

# BIOMEDICAL SCIENCE (BIOM)

## BIOM 500M – Medical Cell Biology and Biochemistry

Students receive fundamental information regarding the structure and function of cells, how cells are organized into tissues and how molecular mechanisms within the cell drive its replication and function, as well as nutrients and biochemical pathways within cells that drive metabolism, energy usage and generation in cellular and homeostatic processes within humans.

5 credits  
In-Person

## BIOM 501 – Molecular Basis of Medicine

The course presents fundamental information regarding biochemistry, molecular biology and medical genetics in a way that is highly practical in today's clinical and/or research setting. This overview course includes discussions of molecular biology and genetics, metabolism and the body's production and use of energy, and blood-related issues such as blood proteins, lipoproteins and hemostasis.

7 credits  
In-Person

## BIOM 502 – The Infectious Process

This course introduces graduate students to fundamental principles of immunology and microbiology. This overview includes discussions of the interplay between the microbial pathogen and the host immune response during the infectious process. Representative microorganisms belonging to each class of pathogen (bacterial, viral, fungal and parasite) are discussed. After the introductory lectures, the focus will be on current topics of interest in infectious disease and public health, including vaccines, cancers with an infectious etiology, and eradication of disease.

3 credits  
In-Person

## BIOM 503 – Human Anatomy

This course provides a comprehensive consideration of the human anatomy as it relates to function in order to provide the anatomical component of diagnosis and treatment. Course objectives include the demonstration of anatomical structural knowledge of all systems in the human body, including musculoskeletal, neuronal, lymphatic, respiratory, cardiovascular, digestive, urinary and reproductive. Emphasis is placed on structural relationships and functional correlations. Learning is facilitated through lecture and group study of anatomical dissections.

6 credits  
In-Person

## BIOM 503M – Medical Microbiology and Immunology

This course introduces graduate students to fundamental principles of immunology and microbiology. This overview includes discussions of the interplay between the microbial pathogen and the host immune response during the infectious process. Representative microorganisms belonging to each class of pathogen (bacterial, viral, fungal and parasite) are discussed.

4 credits  
In-Person

## BIOM 504 – Histology

Students receive fundamental information regarding the structure and function of cells, how cells are organized into tissues and how tissues are organized into organs. In the histology laboratory, students learn to identify cells, tissues and organs through a microscope.

4 credits  
In-Person

## BIOM 504M – Ethics and Professionalism

The student interacts with faculty in discussions and presentations regarding scientific/medical ethics, professional development and career advancement.

1 credits  
In-Person

## BIOM 505 – Neurosciences

This course provides a broad introduction to the basic and clinical neurosciences, including motor function, cerebrovascular blood supply, sensory receptors, higher cortical functions, the limbic system, neurometabolism, and nervous system structure and function.

3 credits  
In-Person

## BIOM 505M – Medical Anatomy

This course provides a comprehensive consideration of the human anatomy as it relates to function in order to provide the anatomical component of diagnosis and treatment. Course objectives include the demonstration of anatomical structural knowledge of all systems in the human body, including musculoskeletal, neuronal, lymphatic, respiratory, cardiovascular, digestive, urinary and reproductive. Emphasis is placed on structural relationships and functional correlations.

5 credits  
In-Person

## BIOM 506 – Medical Pharmacology

This course presents an introduction to the basic concepts and principles of pharmacology. Specific lectures are presented in the areas of pharmacokinetics, autonomic pharmacology, cardiovascular pharmacology, CNS pharmacology and the control of pain.

3 credits  
In-Person

## BIOM 506M – Medical Physiology

The Medical Physiology course introduces students to the foundational physiological mechanisms underlying the normal function of the human body and thus provides the basis for understanding disease processes. The course covers concepts in normal physiology, as well as selected diseases in the following body systems: Neural, Muscular, Cardiovascular, Respiratory, Renal, Gastrointestinal, Endocrine and Reproductive. The goal of the course is to provide the student with an understanding of the fundamental mechanisms of human physiology.

4 credits  
In-Person

## BIOM 507 – Physiology

This introductory course focused on medical physiology correlates the principles of basic functional mechanisms to practical methods for clinical assessment. Students receive hands-on instruction in methods to evaluate physiological mechanisms in a laboratory setting. Classroom and laboratory instruction are correlated to enhance understanding of cardiac, skeletal, and smooth muscle physiology, gastrointestinal, respiratory, cardiovascular, and renal physiology.

3 credits  
In-Person

## BIOM 507M – Medical Terminology

Students are taught the meaning of Latin and Greek word roots, suffixes, and prefixes. With the knowledge of these elements, a student is able to interpret and understand a multitude of complex medical terms.

1 credits  
OnLine

**BIOM 508M – Biomedical Anatomy Lab**

This course provides a hands on consideration of the human anatomy as it relates to function. Course objectives include the demonstration of systems in the human body in a laboratory setting. Learning is facilitated through group study of anatomical dissections.

2 credits

In-Person

**BIOM 509M – Biostatistics**

Students will learn, review and demonstrate knowledge of statistical concepts through the use of numerous real-life data sets and case studies. Students will have opportunities to practice through in-class discussions, homework exercises and class projects.

3 credits

OnLine

**BIOM 510M – Neurophysiology**

Students will learn a range of neuroscience related information including development, cell structure, function and signaling, and associated sensory and executive functions. Emphasis will be placed on broad concepts of structure and physiologic function.

3 credits

OnLine

**BIOM 511M – Journal Club**

The student gives a multimedia presentation that includes appropriate background, methodology, results, interpretations and conclusions of an original study drawn from the recent peer-reviewed literature. Emphasis is placed on developing skills in critical review and in communicating scientific studies in seminar format.

1 credits

In-Person

**BIOM 512M – Medical Anatomy II**

This course provides a consideration of the human skull, face, head and basic brain anatomy. Course objectives include the demonstration of anatomical structural knowledge. Emphasis is placed on structural relationships and functional correlations.

1 credits

In-Person

**BIOM 549G – Scientific Communication Skills**

This course is designed to teach basic scientific communications skills that are crucial to the success of graduate students in the biomedical sciences. Various communication topics and strategies will be addressed in class. Students will be trained to read, interpret and use various formats to communicate scientific information from primary scientific literature. Practice opportunities and critiques will be provided.

2 credits

Hybrid, In-Person

**BIOM 552G – Basic Concepts Biostatistics & Epidemiology**

3 credits

In-Person

**BIOM 553G – Basic Concepts Biomedical Model**

This course is designed to assist the student with developing a functional understanding of basic biochemical, cellular and systems physiologic processes through application of basic physical and chemical principles. The course builds on principles with which students are familiar from prerequisite coursework. Students examine and analyze how these principles have been modified to model cellular and human physiologic systems. Practical examples are used to both explain and test student competency. Students are expected to apply literature and database search techniques to identify specific research examples and to develop an appropriate project proposal. Additionally, public presentation, written assignments and testing are used to assess student academic performance.

2 credits

In-Person

**BIOM 554G – Neuroscience**

This course introduces the student to the field of medical neurosciences including cognition, the senses and the neuromuscular junctions. Emphasis is placed on structural organization and design of the nervous system, supported by the lecture and laboratory approach employed in the Human Gross Anatomy course that precedes this neuroscience experience. Understanding of basic physiologic principles and nervous system design is tested using timed exams that require students to apply their basic knowledge to an analysis of a variety of medically based scenarios.

3, 4 credits

In-Person

**BIOM 557G – Micro Anatomy and Embryology**

The histology component of this course covers basic structure and function of eukaryotic cells, how these cells are organized into four tissue types, and how tissues are organized into organs to support the various systems of the body. The embryology component focuses on gametogenesis through fetal development and explores embryogenesis for each organ system.

4 credits

In-Person

**BIOM 558G – Biochemistry, Cell, & Molecular Biology**

This course provides the basis for understanding concepts of molecular medicine relevant in subsequent coursework in the biomedical sciences. Areas of concentration include biochemistry cell and molecular biology and genetics. Topics include studies of cellular organization; signaling and replication; gene expression and regulation; carbohydrate, lipid, protein and nucleic acid metabolism; enzymes; and mechanisms of inheritance and genetic engineering.

5 credits

In-Person

**BIOM 559G – Biostatistics**

This course introduces the student to basic principles of statistical methods as applied to biomedical research, design and critical reading of the scientific literature. The student is expected to develop ability to use these basic principles to perform simple research data analysis and to interpret data reported in the current scientific research literature. This course in sequence with the new second year course Epidemiology replaces the 3 credit course BIOM 609G – Biostatistics and Epidemiology (formerly BIOM 552G).

2 credits

OnLine

**BIOM 560G – Human Anatomy and Physiology I**

5 credits

In-Person

**BIOM 562G – Biomedical Anatomy**

Students will be introduced to the structures of the human body by a regional approach that will stress the connections between systems. The course will explore the relationships between form and function of the various systems and structures to develop a more complete foundational understanding of the body. Systems to be explored and integrated include musculoskeletal, neural, respiratory, cardiovascular, digestive, urinary, and reproductive. A laboratory component utilizing cadaveric specimens will assist with integration of structural relationships from a 3D perspective.

5 credits  
In-Person

**BIOM 563G – Biomedical Physiology**

The study of human physiology is guided by organ systems and the essential knowledge base required for understanding their functions and their interactions. The organ systems covered include but not limited to the Cardiovascular, Pulmonary, Renal, Gastrointestinal, Endocrine, and Female and Male Reproductive System. Study of each organ system may incorporate the most common diseases or challenges to homeostasis for that system. The integration of the Physiology and Pathophysiology of human organ systems is presented such that the factual and conceptual aspects of normal functions and diseased states are learned as a unified narrative to better understand the major challenges to homeostasis identified for each organ system.

5 credits  
In-Person

**BIOM 567G – Honors Micro Anatomy and Embryology**

4 credits  
In-Person

**BIOM 600G – Critical Analysis of Research**

This course is designed to enhance and promote critical analysis and communication of scientific findings. Students enrolled in the thesis track will meet on a bimonthly basis for one hour. In the first part of the year, students will present and carefully analyze the results of a scientific article. In the later part of the year, students will present the results from their individual research projects. All students are expected to attend and participate in presentations and discussions of research findings. The purpose of this experience is to augment the student's skills and competencies specific to the successful completion and presentation of their thesis research requirement for completion of the MS Degree.

0 credits  
Hybrid

**BIOM 601 – Introduction to Pathology**

The course provides a systematic approach to the pathological basis of medicine. The course begins with an overview of cell injury, death, adaptation, repair and regeneration. It continues with a survey of the dermatological, skeletal, neurological, endocrine, immunological, cardiorespiratory, vascular, gastrointestinal, renal, urological and reproductive systems.

3 credits  
OnLine

**BIOM 601G – Basic Concepts in Biostatistics and Epidemiology**

3 credits  
In-Person

**BIOM 601M – Introduction to Pathology**

The course provides a systematic approach to the pathological basis of medicine. The course begins with an overview of cell injury, death, adaptation, repair and regeneration. It continues with a survey of the dermatological, skeletal, neurological, endocrine, immunological, cardiorespiratory, vascular, gastrointestinal, renal, urological and reproductive systems.

3 credits  
OnLine

**BIOM 602G – Infection and Immunity**

5 credits  
In-Person

**BIOM 602M – Introduction to Pharmacology**

This course provides students with a broad survey of the basic principles of pharmacokinetics, pharmacodynamics and pharmacotherapeutics. This course reviews the mechanism(s) of action, toxicities and interactions of specific drugs and drug classes.

3 credits  
In-Person

**BIOM 603G – Concepts in Pharmacology Toxicology**

This course introduces the student to major concepts used in the study of pharmacology and toxicology. It focuses on drugs used in autonomic and cardiovascular pharmacology and toxicology. The course utilizes a lecture format and several laboratory sessions, one of which involves the use of the patient simulator in the clinical learning laboratory.

3 credits  
In-Person

**BIOM 604G – Nutritional Biochemistry**

This course introduces the student to the foundation of nutrition as it impacts biochemical pathways within the body. This course applies a competency-based approach in which an emphasis is placed on student presentation and active participation in the classroom. Final course evaluation is based on the effectiveness of the student's classroom participation, prior preparation based on classroom outcomes and a final project that requires the student to design an experimental investigation of a topic of his or her own interest and then to apply his/her knowledge base by developing and generating an appropriate NIH-style grant proposal.

3 credits  
In-Person

**BIOM 605 – Global Regulatory Requirements of Quality**

This course is focused on "why" global regulations were adopted, and the evolution of the quality systems grounded in science.

3 credits  
OnLine

**BIOM 606G – Analytical Reading, Molecular Reading**

The focus of this course is on the elaboration of molecular mechanisms in the current literature. This course requires directed readings and presentations of the current literature, exposing students to high-impact areas of the biomedical sciences and enhancing critical reading and public speaking skills.

1 credits  
Hybrid

**BIOM 607G – Independent Study/Scientific Composition**

This course is a graded three term sequence that is a guided independent study in which the student explores the biomedical science basis for health/medical conditions and syndromes that present in the clinic. Under the supervision of a graduate faculty member, the student is required to read and compile current scientific literature on the clinical condition chosen and write a major review article. Students will be required to present their topic in a formal presentation to the program faculty and their class peers. In addition to the presentation, the student must complete a written manuscript that adheres to scientific publication standards. Enrollment in this course requires approval of the program director and identification of a faculty mentor. Course may be substituted for BIOM 650G.

1-5 credits

In-Person

**BIOM 608G – Advanced Topics in Molecular Biology**

1-4 credits

In-Person

**BIOM 609G – Biostatistics & Epidemiology**

3 credits

**BIOM 610G – Medical Immunology**

The course is designed to provide the student with an understanding of the cellular and molecular basis of the immune response, and the role of the immune system in health and disease. Additional topics will cover immune-mediated pathological processes, tumor immunology and autoimmunity.

3 credits

In-Person

**BIOM 611 – Vaccines and Immune Therapies**

Vaccination is perhaps the most successful medical technological intervention. The goal of this course is to expand on students' general understanding of the immune system, and to focus this understanding towards the application of modern vaccines and immune therapies in the 21st century. The course will provide the student a sense of how these principles are applied to vaccine and immune therapeutic development. The course covers basic vaccine science and describes how this science is translated through clinical, regulatory, ethical, and political issues to result in a final vaccine product. The courses' goal is to leave the student with an understanding of the implications of modern vaccines/immunotherapies and their impact on world health.

3 credits

OnLine

**BIOM 611G – Medical Microbiology**

This course is designed to provide the student with the basic principles of medical microbiology and infectious disease. Emphasis will be placed on the identification, recognition and pathogenesis of the major medically relevant microorganisms including bacteria, viruses, fungi and parasites. Additional topics will include physiological and epidemiological factors contributing to human infectious disease and an introduction to antimicrobial agents. Note: Medical Immunology and Medical Microbiology as a sequence replace the former second year first term course Immunity and Infection BIOM 602G.

3 credits

In-Person

**BIOM 612G – Historical Development of Current Themes in Biomedical Research**

The focus of this course is the historical development of current and important research trends through the tracking of an idea or concept from its origins in the original scientific literature to the current applications in cutting edge research. The purpose is for the student to gain an appreciation of how the development of ideas and concepts is essential to the investigation and better understanding across different areas of science. This course requires directed readings and presentations of the current literature, exposing students to high impact areas of the biomedical sciences and enhancing critical reading and interpretation of scientific literature as well as public speaking skills.

1 credits

Hybrid

**BIOM 613G – Molecular Genetics**

The goal of this course is for the student to develop a deeper understanding of the molecular biology techniques introduced in earlier courses. The material will focus on understanding the molecular genetic tools that are having a tremendous impact on medicine. Specific topics will include various types of cloning, gene transfer, methods to study gene expression at the mRNA and protein levels, microRNAs and other recent developments. Prerequisite: BIOM 558G

3 credits

**Prerequisites:** BIOM 558G

In-Person

**BIOM 614G – Developmental Neuroscience**

This course has the goal of providing students with a solid foundation in developmental neuroscience. The student is required to integrate findings from anatomical, cellular, molecular and genetic approaches. Topics covered will include neural induction, regionalization of the neural plate and neural tube, neurogenesis, gliogenesis, cellular determination and differentiation, migration, growth cones and axon pathfinding, dendrite formation, programmed cell death, synapse formation and elimination, critical periods and developmental plasticity. Students are required to have a basic knowledge of cell biology and neuroscience before attempting this course.

3 credits

In-Person

**BIOM 615G – Biomedical Bases of Medicine**

This course is an advanced graduate-level study of problem-based physiology. 8 clinical cases will be presented and discussed which will provide an interdisciplinary and integrated understanding of some common disease states by exploring not only the important physiological concepts, but also the pathophysiology that leads to the development of specific clinical presentations and progression of the disease process.

In addition, appropriate clinical and therapeutic interventions will be discussed as a means to introduce students to the theory and practice of clinical medicine. After successful completion of this course, the student will be able to appreciate the complexity of clinical scenarios and as well interpret information across multiple organ systems.

3 credits

In-Person

**BIOM 616G – Experimental Design and Data Analysis in Biomedical Research**

This course is intended to provide basic training to students about how to start a biological research study with a reasonable experimental design and to apply best practices in data analysis at the end. This course will use examples from molecular biology, electrophysiology and imaging studies to explain how to adopt most currently accepted methods in experimental design and data analysis. Students enrolled in this course are required to have a prerequisite understanding of basic statistics.

2 credits  
In-Person

**BIOM 617 – Business for the Sciences**

An introduction to basic business principles for students with a background in biology and other life science fields.

3 credits  
OnLine

**BIOM 617G – Human Virology Biology**

This course is a discussion- and debate-based review of current topics in stem cell biology and the uses of stem cells in medicine and biotechnology. Topics include review and discussion of cell biology, developmental biology, molecular biology and genetics; stem cell characteristics and preparation; clinical applications and therapeutic uses of stem cells and tissue engineering; and regulatory and ethical issues. Current peer-reviewed literature provides up-to-date information for classroom discussion.

3 credits  
In-Person

**BIOM 618G – Epidemiology**

This course introduces the student to basic principles of epidemiology as applied to biomedical research, design and critical reading of the scientific literature. The student is expected to develop ability to use these basic principles to perform simple epidemiologic analysis and to interpret studies reported in the current scientific research literature. The students are required to identify measures of disease frequency and excess risk and apply these in the context of epidemiologic questions and problems. Students are also asked to interpret and apply the calculation and application of screening test utilities. Students are expected to master concepts including, but not limited to, morbidity and mortality measures, incidence, prevalence, attack rate, relative risk, odds ratio, positive and negative predictive value, sensitivity and specificity.

This course, in sequence with the new first year course Biostatistics (BIOM 559G), replaces the 3 credit course BIOM 609G – Biostatistics and Epidemiology (formerly BIOM 552G)

1 credits  
In-Person

**BIOM 619G – Medical Microbiology Method Practicum**

This course covers basic concepts of microbiology with emphasis on sterile techniques, staining, antibiotic susceptibility testing, isolation and identification of pathogenic microorganisms. As a final learning outcome, students are required to apply his/her acquired knowledge and skills to successfully identify a mixture of two unknowns. This course is the competency-based section of BIOM 611G Microbiology and BIOM 610G Medical Immunology course sequence, and students are registered in conjunction with BIOM 611G. Registration for this course as a separate component or registration for BIOM 611G without this competency-based component requires the approval of the program director.

1 credits  
In-Person

**BIOM 620G – Human Viruses Vaccines and Infectious Diseases**

This course is designed to build upon basic molecular genetics principles in order to familiarize the students with the related principles of virology, including structure, biology, replication, pathogenesis and host-cell interactions. The mechanisms of viral adaptation will be utilized as real-time applications of mutation to see how these can be exploited to predict the severity of viral outbreaks and the development of drug resistance. Students will gain an appreciation for the population genetics of infectious diseases, while the control and prevention of infection is a theme that will be discussed throughout the course. Finally, the development of the host innate immune system and viral counterstrategies will be examined. This course is designed to complement the fundamental concepts introduced in Molecular Genetics (BIOM 613G) and Epidemiology (BIOM 618G). Students should successfully both BIOM 613 G and BIOM 618 G before enrolling in this course. Student who have not completed Molecular Genetics and Epidemiology can only register for BIOM XXX G with the prior approval on the course director and program director.

3 credits  
In-Person

**BIOM 621G – Computational Neuroscience**

This course is designed to provide advanced training to students in the study of neuroscience and electrophysiology using a computational approach. Computational neuroscience is an important method in understanding the information content of neural signals by modeling the nervous system at many different levels. This course will review systemic and cellular neurobiology, basic concepts in biophysics, computer languages. Students will be required to perform electrophysiological recordings, construct biological realistic single neuron or network models using popular simulators, and present their models in both writing and speech. Completion of the course requirements will augment important professional skill sets and competencies for students completing the MS Degree and seeking to continue in many areas of scientific research and diagnostics. Basic knowledge in physics and neurobiology is prerequisite. This course is paired with Advanced Cardiovascular, Pulmonary and Renal Physiology.

3 credits  
Hybrid

**BIOM 622G – Advanced Cardio Pulmonary Renal Physiology**

This course provides advanced training to students in the study cardiac, cardiovascular, pulmonary and renal physiology elaborating on the ideas of how neural/hormonal feedback mechanisms and local control balance the parameters of pressure volume and cardiac output to adequate insure local and systemic blood flow for the purpose of nutrient delivery and waste removal. Students will explore the complexities of this balance through the examination of physical performance and pathophysiologic scenarios as well as analysis of laboratory research data and evidence base medicine cases. Students will be required to present and explain their analyses using both classic physiologic illustration tools and literature graphics. This course is paired with Computational Neuroscience.

3 credits  
In-Person

**BIOM 623G – Integrative Anatomical Skills**

3-4 credits  
In-Person

**BIOM 624G – Embryological Basis of Disease**

This course is designed to provide advanced comprehension of the underlying embryological mechanisms in human development. Students will examine the genetic, cellular, molecular, and environmental mechanisms that contribute to medically relevant malformations, anomalies, defects, and syndrome of major anatomical systems that occur during embryological/fetal life which impact the cardiovascular, neurological, gastrointestinal, urogenital, and head/neck formation. Students will be assigned specific developmental disorders/diseases/malformations and be responsible for discussing and presenting their findings on the assigned topics as individuals and in groups. Over the term, the topics assigned will progress through the major anatomical systems and increase in complexity. The course assumes students have acquired basic knowledge of cell biology and human embryology. Successful completion of Human Embryology is a prerequisite.

Enrollment limited to 12 students.

3 credits

In-Person

**BIOM 625G – Current Challenges in Infectious Diseases**

In today's increasingly intertwined world, the epidemiology of infectious diseases is dynamic and challenging. This course will introduce students to the theory of identifying and controlling infectious diseases through a study of various pathogens such as Ebola, HIV, Avian Influenza, SARS, MERS, Zika and COVID-19 (among others). Using examples, students will develop an appreciation of disease transmission, epidemiology, the importance of surveillance and outbreak investigation in prevention and control, along with a range of disease control strategies implementable at the individual, local and national levels. Topics of particular note will be those diseases of pandemic potential and an analysis of the factors and activities necessary to reduce their occurrence. A student who has not completed BIOM 618G Epidemiology can only register for this course with prior approval of both the course and program directors.

3 credits

**Prerequisites:** BIOM 618G

In-Person

**BIOM 626G – Neurobiology of Disease**

3 credits

OnLine

**BIOM 628G – Topics in Global Health**

This course will give students an overview of major causes of global morbidity and mortality, particularly in third world countries. The course will consist of a combination of lectures and student group presentations. Lecture topics may include: Major Causes of Morbidity and Mortality in Third World Countries, Societal and Economic Impact of HIV/AIDS in Third World Countries, Global Aspects of Malnutrition and Infant Mortality, Global Impact of Malaria and TB, Health Challenges in Refugee Camps, Health Impacts of War and Natural Disasters, Emerging Infectious Diseases.

3 credits

In-Person

**BIOM 629 – Product Development and Validation**

This course covers commercial product development in the life sciences and is divided into 3 parts: pharmaceutical validation, medical device design controls, and emerging technology (such as 3D printing, cell/gene therapy, and artificial intelligence).

3 credits

OnLine

**BIOM 629G – Advanced Gastrointestinal and Endocrine Physiology**

This course provides advanced training to students in the study of gastrointestinal and endocrine physiology comprehensively elaborating on the basic information presented in the first year to establish an application-based understanding of the relationship between structural and secretory defects and their effects on nutrition and health. The gastrointestinal section of the course focuses on ideas of how neural/hormonal feedback mechanisms and local control balance gastrointestinal function for the purpose of nutrient delivery and waste removal. Students will explore the complexities of this balance through the examination of diet and pathophysiologic scenarios as well as analysis of laboratory research data and evidence base medicine cases. For the endocrine portion of the course, focus is placed on the relationship of hormonal function and control as they apply to both the treatment of and life impact of a variety of classic endocrine disorders. Students will be required to present and explain their analyses using both classic physiologic illustration tools and literature graphics. This course while independent in its own right the second course in a two part series covering advanced topics in classic medical physiology.

3 credits

In-Person

**BIOM 635 – Risk and Failure Analysis**

This course introduces students to the investigation processes and writing scientifically justified conclusions linked to true root cause. This course is divided into 2 parts: how to design risk out of your product to begin with, and how to investigate failure if/when it occurs.

3 credits

OnLine

**BIOM 640 – Life Science Innovation I**

This course is open to students interested in learning how to commercialize new technologies. Teams of science and business students will work with inventor-scientists at the Wistar Institute—as well as with external partners such as venture capitalists, intellectual property lawyers, and biotechnology entrepreneurs—to develop proposals on the scientific merit and commercial feasibility of life science research projects.

3 credits

OnLine

**BIOM 642 – Life Science Innovation II**

Part II: This course is open to students interested in learning how to commercialize new technologies. Teams of science and business students will work with inventor-scientists at the Wistar Institute—as well as with external partners such as venture capitalists, intellectual property lawyers, and biotechnology entrepreneurs—to develop proposals on the scientific merit and commercial feasibility of life science research projects.

2 credits

OnLine

**BIOM 643 – Bioinformatics**

This course is an introduction to using computational methods to analyze datasets in biology.

3 credits

OnLine

**BIOM 650G – Special Topics in Biomedical Science Research and Methods**

This course is a graded three term sequence that is a guided independent study in which the student explores an area of interest in either Biomedical Sciences Research or Methods. The course requires a topic selection to be approved by a mentor/instructor. Students are expected to complete a thesis-style paper of twenty-five pages or more which can be a review, project proposal, grant application, etc. (any proposals require paperwork for appropriate regulatory committees); minimum of 75 citations/references, graded presentation, scheduled weekly meetings with faculty mentor; and competency-based testing and assignment completion. Students may enroll in this course only through the approval of the Program Director. Course may be substituted for BIOM 607G.

1-4 credits

In-Person

**BIOM 651 – Pre-Thesis Lab Work**

2nd year work done in a student's chosen thesis lab.

6 credits

In-Person

**BIOM 652 – Thesis Research**

Research performed in a student's thesis lab to generate data for their thesis.

9 credits

In-Person

**BIOM 653 – Cancer Biology**

This is a survey course covering the pathology, cell and molecular biology of cancer and oncogenesis.

3 credits

In-Person

**BIOM 654 – Cancer Biology Lab Rotation**

Introductory lab work for pre-doctoral students.

3 credits

In-Person

**BIOM 655 – Cancer Biology Journal Club**

Presentations and discussion of current literature in the field.

1 credits

In-Person

**BIOM 678 – Scientific Communication Skills**

1 credits

In-Person

**BIOM 681 – Research Proposal**

This course introduces the student to literature review, hypothesis generation, and research design. The student will form a partnership with a research mentor and thesis committee. Working with the mentor, the student develops a written research plan which must be approved by the committee and program director. If the project requires clearance by any regulatory board (IRB, IACUC, etc.), this course is considered "in progress," and no grade is issued until such authorization is secured.

1 credits

**BIOM 682G – Research Proposal**

1 credits

In-Person

**BIOM 682M – Research Proposal**

1 credits

**BIOM 683 – Thesis Manuscript Development**

The student demonstrates mastery of his or her area of research by writing a viable draft of the thesis manuscript comprising abstract, introduction, background, materials and methods, results, discussion and literature cited. The draft is submitted to and approved by the thesis committee, who schedules the thesis defense in conjunction with the program director. Prerequisites/Corequisites: BIOM 681, BIOM 682, BIOM 693.

2 credits

**Prerequisites:** BIOM 681, BIOM 691

In-Person

**BIOM 683G – Thesis Manuscript Development**

1 credits

In-Person

**BIOM 683M – Thesis Manuscript Development**

No Description?

1 credits

In-Person

**BIOM 685 – Thesis Defense**

The candidate demonstrates mastery of his or her area of research, and biomedical research in general, by delivering a public, seminar-format presentation before the faculty and College community. The audience may question the candidate on matters pertaining to the project and related studies. After the public session, the defense continues with the thesis committee discussing both with the candidate and in private matters that may need to be resolved before the final thesis can be submitted. Prerequisites/Corequisites: BIOM 683, BIOM 693.

2 credits

**Prerequisites:** BIOM 692

**BIOM 687 – Thesis Completion**

The candidate revises the written thesis as required by the thesis committee and library guidelines, secures committee approval, and submits the thesis in its final form to the program director, who will then recommend the candidate for degree conferral. This course is considered "in progress" and no grade issued until the final thesis is submitted. At the end of each term that the thesis is not submitted, the candidate must develop an action plan in consultation with the thesis committee and program director; additional fees may be incurred. Thesis status cannot be registered after thesis has been defended. Prerequisite/Corequisite: BIOM 685.

1 credits

**Prerequisites:** BIOM 692

In-Person

**BIOM 687G – Thesis Completion**

1 credits

In-Person

**BIOM 690 – Research Methods**

This course introduces students to fundamental concepts of epidemiology and research design in health and disease. Principles of evidence-based medicine are discussed as they relate to key areas of disease prevention, health promotion and therapy discussed. Community-based issues, problems and solutions are addressed. Students who complete the course will be able to understand and apply basic statistical terms and applications as well as various research design models that appear in current medical literature. Students learn to assess the quality of medical literature research designs to study commonly encountered clinical and community issues. Students will learn to describe the relationship between the medical literature and evidence-based medicine.

1-3 credits  
**Prerequisites:** BIOM 691

Hybrid

**BIOM 691 – Biomedical Research**

The student undertakes mentored research leading to the degree of Master of Science in Biomedical Sciences. Students learn lab techniques and review the relevant literature with the goal of understanding not only the “how” but the “why” of their project. If the project has met all regulatory requirements, data collection may commence. This course may be taken in one or more terms for up to seven total credits, and includes at minimum one meeting of the full thesis committee per term.

1-8 credits  
**Prerequisites:** BIOM 501, BIOM 502, BIOM 503, BIOM 504, BIOM 505, BIOM 506, BIOM 507

**BIOM 691G – Biomedical Science Research**

Supervised individual research projects undertaken by students in the program leading to the degree of Master of Science in Biomedical Sciences.

1-8 credits  
 In-Person

**BIOM 691M – Biomedical Research**

1-8 credits  
 In-Person

**BIOM 692 – Biomedical Research**

The student continues mentored research leading to the degree of Master of Science in Biomedical Sciences. This course may be taken in one or more terms for up to nine total credits, and includes at minimum one meeting of the full thesis committee per term. Prerequisites: BIOM 501, 502, 503, 504, 505, 506, 507, 681, 690, 691.

1-8 credits  
**Prerequisites:** BIOM 681, BIOM 690, BIOM 691

**BIOM 692G – Biomedical Research**

Supervised individual research projects undertaken by students in the program leading to the degree of Master of Science in Biomedical Sciences.

1-8 credits  
 In-Person

**BIOM 693 – Biomedical Research**

Mentored research that brings the project to a conclusion as approved by the thesis committee, such that it may be presented in written and oral form. This course may be taken in one or more terms for up to nine credits per term, and includes at minimum one meeting of the full thesis committee per term. Prerequisite: BIOM 692.

1-10 credits  
**Prerequisites:** BIOM 692

**BIOM 693G – Biomedical Research**

Supervised individual research projects undertaken by students in the program leading to the degree of Master of Science in Biomedical Sciences.

1-8 credits  
 In-Person

**BIOM 694 – Biomedical Research**

1-9 credits

**BIOM 697G – Capstone Continuation**

1 credits

**BIOM 698G – Independent Study**

1-6 credits

**BIOM 698M – Directed Studies****BIOM 699G – Biostatistics Epidemiology**

This course is designed to allow students who have not completed their thesis during the normally allotted time to register and complete their thesis.

3 credits  
 In-Person