) that meets the requirements of the MBBS graduate program whether taken at SIU or at any other institution before admission to the MBBS Program does not need to be repeated. Course equivalency will be determined by the Director of Graduate Studies for the Biochemistry and Molecular Biology Concentration in consultation with the appropriate committee or member of the faculty.

Thesis M.S. Students must also take a minimum of three and maximum of six credit hours of MBBS 599B (Thesis Research-Biochemistry and Molecular Biology), prepare a thesis on the research project and pass a final oral examination, which serves as the comprehensive examination.

A non-thesis M.S. degree may be conferred under extenuating circumstances as decided and recommended by the student's Thesis Committee. Details of requirements will be determined by the committee based upon the student's situation.

Preliminary Examination and Dissertation for the Ph.D. degree in the Biochemistry and Molecular Biology Concentration

Each student in the doctoral program must pass a preliminary examination, complete the Research Tool courses and meet the Graduate School residency requirement before being advanced to candidacy. The students can take the preliminary examination after completing the formal course requirements.

The student's graduate committee will prepare and administer a written preliminary examination covering various areas of molecular biology and biochemistry. The prospectus should address the proposed graduate research project, and be written in the NIH (National Institutes of Health) approved format. The prospectus shall be available to the committee members at least 14 days prior to the date of the initial examination which will include a presentation of the proposed research.

A written preliminary examination score of at least 80 percent is required before a student can proceed to the oral portion of the preliminary examination. Upon satisfactory completion of the written examination, the candidate will meet with the committee as a whole and discuss the prospectus in detail. The committee will then conduct an oral preliminary examination. At this time, the committee may ask in-depth questions about the research project and other areas of molecular biology and biochemistry. At least four of the five committee members must judge the oral performance acceptable for a student to pass the preliminary examination overall. In the event that either the written or oral preliminary examination is failed, a student may request only one re-examination.

Successful completion of both written and oral examinations is required before a student can be advanced to candidacy for the Ph.D. degree. After admission to candidacy, the student must earn at least 24 credit hours of MBBS 600B (Dissertation Research – Biochemistry and Molecular Biology), prepare and defend a dissertation, and present a public seminar based on the student's research.

Biomedical Science Concentration

The Biomedical Science Concentration provides broad interdisciplinary graduate training in the biomedical sciences leading to a non-thesis M.S. degree. The Concentration utilizes the faculty, facilities, and courses from the Physiology, Anatomy, Biochemistry, Microbiology, Pharmacology, and MMCIB (Medical Microbiology, Immunology and Cell Biology) Academic Units. The Concentration is designed for those students who desire a broad-based curriculum in the Biomedical Sciences in preparation for health professions school matriculation or a health professions or research career.

Admission

Applicants must meet the minimal requirements of the Graduate School before being considered for admission to the Biomedical Science Concentration. In addition to Graduate School admission requirements, applicants must hold a bachelor's degree. Completion of professional school prerequisite coursework is strongly recommended:

- Two semesters with laboratory in the biological sciences;
- Two semesters with laboratory of major or pre-medical general chemistry;
- Two semesters with laboratory of major or pre-medical organic chemistry, or a one year organic chemistry/ biochemistry sequence with 2 credits of laboratory;
- Two semesters with laboratory of major or pre-medical physics.

Advisement

Students are advised by the Biomedical Science Concentration director and faculty in the Physiology, Anatomy, Microbiology, Biochemistry, Pharmacology, and MMICB (Medical Microbiology, Immunology and Cell Biology) Academic Units. Advisement arrangements are made immediately after admission. A program of course work must be approved by the advisor and filed with the director no later than the fourth week of the first semester of registration in the program. Any deviation from the course work program during the student's tenure must be approved by the advisor and filed with the director.

Graduation Requirements

Graduation requirements include a total of 30 credit hours of 400- or 500-level courses with the following provisions:

- A minimum of 21 graded hours (A, B, C) in biological sciences content areas, including biology, microbiology, physiology, anatomy, molecular biology, biochemistry, pharmacology, neuroscience and biomedical science, or statistics.
- A 15 credit hour core curriculum consisting of:
- MBBS 505 (Biomedical Science Program Seminar): 1 semester, 1 credit hour total.
- MBBS 506 (Scientific Approach and Application) 1 semester, 2 credit hours total.
- MBBS 554A & 554B (Biochemistry I & II) or equivalent (6 credit hours total).
- 3 credit hours of Human, Mammalian, or Cellular Physiology.
- 3 credit hours of Human Anatomy.
- Electives totaling a minimum of 15 credit hours.
- Completion of a program-administered mock national professional school entrance examination.

Biomedical Science Concentration for MEDPREP

Admission Requirements

Each student must apply and be accepted to the MEDPREP program in the SIU School of Medicine first.

Advisement

Students are advised by MEDPREP faculty in the SIU School of Medicine. Advisement arrangements are made immediately after admission.

Graduation Requirements

Graduation requirements include a total of 47 credit hours of 400- or 500-level courses with the following provisions:

- A minimum of 18 hours of formal coursework in MEDPREP
- MBBS 554A and MBBS 554B (Biochemistry I & II or equivalent): 6 credit hours total.
- 3 credit hours of Human or Mammalian physiology.
- 3 credit hours of Human Anatomy.
- Completion of a program-administered mock national professional school entrance examination.

Cell Biology, Immunology and Cancer Biology Concentration

Graduate courses of study are offered that lead to the M.S. and Ph.D. degree in Cell Biology, Immunology and Cancer Biology. The Concentration is designed to offer advanced training (via lecture, discussion and laboratory) focused in the area of cell biology, immunology, cancer biology, and molecular biology. Both thesis M.S and Ph.D. programs require laboratory research and the completion of a thesis or dissertation, respectively. A non-thesis M.S. degree is available under special circumstances.

Admission Criteria

Prospective graduate students should have an undergraduate degree in any of the biological, chemical or physical sciences. The applicants are recommended to have completed courses in biology, organic chemistry, physics and mathematics. Strong candidates with deficiencies in any area may be admitted, but such deficiencies may lead to requirements for additional courses during graduate study. Students may be admitted to the doctoral program with a bachelor's or master's degree. M.S. students can be admitted to the doctoral program via accelerated entry or the master's equivalency option by the recommendation of the faculty and approval of the Graduate School. An advisory system (see below) will help students in planning their course of study.

The Cell Biology, Immunology and Cancer Biology Concentration requires a cumulative grade point average (GPA) of 2.7 (A = 4.0) for admission into the thesis M.S. degree, and a GPA of 3.0 in graduate level work for admission into the Ph.D. degree. An excellent record in undergraduate coursework and a strong recommendation of the Cell Biology, Immunology and Cancer Biology admissions committee is required for direct admission to the doctoral program after a bachelor's degree. Applicants are encouraged but are not required to submit Graduate Record Examination (GRE) general test scores. International students whose native or first language is not English must take one of the Graduate School-approved English proficiency tests no more than 24 months prior to the term for which they seek admission.

Financial Assistance

Fellowships and assistantships are available through the program for qualified applicants. The Graduate School governs limits on support. Renewal of research assistantships or fellowship support is contingent upon satisfactory performance evaluations as documented in an annual progress report and outlined in the Cell Biology, Immunology and Cancer Biology Concentration operating paper.

Degree types offered

- Master of Science (M.S.) - Non-thesis (coursework only, under special circumstances)
- Master of Science (M.S.) - Thesis
- Doctor of Philosophy (Ph.D.) - Dissertation

Advisement and General Requirements

The Director of Graduate Studies for the Cell Biology, Immunology and Cancer Biology Concentration will assist incoming students with initial planning of a program of study and will advise the student until a Research Advisor is chosen. M.S. and Ph.D. students should select a Research Advisor as soon as possible during the first year. The graduate committee for thesis M.S. students shall consist of the Research Advisor (chair), and two (2) additional graduate faculty members from the Cell Biology, Immunology and Cancer Biology Concentration. The graduate committee for Ph.D. students shall consist of at least five (5) graduate faculty members to include the Research Advisor (chair), and at least one member whose primary faculty appointment lies outside the Cell Biology, Immunology and Cancer Biology Concentration. The Program Director, if not otherwise appointed, is an ex-officio (non-voting) member of every graduate committee. There is no committee requirement for the non-thesis MS.

Graduate Committee Functions

The graduate committee for thesis M.S. and Ph.D. students will:

1. Plan and approve the student's program of study.
2. Review the student's progress in courses and suggest and approve changes in the program of study.
3. Evaluate the student's progress in research and make appropriate recommendations.
4. Meet and determine, on a yearly basis, whether a student is making satisfactory progress and may continue toward a degree. If continuation is denied, the committee must notify the Director of Graduate Studies for the Cell Biology, Immunology and Cancer Biology Concentration, in writing, of the reasons for this denial.
5. Administer written and oral preliminary examinations to the doctoral student.
6. Read and evaluate the student's M.S. thesis or Ph.D. dissertation.
7. Conduct the required oral examinations for M.S. and Ph.D. students.

Formal Course Requirements

All M.S. and Ph.D. students in the Cell Biology, Immunology and Cancer Biology Concentration are required to complete core coursework that is supplemented with appropriate electives. Student should complete a minimum of one credit hour of MBBS 500 (Introduction to Scientific Communication) and one credit hour of MBBS 501 (Advanced Scientific Communication) for each semester in residence. Other core courses are MBBS 504 (Fundamentals of Graduate Research), MBBS 540 (Responsible Conduct of Research), and MBBS 530 (Advanced Cell Biology). Additional courses are selected with the approval of the student's graduate committee, Research Advisor or the Director of Graduate Studies for the Cell Biology, Immunology and Cancer Biology Concentration. Equivalent coursework completed at other institutions or in other collegiate units may be substituted for certain course requirements for graduate course work if approved by the Cell Biology, Immunology and Cancer Biology Concentration and the Graduate School.

Thesis M.S. MBBS Cell Biology, Immunology and Cancer Biology Concentration

All M.S. degrees require a total of 30 credit hours at the 500-level and at least 21 of these 30 hours must be graded hours. The thesis M.S. degree also requires at least 8 credit hours in research [MBBS 515C (Master's degree research-Cell Biology & Immunology), MBBS 515D (Master's degree research-Cancer Biology), MBBS 598C (Research-Cell Biology & Immunology), or MBBS 598D (Research-Cancer Biology)]. Students must also take a minimum of three and maximum of six credit hours of MBBS 599C (Thesis Research-Cell Biology & Immunology) or MBBS 599D (Thesis Research-Cancer Biology), prepare a thesis on the research project and pass a final oral examination, which serves as the comprehensive examination.

Non-Thesis M.S. MBBS Cell Biology, Immunology and Cancer Biology Concentration

A non-thesis MS degree may be conferred under extenuating circumstances as decided and recommended by the student's Thesis Committee. Details of requirements will be determined by the committee based upon the student's situation.

In accordance with the Graduate School, maximum coursework for full-time graduate students is 16 credit hours per semester. Nine (9) credit hours is considered a normal course load and is the minimum required for students supported by assistantships. Nine (9) credit hours is the minimum for fall/spring semesters while three (3) credit hours is the minimum for summer semesters.

Preliminary Examination and Dissertation for the Ph.D. MBBS Cell Biology, Immunology and Cancer Biology Concentration

Doctoral students must pass a preliminary examination, complete the Research Tools courses [Fundamentals of Graduate Research (MBBS 504) and Responsible Conduct of Research (MBBS 540)], and meet the Graduate School residency requirement before being advanced to candidacy. The students can take the preliminary examination after completing the formal course requirements. The student's graduate committee will prepare and administer a written preliminary examination covering various areas of Cell Biology, Immunology and Cancer Biology, with particular emphasis in the area of study declared by the student. This declaration is communicated through a prospectus of a dissertation composed of: (1) a proposal for the dissertation research, (2) biographical information on the candidate, and (3) a list of the courses taken during the candidate's graduate program. The proposal should address the proposed graduate research project, and be written in the NIH (National Institutes of Health) or NSF (National Science Foundation) approved format. The prospectus shall be available to the committee members at least 14 days prior to the date of the examination. A written examination score of at least 80 percent is required before a student can proceed to the oral portion of the preliminary examination. Upon satisfactory completion of the written examination, the candidate will meet with the committee as a whole and discuss the prospectus in detail. The committee will then conduct an oral preliminary examination. At this time, the committee may ask in-depth questions about the research project and other areas of cell biology, immunology and cancer biology. At least four (4) of the five (5) committee members must judge the oral performance acceptable for a student to pass the preliminary examination overall. If either the written or oral preliminary examination is failed, a student may request only one re-examination. Successful completion of both written and oral examinations is required before a student can be advanced to candidacy for the Ph.D. degree. After admission to candidacy, the student must earn at least 24 dissertation credit hours [MBBS 600C (Dissertation Research-Cell Biology & Immunology) or MBBS 600D (Dissertation Research-Cancer Biology)], prepare and defend a dissertation, and present a public seminar based on the student's research.

Medicinal Chemistry Concentration

Graduate courses may be taken leading to a Ph.D. degree in Multidisciplinary Biomedical and Biological Sciences with a concentration in Medicinal Chemistry. The Medicinal Chemistry Concentration offers advanced training in synthetic organic chemistry and/or computational chemistry in order to design new molecules toward drug development. The concentration also includes approaches to improve existing drugs or clinical candidates by optimizing their properties and structure. Medicinal chemistry enables future scientists to take a broad look at a therapeutic area and undertake a hands-on training in healthcare. Once awarded a Ph.D., and depending upon their research project, they can work in pharmaceutical or biotechnology sectors, as well as software companies and academia. Students entering the graduate training program are advised to plan the coursework so as to acquire a broad knowledge of the field before emphasizing on either synthetic chemistry or computational chemistry. Their advisor will help students plan their work.

Admission Criteria

The minimum requirement for admission to the Ph.D. degree in the Medicinal Chemistry Concentration is an undergraduate degree in chemistry or a related subject with a cumulative grade point average

(GPA) of 3.0 (A = 4.0) in the last 2 years. Applicants with an M.S. degree in Pharmaceutical Sciences or a related field should have a cumulative GPA of 3.0 in all graduate coursework.

Students entering the Ph.D. in the Medicinal Chemistry Concentration may be admitted directly from a master's program without completing a thesis in a process called Accelerated Entry. Accelerated entry into the Ph.D. track requires completion of at least 1 semester of M.S. course work at SIU and a cumulative GPA of at least 3.0 in graduate coursework.

Degree Types Offered

- Doctor of Philosophy (Ph.D.)
- Non-thesis M.S. (limited to special circumstances)

Ph.D. MBBS Medicinal Chemistry Concentration

The Ph.D. degree in the Medicinal Chemistry Concentration is a research-intensive graduate program wherein students take core courses in the concentration and Research Tools, along with completing a comprehensive and original research project. The project is the focus of the dissertation, which should be, original research that will make significant contribution to the body of scientific knowledge. Students seeking a Ph.D. degree will develop critical thinking skills and mastery in oral and written communication. All deadlines and formats should follow the guidelines provided by the Graduate School.

Graduation Requirements

1. Completion of core coursework including PHPS 420 (Principles of Drug Action), PHPS 500 (Targets), PHPS 501 (Principles of Drug Discovery), CHEM 541 (Advanced Organic Chemistry), and CHEM 551 (Advanced Biochemistry) with a grade B or better in each course while maintaining a cumulative GPA of 3.0 (A = 4.0) in all graduate coursework.
2. Completion of four credit hour of MBBS 500 (Introduction to Scientific Communication) and one credit hour of MBBS 501 (Advanced Scientific Communication) for each remaining semester in residence.
3. Completion of MBBS 540 (Responsible Conduct of Research) and either CHEM 561 (Advanced Physical Chemistry) or CHEM 531 (Advanced Analytical Chemistry) as Research Tool courses.
4. Completion of a comprehensive written preliminary examination with a grade B or better. Students who do not pass the preliminary examination will be allowed to repeat it one time, no sooner than three months after the initial examination.
5. The residency requirement for the Ph.D. in the Medicinal Chemistry Concentration must be fulfilled after admission to the doctoral program and before formal admission to doctoral candidacy. The residency requirement is satisfied by completion of 24 hours of graduate credit on campus as a Ph.D. student in Medicinal Chemistry within a period not to exceed 4 calendar years. A Ph.D. in Medicinal Chemistry student will not be permitted to count more than 6 credit hours of MBBS 600E (Dissertation Research - Medicinal Chemistry) towards the 24 credit hour residency requirement. To meet the residency requirement, students may enroll in any other course(s) in addition to the core courses and Research Tool courses that meets with the approval of their advisor and dissertation committee, e.g. any formal departmental or non-departmental courses and/or MBBS 590E or MBBS 595E (Readings - Medicinal Chemistry) MBBS 598E (Research - Medicinal Chemistry).
6. Admission to candidacy. The student is admitted to Ph.D. in Medicinal Chemistry candidacy after having completed the residency requirement, the Research Tool requirement and passing the comprehensive written preliminary examination. Admission to candidacy is granted by the Dean of the Graduate School upon recommendation of the student’s dissertation committee or the Graduate Program Committee. The Ph.D. in Medicinal Chemistry degree may not be conferred fewer than six months nor more than five years after admission to candidacy, except upon approval of the Dean of the Graduate School.
7. After admission to candidacy, the student must complete at least 12 credit hours of MBBS 600E and PHPS 600 from the SIUC and SIUE campuses. The student should prepare the dissertation document to meet the requirements of the dissertation committee and the Graduate School.
8. A dissertation proposal is required before the student begins significant research. The dissertation proposal should be written in the style of a NIH F31 grant with some modifications. An oral proposal will be presented as a public seminar. Immediately following this seminar, the proposal will be

defended before the student's dissertation committee. Students must pass both the oral and written portions of the dissertation proposal as determined and documented by their dissertation committee.

9. The student must meet formally with the dissertation committee at least once between defense of the proposal and the dissertation defense. The purpose of this interim meeting is to review progress and to modify the planned experiments, if deemed necessary. While not required, annual meetings with the dissertation committee is recommended.
10. The dissertation defense and seminar will occur no earlier than one year after the dissertation proposal defense and after at least one primary research paper with the student as first author has been submitted for publication to a peer-reviewed journal. The dissertation is expected to be a competent, original research project that will make significant contribution to the body of scientific knowledge. It should include a statement of the problem, an adequate review of literature, a careful analysis of results by whatever methods are appropriate, and an interpretation of the findings.
11. A preliminary draft of the dissertation should be reviewed and approved by the research advisor and a corrected copy should be submitted to other committee members.
12. Results of the dissertation research must be defended in a seminar which must be announced publicly in advance. Any member of the University community may attend the dissertation seminar and may participate in the questioning and discussion, subject to reasonable time limitations imposed by the committee chair. Immediately following the dissertation seminar, a final oral examination will be conducted by the student's dissertation committee. Only members of the committee may participate in the oral examination that occurs after the seminar and may vote or make recommendations concerning acceptance of the dissertation and final examination. A student will be recommended for the degree if members of the dissertation committee judge both the dissertation seminar and the performance at the final oral examination to be satisfactory. If approved, a dissertation approval form will be completed, signed by the committee and the Chair of the Department of Pharmacology and submitted to the Graduate School. In the case of failure of the oral examination, it may be repeated once, no sooner than three months after the first examination. Failure of the second examination will result in dismissal from the Medicinal Chemistry Graduate Program. If the written dissertation is unsatisfactory, the student will be allowed to revise the document and send to either the research advisor only or the whole dissertation committee for review and approval.
13. The student is responsible for electronically submitting the dissertation to the Graduate School, the Graduate Program Director, and their research advisor.
14. Students who have defended their dissertation but who missed the Graduate School deadline for final paper/thesis/dissertation submission to graduate in the same semester may register in MBBS 601 (Continuing Enrollment) until completion of the revised dissertation document. Students must be registered during the semester in which they graduate. Registering in MBBS 601 can negatively impact visa status thus international students should discuss this issue with the Graduate Program Director.

Ph.D. Dissertation Committee

The dissertation committee for a student in the Ph.D. in the Medicinal Chemistry Concentration must have a minimum of five members: the student's research advisor (chair), two faculty members from SIUE's Department of Pharmaceutical Sciences, two faculty members from the Pharmacology and Neuroscience Concentration, and one faculty member from outside these departments/Concentrations. Members of these committees should be able to contribute significantly in the area of the student's research program

Non-Thesis M.S. MBBS Medicinal Chemistry Concentration

A non-thesis M.S. degree may be conferred under extenuating circumstances as decided and recommended by the student's Dissertation Committee. Required courses include PHPS 420 (Principles of Drug Action), PHPS 500 (Targets), PHPS 501 (Principles of Drug Discovery) CHEM 551 (Advanced Biochemistry), CHEM 541 (Advanced Organic Chemistry), Chem 549 (Advanced Topics in Biochemistry), Chem 559 (Advanced Topics in Organic Chemistry), CHEM 531 (Advanced Analytical Chemistry) and/or CHEM 561 (Advanced Physical Chemistry). Other details for the requirements will be determined by the committee based upon the student's situation.

Microbiology Concentration

The Microbiology Concentration offers both M.S. and Ph.D. degrees. The faculty that participate in this Concentration are in the Microbiology Program of the School of Biological Sciences within the College of Agricultural, Life and Physical Sciences on the Carbondale campus. The Concentration is designed to offer advanced training (via lecture, discussion and laboratory) in bacteriology, immunology, pathogenesis, microbial physiology, molecular biology, biotechnology, environmental microbiology, and symbioses.

Admission Criteria

Prospective graduate students should have an undergraduate degree in any of the biological, chemical or physical sciences. The applicants are recommended to have completed courses in biology, chemistry, physics and mathematics. Strong candidates with deficiencies in any area may be admitted, but such deficiencies may restrict the research areas available to the student and may lead to requirements for additional courses during graduate study. An advisory system in the program (see below) will help students in planning their course of study. Prospective students for the thesis M.S. degree and the Ph.D. degree in the Microbiology Concentration are encouraged to contact program faculty in areas of their research interest.

Students may be admitted to the Ph.D. track with a bachelor's or master's degree. Students in the thesis M.S. in the Microbiology Concentration can be admitted to the Ph.D. track via Accelerated Entry or the master's equivalency option by the recommendation of the faculty and approval of the Graduate School.

Financial Assistance

Fellowships and assistantships are available through the Microbiology Concentration for qualified applicants.

Advisement and General Requirements

For thesis M.S. and Ph.D. students in the Microbiology Concentration, a curriculum committee (composed of Microbiology faculty) will advise incoming students on an initial program of study. The Director of Graduate Studies for the Microbiology Concentration will advise the student until a Research Advisor is chosen.

Research Advisor and Graduate Committee Selection

Each student in the Ph.D. or thesis M.S. degrees in the Microbiology Concentration should select a Research Advisor as soon as possible during the first year. The graduate committee for thesis M.S. students shall consist of the Research Advisor (chair), one faculty member from the Microbiology Concentration, and one additional graduate faculty member (within or outside of the program). The graduate committee for Ph.D. students shall consist of at least five graduate faculty members to include the Research Advisor (committee chair), two faculty members from the Microbiology Concentration, and two other graduate faculty members (within our outside of the program).

Graduate Committee Functions

For the Microbiology Concentration, the graduate committee will:

1. Plan and approve the student's program of study.
2. Review the student's progress in courses and suggest and approve changes in the program of study.
3. Evaluate the student's progress in research and make appropriate recommendations.
4. Meet and determine, on a yearly basis, whether a student is making satisfactory progress and may continue toward a degree. If continuation is denied, the committee must notify the Director of Graduate Studies for the Microbiology Concentration, in writing, of the reasons for this denial.
5. Administer preliminary examinations to those students on the Ph.D. track.
6. Read and evaluate the student's thesis or dissertation.
7. Conduct the required thesis or dissertation defenses.

Formal Course Requirements

The formal core course requirement for both the thesis M.S. and Ph.D. degrees can be met by taking a minimum of one credit hour of MBBS 500 (Introduction to Scientific Communication), one credit hour of MBBS 501 (Advanced Scientific Communication) for each semester in residence, MBBS 504 (Fundamentals of Graduate Research), and MBBS 540 (Responsible Conduct of Research). Thesis M.S. students are also required to take four graded non-research MBBS courses with at least one course at the 500-level, a minimum of three and a maximum of six credit hours of MBBS 599F (Thesis Research - Microbiology), prepare a thesis on the research project, and pass a final oral defense. Additional course requirements for the Ph.D. track can be met by taking five graded non-research MBBS courses with at least two at the 500-level. All course requirements are minimum requirements. Additional courses may be required by the student's graduate committee to meet any deficiencies or to provide proficiency in a specialized area. The Director of Graduate Studies, with the advice of the student's graduate committee may designate other courses within or outside of the Concentration to fulfill formal course requirements. Any course (or its equivalent) that meets the requirements of the MBBS graduate program whether taken at SIU or at any other institution before admission to the MBBS Program does not need to be repeated. Course equivalency will be determined by the Director of Graduate Studies for the Microbiology Concentration in consultation with the appropriate committee or member of the faculty.

Preliminary Examination and Dissertation for the Ph.D. MBBS Microbiology Concentration

Each student in the Ph.D. program must pass a preliminary examination, complete the Research Tool courses and meet the Graduate School residency requirement before being advanced to candidacy. The students should take the preliminary examination before the end of their third year and after completing the formal course requirements.

The preliminary examination is composed of a written research proposal and oral defense of the proposal. The prospectus should address the proposed graduate research project and be written in a NIH (National Institutes of Health) or NSF (National Science Foundation) approved format. The prospectus shall be available to the committee members at least 14 days prior to the date of the examination.

The proposal must be approved by 4 out of 5 of the committee members before a student can proceed to the oral portion of the preliminary examination. Following committee approval of the proposal, the candidate will meet with the committee for the oral preliminary examination. At this time, the committee may ask in-depth questions about the research project and other areas of pertaining to the student's coursework. At least four of the five committee members must judge the oral performance acceptable for a student to pass the preliminary examination overall. If the oral portion of the preliminary examination is failed, a student may request only one re-examination.

Successful completion of the preliminary examination is required before a student can be advanced to candidacy for the Ph.D. After admission to candidacy, the student must earn at least 24 credit hours of MBBS 600F (Dissertation Research – Microbiology), prepare and defend a dissertation, and present a public seminar based on the student's research

Molecular and Integrative Physiology Concentration

Graduate courses may be taken leading to a M.S. or Ph.D. degree in Multidisciplinary Biomedical and Biological Sciences with a Concentration in Molecular and Integrative Physiology. The graduate courses can also lead to a Certificate in Anatomy.

The Molecular and Integrative Physiology Concentration offers advanced training in mammalian physiology, vascular physiology, cell physiology, molecular biology, molecular endocrinology, neuroendocrinology, behavioral neuroscience, molecular neuroscience, molecular physiology in sensory organs, reproductive biology, reproductive endocrinology, developmental biology and human anatomy. Students entering the graduate training program are advised to plan their coursework so as to acquire a broad knowledge of the field before emphasizing one of these sub-disciplines. The advisory system in the Molecular and Integrative Physiology Concentration is set up to help students plan their work.

Each term students must be engaged in a training assignment which supplements formal coursework and will consist of research or teaching or both. For the Molecular and Integrative Physiology Concentration,

student are required to have participated in both types of activities. International students must pass a Test of Spoken English in order to have teaching assistantship support in the Division of Molecular and Integrative Physiology.

Thesis M.S. MBBS Molecular and Integrative Physiology Concentration

Admission Criteria

Interdisciplinary Rotations Entry Option

Students accepted into Interdisciplinary Rotations of the MBBS program may select the Molecular and Integrative Physiology Concentration after completion of at least three laboratory rotations in the MBBS 502 (Research Experience through Laboratory Rotations) course. Students should declare the Molecular and Integrative Physiology Concentration by the second semester of study.

Direct Entry Option

Prerequisites for graduate training in the Molecular and Integrative Physiology Concentration include an undergraduate degree in one of the biological, physical or behavioral sciences, preferably with one year each of physics, mathematics and chemistry. The Graduate School requires a cumulative grade point average (GPA) of 2.70 or better (*A* = 4.0) on the last 60 hours of undergraduate coursework. A minimum GPA of 3.00 (*A* = 4.0) in all undergraduate and graduate work is needed for serious consideration.

Curriculum

A total of 30 credit hours at the 400- or 500-level is required for the master's degree. Of the total credit hours completed, at least 21 of these must be graded (*A*, *B*, *C*) hours. At least 15 of the total 30 credit hours must be 500-level courses taken at SIUC. Courses required for the MBBS thesis M.S. degree are MBBS 500 (Introduction to Scientific Communication), MBBS 501 (Advanced Scientific Communication), MBBS 504 (Fundamentals for Graduate Research), MBBS 540 (Responsible Conduct of Research) and MBBS 599G (Thesis Research - Physiology minimum of 3 credit hours). More than three credit hours of MBBS 599G may be taken, however only six may be counted toward the 500-level requirement. MBBS 511A and MBBS 511B (Advanced Mammalian Physiology) courses are required for the Molecular and Integrative Physiology Concentration and must be completed with a grade of B or better. If a student completed PHSL 410A and PHSL 410B with a grade of B or better as a SIUC undergraduate, two semesters of MBBS 590G (Readings – Physiology) may be taken in lieu of the MBBS 511A and MBBS 511B requirement. Each student is required to complete at least one semester of physiology teaching.

Committees

The Director of Graduate Studies for the Molecular and Integrative Physiology Concentration will act as an advisor to new direct-entry M.S. students until a Research Advisor is selected. The choice of a Research Advisor is a very important step and should be carefully considered. During the first semester, Interdisciplinary Rotation students and most direct entry students will rotate through three research laboratories to get acquainted with faculty members and research programs before selecting a Research Advisor who will direct the thesis research and help plan coursework. Students entering through the accelerated M.S. degree option will be encouraged to select an advisor at the time of entry into the program.

The functions of the Research Advisor are:

1. To provide guidance in the student’s research and the use of facilities.
2. To provide mentorship in conducting, evaluating and publishing scientific research.
3. To serve as chair of the Thesis Committee and consultant for selecting other members of the Thesis Committee.

The Thesis Committee should include the chair and at least three additional members from the graduate faculty, including one from outside the Molecular and Integrative Physiology Concentration. Members of the Thesis Committee should provide expertise in or complementary to the student’s research area. The student should meet with the committee yearly or as needed to discuss research and academic progress.

All graduate training programs in the Molecular and Integrative Physiology Concentration are subject to approval of the Graduate Program Committee of the Division of Molecular and Integrative Physiology. The Graduate Program Committee will evaluate students at least annually. Continuation of assistantship support will be conditioned on satisfactory performance in the areas of academics, research and teaching. The student will provide documentation for each of these areas to the Graduate Program Committee. Academic performance will be based on good standing with the Graduate School (cumulative GPA=3.0). Satisfactory research performance will be based on accomplishments outlined in the student's documentation and an annual memo from the research mentor or Thesis Committee indicating progress in the area of research. Evaluation of teaching effectiveness will be carried out by the Graduate Program Committee from sources possibly, but not limited to, course coordinator, student evaluations and direct observation of classes by the Graduate Program Committee.

Thesis

The thesis should represent a competent piece of original research on a specific physiological problem or area under the research advisor's supervision. It should include an adequate review of the literature, a statement of the hypothesis, a set of experiments testing the hypothesis by whatever methods are appropriate, an analysis of the results, and an interpretation of the work and its significance. Upon completion of the thesis research, a final seminar is presented which is open to the public. A comprehensive oral examination will be conducted by the Thesis Committee and will cover the subject of the thesis and other matters related to the discipline.

Ph.D. MBBS Molecular and Integrative Physiology Concentration

Admission Criteria

Interdisciplinary Rotations Entry Option

Students accepted into Interdisciplinary Rotations of the MBBS program may select the Molecular and Integrative Physiology Concentration after completing at least three laboratory rotations in the MBBS 502 (Research Experience through Laboratory Rotations) course. Students should declare the Molecular and Integrative Physiology Concentration by the second semester of study.

Direct Entry Option

Prerequisites for graduate training in Molecular and Integrative Physiology include an undergraduate degree in one of the biological, physical, or behavioral sciences, preferably with one year each of physics, mathematics and chemistry. The Graduate School requires at least a 3.00 cumulative GPA (*A*=4.0) for the last two years of undergraduate coursework. The Molecular and Integrative Physiology Concentration may accept a student with only a bachelor's degree directly into the Ph.D. program, provided that the student has:

1. A cumulative undergraduate grade point average of 3.25 (*A* = 4.0).
2. Sufficient undergraduate course work in biology, chemistry, physics and mathematics.

The Graduate Program Committee will examine credential submitted in the application form.

Accelerated Entry Option

The Molecular and Integrative Physiology Concentration offers an accelerated entry option to a graduate student in the master's program who demonstrates the intellect, research aptitude and commitment to pursue a doctoral degree. At the end of at least one year of studies at the master's level, the student may request that their Thesis Committee review their qualifications and performance in order to establish eligibility for entry into the doctoral program under this option. The student must have a cumulative GPA of at least 3.25 (*A* = 4.0) in graduate coursework. The Thesis Committee must establish that the student is prepared and able to conduct research at the doctoral level, as evidenced by publications, presentations, depth of understanding, quality of seminars or quality of research proposal. The Thesis Committee will recommend that the student should either continue in the Master's program or advance into the doctoral program.

After the student's eligibility has been established, the research advisor and/or the Thesis Committee will prepare a written review of the student's qualifications and submit it to the Graduate Program Committee for approval of accelerated entry into the Ph.D. An Acceleration Form for admission to the doctoral program must be submitted by the student. The Director of Graduate Studies for the Molecular and Integrative Physiology Concentration will notify the Graduate School that admission via accelerated entry is requested.

Curriculum

The requirements for the Ph.D. in the Molecular and Integrative Physiology Concentration are those established by the Graduate School, the MBBS graduate program, Molecular and Integrative Physiology Concentration policy and the student's Dissertation Committee. The Graduate School requires 24 credit hours to be completed at SIUC as a residency requirement prior to candidacy and 24 credit hours of dissertation research.

Courses required for the Ph.D. degree in the Molecular and Integrative Physiology Concentration are MBBS 500 (Introduction to Scientific Communication), MBBS 501 (Advanced Scientific Communication), and the Research Tool courses [MBBS 504 504 (Fundamentals for Graduate Research) and MBBS 540 (Responsible Conduct of Research)]. MBBS 511A and MBBS 511B (Advanced Mammalian Physiology) are required for the Molecular and Integrative Physiology Concentration and must be completed with a grade of B or better. If a student completed PHSL 410A and PHSL 410B with a grade of B or better as a SIUC undergraduate, two semesters of MBBS 590G (Readings – Physiology) may be taken in lieu of the MBBS 511A and MBBS 511B requirement. Each student is required to complete at least one semester of physiology teaching.

Doctoral students must complete 24 credit hours of dissertation research (MBBS 600G - Physiology). No more than six hours of deferred dissertation credit may be applied towards fulfilling the 24 credit hours residency requirement. Any dissertation hours registered for above the six permitted prior to candidacy will not be counted toward completing the doctoral degree.

Committees

The Director of Graduate Studies for the Molecular and Integrative Physiology Concentration will advise new direct-entry graduate students until a Research Advisor is selected. The choice of a Research Advisor is a very important step and should be carefully considered. During the first semester, Interdisciplinary Rotation students and most direct entry students will rotate through three research laboratories to get acquainted with faculty members and research programs before selecting an advisor to direct the dissertation research and help plan coursework.

The functions of the Research Advisor are:

1. To guide the student's research and the use of facilities.
2. To provide mentorship in conducting, evaluating and publishing scientific research.
3. To serve as chair of the Dissertation Committee and consultant for selecting other members of the Dissertation Committee.

The Dissertation Committee should include the chair and at least four additional members from the graduate faculty, including one from outside the Molecular and Integrative Physiology Concentration. Members of the Dissertation Committee should provide expertise in or complementary to the research area. The student should meet with the committee yearly or as needed to discuss research and academic progress.

All graduate training programs in the Molecular and Integrative Physiology Concentration are subject to approval of the Graduate Program Committee of the Division of Molecular and Integrative Physiology. The Graduate Program Committee will evaluate students at least annually. Continuation of assistantship support will be conditioned on satisfactory performance in the areas of academics, research and teaching. The student will provide documentation for each of these areas to the Graduate Program Committee. Academic performance will be based on good standing with the Graduate School (cumulative GPA=3.0) and the passage of the preliminary exam by the end of the third year. Satisfactory research performance will be based on the filing of an approved research proposal by the end of the third year, accomplishments outlined in the student's documentation and an annual memo from the research mentor or Dissertation Committee indicating progress in the area of research. Evaluation of teaching

effectiveness will be carried out by the Graduate Program Committee from sources possibly, but not limited to, course coordinator, student evaluations and direct observation of classes by the Graduate Program Committee.

Preliminary Examination

Preliminary examinations for doctoral students consist of a written examination covering the student's research area and coursework, a research proposal in the area of the dissertation research project and an oral defense of the proposal. In most cases, the written preliminary examination is taken after completion of the second year of study. After passing the written examination with at least 80 percent score, the student will have one month to write the research proposal. The student's Dissertation Committee will evaluate the research proposal and if it is found acceptable, an oral examination, consisting of defense of the proposal and topics related to the discipline, will be scheduled with the Dissertation Committee. Details of the preliminary examinations are available from the Graduate Program Committee.

Admission to Candidacy

A student may be admitted to candidacy after the student has fulfilled the residency requirement, met the Research Tool requirement and passed the preliminary exam. Admission to candidacy is granted by the Dean of the Graduate School upon recommendation of the student's Dissertation Committee and the Graduate Program Committee of the Molecular and Integrative Physiology Concentration. The doctoral degree may not be conferred less than six months after admission to candidacy. The candidate must fulfill all requirements for the Ph.D. degree within a five-year period after admission to candidacy.

Dissertation

The dissertation should represent a competent piece of original research carried out on a specific physiological problem or area under the advisor's supervision. It should include an adequate review of the literature, a statement of the hypothesis, a set of experiments testing the hypothesis by whatever methods are appropriate, an analysis of the results, and an interpretation of the work and its significance. The research should be of sufficient quality and quantity to merit publications in peer-reviewed journals. At least one primary research manuscript with the student as first author must be accepted for publication. Upon completion of the dissertation research, a final public seminar is presented followed by an oral examination in a closed session. The examination will be conducted by the Dissertation Committee and will cover the subject of the dissertation and topics related to the discipline.

Certificate in Anatomy

The Anatomy Certificate is a graduate (post-baccalaureate) certificate program that provides students an opportunity to become proficient in anatomy teaching. This will allow them to compete more effectively for jobs in this field. The student must be currently enrolled in a graduate degree program at SIUC or an individual holding a bachelor's degree and admitted to the Graduate School (non-declared), preferably in an existing anatomically based graduate, masters or Ph.D. program (e.g. MBBS, Biological Sciences, Anthropology or Zoology). However, others will be evaluated on a case-by-case basis. Additional prerequisites, such as embryology, basic vertebrate anatomy, etc. are preferred but other courses may qualify. Students lacking such prerequisites may be encouraged to obtain them prior to admission into the Anatomy Certificate program. The Director of the Anatomy Certificate Program will review all applications. In addition to coursework in anatomy, students in the Anatomy Certificate program will obtain experience teaching gross anatomy to undergraduate and/or graduate students at the PHSL 301, PHSL 401A/B or PHSL 521A/B level. A minimum of 17 graduate credit hours are required for fulfillment of the certificate requirements. They are:

- Advanced Clinical Anatomy with Lab, (MBBS 521A, MBBS 521B, 10 credit hours)
- Advanced Mammalian Histology, (MBBS 509, 4 credit hours)
- Either Advanced Neuroanatomy with Lab (MBBS 514, 4 credit hours) or Advanced Human Embryology (MBBS 503, 3 credit hours).

Where appropriate, these courses may also count for credit toward the master's or Ph.D. degree. The Director of the Anatomy Certificate Program and the student's Thesis or Dissertation Committee will make recommendations for other coursework and oversee the student's progress.

Pharmacology and Neuroscience Concentration

Graduate courses of study leading to the M.S. and Ph.D. degrees in Pharmacology and Neuroscience are offered by Southern Illinois University School of Medicine, Department of Pharmacology. Course offerings in the graduate program have been designed so that graduate students may acquire a broad basic knowledge in Pharmacology and Neuroscience. Graduate students in the thesis M.S. and Ph.D. in Pharmacology and Neuroscience programs may choose from a diversity of specializations when selecting a research advisor and a research topic. These are so research range from sensory processing, motor function, circadian biology, neurodevelopmental disorders, pain, epilepsy, cancer, muscle physiology, memory, and drug addiction, among others. Graduate students in the non-thesis M.S. in Pharmacology and Neuroscience program are not required to perform laboratory research or write a thesis. Instead, these students will complete a capstone project for completion of their degree with the assistance of a faculty advisor, whom they select.

As part a collaboration with the Department of Pharmaceutical Sciences at SIU Edwardsville (SIUE), a cooperative (Co-Op) Ph.D. in Pharmacology and Neuroscience that follows the Pharmacology and Neuroscience curriculum is an alternative training option. Research advisors for Co-Op PhD students should be chosen from the SIUE Department of Pharmaceutical Sciences.

Admission Criteria

The minimum requirement for admission to the Pharmacology and Neuroscience Concentration is an undergraduate degree in one of the biological sciences. Students with undergraduate training in related areas, such as chemistry, physics, mathematics, computer science, psychology or engineering are also eligible for admission in the Pharmacology and Neuroscience Concentration. One year each of physics, mathematics, and chemistry is recommended, but not required.

Unrestricted admission into the M.S. in the Pharmacology and Neuroscience Concentration requires an undergraduate grade point average (GPA) of 2.7 (A = 4.0) in the last 60 hours of the bachelor's degree.

Unrestricted admission into the Ph.D. in Pharmacology and Neuroscience Concentration requires an overall undergraduate or graduate GPA of 3.00 (A = 4.0).

Students entering the Ph.D. in Pharmacology and Neuroscience Concentration may be admitted directly from a master's program without completing a thesis in a process called Accelerated Entry. Accelerated entry (from a master's program) into the Ph.D. track requires (1) the student must have attained a GPA of 3.0 (A = 4.0) in graduate course work and (2) a Research Advisor who has agreed to mentor the student during their dissertation. The advisor should submit a letter of recommendation attesting to the student's ability and potential to perform doctoral research. Approval of this request must be given by the Graduate Program Committee and the Department Chair. The Chair of the Department will then request that the Graduate School waive the master's degree or master's equivalency before entry into the doctoral program.

Degree Types Offered

- Master of Science (M.S.) - Thesis
- Master of Science (M.S.) - Non-thesis (principally online or limited in person under special circumstances)
- Doctor of Philosophy (Ph.D.) - Dissertation

Curriculum and Procedures

All M.S. and Ph.D. Pharmacology and Neuroscience students are required to complete core coursework that is supplemented with appropriate electives. The core courses are MBBS 500 (Introduction to Scientific Communication), MBBS 501 (Advanced Scientific Communication), MBBS 550A and MBBS 550B (Principles of Pharmacology I & II), and MBBS 577 (Neuroscience). Equivalent coursework completed at other institutions or in other collegiate units may be substituted for certain course

requirements for graduate course work in Pharmacology and Neuroscience if approved by the Pharmacology and Neuroscience Graduate Program Committee and the Graduate School.

In accordance with the Graduate School, maximum coursework for full-time graduate students is 16 credit hours per semester. Nine (9) credit hours is considered a normal course load and is the minimum required for students supported by assistantships. Eight (8) credit hours is the minimum for fall/spring semesters while 3 credit hours is the minimum for summer semesters. Students in the Co-Op Pharmacology and Neuroscience Ph.D. concentration with SIUE must be registered on both campus for each semester. If not taking a course taught on the SIUE campus during fall, spring or summer, students should register for 0 credit hours of UNIV 500. If not taking a course taught on the SIUC campus during the fall or spring, student should register for 0 credit hours of MBBS 601 Section 777.

An advisory system in Pharmacology and Neuroscience Concentration will help students in planning their coursework. Upon their admission to the M.S. or Ph.D. Pharmacology and Neuroscience Concentration, the Graduate Program Director will advise students until the student chooses a Research Advisor. The courses chosen by students, their advisors and their thesis/dissertation committees are subject to approval by the Pharmacology and Neuroscience Graduate Program Committee. Students should choose a Research Advisor and assemble a thesis/dissertation committee after completion of core coursework, required Research Tools (for Ph.D. only), and passage of the preliminary examination. Thesis/dissertation committees and advisor selection shall be chosen according to guidelines defined in the Concentration operating paper.

Financial Assistance

The Pharmacology and Neuroscience Concentration may offer financial assistance that includes tuition waivers, research assistantships, and fellowships for M.S. and Ph.D. students; application for this support is made directly to the Department of Pharmacology. The Graduate School governs limits on support. Pharmacology and Neuroscience M.S. and Ph.D. students should be aware that renewal of their research assistantship or fellowship support is contingent upon satisfactory performance evaluations as documented in an annual progress report and outlined in the Concentration operating paper.

Non-Thesis M.S. MBBS Pharmacology and Neuroscience Concentration

Curriculum

The non-thesis M.S. degree in the Pharmacology and Neuroscience Concentration is designed for the majority of coursework described below to be completed online, with the exception MBBS 551 (Methods in Pharmacology), although students have the option of in-person attendance for any course. A faculty advisor assigned to the student by the Pharmacology and Neuroscience Graduate Program Committee will help plan course work until the student choses a faculty advisor with whom to work on the capstone project. Students are not required to perform laboratory research or write a thesis for the non-thesis M.S. degree in Pharmacology and Neuroscience. All deadlines and formats should follow the guidelines provided by the Graduate School and the Pharmacology and Neuroscience Concentration operating document.

Graduation Requirements

1. A total of 34 credit hours at the 500-level is required for the non-thesis M.S. degree in the Pharmacology and Neuroscience Concentration.
2. At least 21 of these 34 hours must be graded hours and should include MBBS 577 (Neuroscience), MBBS 550A (Principles of Pharmacology I), MBBS 550B (Principles of Pharmacology II), MBBS 540 (Responsible Conduct of Research), MBBS 512 (Regulatory Issues in Drug Development) and two semesters of MBBS 500 (Introduction to Scientific Communication).
3. A minimum of 6 of the 34 credit hours should be comprised of MBBS 590H (Readings - Pharmacology and Neuroscience) or MBBS 595H (Readings - Pharmacology and Neuroscience). More than 6 credit hours of MBBS 590H and/or MBBS 595H may be taken.
4. A cumulative GPA of 3.0 (A = 4.0) in all graduate coursework is required to remain in the non-thesis M.S. Pharmacology and Neuroscience Concentration.

1. After completion of core coursework, students will must pass a preliminary exam (described below).

2. Students must complete a capstone project under the direction of a faculty advisor, whom the student chooses. Credit for the capstone project occurs through MBBS 590Hand MBBS 595H courses.

Committees

Students pursuing the non-thesis M.S. degree in the Pharmacology and Neuroscience Concentration shall be advised by a single faculty member and are not required to form a committee.

Preliminary Exam

Students seeking a non-thesis M.S. degree in the Pharmacology and Neuroscience Concentration must pass a preliminary examination with a grade of B or better to fulfill graduation requirements. It will be prepared, conducted and evaluated by the faculty in the Department of Pharmacology with leadership by the Graduate Program Director. Students will take this exam upon completion of the core course work. Students who do not pass the preliminary examination will be allowed to repeat it one time, no sooner than one month after the initial examination.

Capstone Project

Students must complete a capstone project under the direction of a faculty mentor chosen by the student. The capstone project is limited in scope and is developed collaboratively with the student and faculty advisor. The capstone project may take the form of a literature review, data analysis, or limited research project.

Thesis M.S. MBBS Pharmacology and Neuroscience Concentration

Curriculum

The thesis M.S. degree in the Pharmacology and Neuroscience Concentration is a research-focused M.S. degree wherein students take required courses in the concentration along with completing a focused research project. Rather than completing a comprehensive research project that may stand alone as a meaningful contribution, the research project for the thesis M.S. degree should be focused and may not be sufficient for submission as a completed primary research manuscript. Students seeking a thesis M.S. degree will also develop proficiency in oral and written communication within areas of neuroscience and pharmacology. All deadlines and formats should follow the guidelines provided by the Graduate School and the Pharmacology and Neuroscience Concentration operating document.

Graduation Requirements

1. A minimum of two-years of full-time study (one year in residence).
2. A total of 30 credit hours at the 500 level, of which a maximum of six credit hours of MBBS 599H (Thesis Research- Pharmacology and Neuroscience) can be counted.
3. Completion of core coursework that includes MBBS 577 (Neuroscience), MBBS 550A (Principles of Pharmacology I), and MBBS 550B (Principles of Pharmacology II), as well as four semesters of MBBS 500 (Introduction to Scientific Communication).
4. Completion of MBBS 540 (Responsible Conduct of Research) and completion of MBBS 544 (Applied Statistics for Basic Scientists). Students may be exempt from taking MBBS 544 if they have received a B or better in an upper level (400 level or above) statistics course during their undergraduate coursework.
5. Each student is required to have at least three credit hours of MBBS 599H (Thesis Research-Pharmacology and Neuroscience) before their thesis defense.
6. A cumulative GPA of 3.0 (A = 4.0) in all graduate coursework is required to remain in the thesis M.S. in Pharmacology and Neuroscience Concentration.
7. After completion of core coursework, students will must pass a preliminary exam (described below).
8. A thesis must be completed in the student's research area of interest and receive approval from the student's Thesis Committee. The thesis is expected to be a competent, original research project carried out in a selected area under the research advisor's supervision. Results of the thesis research must be defended in an open seminar that must be announced publicly in advance, with

a closed oral examination with the Thesis Committee following the completion of the seminar. Submission of the thesis and the oral defense should be completed following the guidelines of the Graduate School and parameters outlined in the operating paper for the Pharmacology and Neuroscience Concentration. The student will be recommended for the thesis M.S. degree if members of the student's Thesis Committee judge both the thesis and the performance at the oral examination to be satisfactory.

9. The student is responsible for electronically submitting the thesis to the Graduate School, the Graduate Program Director, and their research advisor.
10. Students who have who missed the Graduate School deadline for approved thesis submission to graduate in the same semester may register in MBBS 601 (Continuing Enrollment) until completion of the revised thesis document. Students must be registered during the semester in which they graduate.

M.S. Thesis Committee

The Thesis Committee for a student in the Pharmacology and Neuroscience Concentration must have a minimum of three members: the student's Research Advisor (chair) and two additional faculty, at least one of which must be a member of the Pharmacology and Neuroscience Concentration. Before significant research has begun, a thesis plan is required. The thesis plan will be presented and discussed in an informal meeting with thesis committee members. The thesis plan must be approved by the student's Thesis Committee.

Preliminary Exam

Students seeking a thesis M.S. degree in the Pharmacology and Neuroscience Concentration must pass a preliminary examination with a grade of B or better to fulfill graduation requirements. It will be prepared, conducted and evaluated by the faculty in the Department of Pharmacology with leadership by the Graduate Program Director. Students will take this exam upon completion of the core course work. Students who do not pass the preliminary examination will be allowed to repeat it one time, no sooner than three months after the initial examination.

Ph.D. MBBS Pharmacology and Neuroscience Concentration

Curriculum

The Ph.D. degree in the Pharmacology and Neuroscience Concentration is a research-intensive graduate program wherein students take core courses in the concentration and Research Tools along with completing a comprehensive and original research project. The project is the focus of the dissertation, which should be competent, original research that will make significant contribution to the body of scientific knowledge. Students seeking a Ph.D. degree will also develop mastery in oral and written communication within areas of neuroscience and pharmacology. All deadlines and formats should follow the guidelines provided by the Graduate School and the Pharmacology and Neuroscience Concentration operating document.

Graduation Requirements

1. Completion of core coursework including MBBS 577 (Neuroscience), MBBS 550A (Principles of Pharmacology I), and MBBS 550B (Principles of Pharmacology II), as well as four semesters of MBBS 500 (Introduction to Scientific Communication) with a grade of B or better in each course while maintaining a cumulative GPA of 3.0 (A = 4.0) in all graduate coursework.
2. Completion of one credit hour of MBBS 501 (Advanced Scientific Communication) for each remaining semester after the MBBS 500 requirement is complete.
3. Completion MBBS 540 (Responsible Conduct of Research) and MBBS 504 (Fundamentals for Graduate Research) as Research Tools.
4. Completion of MBBS 544 (Applied Statistics for the Basic Sciences). Students may be exempt from taking MBBS 544 if they have received a B or better in an upper level (400 level or above) statistics course during their undergraduate coursework.
5. After completion of core coursework, students will must pass a preliminary exam (described below).

6. The student is admitted to Ph.D. in Pharmacology and Neuroscience candidacy after having completed the residency requirement, the Research Tool requirement, and passing the preliminary examination. Admission to candidacy is granted by the Dean of the Graduate School upon recommendation of the Graduate Program Director. The Ph.D. in Pharmacology and Neuroscience degree may not be conferred fewer than six months nor more than five years after admission to candidacy, except upon approval of the Dean of the Graduate School.
7. Students must formulate a Ph.D. Dissertation Committee (described below) which should be approved by the Graduate Program Director.
8. Students must complete at least 24 credit hours of MBBS 600H (Dissertation Research - Pharmacology and Neuroscience) to complete the dissertation research project and prepare the dissertation document to meet the requirements of their committee and the Graduate School. Students in the Co-Op Ph.D. in Neuroscience and Pharmacology concentration must have at least 12 credit hours of MBBS 600H and PHPS 600 from each campus.
9. A written dissertation research proposal and an open oral seminar outlining the proposal in a format described by the Pharmacology and Neuroscience Concentration operating paper will be evaluated by the student's Dissertation Committee. The proposal will subsequently be negotiated in a closed meeting with the student's Dissertation Committee. Students must pass both the oral and written portions of the dissertation proposal examination as determined and documented by their Dissertation Committee.
10. The dissertation defense and seminar will occur no earlier than one year after the dissertation proposal defense and after at least one primary research paper with the student as first author has been submitted for publication to a peer-reviewed journal. The research project should include a statement of the problem, an adequate review of literature, a careful analysis of results using appropriate methodology, and an interpretation of the findings. Per procedures described in the Pharmacology and Neuroscience Concentration operating manual, once the dissertation research project is complete, the written dissertation will be provided to the Dissertation Committee. Results of the dissertation research must be presented in an open seminar which must be announced publicly in advance. Immediately following the dissertation seminar, a closed final oral examination will be conducted by the student's Dissertation Committee. A student will be recommended for the Ph.D. degree if members of the Dissertation Committee judge both the written dissertation and the performance at the final oral examination to be satisfactory. If approved, a dissertation approval form will be completed, signed by the committee and the Chair of the Department of Pharmacology, and submitted to the Graduate School. In the case of failure of the oral examination, it may be repeated once, no sooner than three months after the first examination. Failure of the second examination will result in dismissal from the Pharmacology and Neuroscience Graduate Program.
11. The student is responsible for electronically submitting the dissertation to the Graduate School, the Graduate Program Director, and their research advisor.
12. Students who have who missed the Graduate School deadline for final paper/thesis/dissertation submission to graduate in the same semester may register in MBBS 601 (Continuing Enrollment) until completion of the revised dissertation document. Students must be registered during the semester in which they graduate.

Requirement for Admission to Candidacy

After admission to the doctoral program, fulfillment of the residency requirement shall occur before admission to candidacy. The residency requirement is satisfied by completion of 24 hours of graduate credit (core coursework, research tools, and passing the preliminary exam) on campus as a Ph.D. student in the Pharmacology and Neuroscience Concentration within a period not to exceed 4 calendar years. No more than 6 credit hours of MBBS 600H (Dissertation Research- Pharmacology and Neuroscience) will be counted towards the 24 credit hour residency requirement. To meet the residency requirement, students may enroll in any other course(s) including the core courses, Research Tool courses, and/or any formal departmental (MBBS 533) or non-departmental courses and/or readings and research courses (MBBS 590H, MBBS 595H, MBBS 598H).

Ph.D. Dissertation Committee

The Dissertation Committee for a student in the Ph.D. in the Pharmacology and Neuroscience Concentration must have a minimum of five members: the student's Research Advisor (chair), two or three faculty members from the Department of Pharmacology, and at least one faculty member whose

primary appointment originates outside the Concentration. The Dissertation Committee for students in the Co-Op Ph.D. program with SIUE must have two faculty members from SIUE's Department of Pharmaceutical Sciences, two faculty members from the Pharmacology and Neuroscience Concentration, and one faculty member from outside these departments/Concentrations. Members of these committees should be able to contribute significantly in the area of the student's research program. If the research advisor does not have a primary academic appointment in the Department of Pharmacology (except for the Co-Op Ph.D. program), then a co-mentor from the Department of Pharmacology is required and that co-mentor serves as the committee chair. The Chair of the Department of Pharmacology and the Graduate Program Director are ex-officio members for all thesis/dissertation committees of which they are not formal members.

Preliminary Exam

Students seeking a Ph.D. degree in the Pharmacology and Neuroscience Concentration must pass a preliminary examination with a grade of B or better to fulfill graduation requirements. It will be prepared, conducted and evaluated by the faculty in the Department of Pharmacology with leadership by the Graduate Program Director. Students will take this exam upon completion of the core course work. Students who do not pass the preliminary examination will be allowed to repeat it one time, no sooner than three months after the initial examination.

Public Health Laboratory Sciences Concentration

A non-thesis M.S. degree with a focus in the Public Health Laboratory Sciences (PHLS) Concentration offers advanced training with coursework and practical laboratory

experience designed to prepare students for a career in public health laboratory science and requires substantial training in a public health laboratory setting that is directly relevant to career preparation in that area. This program is geared towards individuals who have an interest and talent for rigorous analytical work, and a desire to promote the use of laboratory-derived information to improve public health. Over 2 years, students are provided with advanced training needed to obtain both analytical and leadership roles within state and federal public health laboratories. Graduates are thus able to contribute to the provision of critical information needed to inform policy and program evaluation, and to continuing population science assessment, policy development and assurance. This program draws faculty primarily from the Department of Medical Microbiology, Immunology, and Cell Biology (MMICB) at the School of Medicine on the Springfield campus. Supervisors and staff from the Illinois Department of Public Health (IDPH) Division of Laboratories provide training to students in the public health laboratory setting.

Admission Criteria

Prospective graduate students should have an undergraduate degree in any of the biological, chemical or physical sciences. The applicants are recommended to have completed courses in biology, organic chemistry, physics and mathematics. Strong candidates with deficiencies in any area may be admitted, but such deficiencies may restrict the research areas available to the student and may lead to requirements for additional courses during graduate study. Prospective students are encouraged to contact the Director of the PHLS Concentration for advisement.

The PHLS Concentration requires a cumulative grade point average (GPA) of 2.7 (*A* = 4.0). Applicants are encouraged but not required to submit Graduate Record Examination (GRE) general test scores. International students whose native or first language is not English must take one of the Graduate School-approved English proficiency tests no more than 24 months prior to the term for which they seek admission.

Financial Assistance

Fellowships and assistantships are available through the program for qualified applicants.

Advisement and General Requirements

The PHLS Concentration Director will assist students in the planning a program of study.

Public Health Laboratory Science Concentration Committee

The PHLS Concentration Committee is composed of the Concentration Director and a single member chosen from the MMICB Department. The PHLS Concentration Committee will:

1. Provide programmatic oversight of the structure, curricular design, content and
2. Review applications from students for admission and make admissions recommendations to the MBBS Program Director.
3. Advise PHLS Concentration students in planning a course of study.
4. Monitor student progress toward the program.

Formal Course Requirements

The formal course requirements for the PHLS Concentration can be met by taking: MBBS 403 (Medical Microbiology) or MBBS 405 (Clinical Microbiology), CHEM 431 (Environmental Chemistry), MBBS 460 (Bacterial and Viral Genetics), MBBS 510 (Introduction to Public Health), MBBS 518 (Applied Immunology), MBBS 530 (Advanced Cell Biology), MBBS 540 (Responsible Conduct of Research), MBBS 541A and MBBS 541B (Public Health Laboratory Training), and MBBS 554A (Biochemistry I). PHLS students must also take a minimum of one credit hour of MBBS 500 (Introduction to Scientific Communication) or one credit hour of MBBS 501 (Advanced Scientific Communication) during each semester in residence. Additional courses may be required by the student's committee to meet any deficiencies or to provide proficiency in a specialized area. The PHLS Concentration Committee will make recommendations to whether courses taken at SIU or other universities are equivalent to the program requirements and need not be repeated.

Multidisciplinary Biomedical and Biological Sciences Courses

MBBS403 - Medical Microbiology Lecture (Same as MICR 403) A survey of the more common bacterial, mycotic and viral infections of humans with particular emphasis on the distinctive properties, pathogenic mechanisms, epidemiology, immunology, diagnosis and control of disease-causing microorganisms. Three hours lecture. Spring semester. Prerequisite: MICR 301, or consent of instructor. Credit Hours: 3

MBBS405 - Clinical Microbiology (Same as MICR 405) This course will be offered in Springfield only. A comprehensive course for health science professionals covering the biology, virulence mechanisms, and identification of infectious agents important in human disease and host-defense mechanisms. Clinical applications emphasized. Three hours lecture. Prerequisite: MICR 301, or consent of instructor. Credit Hours: 3

MBBS406 - Mycology (Same as MICR 406) Introduction to Mycology. This course will provide an overview of fungal diversity and taxonomy, fungal cell and molecular biology. Additionally, it will cover the ecological, economic, and historical impact of fungi on the environment, science, and society. Prerequisite: MICR 301 or consent of instructor. Credit Hours: 3

MBBS421 - Biotechnology (Same as MICR 421) Topics covered will include the genetic basis of the revolution in biotechnology, medical applications including genetic screening and therapeutic agents, industrial biotechnology and fermentation, and agricultural applications. Three hours lecture. Fall semester. Prerequisite: MICR 302, or consent of instructor. Credit Hours: 3

MBBS423 - Geomicrobiology (Same as MICR 423 and GEOL 423) The course will focus on the role that microorganisms play in fundamental geological processes. Topics will include an outline of the present understanding of microbial involvement of weathering of rocks, formation and transformation of soils and sediments, and genesis and degradation of minerals. Elemental cycles will also be covered with emphasis on the interrelationships between the various geochemical cycles and the microbial trophic groups involved. Prerequisite: MICR 301 and CHEM 210 and 211. Recommended: GEOL 220, 221 or 222. Credit Hours: 3

MBBS425 - Biochemistry and Physiology of Microorganisms Lecture (Same as MICR 425) Chemical composition, cellular structure, and metabolism of microorganisms. Fall semester. Prerequisite: CHEM 340 or CHEM 339. Credit Hours: 3

MBBS453 - Immunology Lecture (Same as MICR 453) Principles of molecular and cellular immunology. Particular emphasis is given to molecular mechanisms involved in activation and maintenance of the immune response at the basic science level. The role of the immune system in medical diagnostic procedures and in human health is also discussed. Spring semester. Prerequisite: MICR 403, or consent of instructor. Credit Hours: 3

MBBS460 - Bacterial and Viral Genetics (Same as MICR 460) The genetic mechanisms and regulatory events that control gene transfer, lambda phage infection, recombination, and metabolic pathways including a brief introduction to bioinformatics, genome analysis and global regulatory functions. Three hours lecture. Fall semester. Prerequisite: MICR 301 and 302, or consent of instructor. Credit Hours: 3

MBBS470 - Prokaryotic Diversity Lecture (Same as MICR 470) A consideration of the major groups of prokaryotes with special emphasis on their comparative physiology and ecology. Three hours lecture. Spring semester. Prerequisite: MICR 301, or consent of instructor. Credit Hours: 3

MBBS500 - Introduction to Scientific Communication Training in the interpretation of research and current literature in the biomedical and biological sciences. Format will include seminar presentations and/or Journal Club sessions. Credit Hours: 1-16

MBBS501 - Advanced Scientific Communication Presentation and discussion of research and current literature in the biomedical and biological sciences. Format will include seminar presentations and/or Journal Club sessions. Credit Hours: 1-16

MBBS502 - Research Experience through Laboratory Rotations The main objectives of this course are to acquaint students with the techniques and the equipment used in modern research laboratories and to provide instruction in the principles and practice of scientific experimentation. Students rotate through at least three research laboratories. Course is restricted to thesis M.S. and Ph.D. students in the Multidisciplinary Biomedical & Biological Sciences (MBBS) Graduate Program. Credit Hours: 3

MBBS503 - Advanced Human Embryology Embryology is the branch of anatomy that looks at the developmental events that occur prior to birth. This course is designed to provide a basic foundation in human embryology to graduate students who are interested in the biomedical sciences. In this course, we will explore human development from fertilization to birth. Our major focus will be on the morphological changes that take place during development, but we will also explore many of the underlying molecular mechanisms and relevant congenital anomalies. Students will review and discuss current literature relevant to each unit and complete final projects as approved by the course instructor. Approval of the instructor required for enrollment. Students who have passed PHSL 403 are not eligible for enrollment. Credit Hours: 3

MBBS504 - Fundamentals for Graduate Research This course is designed to provide foundational knowledge in topics and concepts that are common to disciplines in biomedical and biological research. Basic skills training in experimental design and research methods will be acquired through lectures, workshops, assignments and through reading and reviewing scientific literature. Credit Hours: 3

MBBS505 - Biomedical Science Program Seminar Seminar on social, professional, and scientific issues of interest to students planning a career in the biomedical sciences. Course focuses on development of professional writing, and approaches to professional school application. Credit Hours: 1

MBBS506 - Scientific Approach and Application Course covers advanced topics in biological and biomedical science. Understanding of biomedical science research and biological problem solving are emphasized. Course also focuses on preparatory strategies for professional school admissions examinations. Credit Hours: 2

MBBS509 - Advanced Mammalian Histology This course is intended to provide students with an understanding of mammalian tissues with a strong emphasis on human anatomy. The course utilizes self-directed and problem-based learning strategies employing on-line resources including virtual microscopy. By completing this course, successful students should 1) be familiar with the organization, structure, and

appearance of mammalian tissues; 2) be able to recognize and identify tissues from all major mammalian organs, 3) be able to describe the relationship between tissue conformation and organ function, 4) be able to discuss methods for histological techniques, 5) be able to discuss troubleshooting for histological techniques and 6) be able to demonstrate critical thinking skills to understand how the altered structure and function of cells, tissues and organs may lead to pathology. Credit Hours: 4

MBBS510 - Functions of Public Health System This course is an introduction to the concepts and practices of public health at the community, state, and national levels. The course addresses the philosophy, purpose, history, organization, functions, activities and impact of public health practice. The course also addresses a number of important health issues and problems facing the public health system. Special emphasis will be placed on the role of public health laboratory in public health practice. Discussion questions and case studies are integrated into the course, serving to stimulate student participation in gaining in-depth knowledge about real world public health issues and practice. Prerequisite: Bachelor's degree in Microbiology or other Biology, Chemistry, Physical Science. Credit Hours: 3

MBBS511A - Advanced Mammalian Physiology Physical and chemical organization and function in mammals, with emphasis on the human. Topics include cell, molecular, excitable membrane, cardiovascular, respiratory, renal, neural, gastrointestinal, endocrine and reproductive physiology. Four lectures per week. Students will develop critical reasoning and understanding in subject areas through the reading and evaluation of current research literature. MBBS 511A and MBBS 511B can be taken in any sequence. Restricted to consent of department. Special approval needed from the instructor. Credit Hours: 4

MBBS511B - Advanced Mammalian Physiology Physical and chemical organization and function in mammals, with emphasis on the human. Topics include cell, molecular, excitable membrane, cardiovascular, respiratory, renal, neural, gastrointestinal, endocrine and reproductive physiology. Four lectures per week. Students will develop critical reasoning and understanding in subject areas through the reading and evaluation of current research literature. MBBS 511A and MBBS 511B can be taken in any sequence. Restricted to consent of department. Special approval needed from the instructor. Credit Hours: 4

MBBS512 - Regulatory Issues in Drug Development This course provides content covering the drug development process and FDA regulatory requirements for over-the-counter and prescription drugs and biologics. It provides an overview of the drug development phases, the pharmaceutical industry, and the regulatory concepts that shape federal oversight and industry decisions. No prerequisites are required. Credit Hours: 2

MBBS514 - Advanced Neuroanatomy with Lab Advanced Human Neuroanatomy with Lab (4 hours) examines the detailed structure of the human nervous system, linking structure to function at both the clinical and neurobiological level. The overall objective of the course will be a three-dimensional understanding of nervous system structure and organization, based upon anatomical connections, functions, and diseases. Graduate students will engage in literature reviews relevant to course material and submit final projects as approved by course instructors. Enrollment requires consent of the instructor. Students who have passed PHSL 402 are not eligible for enrollment. Lab fee: $25. Credit Hours: 4

MBBS515A - Master's Degree Research - Anatomy & Neurobiology Individualized laboratory research and training. Graded credit for Master's Degree only. Credit Hours: 1-6

MBBS515B - Master's Degree Research - Biochemistry & Molecular Biology Individualized laboratory research and training. Graded credit for Master's Degree only. Credit Hours: 1-6

MBBS515C - Master's Degree Research - Cell Biology & Immunology Individualized laboratory research and training. Graded credit for Master's Degree only. Credit Hours: 1-6

MBBS515D - Master's Degree Research - Cancer Biology Individualized laboratory research and training. Graded credit for Master's Degree only. Credit Hours: 1-6

MBBS515F - Master's Degree Research - Microbiology Individualized laboratory research and training. Graded credit for Master's Degree only. Credit Hours: 1-6

MBBS515G - Master's Degree Research - Physiology Individualized laboratory research and training. Graded credit for Master's Degree only. Enrollment requires approval of the instructor. Credit Hours: 1-6

MBBS515H - Master's Degree Research - Pharmacology & Neuroscience Individualized laboratory research and training. Graded credit for Master's Degree only. Credit Hours: 1-6

MBBS518 - Applied Immunology A survey of the components of the immune system and how they interact with each other to produce responses that are important in the control or mediation of human disease. Three hours lecture. Restricted to consent of instructor. Credit Hours: 3

MBBS520 - Advanced Microbial Physiology and Control Mechanisms The physiology, biochemistry and genetics of microbial regulatory mechanisms. Topics include transport phenomena, catabolite and nitrogen repression, the stringent response, and autoregulatory phenomena. Two lectures per week. Prerequisite: MBBS 425; or CHEM 451A and B, or consent of instructor. Credit Hours: 2

MBBS521A - Advanced Clinical Anatomy with Laboratory A-B sequence. Advanced Clinical Anatomy provides students with a thorough understanding of human anatomy and its application to medicine. The course will encompass osteology, musculature, the circulatory system, viscera, the nervous system, and the medical implications of anatomy. This will be achieved through various approaches including demonstrations with prepared specimens, student dissections, anatomical models, case studies, online materials, medical imaging, lectures, guided study sessions, and independent learning. Enrollment by consent of instructor. Lab fee: $20. Credit Hours: 5

MBBS521B - Advanced Clinical Anatomy with Laboratory A-B sequence. Advanced Clinical Anatomy provides students with a thorough understanding of human anatomy and its application to medicine. The course will encompass osteology, musculature, the circulatory system, viscera, the nervous system, and the medical implications of anatomy. This will be achieved through various approaches including demonstrations with prepared specimens, student dissections, anatomical models, case studies, online materials, medical imaging, lectures, guided study sessions, and independent learning. Enrollment by consent of instructor. Lab fee: $20. Credit Hours: 5

MBBS525 - Gene Regulation and Molecular Neuroscience This course will examine the molecular and cellular aspects of physiology in the context of human pituitary and neurological genetic disorders using the primary literature as the source of topics for oral presentations and discussions. Topics include experiments and model systems used to examine the regulation of gene expression, signaling pathways, protein activities, and cellular functions that underlie these disorders. Special approval needed from the instructor. Credit Hours: 3

MBBS530 - Advanced Cellular Biology (This course will be offered in Springfield only). An advanced course based on current literature concerning the cellular biology of eukaryotes. Both students and faculty will make presentations followed by discussion. Topics will include: the cellular and subcellular structure and function of the lower eukaryotes, the biochemistry and biophysics of eukaryotic membrane systems and the higher subcellular functions of mammalian cells. Prerequisite: 400 level course in genetics and in biochemistry or consent of instructor. Credit Hours: 3

MBBS531 - Molecular and Cellular Biology Lecture course in molecular and cellular biological techniques used in the study of organisms; structures and processes involved in genome organization; packaging and replication of DNA; transcription and RNA processing; recombination and transposition of DNA; gene regulation with emphasis on developmental processes; signal transduction; structure and function of cellular components; cell-cell interaction; etc. Prerequisites: MBBS 554A and MBBS 554B or consent of instructor. Credit Hours: 3

MBBS533 - Advanced Pharmacology & Neuroscience The goal of this course is to understand the process involved in scientific discovery and research by reading, analyzing, criticizing and discussing scientific articles covering the field of Pharmacology and Neuroscience and the related field of cellular and molecular biology. Prerequisites: MBBS 550A Principles of Pharmacology and MBBS 577 Neuroscience. Credit Hours: 3

MBBS535 - Advanced Biochemistry Lecture course in control mechanisms of biochemical processes, enzyme kinetics, regulation and allostery, coupled systems and energy transduction, membranes, transport, etc. Prerequisite: BCHM 451A or consent of instructor. Credit Hours: 3

MBBS540 - Responsible Conduct of Research This course will provide information on topics relevant to the ethical conduct of research, including conflict of interest, publication policies, animal and human subjects, peer review, and mentoring. No prerequisite. Credit Hours: 1

MBBS541A - Public Health Laboratory Training This course has a laboratory component of approximately 4-6 hours/week/credit hour of training in a functioning public health laboratory. The content of the course provides in-depth experience in the scientific basis and use of analytical methods in microbiology, immunology and molecular biology that are unique to public health laboratories at the state and national level. Prerequisite: MBBS 545. Credit Hours: 3-9

MBBS541B - Public Health Laboratory Training This course has a laboratory component of approximately 4-6 hours/week/credit hour of training in a functioning public health laboratory. The content of the course provides in-depth experience in the scientific basis and use of analytical methods in environmental chemistry and biochemistry that are unique to public health laboratories at the state and national level. Prerequisite: MBBS 541A. Credit Hours: 3-9

MBBS544 - Applied Statistics for the Basic Sciences This course reviews introductory statistics and focuses on advanced statistics, linear and nonlinear modeling, applicable to basic bimedical sciences. The course will also provide students with experience in the use of statistical package computer programs for data analysis. No prerequisite required. Credit Hours: 3

MBBS545 - Basis of Public Health Laboratory Practice The scientific basis of current laboratory practice of public health science in the areas of microbiology, immunology, molecular biology, environmental chemistry, biochemistry and instrumentation (to accompany 541A,B). Prerequisite: MBBS 510, Bachelor's degree in Biology, Chemistry, Physical Science. Credit Hours: 3

MBBS550A - Principles of Pharmacology I A study of chemistry, pharmacodynamic actions, mechanisms of action, absorption, distribution, metabolism, elimination, adverse effects, interactions and toxic effects of drugs currently used in therapeutics. Three to five hours lecture, one to four hours discussion per week. Must be taken in sequence. Prerequisite: MBBS 577 or instructor permission. Credit Hours: 4

MBBS550B - Principles of Pharmacology A study of chemistry, pharmacodynamic actions, mechanisms of action, absorption, distribution, metabolism, elimination, adverse effects, interactions and toxic effects of drugs currently used in therapeutics. Three to five hours lecture, one to four hours discussion per week. Must be taken in sequence. No prerequisite required. Credit Hours: 4

MBBS551 - Methods in Pharmacology The main objective is to acquaint the student with various sophisticated laboratory equipment, basic techniques/principles of pharmacological experiments. One hour lecture and three hours laboratory twice weekly. This course is prerequisite to all advanced pharmacology courses. (Springfield Only.) Credit Hours: 4

MBBS552 - Cellular Immunology A lecture-discussion course covering contemporary aspects of cellular immunology. The cellular nature of immune responses as well as current information on the regulation of such responses will be considered. Topics will include cellular components of an immune response; receptors, recognition and signals; cellular cooperation; immuno-regulation; and tolerance and autoreactivity. Prerequisites: MBBS 453 or MBBS 518 or consent of instructor. Credit Hours: 3

MBBS554A - Biochemistry I First course of a two semester, comprehensive biochemistry course sequence. Introduction to structure and function of biomolecules including nucleic acids, proteins, sugars, polysaccharides, lipids and membranes, biochemical techniques, expression of genetic information, signal transduction and transport through membranes. Three lectures and one seminar per week. Seminar will consist of primary literature discussion and student presentation on areas covered in lecture. Principal lecturer for each of the area topics will lead discussion and assign the primary literature. Prerequisites: CHEM 340 or CHEM 442 or equivalents with a C- or better, or instructor permission.

Students who have previously passed BCHM/CHEM 451A are not eligible to register for this course. Credit Hours: 3

MBBS554B - Biochemistry II Second course of a two semester, comprehensive biochemistry course sequence. Basic kinetics, enzyme kinetics, enzyme inhibitors, regulation of enzymes, oxidation-reduction, high energy bonds, carbohydrate metabolism, aerobic/anaerobic metabolism, lipid metabolism, nitrogen metabolism, hormonal control of metabolism. Three lectures and one seminar per week. Seminar will consist of primary literature discussion and student presentation on areas covered in lecture. Principal lecturer will lead discussion and assign the primary literature. Prerequisites: CHEM 340 or CHEM 442 or equivalents with a C- or better, or instructor permission. Students who have previously passed BCHM/ CHEM 451B are not eligible to register for this course. Credit Hours: 3

MBBS555 - History of Medicine This course explores the theories and practice of medicine from antiquity to present day by examining changing cultural norms and scientific understanding of the human body throughout history. The focus is on understanding the development of Western medicine, but medical practice in ancient and non-Western cultures will also be explored. Credit Hours: 1-3

MBBS556 - Phylogenetics (Same as ANTH 556, PLB 556, ZOOL 556) An advanced introduction to modern methods of phylogenetic inference, emphasizing both theoretical background concepts and numerical approaches to data analysis. Topics include properties of morphological and molecular characters, models of character evolution, tree estimation procedures, and tree-based testing of evolutionary hypotheses. Special approval needed from the instructor. Credit Hours: 3

MBBS560 - Molecular Oncology A lecture-discussion course in molecular and cellular biology of tumor pathogenesis. The lecture covers various aspect of current tumor biology. The in-depth discussion on recent articles will provide students with opportunity to become familiar with front-line research in molecular oncology. Prerequisite: MBBS 554A or consent of instructor. Credit Hours: 3

MBBS570A - Advanced Topics - Anatomy & Neurobiology Discussion based course of selected topics in Anatomy & Neurobiology of current scientific interest to faculty and students. Credit Hours: 1-6

MBBS570B - Advanced Topics - Biochemistry & Molecular Biology Discussion based course of selected topics in Biochemistry & Molecular Biology of current scientific interest to faculty and students. Credit Hours: 1-6

MBBS570C - Advanced Topics - Cell Biology & Immunology Discussion based course of selected topics in Cell Biology & Immunology of current scientific interest to faculty and students. Credit Hours: 1-6

MBBS570D - Advanced Topics - Cancer Biology Discussion based course of selected topics in Cancer Biology of current scientific interest to faculty and students. Credit Hours: 1-6

MBBS570E - Advanced Topics - Medicinal Chemistry Discussion based course of selected topics in Medicinal Chemistry of current scientific interest to faculty and students. Credit Hours: 1-6

MBBS570F - Advanced Topics - Microbiology Discussion based course of selected topics in Microbiology of current scientific interest to faculty and students. Credit Hours: 1-6

MBBS570G - Advanced Topics - Physiology Discussion based course of selected topics in Physiology of current scientific interest to faculty and students. Enrollment requires approval of the instructor. Credit Hours: 1-6

MBBS570H - Advanced Topics - Pharmacology & Neuroscience Discussion based course of selected topics in Pharmacology & Neuroscience of current scientific interest to faculty and students. Credit Hours: 1-6

MBBS577 - Neuroscience This course provides basic neuroscience knowledge covering the fundamental principles of neural cell biology, neurophysiology, neurochemistry, neuroanatomy and behavior. This knowledge is essential to understand the mode of action of the drugs acting on excitable cells including muscle, autonomic system and central nervous system. No prerequisite. Credit Hours: 4

MBBS590A - Readings - Anatomy & Neurobiology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. Letter grade. Credit Hours: 1-6

MBBS590B - Readings - Biochemistry & Molecular Biology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. Letter grade. Credit Hours: 1-6

MBBS590C - Readings - Cell Biology & Immunology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. Letter grade. Credit Hours: 1-6

MBBS590D - Readings - Cancer Biology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. Letter grade. Credit Hours: 1-6

MBBS590E - Readings - Medicinal Chemistry Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. Letter grade. Credit Hours: 1-6

MBBS590F - Readings - Microbiology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. Letter grade. Credit Hours: 1-6

MBBS590G - Readings - Physiology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. Enrollment requires approval of the instructor. Letter grade. Credit Hours: 1-6

MBBS590H - Readings - Pharmacology & Neuroscience Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. Letter grade. Credit Hours: 1-6

MBBS595A - Readings - Anatomy & Neurobiology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. S/U grading. Credit Hours: 1-12

MBBS595B - Readings - Biochemistry & Molecular Biology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. S/U grading. Credit Hours: 1-12

MBBS595C - Readings - Cell Biology & Immunology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. S/U grading. Credit Hours: 1-12

MBBS595D - Readings - Cancer Biology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. S/U grading. Credit Hours: 1-12

MBBS595E - Readings - Medicinal Chemistry Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. S/U grading. Credit Hours: 1-12

MBBS595F - Readings - Microbiology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. S/U grading. Credit Hours: 1-12

MBBS595G - Readings - Physiology Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. Enrollment requires approval of the instructor. S/U grading. Credit Hours: 1-12

MBBS595H - Readings - Pharmacology & Neuroscience Supervised readings for qualified graduate students. Special arrangements to be made with the instructor with whom the student wishes to work. S/U grading. Credit Hours: 1-12

MBBS598A - Research - Anatomy & Neurobiology Credit for conducting research. Special arrangements to be made with the instructor with whom the student wishes to work. Credit Hours: 1-24

MBBS598B - Research - Biochemistry & Molecular Biology Credit for conducting research. Special arrangements to be made with the instructor with whom the student wishes to work. Credit Hours: 1-24

MBBS598C - Research - Cell Biology & Immunology Credit for conducting research. Special arrangements to be made with the instructor with whom the student wishes to work. Credit Hours: 1-24

MBBS598D - Research - Cancer Biology Credit for conducting research. Special arrangements to be made with the instructor with whom the student wishes to work. Credit Hours: 1-24

MBBS598E - Research - Medicinal Chemistry Credit for conducting research. Special arrangements to be made with the instructor with whom the student wishes to work. Credit Hours: 1-24

MBBS598F - Research - Microbiology Credit for conducting research. Special arrangements to be made with the instructor with whom the student wishes to work. Credit Hours: 1-24

MBBS598G - Research - Physiology Credit for conducting research. Special arrangements to be made with the instructor with whom the student wishes to work. Enrollment requires approval of the instructor. Credit Hours: 1-24

MBBS598H - Research - Pharmacology & Neuroscience Credit for conducting research. Special arrangements to be made with the instructor with whom the student wishes to work. Credit Hours: 1-24

MBBS599A - Thesis Research - Anatomy & Neurobiology Research for Master's degree thesis. Credit Hours: 1-6

MBBS599B - Thesis Research - Biochemistry & Molecular Biology Research for Master's degree thesis. Credit Hours: 1-6

MBBS599C - Thesis Research - Cell Biology & Immunology Research for Master's degree thesis. Credit Hours: 1-6

MBBS599D - Thesis Research - Cancer Biology Research for Master's degree thesis. Credit Hours: 1-6

MBBS599F - Thesis Research - Microbiology Research for Master's degree thesis. Credit Hours: 1-6

MBBS599G - Thesis Research - Physiology Research for Master's degree thesis. Credit Hours: 1-6

MBBS599H - Thesis Research - Pharmacology & Neuroscience Research for Master's degree thesis. Credit Hours: 1-6

MBBS600A - Dissertation Research - Anatomy & Neurobiology Research for Ph.D. degree dissertation. Credit Hours: 1-32

MBBS600B - Dissertation Research - Biochemistry & Molecular Biology Research for Ph.D. degree dissertation. Credit Hours: 1-32

MBBS600C - Dissertation Research - Cell Biology & Immunology Research for Ph.D. degree dissertation. Credit Hours: 1-32

MBBS600D - Dissertation Research - Cancer Biology Research for Ph.D. degree dissertation. Credit Hours: 1-32

MBBS600E - Dissertation Research - Medicinal Chemistry Research for Ph.D. degree dissertation. Credit Hours: 1-32

MBBS600F - Dissertation Research - Microbiology Research for Ph.D. degree dissertation. Credit Hours: 1-32

MBBS600G - Dissertation Research - Physiology Research for Ph.D. degree dissertation. Credit Hours: 1-32

MBBS600H - Dissertation Research - Pharmacology & Neuroscience Research for Ph.D. degree dissertation. Credit Hours: 1-32

MBBS601 - Continuing Enrollment For those graduate students who have not finished their degree programs and who are in the process of working on their dissertation, thesis or research paper. The student must have completed a minimum of 24 hours of dissertation research, or the minimum thesis, or research hours before being eligible to register for this course. Concurrent enrollment in any other course is not permitted. Graded S/U or DEF only. Credit Hours: 1

Multidisciplinary Biomedical and Biological Sciences Faculty

Adlimoghaddam, Aida, Assistant Professor, Ph.D., CRQM, (Springfield), University of Manitoba, Canada, 2015; 2023. Mitochondrial function, brain metabolic activity, inflammation, and cognitive changes in normal aging, Alzheimer's disease, and related diseases; pharmaceutical and dietary interventions, repurposing of FDA-approved drugs; early diagnosis and treatment in Alzheimer's disease.

Arai, Amy C., Professor, Ph.D., (Springfield), Chiba University, 1987; 1999. Molecular and pharmacological modulation of AMPA-type glutamate receptors and its impact on synaptic physiology.

Arbogast, Lydia A., Professor and Director Molecular and Integrative Physiology concentration, Ph.D., (Carbondale), Indiana University, 1988; 1996. Molecular aspects of reproductive neuroendocrinology.

Bany, Brent M., Associate Professor, Ph.D., (Carbondale), Western University (Canada), 1997; 2003. Uterine biology with a focus on the establishment and progression through early pregnancy in rodents and humans.

Bartke, Andrzej, Distinguished Professor, Emeritus, Ph.D., (Springfield), University of Kansas, 1965; 1984. Genetic and hormonal control of aging in mammals.

Bender, Kelly, Associate Professor and Director of Microbiology concentration, Ph.D., (Carbondale), Southern Illinois University, 2003; 2006. Metabolic regulation of bacteria involved in bioremediation, small non-coding regulatory RNAs.

Bhaumik, Sukesh R., Professor, Ph.D., (Carbondale), Tata Institute of Fundamental Research (University of Bombay), 1997; 2003. Regulation of eukaryotic gene expression, transcription-coupled ubiquitination and DNA repair, NMR structural studies on proteins and nucleic acids.

Braundmeier-Fleming, Andrea, Associate Professor, Ph.D., (Springfield), University of Illinois, 2005; 2014. Immune cell function and influence of the microbiome on the pathophysiology of reproductive disorders.

Burgess, Rebecca J., Assistant Professor, Ph.D., (Carbondale), Mayo Clinic College of Medicine 2007; 2023. Chromatin regulation, hematopoietic stem cell function and maintenance, stem cell proteostasis.

Cai, Weijia, Assistant Professor, Ph.D., (Springfield), Wuhan University, China, 2010; 2022. Explore the mechanisms that tumor cells suppress or avert immunogenic cell death (ICD) and discover novel targets to enhance the efficacy of current cancer therapies.

Caspary, Donald M., Research Professor, Emeritus, Ph.D., (Springfield), New York University, 1971; 1973. Sensory physiology, neurophysiology, age-related hearing loss, tinnitus.

Cheatwood, Joseph, Associate Professor, Ph.D., (Carbondale), University of Florida, 2004; 2009. Mechanisms of neuroprotection and recovery of function following central nervous system injury.

Copello, Julio A., Associate Professor, Ph.D., (Springfield), National University of La Plata, 1989; 2005. Molecular mechanism of intracellular calcium signaling and its role in ischemia and breast cancer.

Cox, Brandon, Professor and Director of Multidisciplinary Biomedical and Biological Sciences Graduate Program, Ph.D., (Springfield), Georgetown University, 2008; 2013. Hair cell regeneration in the cochlea and vestibular organs; postnatal maturation of the cochlea, and mechanisms of hair cell survival.

Crider, Michael, Professor, Ph.D., (Edwardsville), University of Kentucky, 1975; 2004. Synthetic medicinal chemistry, somatostatin non-peptides, sigma 2 ligands.

Davie, Judy, Professor and Chair, Department of Biomedical Sciences and Director of Biochemistry and Molecular Biology concentration, Ph.D., (Carbondale), University of California at Berkeley, 1998; 2006. Mechanisms of gene regulation, focusing on myogenin, a transcription factor that controls skeletal muscle development.

Demir, Ebru, Assistant Professor, Ph.D., (Carbondale), University of Vienna, Austria, 2006; 2024. Investigates the neural systems that support social reinforcement and social decision-making, both of which are vital for neuroprotection.

Elble, Randolph C., Associate Professor, Ph.D., (Springfield), Indiana University, 1986; 2005. Tumor suppression mechanisms in breast cancer by CLCA family of chloride current regulators.

Ellsworth, Buffy S., Professor, Ph.D., (Carbondale), Colorado State University, 2002; 2007. Pituitary gland development, molecular biology, regulation of gene expression.

Faingold, Carl L., Distinguished Professor, Ph.D., (Springfield), Northwestern University, 1970; 1972. Convulsive seizure mechanisms and effects of anticonvulsants; pharmacological alterations of cerebral evoked potentials, sudden unexpected death in epilepsy (SUDEP).

Fisher, Derek, Professor, Ph.D., (Carbondale), University of Pittsburgh School of Medicine, 2006; 2012. Bacterial pathogenesis and physiology, developmental regulation in Chlamydia.

Hamilton-Brehm, Scott D., Associate Professor, Ph.D., (Carbondale), University of Georgia, 2008; 2016. Microbial characterization of unique extreme environments, characterization of novel metabolism pathways, and DNA investigations from ancient artifacts.

Hascup, Erin R., Associate Professor, Ph.D., (Springfield), University of Kentucky, 2007; 2013. Neurological, neurochemical, and cognitive changes in aging, Alzheimer's disease, and related disorders; stage-specific therapeutics, early diagnosis and treatment in Alzheimer's disease

Hascup, Kevin N., Associate Professor, Ph.D., (Springfield), University of Kentucky, 2007; 2018. Metabolic and glutamatergic dysregulation during Alzheimer's disease progression and successful aging; identification of disease-modifying life-style factors and biomarker-targeted therapeutics.

Jadavji, Nafisa M., Assistant Professor, Ph.D., (Carbondale), McGill University, 2013; 2024. The impact of nutrition on neurobiology of aging.

Jayakody, Lahiru N, Associate Professor, Ph.D., (Carbondale), Kagoshima University, Japan, 2014; 2019. Developing synthetic microbes to produce renewable fuels, chemicals, pharmaceuticals, and proteins from biomass and industrial waste, including plastic, and investigate protein post-translational mechanisms to develop synthetic microbiology and metabolic engineering tools.

Jensik, Philip, Associate Professor, Ph.D., (Carbondale), Southern Illinois University Carbondale, 2009; 2016. Neurodevelopment and neurodegenerative disorders, functional genetics, neurobehavioral measures.

Kadyrov, Farid, Professor, Ph.D., (Carbondale), Russian Academy of Sciences, 1997; 2008. DNA replication and repair, DNA damage in cancer.

Konjufca, Vjollca, Professor, Ph.D., (Carbondale), University of Arkansas, Fayetteville, 2002; 2010. Immunology, host-pathogen interactions.

Kontoyianni, Maria, Professor and Director of Medicinal Chemistry concentration, Ph.D., (Edwardsville), University of North Carolina-Chapel Hill, 1992; 2009. Computational chemistry, virtual screening, structure- and ligand-based molecular design, hybrid approaches towards drug discovery.

Kvitsiani, Duda, Assistant Professor, Ph.D., (Carbondale), University of Vienna, Austria, 2006; 2024. Circuits that support animal decision-making.

Kwon, Guim, Professor, Ph.D., (Edwardsville), Southern Illinois University, 1992; 2005. Glucose and insulin homeostasis, artificial pancreas system.

Li, Cheng-Shu, Associate Professor, M.D., Ph.D., (Carbondale), Jianusi Medical School, Kochi Medical School, 1982; 1992. Central processing of gustatory information using both in vivo (extracellular recording and intracellular recording) and in vitro (patch clamping) techniques.

Loret de Mola, Ricardo, Professor and Chair of Department of Obstetrics and Gynecology, M.D., (Springfield), Monterrey Institute of Technology 1988; 2007. Care of couples with infertility, and women with endometriosis.

Madigan, Michael T., Professor and Distinguished Scholar, Emeritus, Ph.D., (Carbondale), University of Wisconsin, 1976; 1979.

Metz, Anneke M., Associate Professor and Director of Premedical Programs, Biochemistry, Ph.D., (Carbondale), University of Texas, 1998; 2009. Biology education; pre-health professional education.

Miyoshi, Takushi, Assistant Professor, Ph.D., (Carbondale), Kyoto University, 2017; 2024. Molecular biology in inner ear hair cells.

Nie, Daotai, Professor, Ph.D., (Springfield), University of South Carolina, 1997; 2005. Molecular and cellular biology of cancer, tumor metastasis, development of tumor therapeutics.

Nieto, Marcelo, Professor, Ph.D., (Edwardsville), Universidad Nacional de Cordoba (Cordoba, Argentina), 2000; 2006. Drug design and synthesis of rational focused libraries for diverse therapeutic areas (antimicrobial, anticancer, pain, etc.).

Nordman, Jacob C., Assistant Professor, Behavioral Neuroscience Ph.D., (Carbondale), George Mason University, 2014; 2021. Stress, synaptic and intrinsic plasticity, brain circuits, aggression, maladaptive behavior.

Olivo-Marston, Susan, Associate Professor, Ph.D., M.P.H., (Springfield), Georgetown University, Johns Hopkins University, 2005; 2021. Cancer epidemiology, the role of lifestyle, diet, and obesity on carcinogenesis.

Parrilla Carrero, Jeffrey, Assistant Professor, Ph.D., (Springfield), Medical University of South Carolina, 2015; 2023. Target circuit-specific cellular adaptation associated with addictive drug intake for effective intervention against drug addiction.

Patel, Bhargav, Assistant Professor, Ph.D., (Edwardsville), St. John's University, 2017; 2021. Discovery of anti-cancer agents as well as compounds for the treatment of neurodegenerative diseases.

Pond, Amber, Associate Professor and Director of Anatomy and Neurobiology concentration, Ph.D., (Carbondale), Mississippi University, 1995; 2012. Skeletal muscle physiology and biochemistry, focusing on the mechanisms contributing to skeletal muscle atrophy.

Premkumar, Louis S., Professor, Ph.D., (Springfield), Australian National University, 1992; 1999. Molecular mechanism(s) underlying pain perception; structure, function of ion channels, treatment options for chronic pain associated with peripheral neuropathies.

Rader, Bethany, Associate Professor, Ph.D., (Carbondale), University of Oregon, 2006; 2014. Beneficial host-microbe interactions, innate immunology, microbial ecology and systems biology.

Ran, Sophia, Professor, Ph.D., (Springfield), Weizmann Institute of Science, 1989; 2003. Tumor physiology, angiogenesis and lymphangiogenesis, breast cancer metastasis.

Rao, Krishna, Professor, M.D., Ph.D., (Springfield), University of Washington, University of Miami, 2002; 2007. Role of Rab25 as a tumor suppressor, treatment of head and neck cancer.

Richardson, Ben, Assistant Professor and Director of Pharmacology and Neuroscience concentration, Ph.D., (Springfield), Southern Illinois University, 2012; 2020. Sensorimotor circuit anatomy, function, and plasticity in neurological disease/disorders (autism, alcoholism, and aging).

Rybak, Leonard P., Professor, Emeritus, M.D., Ph.D., (Springfield), University of Minnesota, 1973; 1981. Mechanism(s) underlying drug- and noise-induced hearing loss, development of therapeutics in reducing or preventing hearing loss.

Sarko, Diana K., Associate Professor, Ph.D., (Carbondale), University of Florida, Neuroscience, 2006; 2015. Systems neuroscience including sensory processing and plasticity; multisensory integration; perception; behavior; and comparative neurobiology.

Schober, Joseph, Professor, Ph.D., (Edwardsville), University of Illinois Chicago, 2003; 2007. Cell motility, cell cytoskeleton, cancer cell biology and cell-hydrogel interaction.

Selinfreund, Richard, Associate Professor, Ph.D., (Springfield), New Mexico State University/Los Alamos National Laboratory; 1988; 2021. Clinical biomarkers and treatment for metabolic disease.

Sudheimer, Keith, Assistant Professor, Ph.D., (Carbondale), University of Michigan, 2009; 2020. Neurobiology of stress and emotion.

Tischkau, Shelly A., Professor and Chair of Department of Medical Microbiology, Immunology and Cell Biology and Department of Pharmacology, Ph.D., (Springfield), University of Illinois, Urbana-Champaign, 1995; 2007. Neuroendocrinology, environmental toxicology, regulation of molecular circadian rhythms in health and disease states, including cancer and diabetes.

Tobón, Gabriel J., Assistant Professor, M.D., Ph.D., (Springfield), Université de Bretagne Occidentale, France, 2012; 2021. Study of B lymphocytes in the pathogenesis of Autoimmune Diseases (Systemic Lupus Erythematosus and Sjogren's syndrome).

Torry, Donald S., Professor and Associate Dean for Research, Ph.D., (Springfield), Southern Illinois University, 1989; 2000. Human reproductive biology, cellular biology of angiogenic growth factors and immune cytokines during pregnancy, molecular biology of placental gene expression.

Weilbaecher, Rodney, Assistant Professor, Ph.D., (Carbondale), University of California, Berkeley, 1997; 2007. Gene regulation, post-translational modifications, telomere biology.

Wilber, Andrew, Associate Professor and Director of Cell Biology, Immunology and Cancer Biology concentration, Ph.D., (Springfield) University of Minnesota, 2006; 2008. Gene therapy for hemoglobin disorders beta-thalassemia and sickle cell anemia, gene expression regulation, stable gene delivery using non-viral and viral integrating vector systems and cancer immunotherapy.

Witt, Ken, Professor, Ph.D., (Edwardsville), University of Arizona, College of Medicine 2001; 2005. CNS drug delivery, blood-brain barrier, somatostatin brain effects in aging and disease, develop therapeutics to treat Alzheimer's disease progression.

Young, Matthew J., Associate Professor, Ph.D., (Carbondale), University of Manitoba, Canada, 2008; 2015. Understanding the mechanisms of how toxicants disrupt mitochondrial DNA homeostasis, mitochondrial DNA genome maintenance in human diseases such as cancer and mitochondrial disease.

Yuan, Rong, Associate Professor, M.D., Ph.D., (Springfield), Shanghai Second Medical University, P.R. China, 2000; 2012. Molecular Biology of aging and longevity.

Zheng, Zhengui (Patrick), Associate Professor, Ph.D., (Carbondale), Shanghai University of Traditional Chinese Medicine, 1997; 2014. Steroid hormone-regulated sexual dimorphic development of external genitalia, brain, and limbs and the genetic impact of environmental chemicals on sexual dimorphic organ development.

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