

Master's Program in Medical Sciences: Health Sciences Concentration

Program and Concentration Overview:

Health sciences, the study and research of the human body and health-related issues, are critical to our understanding of how humans function. The knowledge gained from these studies is vital to today's mission of improving health and preventing and curing diseases. In the new millennium, in which science truly complements the art of medicine, advances in the health sciences contribute to our understanding of the structure and function of molecules key to normal body function and the pathogenesis of disease and to design new approaches for diagnosis, treatment and prevention. Recent changes in research and scholarship in the biomedical sciences has directed attention to the development and training of students who are able cross the barriers of traditional disciplines and embrace the concepts of interdisciplinary approaches to biomedical problems. The Health Sciences concentration, within the Master's Program in Medical Sciences, has been developed to provide a new interdisciplinary and concentrated program of study that is designed for students interested in either future doctoral professional programs in the biomedical sciences. The program integrates an array of disciplines, including anatomy, biochemistry, histology, physiology, genetics, microbiology, immunology, pathology, pharmacology and ethics to provide a solid medically relevant foundation. The rigorous program allows students to demonstrate their full academic ability for future graduate programs or medical school. The interdisciplinary program promotes the broad intellectual focus required of future graduate or professional students in the biomedical sciences or health-care related fields. The courses integrate modern distance teaching methods and are designed to improve their academic skills that are critical to their future professional development.

This concentration will take four semesters to complete. Courses are only offered during the terms listed below with the majority only being offered in the fall. **Fall admission only.**

FALL SEMESTER (Year 1)
<ul style="list-style-type: none">GMS 6201 Basic Medical Biochemistry (3cr)GMS 6605 Basic Medical Anatomy (3cr)GMS 6630 Basic Medical Histology (3cr)
SPRING SEMESTER (Year 1)
<ul style="list-style-type: none">GMS 6012 Basic Medical Genetics (3cr)GMS 6141 Basic Medical Microbiology & Immunology (3cr)GMS 6706 Basic Medical Neurosciences (3cr)
SUMMER SEMESTER (Year 1)
<ul style="list-style-type: none">MCB 6433 Clinical Correlations in Molecular Medicine (3cr) * prerequisite GMS 6201 Basic Medical BiochemistryGMS 6871 Health Sciences Ethics (2cr)
FALL SEMESTER (Year 2)
<ul style="list-style-type: none">GMS 6111 Basic Medical Pathology (3cr)GMS 6440 Basic Medical Physiology (3cr)GMS 6505 Basic Medical Pharmacology (3cr)

Course Duration and Mode of Study:

All courses are designed to be completed in one semester utilizing the Canvas site within the USF website. All the components of the course are delivered using a fully “on-line” format and make extensive use of the “Canvas” academic learning environment through audio and video presentations/lectures. Each course has been developed using a modular format that allows each student to complete the various sections using an individualized schedule. This “self-paced” approach results in enhanced information retention and enables students to tailor the course delivery to match their own schedule.

Course Format:

All courses are web-based via Canvas (USF website). Course materials and assignments will be posted on the course website (Canvas). Audio/Video presentations may be included for each unit. These presentations are intended to extend the information on a topic beyond the reading assignment and/or to emphasize the clinical importance as related to the unit topic. Each course is divided into “Modules/Units” consisting of all or any of the following:

Reading Assignments:

Specific chapters, in the required textbook for the course, will be assigned for each unit. The reading assignments are the primary means by which each student will acquire the core content of the course. It is essential that students complete the reading assignments for comprehension early in each unit.

Quizzes:

For each chapter, a weekly quiz will be posted on Canvas with which students can self-test their level of comprehension of the reading assignment.

Exams:

Unit Exams -The unit exams will be comprehensive of all material covered during that unit.

Midterm Exam - Exam will be comprehensive of all material covered in Units 1-3.

Final Exam - Exam will be comprehensive of all material covered during the course.

Reports:

The purpose of the report is to further expose students to topic-specific web-based, information that extends beyond the reading assignment. During the course each student will be assigned a specific topic for their individual reports. Each student will be required to produce and submit an original report on an assigned topic.

Case Studies:

For each unit, a case study may be introduced for class discussion. All students are expected to participate in the class discussions. Appropriate case studies, question and answer activities, as well as identification of valuable web resources may be the focus of the discussions.

Discussions:

Discussions are asynchronous, meaning that participants post messages to discussion lists. This is a lot like using a bulletin board. The advantage of this is that participants do not have to find a time when everyone can log in simultaneously. However, because exchange of ideas is so important, participants will have to be working on the same topics at roughly the same time. It is not possible, therefore, for participants to work entirely at their own pace, for example by doing all coursework in the first few days of the course or by leaving all coursework until the end. Therefore, it is imperative to participate in the discussions on a regular basis during the course.

Course Descriptions & Objectives:

Basic Medical Biochemistry (GMS 6201) is designed to examine the fundamental aspects of biochemistry that are critical to understanding the chemical and cellular mechanisms relevant to human health and disease that form part of the foundation of modern medical practice. This course emphasizes a fundamental understanding of the principles of biochemistry and intermediary metabolism and their relationship to medicine and includes topics such as basic enzymology and the structure and function of proteins; energy metabolism and the metabolism of carbohydrates, lipids, amino acids, purines and pyrimidines, and the storage and transfer of genetic information. The course develops a broad and thorough understanding at the molecular level of the metabolic and regulatory events that control the functioning of normal cells, tissues and organs and an understanding of how these processes are altered by disease. All material is presented in the context of modern medicine such that at the completion of the course, students will be able to:

1. Describe the principal classes of biological macromolecules, identify their components and explain their functions.
2. Describe the steps by which cells break down biological molecules to extract energy for the performance of work.
3. Describe the major human biosynthetic pathways, the steps involved in these pathways and the regulation and control of key enzymes.
4. Explain the principles of metabolic control and the mechanisms by which hormones maintain the caloric homeostasis in various nutritional and disease states.
5. Understand the metabolic roles of the major tissues and organs of the body and how they interact with one another and perceive chemicals from their environment in maintaining body homeostasis.
6. Explain the biochemical bases of certain categories of disease and the diagnostic and therapeutic procedures that involve biochemical aspects of clinical medicine. Particular emphasis will be placed on the study of diabetes and obesity, which are major health problems.
7. Demonstrate an understanding of the role of basic science in guiding diagnosis, management, therapeutics, and disease prevention.

Basic Medical Anatomy (GMS 6605) is designed to examine the fundamental aspects of human anatomy. The course serves as an introduction to the structural organization of the human body and provides an appreciation for how the structural organization relates to function, with a particular focus on organelles, tissues, organs, and systems. Emphasis is placed on normal structure as it relates to function, with consideration of abnormal structures and dysfunctions that may be revealed in a clinical setting. All material is presented in the context of modern medicine such that at the completion of the course, students will be able to:

1. Describe the morphological organization of the body extending inclusive of all of all regions and organ systems that compose the body as a whole.
2. Describe the interaction and interconnection of both the anatomically components and the physiologically processes, as related to the maintenance of normal body homeostasis.
3. Describe the morphological organization of each region of the body with detailed description of the anatomical relationship of each structure to its surrounding morphology
4. Describe the major health related issues associated with each of the above organ systems of the body.
5. Understand a range of health related issues that are the direct result of insult or alteration in the structure and function of the organ system of the human body.
6. Define anatomic terms used to refer to the body and identify and describe the major anatomical features.

Basic Medical Histology (GMS 6630) Includes topics such as cellular, tissue and organ structure and function. The course builds a broad understanding of the cells, tissues and organs of the body and the interaction and control of these structures within the normally functioning human and how these are altered in disease. This material is presented in the context of modern medicine such that at the end of the course the student will be able to:

1. Describe the intracellular components of the cell, compartmentalization of cell processes and how they are controlled.
2. Describe the components and function of the basic tissues of the body and how they are organized.
3. Describe the cellular and tissue components of the organs of the body and how they are arranged to allow for proper function.
4. Describe the control mechanism of the components of the body.
5. Describe the interaction of cells, tissues and organs in normal function.
6. Demonstrate an understanding of the role of basic science in guiding diagnosis, therapies and disease prevention.

Basic Medical Genetics (GMS 6012) presents a concise introduction to one of the most rapidly advancing fields of medicine. While often regarded as the youngest of the medical specialties, an understanding of genetic principles is integral to all aspects of biomedical science. Genetics, as a discipline, is juxtaposed between clinical medicine and the basic sciences, and is essential to understanding the nature of inheritance and transmission patterns of various genetic diseases that affect human health and well-being. This course emphasizes a fundamental understanding of the principles of medical genetics, focusing on both basic principles and important clinical applications. The course features topics such as patterns of inheritance, population genetics, chromosomal abnormalities, single gene defects, triplet expansion errors, the genetics of cancer, linkage analysis, multifactorial disorders, medical genomics, personalized medicine, prenatal diagnosis, genetic counseling and ethics. The course develops a broad and thorough understanding of the principles of human genetics and identifies the major clinical conditions that perturb the functioning of normal cells, tissues and organs and influence development. All material is presented in the context of modern medicine such that at the completion of the course, students will be able to:

1. Describe how genetic factors predispose to Mendelian and multifactorial diseases and the implications of such predispositions for disease diagnosis, treatment and prevention.
2. Explain the clinical manifestations of common Mendelian diseases.
3. Identify the clinical features of common chromosomal aneuploidies and the signs generally associated with other kinds of chromosomal imbalance.
4. Describe how constitutional and acquired genetic alterations can lead to the development of malignant neoplasms and how identification of these changes can be used in the diagnosis, management and prevention of malignancy.
5. Explain how knowledge of a patient's genotype can be used to develop a more effective approach to health maintenance, disease diagnosis, and treatment for that particular individual.
6. Understand the procedures that are generally employed for prenatal genetic diagnosis and the indications for such testing together with the advantages, limitations, and disadvantages of pre-symptomatic testing for genetic disease.
7. Explain the existence of and justification for screening programs to detect genetic disease, and the difference between screening and more definitive testing and describe the differences in goals and approach among screening programs for genetic diseases in newborn infants, pregnant women, and other adults.
8. Explain the conventional approaches to treatment of genetic diseases and the general status of gene-based therapies and what exposures are likely to be teratogenic in humans and how such exposures can be prevented.

Basic Medical Neuroscience (GMS 6706) is designed to examine the fundamental aspects of neuroscience that are critical to understanding the cellular mechanisms relevant to human health and disease that form part of the foundation of modern medical practice. This course emphasizes a fundamental understanding of the principles of the neurosciences and their relationship to medicine and includes topics such as basic neuron anatomy and the structure and function of neural networks; nerve cells and their intracellular processes, comparison of the central and peripheral nervous system, the mechanisms by which neurons process signals physiologically and electrochemically and the pathways by which signals are processed by the dendrites, somas and axons and how neurotransmitters and electrical signals are used to propagate signals in a neuron and how these activities are altered by disease. All material is presented in the context of modern medicine such that at the completion of the course, students will be able to:

1. Describe the macroscopic (gross) structure and organization of the various component parts of the human nervous system.
2. Describe the microscopic structure and intracellular processes of nerve cells and other cells of the nervous system.
3. Describe the neuron-anatomical organization of functional neurological systems.
4. Describe the role of the nervous system in selected activities of everyday living.
5. Describe the macroscopic and biochemical environment in which the nervous system is located including structures and mechanisms required for normal neurological function.
6. Describe selected abnormalities of function that are commonly associated with specific neurological lesions or disease processes.

Basic Medical Immunology & Microbiology (GMS 6141) is designed to examine the fundamental aspects of immunology and microbiology that are critical to understanding the nature of the immune response and identify the various microbiological agents that are relevant to human health and disease that form part of the foundation of modern medical practice. This course emphasizes a fundamental understanding of the principles of immunology that govern the interaction between pathogens and humans and their relationship to modern medical diagnostics and therapeutics. The course features topics such as cells and organs of the immune system, antibody recognition and antigens, the nature of T-cell immunity and the role of the major histocompatibility complex, immunomodulation, immunoassays, infection and immunity, basic and clinical bacteriology, basic and clinical virology, mycology and parasitology. The course develops a broad and thorough understanding of the principles of immunology and microbiology and identifies the major pathological organisms and immunomodulatory events that control the functioning of normal cells, tissues and organs and an understanding of how these processes are altered by infection. All material is presented in the context of modern medicine such that at the completion of the course, students will be able to:

1. Describe the principal components and function of the immune system and identify their roles in controlling infection by microorganisms and foreign pathogens.
2. Describe the role of the acquired immune system that is mediated by antibody recognition of antigens associated with foreign substances or pathogens and understand the nature of antibody-antigen interactions.
3. Understand the structure and function of the major histocompatibility complex and its role in the immune response.
4. Explain the components and properties of the innate immune system and how it provides a defensive barrier against invading pathogens.
5. Describe the adaptive immune response and hypersensitivity.
6. Describe the design and construction of immunoassays and provide examples of their application.
7. Identify the basic principles of bacteriology and describe the different types of clinically-important bacteria. Understand the principles of virology and mycology.
8. Demonstrate an understanding of the role of basic science in guiding diagnosis, management, therapeutics, and disease prevention.

Clinical Correlations in Molecular Medicine (MCB 6433) is designed to assist integration of the study of the basic sciences with the clinical aspects of many diseases that have been primarily shown to result from defects in intermediary metabolism. Understanding the chemical and cellular mechanisms relevant to human health and disease represents a critical part of the foundation of modern medical practice. A significant challenge in the field of molecular medicine has been to relate the diverse array of cellular reactions, chemical mechanisms and metabolic pathways to the normal and pathophysiological processes involved in human health and disease. This course emphasizes how many of the concepts articulated in the study of molecular medicine can be applied to understand specific examples of human disease. The course comprises fourteen topics that have been selected to represent subjects that vary from protein structure and function, fuel metabolism and energetics to intermediary metabolism. The course develops a broad and thorough understanding of several important diseases at the molecular level and provides examples of how the structural, metabolic and regulatory events that control the functioning of normal cells, tissues and organs are altered by disease. All the course material is presented in the context of modern medicine such that at the completion of the course, students will be able to:

1. Describe the principal alterations in cellular function that result in a variety of diseases at the molecular level.
2. Describe the major diagnostic steps that were utilized to define the disease process.
3. Examine potential treatments and therapies that could be used to cure or ameliorate the various diseases.
4. Illustrate if specific groups within the general population are at risk for the various cellular defects and the mode of inheritance for those diseases that are genetically based.
5. Highlight the role of basic science in guiding diagnosis, management, therapeutics, and disease prevention.

Health Sciences Ethics (GMS 6871) is designed to examine selected ethical considerations that have become significant components of the practice of the biomedical sciences and which often represent important considerations that must be addressed in both the “basic” and “clinical” sciences. This course emphasizes a variety of ethical issues and includes such topics as the oversight and design of biosciences projects, informed consent, subject selection for clinical studies, conflicts of interest, the social effects of bioscience research, studies using embryos, fetuses and children, genetic research, the use of animals in research and questions on authorship, publication and scientific misconduct. The course attempts to develop a broad introduction to many of the ethical issues that often confront basic scientists and clinicians during the conduct of various types of research projects and clinical care. While some ethical issues in medicine, such as the use of animals in basic research, euthanasia and abortion have been under discussion for extensive periods of time, other aspects of biomedical research, including the use of human subjects, human tissue acquisition, the collection and use of genetic information and decisions of authorship criteria and scientific fraud, are of comparatively recent vintage. Modern efforts to implement guidelines and standards for the conduct of biomedical research have been developed to provide formal protections for various classes of research participants. Health sciences ethics addresses many of the topics that are of concern to professionals engaged in the health sciences. The course includes the review of selected case studies to provide an appropriate mechanism to analyze and think-through difficult medical and moral situations. All material is presented in the context of modern healthcare such that at the completion of the course, students will be able to:

1. Describe the several points of analysis that should be addressed when evaluating the various types of biomedical studies and will be able to address the potential social impact of research.
2. Identify the dominant motives for most types of research study and discuss the value and justification for the proposed activities.
3. Describe the major facets of the research process, such as the potential risks, access to the resulting information and whether the research is justified in terms of the involvement of animals, children and adults or other selected groups of individuals.
4. Explain the social impact of research in terms of reinforcing inequity, prejudice or discrimination, the potential influence on the legal system and how will the benefits of the research be distributed?

Basic Medical Physiology (GMS 6440) presents a concise introduction to the study of human physiology from a perspective of the function of various human organ systems with an emphasis on understanding important concepts and their correlation to the practice of clinical medicine. Major topics include an introduction of basic physiological principles in homeostasis, followed by cell-to-system physiological principles for the musculoskeletal system, cardiovascular system, pulmonary system, renal system, and endocrine and reproductive systems. Archived lectures are primarily focused on normal physiological function, with introductory topics covering selected clinical dysfunction to emphasize fundamentals. On completion of this course students will be able to:

1. Understand normal function of the human body from molecular to cellular, cellular to tissue, tissue to organ, and organ to organ system levels.
2. Understand interrelationships between organ systems.
3. Understand human disease processes and medical interventions at an introductory level.

Basic Medical Pathology (GMS 6111) presents a concise introduction to the basic pathophysiologic principles that are characteristic of the diseased state. Pathology, as a discipline, is juxtaposed between clinical medicine and the basic sciences and is crucial to understanding the nature of important pathophysiologic mechanisms that are critical to human health and disease and comprise part of the foundation of modern medical practice. This course emphasizes a fundamental understanding of the principles of pathology and focuses on both basic pathophysiology and important pathologic processes in specific organ systems. The course features topics such as cell injury and cell death, inflammation, tissue damage and repair, neoplasia, cardiovascular pathology, endocrine pathology, hematopoietic pathology and the nervous system. The course develops a broad and thorough understanding of the principles of human pathology and identifies the major pathological conditions that perturb the functioning of normal cells, tissues and organs. All material is presented in the context of modern medicine such that at the completion of the course, students will be able to:

1. Communicate an understanding of tissue injury and disease processes, using appropriate pathology terms and recognize the morphological and functional differences between normal and injured or diseased tissue.
2. Describe, from a structural, functional and biochemical perspective, the different types of pathological lesions and provide scenarios for how they each arise.
3. Explain the major pathological changes that occur in the various organ systems including the heart, lungs and skin. Describe the pathology of the gastrointestinal tract, the endocrine and hematopoietic systems.
4. Identify the various tumor types that are common to the different organ systems.
5. Explain the causes of various degenerative diseases of the nervous system such as Alzheimer's disease, Parkinson's disease, Huntington's disease and Amyotrophic Lateral Sclerosis.
6. Explain neoplasm and the different modes of dysregulation of cell growth and division.
7. Illustrate the various causes of carcinogenesis, such as irradiation, chemical, viral, inflammatory and genetic effects.
8. Explain inflammation and how it is critical to host defense against microorganisms and parasites, identify the different patterns of inflammatory response and the various types of autoimmune disorders.
9. Demonstrate an understanding of the different pathologies of the male and female reproductive systems.

Basic Medical Pharmacology (GMS 6505) is designed to examine the fundamental aspects of pharmacology that are a vital component of modern medical practice. In its broadest sense, pharmacology can be defined as the study of the effect of drugs on living organisms with the objectives of defining the underlying mechanisms by which the responses are generated. Pharmacology is an integrative discipline that includes aspects of biochemistry, physiology, microbiology and immunology. Knowledge of pharmacology is essential in the practice of both human and veterinary medicine, where drugs are used to treat disease. The principles of pharmacology also apply to toxicology, where the effects of the chemicals of interest are harmful rather than therapeutic.

This course emphasizes a fundamental understanding of the principles of pharmacology that govern the interaction between drugs and xenobiotics and humans and their relationship to modern medical diagnostics and therapeutics. The course features topics such as pharmacologic terminology, the underlying concepts of pharmacokinetics, qualitative and quantitative descriptions of drug actions (pharmacodynamics), an introduction to toxicology and the methods used to reduce levels of hazardous substances within the body, the treatment of infectious diseases, immunopharmacology and cancer, examples of drugs that target the autonomic nervous system, the actions of anticoagulants, platelet inhibitors and thrombolytics and their relevance to hematology, gastrointestinal and endocrine pharmacology. The course develops a broad and thorough understanding of the principles of pharmacology and the types of interactions of various drugs that influence and control the functioning of normal cells, tissues and organs and an understanding of how various drugs are used in disease therapeutics. All material is presented in the context of modern medicine such that at the completion of the course, students will be able to:

1. Describe the general principles of drug action and identify the four different levels of action that include the molecular and cellular levels, the tissue specificity and the major system interaction, such as the cardiovascular system.
2. Demonstrate an understanding of the terminology used to describe basic pharmacologic principles and identify the major pharmacologic classifications of drugs that indicate their respective mode of action.
3. Understand the principles of pharmacokinetics and other factors that influence drug action.
4. Describe the principles of pharmacodynamics and the methods utilized in the measurement of drug action, controls used to ensure drug safety and the concept of pharmacovigilance.
5. Differentiate between terms such as efficacy, potency and therapeutic index as they relate to drug therapy and demonstrate an understanding of the basic mechanisms of drug-induced toxicity and drug-drug interactions and develop appropriate approaches to their management.
6. Describe the interaction of selected drugs with viruses, bacteria, fungi and various parasites.
7. Discuss the actions of selected drugs on various body systems and targets including the hematopoietic system, the central and peripheral nervous system and the renal, gastrointestinal and pulmonary system.