



**GRADUATE SCHOOL OF
BIOMEDICAL SCIENCES**

Course Catalog

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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

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Cell and Molecular Biology (CMB) Program: PhD; DO-PhD; MS (thesis only)

Course Descriptions

CMB 00701 GRADUATE BIOCHEMISTRY FALL 4 Credits FOUNDATION COURSE
COURSE DIRECTORS: DR. SERGEI BORUKHOV
PREREQUISITE: NO

REQUIRED TEXTBOOK: Lehninger Principles of Biochemistry, 7th Edition. D.L. Nelson and M.M. Cox. W.H. Freeman and Company Publishing, 2017. ISBN: 9781464126116

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 FOUNDATION COURSE
COURSE DIRECTOR: DR. MICHAEL HENRY
PREREQUISITE: NO

REQUIRED TEXTBOOK: Molecular Biology of the Cell, 6th Edition. B. Alberts, A. Johnson, J. Lewis, D. Morgan, M. Raff, K. Roberts, P. Walter. Garland Publishing, 2014. ISBN: 9780815344322

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

REQUIRED TEXTBOOKS: In Search of Mechanisms: Discoveries Across the Life Sciences. Craver, CF and Darden, L. 2013. Chicago: The University of Chicago Press. ISBN-10: 9780226039794

How Sloppy Science Creates Worthless Cures, Crushes Hope, and Wastes Billions. Harris, R. 2017, Rigor Mortis: New York: Basic Books. ISBN-10: 154164414X

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: DRs. NATALIA SHCHERBIK AND JESSICA LOWETH
PREREQUISITE: NO

SUGGESTED SUPPLEMENTARY TEXTBOOK: Kandel, ER, Schwartz JH, Jessell TM, Siegelbaum SA, Hudspeth AJ. (2013) Principles of Neural Science, 5th edition. Appleton and Lange, Norwalk, CT

This course provides a basic foundation in neurophysiology for research-oriented graduate students. Topics are presented by members of the Department of Cell Biology and Neuroscience in lecture format. The assigned text is Cellular and Molecular Neurophysiology, 4th edition by Constance Hammond. Through readings, lectures, and discussion students will develop a basic knowledge the electrochemical properties cellular communication within the nervous system.

CMB 00815 NEUROPHARMACOLOGY & BEHAVIOR SPRING 2 Credits FOCUS COURSE

COURSE DIRECTOR: DRS. DANIEL MANVICH AND RACHEL NAVARRA

PREREQUISITE: NO

REQUIRED TEXTBOOK: Nestler EJ, Hyman SE, Holtzman DM, Malenka RC (2015). Molecular Neuropharmacology: A Foundation for Clinical Neuroscience, Third Edition. The McGraw-Hill Companies, Inc. Note: An online version of this textbook is available free-of-charge to students via Rowan University's subscription to AccessNeurology (<https://neurology.mhmedical.com/>).

RECOMMENDED SUPPLEMENTARY TEXTBOOK: Iversen LL, Iversen SD, Bloom FE, Roth RH (2008) Introduction to Neuropsychopharmacology, First Edition. Oxford University Press.

RECOMMENDED SUPPLEMENTARY TEXTBOOK: Cooper JR, Bloom FE, Roth RH (2003) The Biochemical Basis of Neuropharmacology, Eighth Edition. Oxford University Press.

The course will begin with a basic overview of neuronal function and neurotransmission, with specific emphasis placed on describing how transmission of major neurotransmitters and neuropeptides may be affected by exogenous drugs. This will be followed by an introduction to fundamental concepts in pharmacology including but not limited to pharmacodynamics, pharmacokinetics, receptor theory, and dose-response relationships. With this framework in place, the remainder of the course will describe the neuropharmacological mechanisms of action of various drug classes and how they alter brain function and behavior in preclinical models of disease and/or produce therapeutic benefit in human pathologies. Examples of drug classes to be discussed include but are not limited to: treatments for neurodegenerative diseases (e.g. Parkinson's disease, Alzheimer's disease); wakefulness-promoting and sleep-promoting drugs; opioid and non-opioid treatments for pain; affective disorders (e.g. anxiety, depression); antipsychotics; drugs of abuse (e.g. psychostimulants, opioids, alcohol, etc.).

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.

CMB 00905 LABORATORY ROTATION FALL – CMB FALL 3 Credits REQUIRED COURSE

CMB 00906 LABORATORY ROTATION SPRING – CMB SPRING 3 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. DIMITRI PESTOV

PREREQUISITE: PERMISSION BY FACULTY/INVESTIGATOR

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.

CMB 00910 RESPONSIBLE CONDUCT IN RESEARCH FALL 0 Credits REQUIRED COURSE
COURSE DIRECTOR: DR. CATHERINE NEARY
PREREQUISITE: NO

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 and this course must be renewed every four years.

CMB 00690 THESIS RESEARCH - MSCMB SUMMER 7 Credits REQUIRED COURSE
COURSE DIRECTOR: DR. MICHAEL ANIKIN

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.

CMB 00699 MS THESIS CONTINUATION FALL/SPRING (Summer, if necessary) 1-9 Credits REQUIRED COURSE
COURSE DIRECTOR: DR. MICHAEL ANIKIN

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.

CMB 00920 ADVANCED GRADUATE RESEARCH FALL/SPRING 5 Credits REQUIRED COURSE
COURSE DIRECTOR: DR. DANIEL MANVICH

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.

Eligibility:

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.

CMB 00925 SUMMER RESEARCH IN CELL AND MOLECULAR BIOLOGY SUMMER 4 Credits REQUIRED COURSE
COURSE DIRECTOR: DOCTORAL STUDENT'S MENTOR

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.

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

REQUIRED TEXTBOOK: Biochemistry: A Short Course, 4th Edition. John L. Tymoczko, Jeremy M. Berg, Lubert Stryer. W.H. Freeman, 2019. ISBN: 978-1-3191-1483-1

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

REQUIRED TEXTBOOK: Essential Cell Biology, 5th Edition. B. Alberts, K. Hopkin A. Johnson, D. Morgan, M. Raff, K. Roberts, P. Walter. Garland Science, Taylor and Francis Group, LLC, 2018. ISBN: 978-0-3936-8036-2

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

REQUIRED TEXTBOOK: Medical Genetics, 5th Edition. Lynn Jorde, John Carey and Michael Bamshad. Elsevier, 2015

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

REQUIRED TEXTBOOK: Microbiology (an Introduction), 13th Edition. G. Tortora, B. Funke, C. Case, D. Weber, W. Bair, 2018. ISBN: 978-0-1346-0518-0

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, Virioids, 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.

Neuroinflammation and HIV-associated Neurocognitive 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)

HIGHLY SUGGESTED TEXTBOOK: Exercise Physiology, 8th Edition. William McArdle, Frank Katch, Victor Katch. Lippincott, Williams & Wilkins, 2014

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)

RECOMMENDED TEXT: Robbins Basic Pathology, 10th Edition. Kumar, V., Abbas, A.K., & Aster, J.C. Elsevier, 2018

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)

REQUIRED TEXTBOOK: Pathophysiology of Heart Disease, 6th Edition. L.S. Lilly. Lippincott, Williams & Wilkins Publishing, 2016. ISBN 978-1-4511-9275-9

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 SPRING 3 Credits

COURSE DIRECTOR: DR. BERND SPUR

PREREQUISITE: NO

REQUIRED TEXTBOOK: Basic and Clinical Pharmacology, 13th Edition. B.G. Katzung. McGraw-Hill Publishing, 2015.

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** **FALL/SPRING/SUMMER** **2 Credits**

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** **FALL** **2 Credits**

COURSE DIRECTOR: DR. DMITRIY MARKOV

PREREQUISITES: MBS 00501, MBS 00502 & MBS 00503 (Must pass each course)

RECOMMENDED TEXTBOOKS:

1) **Biology of Aging, 1st Edition, 360 pages. Roger B. McDonald. Garland Science, 1st edition (July 2, 2013). ISBN-10: 0815342136. ISBN-13: 978-081534213**

2) **Cell Aging: Molecular Mechanisms and Implications for Disease (SpringerBriefs in Molecular Medicine series), 2014th edition, 108 pages. Christian Behl and Christine Ziegler. Springer; 2014 edition (December 18, 2013). ISBN-13: 978-3642451782. ISBN-10: 3642451780**

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).

MBS 00680 **LABORATORY RESEARCH (A) – MBS** **FALL/SPRING/SUMMER** **2 Credits**

MBS 00681 **LABORATORY RESEARCH (B) – MBS** **FALL/SPRING/SUMMER** **2 Credits**

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.

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

REQUIRED TEXTBOOK: Biochemistry: A Short Course, 4th Edition. John L. Tymoczko, Jeremy M. Berg, Lubert Stryer. W.H. Freeman, 2019. ISBN: 978-1-3191-1483-1

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

REQUIRED TEXTBOOK: Essential Cell Biology, 5th Edition. B. Alberts, K. Hopkin A. Johnson, D. Morgan, M. Raff, K. Roberts, P. Walter. Garland Science, Taylor and Francis Group, LLC, 2018. ISBN: 978-0-3936-8036-2

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)

RECOMMENDED TEXTBOOK: Berne & Levy Physiology, 6th Edition

ISBN: 0-323-04582-0

B.M. Koeppen, and B.A. Stanton

Elsevier Healthsciences Division Publishing, 2008.

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.

MBS 00609 MECHANISMS OF DISEASE FALL 2 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. CATHERINE NEARY

PREREQUISITES: MBS 00501 & MBS 00502 (“C” grade or better in each course)

RECOMMENDED TEXTBOOK: Robbins Basic Pathology, 10th Edition. Kumar, V., Abbas, A.K., & Aster, J.C. Elsevier, 2018

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.

MHP 00610 BASIC LABORATORY TECHNIQUES – BIOLOGY SPRING 3 Credits REQUIRED COURSE

COURSE DIRECTORS: DR. RENEE M. DEMAREST & DR. CATHERINE L. NEARY

PREREQUISITES: MBS 00501 & MBS 00502 (“C” grade or better in each course)

REQUIRED TEXTBOOK: At the Bench: A Laboratory Navigator, Barker K. 2nd Ed., 2004, Cold Spring Harbor Laboratory Press.

RECOMMENDED TEXTBOOK: Principles and Techniques of Biochemistry and Molecular Biology, Wilson, K. and Walker, J. 7th Ed., 2010, Cambridge University Press.

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.

MHP 00611 HISTOLOGY I: BASIC TISSUE TYPES SPRING 3 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. CATHERINE L. NEARY

PREREQUISITES: MBS 00501 & MBS 00502 (“C” grade or better in each course)

REQUIRED TEXTBOOKS: Histology and Cell Biology, Kierszenbaum, A.L., and Tres, L.L., 4th Ed., 2016, Elsevier Saunders *and* Di Fiore’s Atlas of Histology with Functional Correlations, Eroschenko, V.P., 12th Ed., 2012, Lippincott Williams & Wilkins.

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.**

MHP 00612 HISTOLOGY II: TECHNIQUES SUMMER 4 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. RENEE M. DEMAREST

PREREQUISITES: MHP 00610 & MHP 00611 (“C” grade or better in each course)

REQUIRED TEXTBOOK: Histological and Histochemical Methods: Theory and Practice, Kiernan, J., 5th Ed., 2015, Scion Publishing Ltd.

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.

MHP 00613 HISTOLOGY III: ORGAN SYSTEMS SPRING 3 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. CATHERINE L. NEARY

PREREQUISITES: MHP 00611 & MBS 00503

REQUIRED TEXTBOOK: Histology and Cell Biology, Kierszenbaum, A.L., & Tres, L.L., 4th Ed., 2016, Elsevier Saunders *and* Di Fiore’s Atlas of Histology with Functional Correlations, Eroschenko, V.P., 12th Ed., 2012, Lippincott Williams & Wilkins.

In this course, students will apply their knowledge of tissue types to develop an understanding of organ structure and function. This will include information specific to commonly used animal models (e.g. rats, mice, rabbits). **This course is only open to students in the Masters in Histopathology program.**

MHP 00614 BASIC LABORATORY ANIMAL TECHNIQUES FALL 4 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. RENEE M. DEMAREST

PREREQUISITES: MHP 00610, MHP 00611 & MHP 00612

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

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

RECOMMENDED TEXTBOOK: Histology and Cell Biology, Kierszenbaum, A.L., & Tres, L.L., 4th Ed., 2016, Elsevier Saunders

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.

CMB 00910 RESPONSIBLE CONDUCT IN RESEARCH FALL 0 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. CATHERINE NEARY

PREREQUISITES: NO

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

MBS 00501 BIOCHEMISTRY AND MOLECULAR BIOLOGY FALL 3 Credits REQUIRED COURSE
COURSE DIRECTOR: DR. SALVATORE CARADONNA
PREREQUISITE: NO

REQUIRED TEXTBOOK: Biochemistry: A Short Course, 4th Edition. John L. Tymoczko, Jeremy M. Berg, Lubert Stryer. W.H. Freeman, 2019. ISBN: 978-1-3191-1483-1

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

REQUIRED TEXTBOOK: Essential Cell Biology, 5th Edition. B. Alberts, K. Hopkin A. Johnson, D. Morgan, M. Raff, K. Roberts, P. Walter. Garland Science, Taylor and Francis Group, LLC, 2018. ISBN: 978-0-3936-8036-2

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 Credits CORE COURSE
COURSE DIRECTOR: DR. JOSEPH NICKELS
PREREQUISITES: NO

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 Credits CORE COURSE
COURSE DIRECTOR: DR. JOSEPH NICKELS
PREREQUISITES: NO

GENESIS BIOTECHNOLOGY GROUP FACILITY: Galaxy Building, North One Conference Room

REQUIRED TEXTBOOK: None. Will be taught from current literature.

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

GENESIS BIOTECHNOLOGY GROUP FACILITY: Galaxy Building, North One Laboratory

REQUIRED TEXTBOOK: None.

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

GENESIS BIOTECHNOLOGY GROUP FACILITY: Galaxy Building, North One Conference Room

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

GENESIS BIOTECHNOLOGY GROUP FACILITY: Galaxy Building, North One Conference Room

This course prepares the student for reading, analysing, criticising 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 related 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.

MPI 00680 MOL PATH & IMMUNO LAB ROTATION I (7 weeks each) FALL 1 Credit REQUIRED COURSE

MPI 00681 MOL PATH & IMMUNO LAB ROTATION II (7 weeks each) FALL 1 Credit REQUIRED COURSE

COURSE DIRECTORS: GENESIS BIOTECHNOLOGY GROUP GSBS FACULTY MENTOR**PREREQUISITE: PERMISSION BY FACULTY/INVESTIGATOR**

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.

CMB 00910 RESPONSIBLE CONDUCT IN RESEARCH FALL 0 Credits REQUIRED COURSE
COURSE DIRECTOR: DR. CATHERINE NEARY
PREREQUISITES: NO

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.

MPI 00685 MOL PATH & IMMUNO RESEARCH I SPRING 1 Credit REQUIRED COURSE
MPI 00686 MOL PATH & IMMUNO RESEARCH II SUMMER 2 Credits REQUIRED COURSE
COURSE DIRECTOR: GENESIS BIOTECHNOLOGY GROUP GSBS FACULTY MENTOR

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.

MPI 00690 THESIS RESEARCH – MSMPI FALL 7 Credits REQUIRED COURSE

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.

MPI 00699 MS THESIS CONTINUATION FALL/SPRING/SUMMER 1-9 Credits

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.