School of Biological Sciences

UMKC 2007-08 Graduate and Professional Catalog (1.0)

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Contents

School of Biological Sciences

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History and Description of School

The School of Biological Sciences was established (originally as the School of Basic Life Sciences) in 1985. The school's vision is to better the quality of life through excellence in education and research. This vision is realized through the provision of quality education at the undergraduate and graduate levels, the expansion of knowledge through scientific research and the application of scientific information for the advancement of human welfare. The School has been designated as an eminence program by the curators of the University of Missouri, and as such, is a unit targeted for expansion and development.

Research by faculty, graduate and undergraduate students is focused on cellular and molecular aspects of modern biology, with emphasis in molecular genetics, cell biology and structural biology. Advances in these areas will provide fundamental knowledge for biotechnology, molecular medicine, environmental remediation and computational biology. Students are encouraged to gain hands-on research experience, involving them in the process of creating knowledge and equipping them to shape the future.

Quality curriculum combined with research-active faculty and state-of-the-art equipment, provide students an outstanding opportunity to expand critical thinking and problem-solving skills while developing an in-depth understanding of the molecular, cellular and genetic foundations of biological sciences.

Graduate Programs

The School of Biological Sciences offers programs of study leading to a master of science degree in cellular and molecular biology. In addition, a master of arts degree in biology is offered. The school participates in UMKC's Interdisciplinary Ph.D. program in Cell Biology/Biophysics and Molecular Biology/Biochemistry.

Graduates with research experience in cell biology and biophysics or molecular biology and biochemistry may enter careers in many areas, including biotechnology, pharmaceutics, academia or governmental research involving the environment, agriculture, energy, defense or health.

Graduate Admissions

Admission to the school's graduate programs is competitive and students are encouraged to apply early. Applications are reviewed by an admissions committee that evaluates students on the basis of past performance and evidence of ability to pursue graduate studies successfully. The school admits students to its doctoral and master's degree programs throughout the year; however, early application (by Feb. 15) is advised to receive consideration for assistantships and other financial support.

Information on admission to master's or Ph.D. degree programs may be found at the Graduate Programs Web site at http://www.umkc.edu/sbs/graduate, in the Graduate Academic Regulations and Information section of this catalog, by e-mail to sbs-grad@umkc.edu, or by writing to our graduate programs office at the mailing address at the beginning of this section.

Graduate teaching assistantships, graduate research assistantships and fellowships are available through the school and are awarded on a competitive basis. Currently, all fully admitted, full-time doctoral students receive financial support.

To be eligible for admission to the School of Biological Sciences' graduate programs, the applicant must:

- Possess a bachelor's degree in biological sciences or a related field with a minimum of 120 credit hours, or possess an advanced degree in a health sciences field.
- Have an undergraduate GPA of at least 3.0.
- Have sufficient background coursework to undertake graduate studies in biological sciences.
- Have acceptable scores in the Graduate Record Examination aptitude tests.
- Submit three letters of recommendation from individuals familiar with the student's academic performance and scientific abilities.

Students may be admitted with certain deficiencies, with the stipulation that these can be removed early in the course of study.

Advising

New students will be advised by the principal graduate adviser until they have selected their permanent research adviser. The graduate programs office will contact students in advance of their first semester for information about advising and registration.

Students are responsible for becoming familiar with all academic regulations of the campus as outlined in the catalog and in other University documents.

Laboratories

The School of Biological Sciences has modern, well-equipped laboratories organized into the following divisions:

Division of Cell Biology and Biophysics
This division houses the laboratories of anatomy, biophysics, developmental biology, cell biology, microbiology, neurobiology, structural biology and virology.

Division of Molecular Biology and Biochemistry
This division houses the laboratories of biochemistry, genetics, genetic engineering, membrane biochemistry, molecular biology, macromolecular structure, neurophysiology and cellular and molecular physiology.

Organizations and Activities

A campuswide biological sciences seminar program is organized and administered by the school. Throughout the year, weekly advanced research seminars are held, featuring presentations by nationally recognized visiting scientists and campus faculty.

The School of Biological Sciences has both graduate and undergraduate student organizations that meet periodically for scientific discussions and social events.

Requirements for Retention in the School of Biological Sciences Graduate Programs

General requirements for retention of graduate students are described in the Graduate Academic Regulations and Information section of this catalog. For all graduate students, a 3.0 (B) GPA is required for satisfactory progress. No F grades are permitted.

Doctoral degree students must earn a grade of B or better in LSMBB 5561/5562. Any doctoral student who receives more than one C grade in a basic course will be dropped from the doctoral program.

Any master's student who receives more than two C grades or more than one C and one D grade in graduate courses will be dropped from the program.

Master of Science in Cellular and Molecular Biology

Degree Requirements

Thesis option	**Hours**
LSMBB 5561/5562 General Biochemistry I and II	8
LSMBB 5611 **-or-** LSCBB 5612 Seminar	1
LSMBB 5599 **-or-** LSCBB 5599 Thesis Research	6
Electives	15
Total	**30**

Elective courses may be selected from the following list or from other alternatives approved by the School of Biological Sciences Graduate Programs Committee: LSCBB 5505, 5520, 5530, 5566, 5569, 5596, 5597; LSMBB 5503, 5565, 5567, 5596, 5597. A limited number of credit hours of upper-level undergraduate courses may be allowed.

Students pursuing the thesis option must also satisfactorily complete written and oral thesis exams.

Non-thesis option	**Hours**
LSMBB 5561/5562 General Biochemistry I and II	8
LSMBB 5611 **-or-** LSCBB 5612 Seminar	1
BIOL 5593 M.S. Topics	3
Electives	24
Total	**36**

Elective courses may be selected from the following list or from other alternatives approved by the School of Biological Sciences Graduate Programs Committee: LSCBB 5505, 5520, 5530, 5538, 5566, 5569, 5596, 5597; LSMBB 5503, 5538, 5565, 5567, 5596, 5597. A limited number of credit hours of upper-level undergraduate courses may be allowed.

Emphasis in Bioinformatics

The emphasis in bioinformatics is a degree option with specific requirements.

This degree option trains students in the fundamental principles of bioinformatics and prepares them for careers in research, medical and corporate settings. Students will learn how to manage and analyze data stored in databases, become familiar with the various computational tools and techniques available to analyze biological data, become familiar with the types of questions and problems within biology that lend themselves to bioinformatics analysis and gain proficiency with a variety of statistical techniques necessary to analyze genomic, proteomic and integrated biological data sets.

Emphasis requirements, in addition to the specified degree requirements.

Required electives:	**Hours**
BDS 5508 Statistical Analysis in Business **-or-** BIS 5502 Management Information Systems	3
BIOL 5519 Principles of Evolution	3
BIOL 5525 Bioinformatics and Data Analysis	3
Total	**9**

Master of Arts in Biology

Degree Requirements

The master of arts program of study requires a minimum of 36 credit hours. No more than 40 percent of the program may be at the 300- to 400-level; the balance must be at the 5500-level or above. Master of Arts Topics in Biology, BIOL 5592, is required on an approved topic for an extensive investigation with oral presentation. This investigation may be accomplished through literature search or laboratory experimentation. No more than six hours of BIOL 5591, Directed Individual Studies, may be applied to this program.

Students typically pursue the master of arts in biology and a certificate in the Truman Medical Center Nurse Anesthesia Program concurrently. For information about admission and degree requirements, students interested in the CRNA certificate should first contact the School of Nurse Anesthesia at Truman Medical Center, and then contact the School of Biological Sciences. Admission by both programs is required.

Doctor of Philosophy

The Ph.D. program at UMKC is interdisciplinary. Students interested in studies at the doctoral level in the disciplines of cell biology and biophysics, *or* molecular biology and biochemistry, should apply to the Interdisciplinary Ph.D. program in the School of Graduate Studies. Students interested in a combination of cell biology and biophysics *with* molecular biology and biochemistry should apply to our graduate programs at http://sbs.umkc.edu/programs/graduate/application.html or by writing to the mailing address at the beginning of this section.

Detailed information on the general and discipline-specific admission requirements for the Ph.D. is found in the School of Graduate Studies section of this catalog, with specific details on the school's Web site at http://www.umkc.edu/iphd.

Students pursuing Interdisciplinary Ph.D. studies who have selected cell biology and biophysics, or molecular biology and biochemistry as one of their disciplines should consult the School of Graduate Studies section of this catalog for degree requirements and other academic regulations applicable to their degree program.

Biology (BIOL) Courses

5519 Principles Of Evolution (3). Synthesis of the modern concepts of evolution. Discussion of the biological processes that produce organic diversity through phyletic change. Discussed are variation, mutation, population genetics, natural selection and adaptation. Three hours lecture a week. Prerequisites: BIOL 206 or consent of instructor.

5525 Bioinformatics And Data Analysis (3). Methods and procedures for the storage, retrieval and analysis of information in biomolecular and biological databases. Emphasis will be given to the use of database information in biological research and to recent developments in genomics and proteomics. Offered: Every Winter Prerequisites: LSBIOC 341, LSBIOC 360, upper level undergraduate biochemistry or molecular genectics course, or permission of instructor.

5534 Cardiovascular Pulmonary Physiology (3). Function of the cardiovascular and pulmonary systems at the cellular, tissue, and system levels with particular emphasis on regulation, maintenancy of homeostasis and integration with other systems. Consent number required. Restricted to SBS graduate students and interdisciplinary Ph.D students. Prerequisites: LSPHYS 316 or equivalent.

5539 Mammalian Physiology (4). Study of the physiological functions and controls in human and related mammalian systems, with emphasis on fundamental processes that underlie normal and abnormal clinical conditions. Prerequisites: LSPHYS 316 or equivalent. Restricted to SBS graduate students and interdisciplinary Ph.D students. Consent required. Offered: Every Fall

5542 Neurobiology (3). Neurobiology will consist of the presentation of theory and data concerning cellular and molecular fundamentals of the nervous system, synaptic mechanisms, sensor-motor systems, and higher-order functions of the nervous system. Three hours of lecture per week. Consent number required Restricted to SBS graduate students and interdisciplinary PhD students. Prerequisites: LSBIOC 304

5591 Directed Individual Studies (1-6). Intensive readings and/or research in an area selected by the graduate student in consultation with the instructor. Not to be identified with thesis research. Restricted to SBS graduate students and Interdisciplinary Ph.D. students.

5592 Master Of Arts Topics In Biology (1-6). Special problems and topics in biology specifically intended to satisfy the project or report requirement for the master of arts degree in biology. Enrollment is restricted to persons having satisfactorily completed at least nine hours of graduate work in Biology. Restricted to SBS graduate students.

5593 Master Of Science Topics (1-4). Investigation of problems and topics to satisfy the M.S. topics requirement for the master of science degree in Cellular and Molecular Biology. Restricted to SBS graduate students. Prerequisites: LSMBB 5561 and LSMBB 5562.

5899 Required Graduate Enrollment (1).

Life Sciences (LS) Courses

5899 Required Graduate Enrollment (1).

Life Sciences - Cell Biology and Biophysics (LSCBB) Courses

5505 Molecular And Cellular Neurobiology (3). The molecular basis of chemical and electrical communication between nerve cells. Topics will include: neurotransmitters, neuropeptides, receptors, channels, second messengers, cytoskeleton, cell adhesion, development, neuronal plasticity and psychopharmacology. Prerequisite or corequisite: LSMBB 5561 and 5562.

5520 Eukaryotic Cell Biology (3). A presentation of the cellular and subcellular organization and function of eukaryotic cells. Discussions will emphasize basic concepts by which structure and functions are integrated. Prerequisite or co-requisite: LSMBB 5561 and 5562.

5530 Prokaryotic Molecular Biology (3). Molecular aspects of gene structure and function in microorganisms and their viruses. Emphasis on macromolecular synthesis, regulation of gene expression, genetic transfer and recombinant DNA techniques. Prerequisite or corequisite: LSMBB 5561 and 5562.

5538 Molecular Recognition In Cellular Biology (2). Graduate Research Seminar. Studies of the latest development leading to an increased understanding of cellular biology processes when the experimental tools for structure biology analysis and molecular genetics are applied. Prerequisites: LSMBB 5561 as co-or pre-requisite, or permission of SBS graduate advisor. Offered: Fall

5566 Membrane Biochemistry And Biophysics (3). Structure and function of biological membranes including architecture, dynamics, models, biochemical compartmentation, energy transduction, transport mechanisms, membrane protein structures, and cell surface receptors. Prerequisite or corequisite: LSMBB 5561 and 5562.

5569 Structural Biology, Methods And Strategies (3). Analysis of strategies and methodologies such as X-ray crystallography, nuclear magnetic resonance and advanced microscopy procedures including imaging analysis for the study of relationships of higher order macromolecular structures to biological functions. Prerequisites: LSMBB 5561 AND LSMBB 5562. Restrictions: Restricted to AU 60 and 73 students.

5583 Current Topics In Cell Biology And Biophysics (1-3). Current topics and recent developments in cell biology and biophysics with emphasis on rapidly developing research areas. Prerequisite or co-requisite: LSMBB 5561 and 5562. Restricted to SBS graduate students and Interdisciplinary Ph.D. students.

5591 Directed Individual Studies In Cell Biology And Biophysics (1-6). Intensive reading and/or research in an area selected by the graduate student in consultation with the instructor. Prerequisites: Prerequisite or corequisite: LSMBB 5561 and 5562. Restricted to SBS graduate students and Interdisciplinary Ph.D. students.

5596 Advanced Experimental Cell Biology I (2). Structured laboratory work with individual tutorial sessions designed to familiarize first year Interdisciplinary Ph.D. students with concepts and techniques of modern cell biology research. 1-2 hr/wk tutorial and 15-20 hr/wk of laboratory work. Prerequisite or co-requisite: LSMBB 5561. Restricted to Interdisciplinary Ph.D. students with CBB or MBB as coordinating unit.

5597 Advanced Experimental Cell Biology II (2). Continuation of LSCBB 5596. Prerequisite or corequisite: LSMBB 5561 and 5562. Restricted to Interdisciplinary Ph.D. students with CBB or MBB as coordinating unit.

5599 Thesis Research In Cell Biology And Biophysics (1-12). Research and thesis preparation for M.S. degree candidates. Prerequisite or co-requisites: LSMBB 5561 and 5562. Restricted to School of Biological Sciences graduate students and Interdisciplinary Ph.D. students.

5612 Seminar In Cell Biology And Biophysics (1). Presentation and discussion of selected areas in cell biology and biophysics. This course may be repeated by doctoral students for a maximum of 3 credit hours. Prerequisite or corequisite: LSMBB 5561 and 5562.

5690 Analytical Methods In Cell Biology And Biophysics (1-4). A course that emphasizes the development of skills in experimental design, analytical methods and instrumentation as applied to problems of interest to modern cell biology and biophysics, and analysis of results. Can be repeated up to a maximum of eight hours total. Prerequisites: LSMBB 5561+LSMBB 5562; admission in I.Ph.D program with CBB as coordinating or co-discipline; can only be taken prior to reaching candidacy.

5699 Dissertation Research In Cell Biology And Biophysics (1-12). Research and dissertation preparation for interdisciplinary Ph.D. degree students who have Cell Biology and Biophysics as a discipline. Prerequisite or corequisite: LSMBB 5561 and 5562. Restricted to SBS graduate students and Interdisciplinary Ph.D. students.

Life Sciences - Molecular Biology and Biochemistry (LSMBB) Courses

5503 Eukaryotic Molecular Biology (3). Molecular aspects of gene structure and function in eukaryotic organisms and their viruses. Emphasis on genome structure and organization, gene expression and regulation and the molecular basis of growth and development. Prerequisite or Co-requisite: LSMBB 5561 and 5562.

5538 Molecular Recognition In Molecular Biology (2). Graduate Research Seminar. Analysis of the impact of most recent developments in molecular genetics and structural biology as related to fundamental molecular recognition events. Prerequisites: LSMBB 5561 as co-or pre-requisite, or permission of SBS graduate advisor. Offered: Winter

5561 General Biochemistry I (4). The first semester of a two-semester sequence in general biochemistry. This course will emphasize the structure of biological molecules, thermodynamics and kinetics of biological reactions, and selected aspects of energy metabolism and metabolic pathways. Prerequisite: CHEM 322R.

5562 General Biochemistry II (4). The second semester of a two-semester sequence in general biochemistry. This course will emphasize selected aspects of the biochemistry of metabolism and macromolecular assemblies. The molecular basis of genetic and metabolic regulation will be discussed. Prerequisite: LSMBB 5561.

5565 Structure And Function Of Proteins (3). This course will discuss structure-function relationships of proteins. Topics will include: methods of structure-function analysis, catalytic mechanisms, and regulation of enzyme activity. Prerequisite or corequisite: LSMBB 5561 and 5562.

5567 Physical Biochemistry (3). Application of physical and chemical principles to elucidate structure and function of biochemical systems. The various modes of interactions between biologically important molecules and the specificity of their interaction will be examined through selected literature examples. Prerequisite or co-requisite: LS MBB 5561 and 5562.

5569 Current Topics In Molecular Biology And Biochemistry (1-3). Current topics and recent developments in biochemistry and molecular biology with emphasis on rapidly developing research areas. Prerequisite or co-requisite: LSMBB 5561 and 5562. Restricted to SBS graduate students and Interdisciplinary Ph.D. students.

5591 Directed Individual Studies In Molecular Biology And Biochemistry (1-6). Intensive readings and/or research in an area selected by the graduate student in consultation with the instructor. Prerequisite or co-requisite: LSMBB 5561 and 5562. Restricted to SBS graduate students and Interdisciplinary Ph.D. students.

5596 Advanced Experimental Molecular Biology I (2). Structured laboratory work with individual tutorial sessions designed to familiarize first year Interdisciplinary Ph.D. students with concepts and techniques of modern molecular biology research. 1-2 hr/wk tutorial and 15-20 hr/wk of laboratory work. Prerequisite or co-requisite: LSMBB 5561. Restricted to Interdisciplinary Ph.D. students with CBB or MBB as coordinating unit.

5597 Advanced Experimental Molecular Biology II (2). Continuation of LSMBB 5596. Prerequisite or co-requisite: LSMBB 5561 and 5562. Restricted to Interdisciplinary Ph.D. students with CBB or MBB as coordinating unit.

5599 Thesis Research In Molecular Biology And Biochemistry (1-12). Research and thesis preparation for M.S. degree candidates. Prerequisite or co-requisite: LSMBB 5561 and 5562. Restricted to School of Biological Sciences graduate students and Interdisciplinary Ph.D. students.

5611 Seminar In Molecular Biology And Biochemistry (1). Presentation and discussion of selected areas in biochemistry and molecular biology. This course may be repeated by doctoral students for a maximum of 3 credit hours. Prerequisite or co-requisite: LSMBB 5561 and 5562.

5690 Analytical Methods In Molecular Biology And Biochemistry (1-4). A course that emphasizes the development of skills in experimental design, analytical methods and instrumentation as applied to problems of interest to modern molecular biology and biochemistry, and analysis of results. Can be repeated up to a maximum of eight hours total. Prerequisites: LSMBB 5561+LSMBB 5562; admission into I.Ph.D. program with MBB as coordination or co-discipline; can only be taken prior to reaching candidacy.

5699 Dissertation Research In Molecular Biology And Biochemistry (1-12). Research and dissertation preparation for interdisciplinary Ph.D. program students who have Molecular Biology and Biochemistry as a discipline. Prerequisite or co-requisite: LSMBB 5561 and 5562. Restricted to SBS graduate and Interdisciplinary Ph.D. students.