Course Catalog

Table of Contents:

Cell and Molecular Biology Program: PhD; DO/PhD; MS (thesis only)  Page 2
Biomedical Sciences Program: MBS (non-thesis); Certificate  Page 7
Histopathology Program: MS (non-thesis)  Page 13
Molecular Pathology and Immunology Program: MS (thesis)  Page 17

Full time status:  Fall/Spring Terms are 9 credits  Summer Term is 4 credits
Part time status:  Fall/Spring Terms are 5 credits  Summer Term is 2 credits

"This catalog is informational only and does not constitute a contract between Rowan University and any student. It may be changed by Rowan University without prior notice to students. Any rules, regulations, policies, procedures or other representations made herein may be interpreted and applied by Rowan University to promote fairness and academic excellence, based on the circumstances of each individual situation.

Rowan University may at any time eliminate, modify or change the location of any School, Institute, Center, Program, Department, course or academic activity."
Cell and Molecular Biology (CMB) Program: PhD; DO-PhD; MS (thesis only)

Course Descriptions

CMB 00701  GRADUATE BIOCHEMISTRY  FALL  4 Credits  CORE COURSE
COURSE DIRECTORS: DR. SERGEI BORUKHOV
PREREQUISITE: NO
T,TH  9:30-11:30 AM  SC-145
This is a problem-oriented biochemistry course that requires substantial student preparation for the class and in-class participation. The course covers the major areas of biochemistry including - DNA, RNA, protein, carbohydrate and lipid structure and biosynthesis; enzyme kinetics; carbohydrate, lipid and nucleotide metabolism; DNA replication, repair and recombination; transcription; and translation. Class-time consists of a dialog on learning objectives and problems in various aspects of biochemistry. Prior knowledge of biochemistry at the college level is necessary. Students are expected to come to class prepared to address the learning objectives and to discuss the problems relevant to each section of the course. Before each class, students will receive a list of topic-related questions to which they are expected to prepare written answers. Alternatively, instructors may choose to conduct a short in-class quiz using topic-related questions. This graduate level course assumes a background in chemistry and biology.

CMB 00702  MOLECULAR BIOLOGY OF THE CELL  SPRING  4 Credits  CORE COURSE
COURSE DIRECTOR: DR. MICHAEL HENRY
PREREQUISITE: NO
T,TH  9:30-11:30 AM  SC-145
This course is the cornerstone of the CMB program graduate curriculum and is taken in the Spring semester of the student’s first year of graduate study. There are four sections to this course: I. Introduction to the cell. This section includes evolutionary aspects of the cell, a study of small molecules, energy metabolism and biosynthesis, macromolecular structure and function. II. Molecular genetics, including protein function, genetic mechanisms, recombinant DNA technology, the cell nucleus, and the control of gene expression. III. Internal organization of the cell, including membrane structure, transport mechanisms, cell signaling, cell division and the mechanisms controlling the phases of the cell-cycle. IV. Cells in their social context, including cell junctions, cell adhesion, germ cells and fertilization, cellular mechanisms of development, differentiation and tissue formation, the immune system and specialized tissues.

CMB 00802  EXPERIMENTAL DESIGN  FALL  2 Credits  SKILL COURSE
COURSE DIRECTOR: DR. ERIC MOSS
PREREQUISITE: NO
M  10:00 AM - 12:00 PM  SC-117
This course covers generally how experiments are designed, interpreted and critiqued in biomedical sciences. The focus is on how research is approached, including the reasoning behind hypotheses, controls, interpretation, and presentation. Discussions will revolve around published work and theoretical issues. The course will consist of advance reading assignments followed by in-class discussion and several writing assignments. The goal of the course is to give students the vocabulary and thinking skills to read biomedical research literature critically, participate constructively in peer review, and to better approach research problems.

CMB 00803  SCIENTIFIC WRITING  SPRING  2 Credits  SKILL COURSE
COURSE DIRECTORS: DR. NATALIA SHCHERBIK AND JESSICA LOWETH
This course presents the fundamental principles of scientific writing. Topics include components of a research paper, elements of a grant proposal, posters and power point presentations. Students will write an Abstract of a research paper and a Specific Aims page of a grant proposal. Students will also complete frequent short homework assignments, deliver an oral presentation, and critique/edit each other's work. This course is required for all first-year CMB doctoral and masters students.

This course focuses on a key skill for scientists: how to effectively read and interpret scientific papers. The course takes the format of a classroom discussion of primary scientific literature, moderated by faculty from SOM's two basic science departments. The students will read journal articles provided to them on Blackboard and discuss these articles in class, with an emphasis on evaluating experimental support for the paper's claims, rigor in data analysis and the use of different methods to communicate ideas in a research manuscript.

This course addresses the fundamentals of statistics and other quantitative methods for researchers in biomedical sciences. It covers the basics of probability, distributions, power analysis, sampling from populations, comparisons between populations, statistical significance, regressions, curve fitting, and graphing data. Students will also become acquainted with basic bioinformatics analysis and their quantitative aspects. Each of six topics will be taught in two sessions: first, a lecture session, and second, a problem-solving session. The course is intended to impart practical skills and resource building so students can expand their knowledge in their laboratories and with their own data sets. This course is required for all second-year CMB doctoral and masters students.

This course will introduce the student to major theories and methods of analysis of cellular-level functions and behaviors that underlie normal development in multicellular organisms and pathologies such as cancer and tissue aging. The first part of the course focuses on the design and interpretation of experiments in mammalian cell culture, with a particular emphasis on the validity of cell culture models for studying biological processes in vivo. The second part covers the fundamentals of stem cell biology, transgenic technologies and emerging therapeutic applications of stem cells.

This course presents the fundamental principles of scientific writing. Topics include components of a research paper, elements of a grant proposal, posters and power point presentations. Students will write an Abstract of a research paper and a Specific Aims page of a grant proposal. Students will also complete frequent short homework assignments, deliver an oral presentation, and critique/edit each other's work. This course is required for all first-year CMB doctoral and masters students.
TH 2:00-4:00 PM SC-145
This course covers advanced topics in genetic analysis and genetic methods. Our focus will be on the techniques and logic common to all research subjects, from viruses to humans. Previous exposure to Genetics is helpful but not required. Students must attend lectures, read the textbook, solve problems and read papers before each class.

CMB 00810 BIOMOLECULAR INTERACTIONS SPRING 2 Credits FOCUS COURSE
COURSE DIRECTOR: DR. SERGEI BORUKHOV
PREREQUISITE: NO
F 2:00-4:00 PM SC-145
This course will introduce students to a wide range of experimental approaches including the cutting edge biochemical, immunological, biophysical, genetic and computational methods that are currently used to detect, visualize and characterize protein-protein and protein-nucleic acid interactions in biomedical research and molecular diagnostics applications. The course instructors are research scientists, who have hands-on knowledge and expertise in various methods and techniques to study biomolecular interactions. This course is aimed to be highly interactive with the purpose of developing a student's analytical skills.

CMB 00811 FUNDAMENTALS OF NEUROSCIENCE FALL 2 Credits FOCUS COURSE
COURSE DIRECTOR: DRS. BARRY WATERHOUSE AND DANIEL CHANDLER
PREREQUISITE: NO
W 2:00-4:00 PM SC-145
This course provides a basic foundation in neuroscience for research-oriented graduate students. Topics derived from the textbook and modern techniques in neurobiology research are presented by members of the Department of Cell Biology and Neuroscience in lecture and discussion-based formats. Through readings, lectures, and discussion students will develop a basic knowledge of neuroscience concepts and methods as they pertain to the structure, function and study of the mammalian central nervous system.

CMB 00901 LABORATORY ROTATION A – CMB FALL 1 Credit DO/PhD REQUIRED COURSE
CMB 00902 LABORATORY ROTATION B – CMB FALL 1 Credit DO/PhD COURSE
COURSE DIRECTOR: DR. DIMITRI PESTOV
PREREQ: PERMISSION BY FACULTY/INVESTIGATOR
Laboratory rotations are essential components of a student’s education in the Cell and Molecular Biology program. These experiences introduce students to specific areas of cell and molecular biology, expose students to specialized techniques, and familiarize students with specific projects in the program in anticipation of choosing a research advisor. Students will be evaluated on their attendance, motivation and interest within the lab as well as their attendance and participation at lab meetings. Students are responsible for learning new techniques, asking questions and working semi-independently by the end of each lab rotation. Students are encouraged to select their laboratory rotations so as to acquire diverse research experiences. Three laboratory rotations must be completed in the Cell and Molecular Biology program prior to the selection of a thesis advisor. Each lab rotation will consist of 7 weeks. DO/PhD students are expected to perform 1 or 2 Summer Medical Research Fellowships (SMRF) while still being a 1st or 2nd year DO student prior to officially enrolling in the PhD program.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
<th>Credits</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMB 00905</td>
<td>Laboratory Rotation FALL – CMB</td>
<td>FALL</td>
<td>3</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td>CMB 00906</td>
<td>Laboratory Rotation SPRING – CMB</td>
<td>SPRING</td>
<td>3</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td></td>
<td>COURSE DIRECTOR: DR. DIMITRI PESTOV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PREREQUISITE: PERMISSION BY FACULTY/INVESTIGATOR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>During the first year in the program, GSBS students perform research rotations in the laboratories of GSBS faculty members. All Cell and Molecular Biology program students are required to complete three rotations. The fourth rotation may be in a new laboratory or the laboratory of the mutually agreed upon thesis mentor in the Spring semester. Exposure to different laboratories allows students to become acquainted with potential advisors for a thesis while exploring diverse scientific areas and learning new experimental approaches.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMB 00910</td>
<td>Responsible Conduct in Research</td>
<td>FALL</td>
<td>0</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td></td>
<td>COURSE DIRECTOR: DR. CATHERINE NEARY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F 12:00-1:00 PM SC-290</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PREREQUISITE: NO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Responsible Conduct in Research training presents a series of 10 one-hour sessions whereby faculty, postdoctoral fellows, and students discuss professional standards of science. Participating individuals are enlightened as to why adherence to these standards is essential for continued scientific progress. Case studies along with open dialog between attendees provides the backdrop for discussion on issues that may arise in the laboratory setting. The grading for this zero (0) credit course is Satisfactory/Unsatisfactory. All PhD and MS students must earn a grade of Satisfactory to fulfill degree requirements.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMB 00690</td>
<td>Thesis Research - MSCMB</td>
<td>SUMMER</td>
<td>7</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td></td>
<td>The Mentor or Mentor-of-Record is responsible for grading this Satisfactory/Unsatisfactory graded course, which must be laboratory (not library) based and must be hypothesis driven. A student can enroll in this course just once. However, please note that the research thesis is done over two or more semesters. The conclusion of the research is based on proving the hypothesis. The student must publically defend his/her thesis. The grading for this course is Satisfactory/Unsatisfactory, which does not affect the grade point average.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMB 00699</td>
<td>MS Thesis Continuation</td>
<td>FALL/SPRING (Summer, if necessary)</td>
<td>1-9</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td></td>
<td>After completing the number of thesis credits as defined by the MS program requirements and completing required coursework, students may register for Master of Science Thesis Continuation during each subsequent semester of thesis phase. Master of Science Thesis Continuation will carry a variable credit weight of 1-9 credits. The student's mentor will be responsible for certifying that a student is working on his/her thesis on a part-time or full-time basis commensurate with the number of credits they are registered for in a semester. Students will be charged the Master of Science Thesis Continuation fee of $200 per semester for thesis continuation regardless of the number of thesis credits for which they are registered. The maximum number of semesters that a student can register for thesis research and thesis continuation is four (2 years). The grading for this course is Satisfactory/Unsatisfactory, which does not affect the grade point average.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMB 00920</td>
<td>Advanced Graduate Research</td>
<td>FALL/SPRING</td>
<td>5</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td></td>
<td>COURSE DIRECTOR: DR. DANIEL MANVICH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To enroll in this course, students must have selected a permanent research advisor and laboratory in which to perform their dissertation research, but should not yet have progressed to Ph.D. candidacy. The overall objectives for the course are 1) to successfully prepare for the Qualifying Examination, and 2) for the student to receive appropriate feedback from the mentor regarding their performance in the laboratory and their progress in Qualifying Examination preparations.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eligibility:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To enroll in this course, students must have selected a permanent research advisor and laboratory in which to perform their dissertation research, but should not yet have progressed to Ph.D. candidacy.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CMB 00925</td>
<td>Summer Research in Cell and Molecular Biology</td>
<td>SUMMER</td>
<td>4</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td></td>
<td>COURSE DIRECTOR: DOCTORAL STUDENT'S MENTOR</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Each course will be directed by a doctoral student’s mentor and its content will reflect his/her research interests. The goal is to have the student gain experience in a research laboratory and gain insight into the creative research process. Satisfactory/Unsatisfactory graded course.

**CMB 00990  SUMMER THESIS RESEARCH/PhD**  
**COURSE DIRECTOR:** DOCTORAL STUDENT’S MENTOR  
**SUMMER**  
4 Credits  
REQUIRED COURSE  
This course is based on the laboratory research that each doctoral student performs as they work toward their thesis defense. The chair of each student’s thesis research committee has the responsibility of ensuring that the course goals are met for that student. The summer semester will not require any formal update to the committee. As this course recurs every summer semester for qualified doctoral candidates, the course is considered completed when the student successfully defends her/his thesis. It is a Satisfactory/Unsatisfactory graded course.

**CMB 00999  THESIS RESEARCH/PhD**  
**COURSE DIRECTOR:** DR. MICHAEL ANIKIN  
**FALL/SPRING**  
9 Credits  
REQUIRED COURSE  
This course is based on the laboratory research that each doctoral student performs as they work toward their thesis defense. The chair of each student’s thesis advisory committee has the responsibility of ensuring that the course goals are met for that student. The course requires that the student formally present their research progress and plan for future work and receive critical feedback from committee members. The presentation will be either a written report or an oral presentation, alternating these formats each fall and spring semester. The students will receive detailed feedback in the form of a written review and discussion with committee members. The student is expected to take advantage of the feedback and present again the next fall or spring semester what steps were taken in response. As this course recurs every fall and spring semester for qualified doctoral candidates, the course is considered completed when the student successfully defends her/his thesis. It is a Satisfactory/Unsatisfactory graded course.
Biomedical Sciences Program: MBS (non-thesis); Certificate
Course Descriptions

MBS 00501  BIOCHEMISTRY AND MOLECULAR BIOLOGY  FALL  3 Credits  REQUIRED COURSE
COURSE DIRECTOR: DR. SALVATORE CARADONNA
PREREQUISITE: NO
T 5:00-8:00 PM  AC-279
We will be using Macmillan Launchpad as our information resource. I have already set up a course at the following website. This is an all-inclusive site that contains the E-book, learning exercises and quizzes. You will have to purchase a 6-month access for this site. Go to https://www.macmillanlearning.com/college/us/product/Biochemistry-A-Short-Course/p/1319114636?searchText=biochemistry.
This course will cover the broad topic of biochemistry. This starts with a basic understanding of thermodynamics and chemical bonds and leads into amino acids, proteins and enzymes as well as carbohydrate and lipid structure and function. We will also cover intermediary metabolism and provide a perspective of disease states. The intent is to learn biochemistry by studying and learning how proteins underlie human disease.

MBS 00502  CELL BIOLOGY       FALL  3 Credits  REQUIRED COURSE
COURSE DIRECTOR: DR. DMITRIY MARKOV
PREREQUISITE: NO
W 5:00-8:00 PM  AC-279
This course is focused on biology and physiology of the cell and is organized around the central theme of homeostasis – how the cells adopt to various environmental changes while maintaining their internal constancy necessary for all tissues and organs to function. It is a course for both the basic scientists who seek general principles about cellular function, and the students preparing for health-related careers who wish to apply fundamental knowledge on cell biology to understand the molecular mechanisms of cellular dysfunction in human diseases.

MBS 00505  HUMAN GENETICS      FALL  3 Credits  REQUIRED COURSE
COURSE DIRECTOR: DR. RONALD ELLIS
PREREQUISITE: NO
TH 5:00-8:00 PM  AC-279
This course will cover the key concepts in classical and molecular genetics, with a focus on their application to humans.

MBS 00610  MICROBIOLOGY       FALL  3 Credits  REQUIRED COURSE
COURSE DIRECTOR: DR. MICHAEL HENRY
PREREQUISITE: NO
M 5:00-8:00 PM  AC-279
This is an introductory Microbiology course taken in the Fall Semester of the student's first or second year of graduate study. It strikes an appropriate balance between microbiological fundamentals and medical/research applications. It also provides a foundation in microbiology for those students planning to pursue advanced degrees. There are three sections to this course: I. Fundamentals of Microbiology. This section includes a brief history, methods used to observe microorganisms, and a study of microbial cell anatomy, metabolism, growth and
genetics. II. A survey of the Microbial World, including classifications of Eukaryotes, Prokaryotes, Viruses, Viriods, and Prions. III. Interaction between the Microbe and host, including principle of disease and epidemiology, mechanisms of pathogenicity, innate and adaptive immunity, immunology and antimicrobial drugs. Although this course assumes no previous study of biology chemistry, a basic understanding of DNA, RNA, and proteins is recommended.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term</th>
<th>Credits</th>
<th>Type of Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBS 00503</td>
<td>SYSTEMS PHYSIOLOGY</td>
<td>SPRING</td>
<td>3</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td></td>
<td>COURSE DIRECTOR: DR. KINGSLEY YIN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PREREQUISITES: MBS 00501 &amp; MBS 00502 (“C” grade or better in each course)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T 5:00-8:00 PM AC-279</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This course will focus on physiological systems of the human body, namely, the cardio-renal system and endocrinology. The course will be in the form of didactic lectures. Students will be evaluated on their performance on three examinations. At first the student will be introduced to basic physiological aspects of the cardiovascular system and how it interacts with the kidney. Integrated within the lectures, there will be discussion on diseases that may affect the heart and kidneys and pharmacological treatments for these disorders. In the endocrinology section, the student will be introduced to the actions of various hormones, which affect macro- and micronutrient metabolism. These series of lectures will provide the student with a clear understanding of three complex physiological systems. In order to consolidate understanding of these systems, lectures will be supplemented with appropriate literature outside of texts.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MBS 00506</td>
<td>BIOMEDICAL ANATOMY</td>
<td>SPRING</td>
<td>3</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td></td>
<td>COURSE DIRECTOR: DR. KATHARINE MILANI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PREREQUISITES: NO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>W 5:00-8:00 PM AC-343</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>REQUIRED TEXTBOOKS:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primal Pictures Anatomy &amp; Physiology—available through the library website (<a href="https://rowanmed.libguides.com/gsbs/biomedical">https://rowanmed.libguides.com/gsbs/biomedical</a>) * Firefox or Safari are the recommended browsers.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>COURSE DESCRIPTION:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This course presents fundamentals of human gross anatomy with a focus on the microanatomy associated with each of the major organ systems. Sessions will incorporate lectures and interactive assignments that may utilize virtual histology. Students will use textbooks, virtual histology slides, and Primal Pictures assist in their study and comprehension of the material presented each week.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MBS 00603</td>
<td>IMMUNOLOGY</td>
<td>SPRING</td>
<td>3</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td></td>
<td>COURSE DIRECTOR: DR. RENEE DEMAREST</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PREREQUISITES: MBS 00501 &amp; MBS 00502 (“C” grade or better in each course)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TH 5:00-8:00 PM AC-279</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students will learn the basic concepts of the immune response and its role in human health and disease. The underlying mechanisms that lead to immunosuppression, autoimmunity, and hypersensitivity will be explored. In addition, the role of the immune system in cancer development and treatment will be examined. An emphasis will be placed on applying the learned concepts to clinical case studies throughout the course.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MBS 00616  BIOMEDICAL DATA ANALYSIS  SPRING  3 Credits  REQUIRED COURSE
COURSE DIRECTOR: DR. HRISTO HOUBAVIY
PREREQUISITE: NO
M  5:00-8:00 PM  AC-279
ISBN: 9781936221486
This course is intended to serve as a practical guide to analyzing biological and biomedical data. We will begin by introducing basic data representation concepts, followed by selected topics in introductory probability and statistics, which will provide the basis for the data analysis techniques introduced towards the end of the course. The latter include t-tests, ANOVA, correlation and regression as well as selected non-parametric methods. The emphasis of this course is on real-life biomedical data problem solving via worked out example cases in class sessions as well as via independent problem-solving homework assignments. While the focus is on practical applications, effective data analysis does require a basic understanding of the principles on which data analysis tools are built. Therefore, the course will provide a fairly robust, albeit intuitive, introduction to basic probability and mathematical statistics. However, formal mathematical derivations will be avoided wherever possible and mathematical statistical concepts will be introduced only if complementary to the course's practical applications focus. Students are not expected to have a background in higher mathematics (i.e. calculus or linear algebra) nor any prior experience with probability, statistics and data analysis. Students enrolled in this course can expect to learn skills in analytical thinking and biological data analysis, both of which are an MCAT focal point.

MBS 00602  ANTIMICROBIAL DRUGS: MECHANISMS OF ACTION & RESISTANCE  SPRING  3 Credits
COURSE DIRECTOR: DR. SERGEI BORUKHOV
PREREQUISITE: MICROBIOLOGY RECOMMENDED; COMPLEMENTS PRINCIPLES OF PHARMACOLOGY
T  5:00-8:00 PM  SC-145
This course covers the mechanisms of action, selectivity, and resistance to agents that are used to treat microbial infections, including bacterial, fungal, protozoal, helminthic, and viral infections. The course does not cover clinical aspects of Pharmacology but is focused on molecular mechanisms of action of antimicrobial agents. It is intended to complement the Principles of Pharmacology (MBS 00612) course which is more clinically oriented. There is no substantial overlap with other GSBS courses including Principles of Pharmacology and Microbiology. It is recommended that students complete Microbiology (MBS 00610) and Fundamentals of Biochemistry and Molecular Biology (MBS 00501) or comparable undergraduate courses prior to taking this course.

MBS 00604  CANCER CHEMOTHERAPY  SPRING  2 Credits
COURSE DIRECTOR: DR. GARY GOLDBERG
PREREQUISITES: MBS 00501 & MBS 00502 (“C” grade or better in each course) OR BY PERMISSION OF COURSE DIRECTOR
Th  5:00-7:00 PM  RMB-3000
Over 30% of people in the USA are diagnosed with cancer in their lifetimes. A recent (December 2014) PubMed search for “cancer” finds over 3 million publications. This represents several times more papers on cancer than other widespread ailments including “diabetes” or “arthritis”. This sheer volume of cancer information attests to the complexities of cancer. This course is designed clarify chemotherapeutic approaches, their underlying mechanisms, and how research can lead to new and effective cancer treatments.
MBS 00606  ESSENTIAL NEUROSCIENCE  FALL  3 Credits
COURSE DIRECTOR: DR. PAOLA LEONE
PREREQUISITE: MBS 00502 ("C" grade or better)
W  5:00-8:00 PM  RMB-3000
This course focuses on the basic molecular and biochemical aspects of neuronal physiology, emphasizing mechanisms that underlie the major classes of neurological disorders. Students will be provided with a fundamental understanding of the gross anatomy and general functions of the central nervous system at the cellular and molecular levels. The course will introduce essential concepts and facts on how neuronal cells communicate with each other, with examples of how neurotransmitter dysregulation and metabolic malfunction lead to the development of mental disorders. The course instructors are research scientists who have expertise in clinical neuroscience and translational research. There will be invited speakers who specialize in various neurological and psychiatric diseases with complex or heterogeneous etiology, including Alzheimer's Disease, Parkinson's Disease, White Matter Disease, Neuroinflammation and HIV-associated Neurorocognitive Disorders, Autism & Pharmacotherapy of Drug Addiction and Alcohol Abuse. The major goals of the course will be to introduce Master students to translational neuroscience and to the pivotal role that neuroscience plays in understanding and treatment of human brain diseases. Lectures will be supplemented with handouts, references and PowerPoint presentations.

MBS 00607  EXERCISE PHYSIOLOGY  SUMMER  3 Credits
COURSE DIRECTOR: DR. RENEE DEMAREST
PREREQUISITE: MBS 00503 ("C" grade or better)
M&TH  5:00-8:00 PM  SC-145
A major emphasis will be placed on examining the mechanisms underlying the body’s response to acute and chronic exercise stress. The first portion of the course will include the fundamentals of bioenergetics and metabolism, measurement of work, power and energy expenditure, respiratory system, cardiovascular system, endocrine system, neuromuscular system, and the physiological adaptations of training. The latter part of the course will delve into selected topics in the field of exercise physiology such as obesity and weight loss, slowing age-related changes with exercise, ergogenic aids, overtraining and fatigue and gender differences in physiology and performance.

MBS 00609  MECHANISMS OF DISEASE  FALL  2 Credits
COURSE DIRECTOR: DR. CATHERINE NEARY
PREREQUISITES: MBS 00501 & MBS 00502 ("C" grade or better in each course)
T  5:00-7:00 PM  SC-145
Advances in biochemical and genetic techniques have produced substantial information about altered cellular function in pathological conditions. This course is an introduction to the mechanisms by which disease processes develop on a cellular, tissue, and organ level, focusing on their impact on physiological functions and subsequent clinical manifestations. Each week, pathological conditions will be discussed in the context of the normal function of the relevant organ system as well as known cellular signaling pathways involved in the disease process.

MBS 00611  PATHOPHYSIOLOGY OF THE CARDIOVASCULAR SYSTEM  FALL  3 Credits
COURSE DIRECTOR: DR. CARL HOCK
PREREQUISITE: MBS 00503 ("C" grade or better)
T  6:00-9:00 PM  RMB-3000
Cardiovascular disease remains the number one killer in the United States. Despite the current successes in the treatment of acute myocardial infarction, the incidence of heart failure continues to increase as the population ages. This course will explore the underlying causes of heart disease and other cardiovascular diseases with an emphasis on normal physiology, pathophysiologic changes and current controversies. The course will cover selected topics of cardiovascular disease including: common cardiac arrhythmias, ischemic heart disease, acute coronary syndromes, atherosclerosis, hypertension, diseases of the peripheral vasculature and heart failure. The purpose of this course is to examine the underlying causes and the most current thinking as it relates to cardiovascular disease. The course will involve both lecture presentation and discussion of current literature.

**MBS 00612  PRINCIPLES OF PHARMACOLOGY**  
**COURSE DIRECTOR: DR. BERND SPUR**  
**PREREQUISITE: NO**  
**TH 5:30-8:30 PM AC AUDITORIUM**  

The modern discipline of pharmacology involves understanding how medications are used in the prevention, diagnosis and treatment of human diseases. The emphasis of this course is on mechanisms of drug action, therapeutic applications, adverse effects, contraindications and drug interactions. The overall mission of the course will be to introduce students to the basic principles of pharmacology and to familiarize them with classes of drugs and examples of specific drugs used frequently in the clinical setting.

**MBS 00613  INDEPENDENT STUDY**  
**COURSE DIRECTOR: DR. DEBORAH PODOLIN**  
**PREREQUISITE: PERMISSION BY FACULTY/INVESTIGATOR**

This course introduces students to biomedical research by preparing a review of published scholarly literature on a topic of their own interest. With the guidance of a faculty advisor, students will identify a suitable topic and develop the skills of literature research, writing, revision, and oral presentation. Students will prepare an essay of at least 4000 words that presents the current understanding of the topic aimed at an audience of professionals. The student will also prepare an oral presentation which will be delivered at the end of semester.

**Eligibility:**
Matriculated students in the MBS program who have completed 9 or more course credits and are in good academic standing are eligible to register for Independent Study. Only one Independent Study course may count toward the Certificate in Biomedical Sciences or Masters in Biomedical Sciences degree.

**MBS 00614  MOLECULAR MECHANISMS OF AGING**  
**COURSE DIRECTOR: DR. DMITRIY MARKOV**  
**PREREQUISITES: MBS 00501, MBS 00502 & MBS 00503 (Must pass each course)**  
**M 5:00-7:00 PM SC-145**  
**RECOMMENDED TEXTBOOKS:**

The major goal of this course is to acquaint second-year Master’s students with fundamental information regarding the aging-associated molecular pathways and to update them on the most recent advancements in the studies of molecular mechanisms of aging. The emphasis will be given to the discussion of the most popular aging theories, experimental attempts to improve longevity in animal models, and their critical analysis from the scientific standpoint. During the course, the students will be provided a solid understanding of the most popular subject in translational science that attracts billions of research dollars but is seldom taught as a conceptual course. It is a course for both the basic biomedical scientists who seek to understand the nature of aging and aging-associated processes, and the students preparing for health-related careers who are eager to expand their knowledge on "diseases and conditions associated with growing older, in order to extend the healthy, active years of life" (from the National Institute of Aging Mission Statement).
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBS 00680</td>
<td>LABORATORY RESEARCH (A) – MBS</td>
<td>FALL/SPRING/SUMMER</td>
<td>2 Credits</td>
</tr>
<tr>
<td>MBS 00681</td>
<td>LABORATORY RESEARCH (B) – MBS</td>
<td>FALL/SPRING/SUMMER</td>
<td>2 Credits</td>
</tr>
</tbody>
</table>

**COURSE DIRECTOR:** DR. ERIC MOSS  
**PREREQUISITE:** PERMISSION BY FACULTY/INVESTIGATOR  
**PREREQUISITE:** MBS 00680 MUST BE TAKEN BEFORE MBS 00681

Laboratory Research introduces students to biomedical research as it is carried out in one of the school’s basic science laboratories. Students work on a project under the guidance of a faculty advisor and their research team. The student is expected to spend 8 to 10 hours per week in the lab for the semester. The student prepares a short report presenting their topic, summarizing their work, and recording their results.

**Eligibility:**
Matriculated students in the MBS program who have completed 9 or more course credits and are in good academic standing are eligible to register for Laboratory Research. A student may continue their research project with the same faculty advisor for a second semester. The first semester is graded on the standard scale and the second semester is satisfactory/unsatisfactory only.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Term</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBS 00699</td>
<td>MS THESIS CONTINUATION</td>
<td>FALL/SPRING/SUMMER</td>
<td>1-9 Credits</td>
</tr>
</tbody>
</table>

After completing the number of thesis credits as defined by the MS program requirements and completing required coursework, students may register for Master of Science Thesis Continuation during each subsequent semester of thesis phase. Master of Science Thesis Continuation will carry a variable credit weight of 1-9 credits (5 credits are part-time status; 9 credits are full-time status). The student's mentor will be responsible for certifying that a student is working on his/her thesis on a part-time or full-time basis commensurate with the number of credits they are registered for in a semester. Students will be charged the Master of Science Thesis Continuation fee of $200 per semester for thesis continuation regardless of the number of thesis credits for which they are registered. The maximum number of semesters that a student can register for thesis continuation is four (2 years). The grading for this course is Satisfactory/Unsatisfactory, which does not affect the grade point average.
Histopathology Program: MS (non-thesis)
Course Descriptions

MBS 00501   BIOCHEMISTRY AND MOLECULAR BIOLOGY      FALL   3 Credits      REQUIRED COURSE
COURSE DIRECTOR: DR. SALVATORE CARADONNA
PREREQUISITE: NO
T  5:00-8:00 PM  AC-279
We will be using Macmillan Launchpad as our information resource. I have already set up a course at the following website. This is an all-inclusive site that contains the E-book, learning exercises and quizzes. You will have to purchase a 6-month access for this site. Go to https://www.macmillanlearning.com/college/us/product/Biochemistry-A-Short-Course/p/1319114636?searchText=biochemistry.
This course will cover the broad topic of biochemistry. This starts with a basic understanding of thermodynamics and chemical bonds and leads into amino acids, proteins and enzymes as well as carbohydrate and lipid structure and function. We will also cover intermediary metabolism and provide a perspective of disease states. The intent is to learn biochemistry by studying and learning how proteins underlie human disease.

MBS 00502  CELL BIOLOGY       FALL  3 Credits REQUIRED COURSE
COURSE DIRECTOR: DR. DMITRIY MARKOV
PREREQUISITE: NO
W  5:00-8:00 PM  AC-279
This course is focused on biology and physiology of the cell and is organized around the central theme of homeostasis – how the cells adopt to various environmental changes while maintaining their internal constancy necessary for all tissues and organs to function. It is a course for both the basic scientists who seek general principles about cellular function, and the students preparing for health-related careers who wish to apply fundamental knowledge on cell biology to understand the molecular mechanisms of cellular dysfunction in human diseases.

MBS 00503  SYSTEMS PHYSIOLOGY     SPRING 3 Credits  REQUIRED COURSE
COURSE DIRECTOR: DR. KINGSLEY YIN
PREREQUISITES: BIOCHEMISTRY AND MOLECULAR BIOLOGY & CELL BIOLOGY (“C” grade or better in each course)
T  5:00-8:00 PM  AC-279
RECOMMENDED TEXTBOOK: Berne & Levy Physiology, 6th Edition
ISBN: 0-323-04582-0
B.M. Koeppen, and B.A. Stanton
This course will focus on physiological systems of the human body, namely, the cardio-renal system and endocrinology. The course will be in the form of didactic lectures. Students will be evaluated on their performance on three examinations. At first the student will be introduced to basic physiological aspects of the cardiovascular system and how it interacts with the kidney. Integrated within the lectures, there will be discussion on diseases that may affect the heart and kidneys and pharmacological treatments for these disorders. In the endocrinology section, the student will be introduced to the actions of various hormones, which affect macro- and micronutrient metabolism. These series of lectures will provide the student with a clear understanding of three complex physiological systems. In order to consolidate understanding of these systems, lectures will be supplemented with appropriate literature outside of texts.
Advances in biochemical and genetic techniques have produced substantial information about altered cellular function in pathological conditions. This course is an introduction to the mechanisms by which disease processes develop on a cellular, tissue, and organ level, focusing on their impact on physiological functions and subsequent clinical manifestations. Each week, pathological conditions will be discussed in the context of the normal function of the relevant organ system as well as known cellular signaling pathways involved in the disease process.

This course will teach students basic techniques used in a modern biomedical laboratory, to prepare them to integrate these techniques into more advanced processes they will use later. *This course is only open to students in the Masters in Histopathology program.*

This course introduces students to the basic tissue types, as well as some of the common stains used to differentiate elements of tissue. In addition, students will learn to use a microscope and analyze photomicrographs critically. *This course is only open to students in the Masters in Histopathology program.*

This lab-intensive course builds upon the theory learned in Histology I: Basic Tissue Types. Students will be trained in histological techniques in a hands-on setting, in order to develop the critical skills required to become a histotechnologist. Students will learn to section various animal tissue utilizing a microtome and cryostat, and perform basic staining procedures. *This course is only open to students in the Masters in Histopathology program.*

This course is open only to students in the Masters in Histopathology program.

MHP 00613  HISTOLOGY III: ORGAN SYSTEMS  SPRING  3 Credits  REQUIRED COURSE
COURSE DIRECTOR:  DR. CATHERINE L. NEARY
PREREQUISITES:  MHP 00611 & MHP 00503
MHP 00614  BASIC LABORATORY ANIMAL TECHNIQUES  FALL  4 Credits  REQUIRED COURSE
COURSE DIRECTOR:  DR. RENEE M. DEMAREST
PREREQUISITES:  MHP 00610, MHP 00611 & MHP 00612
T 9:00-1:00 PM and F 1:00-5:00 PM  SC-123
REQUIRED TEXTBOOK:  No required text – learning materials will be provided.
This basic animal techniques course will teach students basic mouse colony management and preclinical research techniques. This course is lab intensive. Students will receive one-on-one instruction for each of the indicated skills listed in the syllabus. This format allows students to develop the ability to perform basic mouse colony management, tissue collection and processing, and molecular and histological analysis of primary tissue.  *This course is only open to students in the Masters in Histopathology program.*

MHP 00615  ADVANCED LABORATORY ANIMAL TECHNIQUES  SPRING  4 Credits  REQUIRED COURSE
COURSE DIRECTOR:  DR. RENEE M. DEMAREST
PREREQUISITES:  MHP 00610, MHP 00611, MHP 00612 & MHP 00614
T 9:00-1:00 PM and F 1:00-5:00 PM  SC-122
REQUIRED TEXTBOOK:  No required text – learning materials will be provided.
This advanced animal techniques course will reinforce what students learned about basic mouse colony management and teach students advanced preclinical research techniques. This course is lab intensive. Students will receive one-on-one instruction for each of the indicated skills listed in the syllabus. This format allows students to develop advanced animal research skills, including the ability to perform various surgical procedures and familiarity with a variety of mouse models of disease.  *This course is only open to students in the Masters in Histopathology program.*

MHP 00616  TOPICS IN PATHOLOGY  SPRING  2 Credits  REQUIRED COURSE
COURSE DIRECTOR:  DR. CATHERINE L. NEARY
PREREQ:  MBS 00609
CO-REQUISITE:  MHP 00613
F 3:00-5:00 PM  SC-145
This course will provide students in the Masters in Histopathology program exposure to the pathology of major organ systems.  *This course is only open to students in the Masters in Histopathology program.*

MHP 00650  HISTOPATHOLOGY INTERNSHIP  FALL/SPRING  3 Credits  REQUIRED COURSE
COURSE DIRECTOR:  DR. RENEE M. DEMAREST
PREREQUISITES:  NO
Students will perform internships at affiliate sites throughout the semester in order to build upon their basic histological techniques in various histology lab settings. The grading for this 3 credit course is Pass/Fail.
Responsible Conduct in Research training presents a series of 10 one-hour sessions whereby faculty, postdoctoral fellows, and students discuss professional standards of science. Participating individuals are enlightened as to why adherence to these standards is essential for continued scientific progress. Case studies along with open dialog between attendees provides the backdrop for discussion on issues that may arise in the laboratory setting. The grading for this zero (0) credit course is Satisfactory/Unsatisfactory. All PhD and MS students must earn a grade of Satisfactory to fulfill degree requirements.
### Molecular Pathology and Immunology Program: MS (thesis)

**Course Descriptions**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Semester</th>
<th>Credits</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBS 00501</td>
<td>BIOCHEMISTRY AND MOLECULAR BIOLOGY</td>
<td>FALL</td>
<td>3</td>
<td>REQUIRED COURSE</td>
</tr>
<tr>
<td></td>
<td>COURSE DIRECTOR: DR. SALVATORE CARADONNA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PREREQUISITE: NO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T 5:00-8:00 PM AC-279</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>We will be using Macmillan Launchpad as our information resource. I have already set up a course at the following website. This is an all-inclusive site that contains the E-book, learning exercises and quizzes. You will have to purchase a 6-month access for this site. Go to <a href="https://www.macmillanlearning.com/college/us/product/Biochemistry-A-Short-Course/p/1319114636?searchText=biochemistry">https://www.macmillanlearning.com/college/us/product/Biochemistry-A-Short-Course/p/1319114636?searchText=biochemistry</a>.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>This course will cover the broad topic of biochemistry. This starts with a basic understanding of thermodynamics and chemical bonds and leads into amino acids, proteins and enzymes as well as carbohydrate and lipid structure and function. We will also cover intermediary metabolism and provide a perspective of disease states. The intent is to learn biochemistry by studying and learning how proteins underlie human disease.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| MBS 00502   | CELL BIOLOGY                                     | FALL     | 3       | REQUIRED COURSE |
|             | COURSE DIRECTOR: DR. DMITRIY MARKOV              |          |         |               |
|             | PREREQUISITE: NO                                 |          |         |               |
|             | W 5:00-8:00 PM AC-279                            |          |         |               |
|             | This course is focused on biology and physiology of the cell and is organized around the central theme of homeostasis – how the cells adopt to various environmental changes while maintaining their internal constancy necessary for all tissues and organs to function. It is a course for both the basic scientists who seek general principles about cellular function, and the students preparing for health-related careers who wish to apply fundamental knowledge on cell biology to understand the molecular mechanisms of cellular dysfunction in human diseases. |

| MPI 00503   | MOL PATH & IMMUNO SEMINAR                        | FALL     | 2       | CORE COURSE   |
|             | COURSE DIRECTOR: DR. JOSEPH NICKELS              |          |         |               |
|             | PREREQUISITES: NO                                |          |         |               |
|             | W 9:00-11:00 AM GENESIS BIOTECHNOLOGY GROUP FACILITY: Galaxy Building, North One Conference Room |
|             | All students are required to attend the Medical Diagnostic Laboratories (MDL) and HUMIGEN Basic Research Seminar and Distinguished Lecturer Seminar Series during their first semester. The Basic Research Seminar series is a weekly meeting that includes the presentation and discussion of scientific data from individual members of MDL's basic research groups. These seminars will serve two functions: the critical analysis and proper planning of experiments and the opportunity to become familiarized with the various research projects and multiple scientific disciplines offered within MDL. This exposure will aid the students in their selection of laboratory rotations during the current semester. Held on a monthly basis, the Distinguished Seminar Series provides students the unique opportunity to learn about various scientific disciplines from invited speakers who are experts in their fields. Both seminar series are held on MDL's campus. Within this course students are expected to participate in the scientific discussion and are invited to ask questions of the presenters and are required to submit written summaries, supplemented with information and references from relevant published articles, of each presentation. |

| MPI 00504   | TOPICS IN MOL PATH AND IMMUNO                    | SPRING   | 4       | CORE COURSE   |
|             | COURSE DIRECTOR: DR. JOSEPH NICKELS              |          |         |               |
|             | PREREQUISITES: NO                                |          |         |               |
This course provides the student with a factual understanding of key host/pathogen elements related to the development of human disease, in an introductory manner. The course will cover major human pathogens and their disease-causing mechanisms (Microbiology). In addition, the human immune system is presented in the context of host-defense against infectious and malignant disease (Immunology). Mechanisms of tumorigenesis and metastasis are explored (Cancer), as are the metabolic mechanisms underpinning diabetes, obesity and related disorders (Metabolic Diseases). Finally, shorter elements describe the creation, validation and standardization of new molecular diagnostic tools (Diagnostics); the critical (statistical) evaluation of experimental data (Statistics); important elements of high-throughput screening and early stage drug discovery (Drug Discovery); an introduction to the discovery, mechanism of action, and resistance to antimicrobial agents (Antimicrobial Agents); as well as a discussion of the genetics of cancer and other diseases (Medical Genetics). Upon completion of the course, students will have gained a broad overview of the theoretic and practical aspects of the subjects that underlie the laboratory courses they may take in the future.

MPI 00601  TECHNIQUES IN MOLECULAR DIAGNOSTICS  SPRING  2 Credits  REQUIRED COURSE
COURSE DIRECTOR:  DR. JOSEPH NICKELS
PREREQUISITES:  NO
This course is designed to allow students to master techniques routinely used in molecular diagnostics. Students will develop and apply these techniques in a laboratory-based setting. Methods include DNA and RNA isolation and quantification, protein expression, purification, and analysis, molecular cloning methods, diagnostic methods used for genetic testing, culture methods for growth of bacteria, yeast, and viruses, microscopic methods for diagnostic testing, etc. Students will select two techniques during the course to perform and master. The student will be required to write a short 4-5 page NIH type introduction on each method. In addition, the student will give an oral presentation on one of the techniques mastered. Upon completion of this course students will have acquired a basic mastery of a subset of methods routinely used in the molecular diagnoses of disease.

MPI 00602  MOL PATH & IMMUNO READINGS I  SUMMER  2 Credits  REQUIRED COURSE
COURSE DIRECTOR:  DR. VENUGOPALAREDDY BOMMIREDDY VENKATA
This course provides the student with an opportunity to learn how to delve into the complexities of modern scientific papers presented in high-impact journals, and to analyze their data, methods and conclusions. The class is provided with three papers from the current scientific literature, each in a different field. The class meets together for several sessions where these papers are overviewed in turn, and key experimental and analytic methodologies are highlighted. The class members are then encouraged to work together to explore the papers in depth, with reference to the instructor as required. Finally, each member of the class produces her/his own in-depth critique (usually 10+ pages) of each of the three papers, where s/he discusses the background to each work, the hypotheses tested in each work, the strengths and weaknesses of the methodologies used and the validity of the conclusions drawn. These three written papers form the sole basis of the assessment. Candidates should note that this class requires independent initiative on behalf of those taking it, and a willingness to share ideas and have them addressed in open discussion.

MPI 00603  MOL PATH & IMMUNO READINGS II  FALL  2 Credits  REQUIRED COURSE
COURSE DIRECTOR:  DR. JOSEPH NICKELS
This course prepares the student for reading, analysing, critiquing and summarizing the scientific literature, and to write their own. Students will participate in group discussion reviews of scientific publications, and prepare and present one additional paper for group discussion. Students will review carefully the scientific literature on a topic of their choosing unrelated to any previous laboratory rotations, and prepare a small series of relevant research questions, describe their biomedical significance and provide an appropriate description of the background to these research questions. Upon completion of the course, students will have gained experience in reviewing the scientific literature, analyzing research communications, in order to formulate hypotheses and justify research questions. Optimally, work on this course will be conducted in parallel with laboratory research.
Laboratory rotations are essential components of a student’s education in the Molecular Pathology and Immunology Program. These experiences introduce students to specific areas of molecular pathology and immunology; expose students to specialized techniques, and familiarize students with specific projects in the program in anticipation of choosing a research advisor. Students will be evaluated on their attendance, motivation and interest within the lab as well as their attendance and participation at lab meetings. Students are responsible for learning new techniques, asking questions and working semi-independently by the end of each lab rotation. Students are encouraged to select their laboratory rotations so as to acquire diverse research experiences. A Molecular Pathology and Immunology Program student needs to complete two laboratory rotations prior to the selection of a thesis advisor. The length of each laboratory rotation is 7 weeks and each must be completed within the fall semester of the student’s first year. Hence, by the end of the fall semester, the student will know which lab they will do their research in for their thesis.

Responsible Conduct in Research training presents a series of 10 one-hour sessions whereby faculty, postdoctoral fellows, and students discuss professional standards of science. Participating individuals are enlightened as to why adherence to these standards is essential for continued scientific progress. Case studies along with open dialog between attendees provides the backdrop for discussion on issues that may arise in the laboratory setting. The grading for this zero (0) credit course is Satisfactory/Unsatisfactory. All PhD and MS students must earn a grade of Satisfactory to fulfill degree requirements.

Each course will be directed by a masters student's Mentor who is a member of the GSBS Faculty at MDL/Humigen and its content will reflect his/her research interests. The goal is to have the student gain experience in a research laboratory and gain insight into the creative research process.

The Mentor or Mentor-of-Record is responsible for grading this Satisfactory/Unsatisfactory graded course, which must be laboratory (not library) based and must be hypothesis driven. A student can enroll in this course just once. However, please note that the research thesis is done over two or more semesters. The conclusion of the research is based on testing the hypothesis but not necessarily on proving the hypothesis (unlike a doctoral or masters thesis in the Cell and Molecular Biology program). The student must publically defend his/her thesis. The grading for this course is Satisfactory/Unsatisfactory, which does not affect the grade point average.

After completing the number of thesis credits as defined by the MS program requirements and completing required coursework, students may register for Master of Science Thesis Continuation during each subsequent semester of thesis phase. Master of Science Thesis Continuation will carry a variable credit weight of 1-9 credits (5 credits are part-time status; 9 credits are full-time status). The student’s mentor will be responsible for certifying that a student is working on his/her thesis on a part-time or full-time basis commensurate with the number of credits they are registered for in a semester. Students will be charged the Master of Science Thesis Continuation fee of $200 per semester for thesis continuation regardless of the number of thesis credits for which they are registered. The maximum number of semesters that a student can register for thesis research and thesis continuation is four (2 years). The grading for this course is Satisfactory/Unsatisfactory, which does not affect the grade point average.