Graduate School of Biomedical Sciences

Courses and descriptions of the various programs and concentrations can be found in this course listing. Students interested in pursuing a career in academic medicine as a research scientist are strongly encouraged to apply to the M.D./Ph.D. program. The M.D./Ph.D. program permits a student to complete the requirements of both the Ph.D. and M.D. programs in approximately five years. Students admitted to the M.D./Ph.D. program may receive a stipend, tuition scholarships for both the medical and graduate portions of the program, and health benefits for the duration of the stipend. This program is designed to be completed in approximately seven years and will provide the student with rigorous training in both clinical medicine and biomedical research. Students interested in this program should indicate their interest on the application form submitted to the American Medical College Application Service. For more information and to apply online, visit www.amcasc.org.

About the School

Development of a strong program of graduate education in the basic biomedical and related health sciences is one of the major responsibilities and goals of the Texas Tech University Health Sciences Center. Present-day medicine cannot exist outside the academic framework and intellectual discipline which the biological, chemical, and medical sciences provide. Graduate training in these areas, an integral component of the overall program of the Health Sciences Center, is provided by the Graduate School of Biomedical Sciences (GSBS). Opportunities for study and research lead to the following degrees:

Biology Technology Program
- Master of Science in Biotechnology
- Master of Science in Biomedical Sciences Concentration Areas:
  - Biomedical Studies - El Paso
  - Cell and Molecular Biology
  - Cell Physiology and Molecular Biophysics
  - Medical Microbiology
  - Pre-Clinical Studies
  - Pre-Medical Sciences
- Doctor of Philosophy (Ph.D.) in Biomedical Sciences Concentration Areas:
  - Biochemistry and Molecular Genetics
  - Cell Biology and Molecular Biology
  - Cell Physiology and Molecular Biophysics
  - Medical Microbiology
  - Pharmacology and Neuroscience

Pharmaceutical Sciences Program
- Master of Science in Pharmaceutical Sciences
- Doctor of Philosophy in Pharmaceutical Sciences

Further information about graduate programs offered through the Health Sciences Center Graduate School of Biomedical Sciences may be obtained by contacting the Graduate School of Biomedical Sciences, Texas Tech University Health Sciences Center, 3601 4th Street, Lubbock, Texas 79430-6206, 806.743.2556, 806.528.5391, FAX 806.743.2056, or e-mail graduate.school@ttuhsc.edu. For more information and to apply online, visit www.ttuhsc.edu/gsbs.

The policies and procedures for the Graduate School of Biomedical Sciences differ from those established by the Graduate School of Biomedical Sciences at the Texas Tech University Health Sciences Center. 3601 4th Street, Lubbock, Texas 79430-6206, 806.743.2556, 806.528.5391, FAX 806.743.2056, or e-mail graduate.school@ttuhsc.edu. For more information and to apply online, visit www.ttuhsc.edu/gsbs.

The policies related to curriculum can be found in the GSBS catalog which is available on the GSBS web site at catalogs.aspx. Programs are subject to change, depending on availability of resources and educational goals.

Interdisciplinary Courses

The following interdisciplinary courses are available in addition to course offerings within each research area throughout the Graduate School of Biomedical Sciences.

Graduate School of Biomedical Sciences (GSBS)

5099. Topics in Biomedical Sciences (V1-6). Specific areas in biomedical sciences that have been reviewed and research not normally included in other courses. May be repeated for credit.
5101. Responsible Conduct of Research (1:1:0). This course will address the regulatory and ethical environment of today’s biomedical sciences and provide students with an understanding of the authorship and data management. The class format is lectures and case discussions. Course is required for all GSBS students.
5102. How to be a Scientist: Professional Skills for the Biomedical Scientist (1:1:0). Teaches useful concepts in the scientific professionalism that might not be learned elsewhere: how science is conducted in the United States and at TUTHISC, the importance of oral communication in science and tips for being a scientist in a classroom.
5174. Core IV: Biomedical Seminar Series (1:1:0). Students will attend and participate in the seminars and consider topics of common interest in the biomedical sciences. Emphasis will be placed on the principles and methods of epidemiologic investigation. Arranged.
5275. Core V: Introduction to Biomedical Research (2:0:0). Introduces the first-year graduate student to the fundamental principles and basic biomedical research.
5303. Introduction to Clinical Research (2:2:2). Students will be introduced to research for and execution of prospective human studies and retrospective chart reviews. The didactic training deals with the regulations and ethical considerations of study design, data management, the process of obtaining approval for a study and the requirements associated with conducting a study. Prerequisites include the required courses in the first year GSBS Curriculum and Core I: Molecules.
5310. Introduction to Statistical Methods in the Biomedical Sciences (2:2:0). Provides students explanation and application of classical test theory involving univariate statistics. The course will include discussion about classical test theory (p values, scales of measurement, assumptions of analyses, etc.) and application of this theory for various statistical analyses, such as tests, anova, correlation. There will be a small introduction to non-parametric analyses.
5350. Laboratory Methods in Biomedical Sciences (2:2:2). Introduces the first-year graduate student to the fundamental principles and techniques in basic science research. Following a lecture on laboratory techniques and instrumentation, students will conduct a well-defined laboratory exercise and provide a brief written report. Course is arranged.
5372. Core II: Cells (3:3:0). The structure/function relationships that underlie basic cellular processes, including translation, protein trafficking, cytoskeletal organization and motility, cell adhesion, and cell division. Required for first year student.
5373. Core III: Genes (3:3:0). Teaches essential scientific concepts and techniques relating the field of Molecular and Genetic Sciences. Required for first year students.
5399. Topics in Biomedical Science (3:3:0). Specific areas in biomedical sciences or related research not normally included in other courses. May be repeated for credit.
4701. Core I: Molecules (4:4:0). This course offers a broad coverage of biochemistry with an emphasis on structure and function of molecules, biochemistry of small molecule precursors of macromolecules, and the pathways of inter- mediate metabolism. Required for first year students.

Neuroscience (IDGN)

5910. Integrated Neurosciences (9.1:1). This cooperative, interdepartmental effort offers a detailed study of the nervous system. Students examine both gross and fine structure sciences or function from the subcellular to the behavioral level.

Health Communications (GIHC)

5319. Seminar in Current Topics of Information Sciences (1:1:0). Current topics include how to locate, evaluate, and utilize information and how to present both oral and written presentations. May be repeated for credit.
5471. Core I: Molecules (4:4:0). This course offers a broad coverage of biochemistry with an emphasis on structure and function of molecules, biochemistry of small molecule precursors of macromolecules, and the pathways of intermediate metabolism. Required for first year students.

Preventive Medicine (GIPM)

6303. Principles of Epidemiology (3:3:0). Considers the variety, behavior, and distribution of both infectious and noninfectious diseases in populations. It will show how an understanding of the etiology, transmission, and pathogenesis of disease can lead to the development of disease prevention. Emphasis will be placed on the principles and methods of epidemiologic investigation. Arranged.

Biotechnology and Molecular Genetics (GBMG)

Harry M. Weitlauf, M.D., Chairperson for the School of Medicine Department of Cell Biology & Biochemistry

Sandra Whelly, Ph.D., Graduate Advisor

For more information on Biochemistry and Molecular Genetics contact Dr. Sandra Whelly, Graduate Advisor, at 806.743.2700, Ext. 247.

GBMG Courses:

5136. Research Presentation Skills (1:0:0). A comprehensive coverage of the most widely used research presentation methods used at national and international meetings. The course is offered at the request of a faculty member or the request of a student or group of students. May be repeated with credit. Prerequisite: Successful completion of GSBS core curriculum or consent of course director.
5421. General Biochemistry (4:4:0). Human life processes at the molecular level with emphasis on biochemical homeostasis and control mechanisms.
6000. Master’s Thesis (V1-4).
6055. Research Methods (V1-6). Prerequisite: Consent of instructor. Students will attend and participate in the seminars and consider topics of common interest in the biomedical sciences not normally included in other courses. Literature searches for orientation, organization, writing, and oral presentation by the student are emphasized. May be repeated for credit.
6121. History of Biochemistry (1:1:0). Discussion of highlights in the advancement of biochemical knowledge.

TTUHSC GSBS Course Listing 2012-2013
The Biomedical Studies MS program will provide foundational coursework necessary for training in the areas of biochemistry, cell biology, and genetics in addition to elective courses that explore specialized topics, recent advances, and current literature in research areas. Students graduating from this program will be prepared to provide a superior and competitive training environment in four state-of-the-art core laboratories. Core laboratory areas are established at the Paul L. Foster / El Paso Health Sciences Center of Excellence. The program is an interdisciplinary degree supported by faculty and special guests for group critical discussions of recent research papers. The biomedical sciences track is a 21-month curriculum consisting of two terms (nine months) of coursework and 12 months of full-time laboratory research. This program is an interdisciplinary degree supported by all basic sciences departments in the Texas Tech University Health Sciences Center (TTUCHSC). The Texas Tech University Health Sciences Center general graduate faculty have active research programs that do their research at the TTUHSC campus will work with a TTUHSC graduate student. The TTUHSC Center for Pharmacology graduate student will be assigned to the TTUHSC Center for Pharmacology for the program for include a bachelor of science in which the student is completing at least one semester of organic chemistry.

GBTC Courses:
5338. Biochemical Methods (2:1:0). Provides integrated approach to modern biochemical techniques and present methods used to manipulate a gene, purify and characterize protein, and study the biochemical properties of proteins. 6000. Master’s Thesis (V1-12). This course will teach structural bioinformatics and protein function, and the different areas of bioinformatics and protein function, and the different areas of bioinformatics.
6020. Biomedical Informatics (2:0:2). Provides a broad coverage of topics with high current interest and utility to the medical and agricultural biotechnology industries. Emphasizes applications to biotechnology and bioinformatics.
6000. Master’s Thesis (V1-12). Biomedical Informatics (2:0:2). Provides a broad coverage of topics with high current interest and utility to the medical and agricultural biotechnology industries. Emphasizes applications to biotechnology and bioinformatics.
7000. Research (V1-12).

About the Concentration

Cell and Molecular Biology will prepare students for careers in cellular, developmental, and molecular biology. Employment opportunities for graduates include traditional university positions, as well as medical and governmental appointments. The current student body consists of three full-time faculty members and one part-time biology instructor. The program is under the leadership of Dr. Paul Weidanz, Ph.D., Co-Director of the Texas Tech University Health Sciences Center (TTUCHSC). The program is an interdisciplinary degree supported by faculty and special guests for group critical discussions of recent research papers. Recent offerings have included oncogenes and molecular biology as a core requirement for the Ph.D. program. This course will teach structural bioinformatics and protein function, and the different areas of bioinformatics and protein function, and the different areas of bioinformatics.
6020. Biomedical Informatics (2:0:2). Provides a broad coverage of topics with high current interest and utility to the medical and agricultural biotechnology industries. Emphasizes applications to biotechnology and bioinformatics.
6000. Master’s Thesis (V1-12). The program is an interdisciplinary degree supported by faculty and special guests for group critical discussions of recent research papers. Recent offerings have included oncogenes and molecular biology as a core requirement for the Ph.D. program. This course will teach structural bioinformatics and protein function, and the different areas of bioinformatics and protein function, and the different areas of bioinformatics.
6020. Biomedical Informatics (2:0:2). Provides a broad coverage of topics with high current interest and utility to the medical and agricultural biotechnology industries. Emphasizes applications to biotechnology and bioinformatics.
7000. Research (V1-12).
Cell Physiology and Molecular Biophysics (GPHY)

Luis Reuss, M.D., Chairperson for the School of Medicine
Department of Cell Physiology and Molecular Biophysics
Raul Martinez-Zagunig, Ph.D., and Michaela Jansen, Ph.D., Graduate Advisor
Primary Faculty: Altenberg, Artigas, Cuello, Fowler, Guan, Jansen, Lusher, Martinez-Zagunig, Perez-Zoghi, Zou
Associate Faculty: Blanton, Jaski, Prin, E. Reuss, Terenin

About the Concentration

The concentration’s main research interest is focused on cell physiology and molecular biophysics, and applies this knowledge to tissue engineering and computational biology. The concentration is designed for students who have completed introductory cell biology and who wish to pursue advanced study in this area.

GPHY Courses:

5220. Experiments in Molecular Cell Physiology (2:2:0).
A laboratory course coordinated with the topics of GPHY 5320. Students will learn to interpret experimental results and to understand the role of logic and models in the development of molecular pathways and normal and pathological conditions.

5320. Human Physiology (2:2:0).
This introductory course focuses on the basic understanding of the human body, including the functions, regulation, and interactions of the organs and tissues. No prerequisites are required.

An introduction to the physical and chemical bases of cell physiology. This course will cover advanced topics in cell biology and cellular signaling, including the role of cell surface receptors, signal transduction pathways, and gene expression.

Prerequisite: GPHY 5330. This course will cover advanced topics in cell biology and cellular signaling, including the role of cell surface receptors, signal transduction pathways, and gene expression.

Topics include structure and function of organelles, membrane structure and function, cell division, adhesion, and transcription.

6310-6310. Microbiology Seminar (1:1:0).
Students will attend and participate in departmental seminars.

8000. Doctoral Dissertation (V1-12).

Medical Microbiology (GMB)

Matthew Grisham, Ph.D., Professor and Chair for the School of Medicine
Department of Cell Physiology and Molecular Biophysics
Robert Bright, Ph.D., Graduate Advisor
Primary Faculty: Ahmad, Alkam, Alman, Blumenthal, Colmenero, Combs, Craig, Dodson, Elliott, Evans, Frey, Fruin, Gulliford, Hamond, Haynes, Hammett, Jackson, Jansen, Lohse, Luster, Martinez-Zagunig, Perez-Zoghi, Zou
Associate Faculty: Blanton, Jaski, Prin, E. Reuss, Terenin

About the Concentration

Medical Microbiology is designed to graduate exceptionally well trained professionals who possess the necessary background and experience for a career in research and teaching in Microbiology and Immunology. Applicants are urged to possess research experience and should have a basic knowledge of microbiology and immunology. Applicants are urged to possess research experience and should have a basic knowledge of microbiology and immunology.

MGB Courses:

5181, 5281, 5381. Selected Topics in Microbiology (1:1:1; 2:2:0; 3:3:0). Prerequisite: Consent of instructor. Specific areas in microbiology and immunology are not normally included in other courses. May be repeated for credit.

5340. Cellular and Molecular Immunology (3:3:0). Consent of instructor. Cellular and Molecular Immunology is a study of the development of the immune system, and immunity against microbial and tumor infections.

5399. Introduction to Microbial Research (3:3:0). Prerequisite: Consent of instructor. Research methods and data analysis in the laboratory of three faculty members.

6323. Genetics and Molecular Biology of Procaroctytes (3:3:0). Prerequisite: Microbiology. Current concepts in the molecular biology and genetics of bacteria with emphasis on procaroctytes.

6324. The Molecular Biology of Pathogenic Bacteria (3:3:0). Prerequisite: Molecular Microbiology. Biochemistry. Lectures and discussions concerning the molecular analysis of mechanisms by which pathogenic bacteria produce infection.

6329. The Biology of Animal Viruses (3:3:0). Prerequisite: General biochemistry and general microbiology. Emphasis will be placed on DNA and RNA viruses, virus suppressor genes and human immunodeficiency virus.

6339. Advances in Immunology (3:3:0). Prerequisite: Consent of instructor. Current knowledge of the immune system with emphasis on molecular and cellular interactions.

6335. The Pathogenesis of Infectious Disease (3:3:0). Prerequisite: Medical or pathogenic microbiology or consent of the instructor. A study of the processes by which microorganisms produce disease in humans and how the host responds.

6346. Medical Bacteriology (3:3:0). Beginning student. A study of bacterial classification, structure, virulence and pathogenesis. No prerequisites are required. Consent of instructor is required to control these organisms.

6347. Medical Mycology, Parasitology, and Virology (3:3:0). Beginning student. A study of the classification, structure, and pathogenicity of fungi, viruses, and protozoa that cause human disease and the ways used to control these diseases.

Medical Microbiology

7000. Research (V1-12).

About the Program

Pharmaceutical Sciences (GPS)

Thomas Abruscato, Ph.D., GBS Associate Dean, Graduate Programs
Thomas Abruscato, Ph.D., Interim Chair, Pharmaceutical Sciences
Juxuan Lu, Ph.D., Chair, Biomedical Sciences
Joint Faculty: Wright, Mark, Depew, M. Wang, A. Wang, V. Wright
Adjunct Faculty: Arumugam

About the Program

Pharmaceutical Sciences encompass all areas of pharmacy research that pertain to drug delivery, design, formulation, and therapeutic effect on disease and health.
delivery, pharmacology, pharmaceutics (including formulation and industrial pharmacy), pharmacokinetics, drug receptor modeling, molecular biology, biochemical pharmacology, immunology and cancer therapy, toxicology, and pharmacy administration. The graduate program in pharmaceutical sciences is designed for students for careers in pharmaceutical industry, academia, and federal agencies including the FDA. Admission and continuing graduate standing requires a degree in pharmacy, chemistry, biology, or related areas. Teaching and research assistantships are awarded on a competitive basis. The departmental courses are listed below. For more information contact Margaret Yandle, graduate program coordinator, 806.356.4015 ext. 287 or email pharma.grad@ttuhsc.edu.

**GPSC Courses**

5101. Topics in Pharmaceutical Sciences (1:1:0). Special topics in pharmaceutical sciences that are not normally included in other courses. May be repeated for credit with change in content.

5201. Topics in Pharmacological Sciences (2:2:0). Special topics in pharmacological sciences that are not normally included in other courses. May be repeated for credit with change in content.

5202. Graduate Pharmacokinetics Part 1 (2:2:0). This course will cover the basic principles of pharmacokinetics for the development of formulations that are stable and therapeutically effective.

5220. Drugs of Abuse (2:2:0). This course is designed to teach the pharmacology of the different classes of abused drugs and the physiologic and societal aspects of addiction. Course Prerequisite: Biochemistry. Principles of Drug Action and-Physiology-Based Pharmacology.

5301-5304. Topics in Pharmaceutical Sciences (3:3:0). Special topics in pharmaceutical sciences that are not normally included in other courses. May be repeated for credit with change in content.


5307. Pharmaceutical Sciences Research Methods Part 1 (2:2:0). This course will cover the principles of research methods in pharmacological sciences. Emphasis will be made on the fundamentals of research design and statistical analysis.


5430. Advanced Pharmacology (4:4:0). A comprehensive course designed to provide critical thinking skills and information necessary for the advancement of scientific knowledge. The student will be required to express complicated immunological concepts through a series of hands-on laboratory exercises. Numerical treatment of selected data will be included in other courses. May be repeated for credit with change in content.

5431. Advanced Pharmacology (3:3:0). Prequisite: Consent of instructor. A study of the principles and theories of pharmacokinetics and pharmacodynamics of chemicals in relationship to dose and time. The course will consist of lectures, discussions, and oral presentations of original papers by the class and is oriented for both pharmacology and nonpharmacology majors.

5432. Pharmacology of the Autonomic Nervous System (3:3:0). A conceptual study of drugs which alter the function of the autonomic nervous system. Emphasis will be on mechanisms by which drugs affect transmitter synthesis, release, uptake, and metabolism as well as receptor function.

5433. Molecular and Cellular Pharmacology (3:3:0). Prequisite: Consent of instructor. Course focuses on experimental methods employed in pharmacological research. Topics include: the discovery of new drugs and drug development, receptor binding, gene microarrays, patch clamp recording, etc. The course will consist of selected topics, lectures, and student discussions.

5434. Pharmacological Research Design and Analysis (3:3:0). Prequisite: Consent of instructor. A structured in-depth study of specific topics concerning neurochemical, behavioral pharmacology, and neuropharmacology. Topics to be studied will vary each semester. The course will consist of lectures, discussions, and oral presentations of original papers by the class.

5500. Master's Thesis (V1-12). Consent of instructor. A structured in-depth study of specific topics concerning neurochemical, behavioral pharmacology, and neuropharmacology. Topics to be studied will vary each semester. The course will consist of lectures, discussions, and oral presentations of original papers by the class.

5501, 5510-5519. Graduate Immunology and Cancer Therapy (3:3:0). A study of the cellular and molecular basis of cancer. It offers principles of cancer biology and immunology and cancer therapy, toxicology, and pharmacy administration. The graduate program in pharmaceutical sciences is designed for students for careers in pharmaceutical industry, academia, and federal agencies including the FDA. Admission and continuing graduate standing requires a degree in pharmacy, chemistry, biology, or related areas. Teaching and research assistantships are awarded on a competitive basis. The departmental courses are listed below. For more information contact Margaret Yandle, graduate program coordinator, 806.356.4015 ext. 287 or email pharma.grad@ttuhsc.edu.

**About the Concentration**

The objective is to prepare students for careers in research and teaching. The faculty of the concentration seeks to foster a creative and productive research atmosphere, to provide encouragement and positive challenge, and to equip students with the intellectual tools they will need to be effective scientists. Combining course work and research training is available in the areas of aging, biochemical and behavioral pharmacology, cardiovascular pharmacology, immunopharmacology, neuroscience, and molecular pharmacology. In addition, the SOM Pharmacology and Neurosciences department houses the South Plains Alcohol and Addiction Research Center (SPARC), a team of graduate faculty and other investigators with research interests focused on all aspects of drug use. For more information visit: http://www.ttuhsc.edu/som/ pharmacology.

**GPHM Courses**


5220. 5309. Techniques in Pharmaceutical Research (2:2:6). Prequisite: Consent of instructor. A study of experimental design and theories of pharmacokinetics and pharmacodynamics of chemicals in relationship to dose and time. The course will consist of lectures, discussions, and oral presentations of original papers by the class and is oriented for both pharmacology and nonpharmacology majors.

5312. Medical Pharmacology (1:0:3). A study of the principles and theories of pharmacokinetics and pharmacodynamics of chemicals in relationship to dose and time. The course will consist of lectures, discussions, and oral presentations of original papers by the class and is oriented for both pharmacology and nonpharmacology majors.

5312. Medical Pharmacology (1:0:3). A study of the principles and theories of pharmacokinetics and pharmacodynamics of chemicals in relationship to dose and time. The course will consist of lectures, discussions, and oral presentations of original papers by the class and is oriented for both pharmacology and nonpharmacology majors.