MASTER OF SCIENCE IN BIOMEDICAL SCIENCES (M.S.)

Purpose
The Master of Science in Biomedical Sciences is a 39-hour graduate-level program that serves primarily as a post-baccalaureate academic enhancement program to improve students' academic record and increase their chances for admission to medical school and other professional programs. The program has two delivery formats: a one-year residential format and a two-year residential format. The one-year program can be completed in 2 semesters (fall, spring) or 3 semesters (summer, fall, spring), Course are taught from a biblical worldview and the program includes a required course in biomedical ethics.

Program Learning Outcomes
The student will be able to:
1. Apply scientific knowledge to problem solving in the biomedical sciences.
2. Synthesize and interpret information from the biomedical science literature.
3. Defend ethical decisions in biomedicine based on biblical principles.

Program Specific Admission Procedures
In addition to the General Admission Procedures outlined in this Catalog, applicants to the Master of Science in Biomedical Sciences program must have:

1. An earned baccalaureate degree or its equivalent from an institution accredited by an agency recognized by the U.S. Department of Education (e.g., SACSCOC, TRACS, ABHE, etc.).
2. Official college transcript documenting the minimum GPA requirement and course prerequisites should be submitted. Minimum GPA for the one-year program is 2.75 and the minimum GPA for the two-year program is 2.75. Prerequisite courses include:
   a. one year of general chemistry with lab
   b. one year of biology with lab
   c. one semester organic chemistry with residential lab (2 semesters recommended)
   d. one semester physics with residential lab (2 semesters recommended)
   e. At least four of the following courses:
      i. One year of Anatomy/Physiology or one semester of Physiology or one semester of Anatomy
      ii. One semester of Genetics
      iii. One semester of Microbiology
      iv. One semester of Cell Biology
      v. One semester of Biochemistry
      vi. One semester of Biostatistics is recommended but not required
   f. Students who have not completed four of the courses in (e.) will be required to enroll in BIOM 500 Introduction to Biomedical Sciences (3 c.h.) and receive a minimum grade of B-
   3. Accept on caution (Residential)
   4. For all new graduate applicants who apply to the 1-year Biomedical Sciences track and who do not meet the GPA, test score or prerequisite requirements, a cautionary acceptance can be considered on a case-by-case basis (by the department) for a student who has a GPA between 2.50-2.74. If accepted, these students will be required to successfully complete BIOM 500 Introduction to Biomedical Sciences (3 c.h.) as a prerequisite for BIOM 515 Human Physiology (5 c.h.).
   b. For all new graduate applicants who apply to the 2-year Biomedical Sciences track and who do not meet the GPA, test score or prerequisite requirements, a cautionary acceptance can be considered on a case-by-case basis (by the department) for a student who has a GPA between 2.50-2.74. If accepted, these students will be required to successfully complete BIOM 500 Introduction to Biomedical Sciences (3 c.h.) as a prerequisite for BIOM 515 Human Physiology (5 c.h.).
   4. Students must submit one of the following tests with a minimum score:
      a. MCAT - New scoring system (2015 and later): composite score of 490; Old scoring system (prior to 2015): score of 18 for the two-year program.
      b. MCAT - New scoring system (2015 and later): composite score of 493; Old scoring system (prior to 2015): score of 20 for the one-year program
      c. GRE Verbal 140, Quantitative 145; or
      d. DAT – 14.5 average
      e. PCAT – 50th percentile or higher
   5. Contact information for recommendations (Residential)
   a. Applicants to the MS Biomedical Sciences program are required to submit contact information for three (3) recommendations - which may be academic, professional or personal.
   6. TOEFL Scores for students who speak English as a second language (score of 600 paper-based test; 250 computer-based test, 80 internet-based test).

Acceptance to the one year M.S. in Biomedical Science track may be granted based on a recommendation from Liberty University’s College of Osteopathic Medicine.

Note: Students intending to apply for admission to Liberty University’s College of Osteopathic Medicine (LUCOM) will need to meet LUCOM’s admission standards.

Transfer Credit
Students may transfer up to 18 hours of graduate course work from an accredited institution. In order to be eligible for transfer, course work must have a minimum grade of B-, and must have been completed in the past 10 years. Credits from a prior degree on the same academic level earned through Liberty University are considered transfer credits.

Graduation Requirements
1. Satisfactory completion of 39 hours.
2. A maximum of 50% of the program hours may be transferred if approved and allowable, including credit from an earned degree from Liberty University on the same academic level. (For this degree program, the maximum is 19 hours.)
3. 3.00 GPA
4. No grades of C or D (including +/- grades) may be applied to the degree.
5. Students may earn one grade of C+/C/C-, which must be repeated for a grade of B- or higher.
6. For information regarding the repeat policy, please refer to "Course Repeat Policy" in the Academic Information and Policies section of this Catalog.
7. Degree must be completed within 5 years.
8. Submission of Degree Completion Application must be completed within the last semester of a student's anticipated graduation date.

Program of Study

Delivery Format: Residential Only

- Biomedical Sciences (M.S.)

Career Opportunities

- College Professor
- Chemical Technician
- Environmental Biologist
- Forensic Biologist
- Medical Technologist

Courses

BIOM 500 Introduction to Biomedical Sciences 3 Credit Hour(s)
This course employs the exploration of the molecular, genetic, biochemical and cellular basis of human oncogenesis, tumor metastasis, cancer detection and therapeutic advances as a comprehensive background for understanding and engaging the field of biomedicine. It provides a solid foundation in the basic biomedical principles that serve as the framework for advancing medical science including genetics, cellular anatomy, metabolism and cell signaling.
Offered: Online

BIOM 503 Human Genetics 3 Credit Hour(s)
Prerequisite: (BIOM 513 and BIOM 515) or (BIOM 523 and BIOM 524 and BIOM 525 and BIOM 526)
A study of the molecular causes of human disease with an emphasis on the specific gene perturbations that influence human health. Specific modes of genetic assault (e.g. mutations, epigenetic mechanisms, nutritional factors, and viral infections) will be discussed.
Offered: Resident and Online

BIOM 513 Human Gross Anatomy 5 Credit Hour(s)
This is an intensive course that covers all aspects of human anatomy through lectures, followed by practical application using cadavers. In addition, imaging techniques including CT scans and x-ray radiography are used to introduce the student to the physician's perspective.
Offered: Resident

BIOM 515 Human Physiology 5 Credit Hour(s)
A concentrated, comprehensive course that provides the student with a high level of understanding of the physiological basis of medicine. The essential concepts of mechanisms of body function are presented at various levels of organization, ranging from cellular and molecular to tissue and organ system levels. Emphasis is placed on understanding the integrated regulation of various body processes among the major systems.
Offered: Resident

BIOM 523 Human Gross Anatomy Lecture 4 Credit Hour(s)
This is an intensive course that covers all aspects of human anatomy through lectures. Students will be shown how imaging techniques including CT scans and x-ray radiography are viewed from the physician's perspective. This course precedes BIOM 524 Human Anatomy Cadaver Lab which includes the use of human cadavers. (BIOM 523 and 524 are equivalent to BIOM 513).
Offered: Online

BIOM 524 Human Anatomy Cadaver Lab 1-2 Credit Hour(s)
Prerequisite: BIOM 523
A laboratory study of the structure and function of the human body using a regional approach with emphasis on the detailed osteology, musculature, vasculature, and innervation of each region along with an understanding of the interrelationship between organ systems. This course follows BIOM 523 Human Gross Anatomy Lecture. (BIOM 523 and 524 are equivalent to BIOM 513).
Offered: Resident and Online

BIOM 525 Human Physiology Lecture 4 Credit Hour(s)
Prerequisite: BIOM 525
This is a concentrated, comprehensive course that provides the student with a high level of understanding of the physiological basis of medicine. The essential concepts of physiology and mechanisms of body function are presented at various levels of organization ranging from cellular and molecular to tissue and organ system levels. Emphasis is placed on understanding the integrated regulation of various body processes among the major systems. This course precedes BIOM 526 Human Physiology Lab. (BIOM 525 and 526 are equivalent to BIOM 515).
Offered: Online

BIOM 526 Human Physiology Lab 1 Credit Hour(s)
Prerequisite: BIOM 525
Human physiology is the study of the functions of the body and how it maintains homeostasis. This lab course practically examines systemic functions using human subjects and simulated case studies. It also allows students to independently develop and test hypotheses about homeostatic control mechanisms in health and disease. Special attention is placed on medically vital systems including the nervous, cardiovascular, respiratory, digestive, endocrine systems and the effects of exercise, altitude and depth on these. (BIOM 525 and 526 are equivalent to BIOM 515).
Offered: Resident and Online

BIOM 600 Biomedical Ethics 3 Credit Hour(s)
An in-depth ethical analysis and evaluation of present and emerging biomedical technologies in the 21st century. While not ignoring other ethical schools of thought, the focus of this course will be on the Hippocratic and Judeo-Christian traditions with their emphasis on the inherent dignity and worth of humanity as a whole, as well as the individual patient. This ethical foundation will serve as the primary framework for discussing medical decision making and practice.
Offered: Resident and Online

BIOM 610 Human Neurology and Neuroanatomy 3 Credit Hour(s)
Prerequisite: (BIOM 513 and BIOM 515) or (BIOM 523 and BIOM 524 and BIOM 525 and BIOM 526)
This course will provide an introduction to the structural and functional features of the nervous system. Topics covered will include the gross anatomy of the brain and spinal cord, cellular and molecular neurobiology, sensory and motor systems, the major neurotransmitter systems, and brain regulation of behavior and body physiology.
Offered: Resident and Online
BIOM 613  Human Gross Anatomy II  3 Credit Hour(s)
Prerequisite: BIOM 513
A continuation of BIOM 513 with additional and more advanced dissections of human cadavers.
Offered: Resident

BIOM 615  Advanced Cell Biology  4 Credit Hour(s)
Prerequisite: (BIOM 513 and BIOM 515) or (BIOM 523 and BIOM 524)
Advanced study on the structure, function and organization of the cell. Major topics include structure and function of cellular organelles, the cytoskeleton and extracellular matrix; cell signaling; membrane transport; protein targeting, vesicular transport, and cell division.
Offered: Resident and Online

BIOM 620  Advanced Immunology  3 Credit Hour(s)
Prerequisite: (BIOM 513 and BIOM 515) or (BIOM 523 and BIOM 524 and BIOM 525 and BIOM 526)
A detailed study of the cells and molecules that result from an immune response to disease. The course will include antigen presentation, cytokine networks, vaccines and vaccine development, immunodeficiency diseases, tumor immunity, tolerance, autoimmunity and contemporary topics in immunology.
Offered: Resident and Online

BIOM 623  Human Developmental Biology  3 Credit Hour(s)
Prerequisite: BIOM 513 and BIOM 515
Advanced study of the major events of normal and abnormal human embryonic development. Major topics include gametogenesis, fertilization, axis formation, molecular pathways involved in tissue formation, and development of organ systems.
Offered: Resident

BIOM 625  Microbial Pathogenesis and Virology  3 Credit Hour(s)
A comprehensive study of the viruses that cause human disease and the basic principles of microbial pathogenesis, including the molecular basis of infectious disease, how microbes establish infections, gain nutrients, cause damage to the host and disease, evade host defense mechanisms. The course will also include case studies.
Offered: Resident and Online

BIOM 630  Principles of Pathology  3 Credit Hour(s)
Prerequisite: (BIOM 513 and BIOM 515) or (BIOM 523 and BIOM 524 and BIOM 525 and BIOM 526)
This course reviews basic pathology principles including: Inflammation, Infection, Repair, Thrombosis, Hemostasis, Hyperplasia, Hypertrophy, Neoplasia, and Apoptosis. In addition, the pathophysiology of disease applied to various organ systems is covered in depth. Correlations with appropriate laboratory results and physical findings will elucidate the basis for signs and symptoms of various common diseases. Both diagnostic features of diseases and critical thinking skills will be stressed.
Offered: Resident and Online

BIOM 633  Advanced Histology  4 Credit Hour(s)
Prerequisite: BIOM 513
This course provides a detailed orientation to the structure and organization of cells and tissues. Students will learn a variety of techniques involved in the preparation of histological slides (including use of the microtome, vibratome, and cryostat) and staining specimens. Students will assist undergraduate students in tissue preparation.
Offered: Resident