



**GRADUATE SCHOOL OF
BIOMEDICAL SCIENCES**

Course Descriptions

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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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ANS 00504 HUMAN ANATOMY IN DIAGNOSTIC IMAGING FALL 3 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. ROCCO CARZIA

PREREQUISITE: ANS 00501 ("C" grade or better)

SUGGESTED TEXTBOOK: Weber, E.C., et al.: Netter's Concise Radiologic Anatomy, Update Edition 2, Elsevier, 2018.

This course takes a regional approach in human gross anatomy and focuses on the translation of anatomical structure into various diagnostic imaging modalities, mainly X-ray, computed tomography and magnetic resonance imaging. Where appropriate, surface ultrasonography is included. This course is particularly suited for students of the anatomical sciences. **This course is only open to students in the Anatomical Sciences program.**

ANS 00505 HUMAN DEVELOPMENTAL ANATOMY FALL 3 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. ROCCO CARZIA

PREREQUISITE: ANS 00501 ("C" grade or better)

REQUIRED TEXTBOOK: Langman's Medical Embryology, 14th edition; Sadler, T. W.; Wolters Kluwer, 2019.

Unlike typical embryology courses, this course takes a regional approach like most courses in human gross anatomy and focuses on the morphogenic movements underlying the development of regional anatomy and the contained organs. Where appropriate, the principles and mechanisms of morphogenesis and dysmorphogenesis are brought into discussion without heavy reliance on an understanding of complex genetics and signaling pathways. The prominent clinical consequences of dysmorphogenesis, i.e., anomalies, syndromes, etc., are discussed with each topic. Thus, this course is particularly suited for students of the anatomical sciences. **This course is only open to students in the Anatomical Sciences program.**

Additional Required courses for the MS degree in Anatomical Sciences:

MBS 00503 SYSTEMS PHYSIOLOGY SPRING 3 Credits MS REQUIRED COURSE

COURSE DIRECTOR: DR. DEBORAH PODOLIN

PREREQUISITES: MBS 00501 & MBS 00502 OR ANS 00501 CIHA ("C" grade or better in each course)

RECOMMENDED TEXTBOOK: Berne & Levy Physiology, 6th Edition. B.M. Koeppen, and B.A. Stanton. Elsevier Healthsciences Division Publishing, 2008. ISBN: 0-323-04582-0

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.

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

COURSE DIRECTOR: DR. CATHERINE NEARY

PREREQUISITES: MBS 00501 & MBS 00502 OR ANS 00501 CIHA ("C" grade or better in each course)

REQUIRED TEXTBOOKS: Histology and Cell Biology, Kierszenbaum, A.L., and Tres, L.L., 5th Ed., 2019, Elsevier Saunders and Di Fiore's Atlas of Histology with Functional Correlations, Eroschenko, V.P., 13th Ed., 2017, 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 Histopathology and Anatomical Sciences programs.**

Biomedical Sciences Program: MBS (non-thesis); Certificate

Course Descriptions

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

REQUIRED TEXTBOOK: *Lippincott Illustrated Reviews: Biochemistry, 7th ed.* ISBN 9781496344496 (e-text available through library website)

This course will cover fundamental topics in biochemistry and how they relate to human health and disease. This begins with the introduction of the biomolecules that are central to human metabolism at the cellular and organismal level. We then explore the bioenergetic and thermodynamic principles that govern this metabolism, as well as how the body uses enzymes to harness these properties. We then move onto the study of the biochemical pathways that underly human metabolism and how these pathways can be dysregulated in human disease.

MBS 00502 CELL BIOLOGY FALL 3 Credits REQUIRED COURSE
COURSE DIRECTOR: DR. DANA ZAMBITO
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.

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. KATHARINE MILANI

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. JEFFERY POWERS
PREREQUISITE: NO

REQUIRED TEXTBOOK: *Lippincott Illustrated Reviews: Biochemistry, 7th ed.* ISBN 9781496344496 (e-text available through library website)

This course will cover fundamental topics in biochemistry and how they relate to human health and disease. This begins with the introduction of the biomolecules that are central to human metabolism at the cellular and organismal level. We then explore the bioenergetic and thermodynamic principles that govern this metabolism, as well as how the body uses enzymes to harness these properties. We then move onto the study of the biochemical pathways that underly human metabolism and how these pathways can be dysregulated in human disease.

MBS 00502 CELL BIOLOGY FALL 3 Credits REQUIRED COURSE
COURSE DIRECTOR: DR. DANA ZAMBITO
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. DEBORAH PODOLIN
PREREQUISITES: MBS 00501 & MBS 00502 OR ANS 00501 CIHA (“C” grade or better in each course)

RECOMMENDED TEXTBOOK: *Berne & Levy Physiology, 6th Edition,* B.M. Koepfen, and B.A. Stanton. Elsevier Healthsciences Division Publishing, 2008. ISBN: 0-323-04582-0

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 3 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: DRS. RENEE DEMAREST AND CATHERINE 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 NEARY

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

REQUIRED TEXTBOOKS: Histology and Cell Biology, Kierszenbaum, A.L., and Tres, L.L., 5th Ed., 2019, Elsevier Saunders *and* Di Fiore’s Atlas of Histology with Functional Correlations, Eroschenko, V.P., 13th Ed., 2017, 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 Histopathology and Anatomical Sciences programs.**

MHP 00612 HISTOLOGY II: TECHNIQUES SUMMER 4 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. RENEE 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 NEARY

PREREQUISITES: MHP 00611 & MBS 00503

REQUIRED TEXTBOOK: Histology and Cell Biology, Kierszenbaum, A.L., & Tres, L.L., 5th Ed., 2019, Elsevier Saunders *and* Di Fiore’s Atlas of Histology with Functional Correlations, Eroschenko, V.P., 13th Ed., 2017, 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 Histopathology and Anatomical Sciences programs.**

MHP 00614 BASIC LABORATORY ANIMAL TECHNIQUES FALL 4 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. RENEE 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 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 NEARY

PREREQ: MHP 00611 & MBS 00503

CO-REQUISITE: MHP 00613

RECOMMENDED TEXTBOOK: Histology and Cell Biology, Kierszenbaum, A.L., & Tres, L.L., 5th ed., 2019, Elsevier Saunders.

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

This course will provide students exposure to the pathology of major organ systems. **This course is only open to students in the Histopathology and Anatomical Sciences programs.**

MHP 00650 HISTOPATHOLOGY INTERNSHIP FALL/SPRING 3 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. RENEE 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.

MHP 00640 HISTOPATHOLOGY INDEPENDENT STUDY FALL/SPRING/SUMMER 3 Credits ELECTIVE

COURSE DIRECTORS: DR. RENEE DEMAREST AND CATHERINE NEARY

PREREQUISITES: NO

This course introduces students to the use of histopathology techniques in 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 6,000 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 the semester.

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 DIRECTORS: 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 – MCBN FALL 1 Credit DO/PhD REQUIRED COURSE
CMB 00902 LABORATORY ROTATION B – MCBN 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 Molecular Cell Biology and Neuroscience program. These experiences introduce students to specific areas of cell biology, molecular biology, and neuroscience, 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 Molecular Cell Biology and Neuroscience 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 – MCBN FALL 3 Credits REQUIRED COURSE
CMB 00906 LABORATORY ROTATION SPRING – MCBN 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 Molecular Cell Biology and Neuroscience program students are required to complete three rotations in different laboratories. 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				
<i>Responsible Conduct in Research</i> 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 – MS MCBN	SUMMER	7 Credits	REQUIRED COURSE
COURSE DIRECTOR: DR. MIKHAIL 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. <u>However, please note that the research thesis is done over two or more semesters.</u> The conclusion of the research is based on proving the hypothesis. The student must publicly 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. MIKHAIL 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 MCBN	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.				
CMB 00990	SUMMER THESIS RESEARCH/PhD	SUMMER	4 Credits	REQUIRED COURSE
COURSE DIRECTOR: DOCTORAL STUDENT'S MENTOR				

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. MIKHAIL 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 all 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.

Molecular Pathology and Immunology Program: MS (thesis)

Course Descriptions

MBS 00501 BIOCHEMISTRY AND MOLECULAR BIOLOGY FALL 3 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. JEFFERY POWERS

PREREQUISITE: NO

REQUIRED TEXTBOOK: *Lippincott Illustrated Reviews: Biochemistry, 7th ed.* ISBN 9781496344496 (e-text available through library website)

This course will cover fundamental topics in biochemistry and how they relate to human health and disease. This begins with the introduction of the biomolecules that are central to human metabolism at the cellular and organismal level. We then explore the bioenergetic and thermodynamic principles that govern this metabolism, as well as how the body uses enzymes to harness these properties. We then move onto the study of the biochemical pathways that underly human metabolism and how these pathways can be dysregulated in human disease.

MBS 00502 CELL BIOLOGY FALL 3 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. DANA ZAMBITO

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/SPRING 2 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. JOSEPH NICKELS

PREREQUISITES: NO

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

All MSMPI students are required to attend both of the Genesis Biotechnology Group (GBG) Seminar Series during their first year. The *Basic Research Seminar Series* is a weekly meeting that includes the presentation and discussion of scientific data from individual members of GBG'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 GBG. This exposure will aid the students in their selection of laboratory rotations during the current semester. Held on a monthly basis, the *Distinguished Lecturer 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 the GBG campus. Within this course, students are expected to participate in the scientific discussion, are invited to ask questions of the presenters, and are required to submit written summaries, supplemented with information and references from relevant published articles, for each presentation.

MBS 00603 IMMUNOLOGY SPRING 3 Credits REQUIRED COURSE

COURSE DIRECTOR: DR. RENEE DEMAREST

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

REQUIRED TEXTBOOK: *The Immune System, Peter Parham, Fourth Edition, 2015.* Garland Press

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.

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
MPI 00682	MOL PATH & IMMUNO LAB ROTATION III (7 weeks each)	SPRING	1 Credit	Optional Elective 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. There is also an optional spring semester lab rotation, if needed.

CMB 00910	RESPONSIBLE CONDUCT IN RESEARCH	FALL	0 Credits	REQUIRED COURSE
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COURSE DIRECTOR: DR. JOSEPH NICKELS

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 MSMPI 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 Genesis Biotechnology Group 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
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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 Molecular Cell Biology and Neuroscience 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
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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.