Boston University Chobanian & Avedisian School of Medicine
Graduate Medical Sciences

Program in Biomedical Sciences (PiBS)

Graduate Handbook
2023-2024

* Approved by the PiBS Executive Committee

CONTENTS

1. Welcome

Welcome to the Program in Biomedical Sciences (PiBS). We're pleased to have you join PiBS, which is a Ph.D. program within the Graduate Medical Sciences (GMS) at the Boston University Chobanian & Avedisian School of Medicine. This umbrella program embodies 9 participating departments/programs within GMS (Biochemistry, Biophysics, Genetics & Genomics, Microbiology, Molecular & Translational Medicine, Nutrition & Metabolism, Orofacial & Skeletal Biology, Pathology and Physiology). In addition, students can participate in the Immunology Training Program, ultimately earning their degrees within either the Microbiology or Pathology programs. Students fulfill requirements of PiBS and upon choosing a dissertation laboratory and a department/program affiliation, requirements of the department/program are fulfilled as well.

This guide is intended to provide graduate students (as well as faculty members) within PiBS with a description of the policies and requirements of the graduate program. This guide was prepared to assist students in progressing through the program. This handbook is intended only to describe general PiBS requirements/policies, not those of the individual participating departments/programs *i.e.* as mentioned above, students are required to complete both PiBS as well as the department/program-specific requirements. As program policies and requirements may change, students are advised to consult with their advisors during the first year in the PiBS program, and upon choosing a dissertation laboratory, they should consult with their dissertation advisors and the directors of graduate studies of the departments/programs they join (see below for more information about this process). To be certain that they are in compliance with all policies and requirements, students must also adhere to the guidelines of GMS at Boston University Chobanian & Avedisian School of Medicine, as well as Boston University at large, and they are advised to consult relevant administrative personnel for further information regarding graduate study at Boston University. It is each student's responsibility to be certain that all program requirements are fulfilled. Students are encouraged to consult regularly with their advisors to be certain they are progressing as expected and that all requirements will be completed in time for the planned graduation.

2. Title IX & Boston University Policies

"Title IX of the Education Amendments of 1972 is a federal civil rights law that prohibits sex-based discrimination in federally funded education programs and activities. Sex-based discrimination includes sexual harassment and sexual violence, such as rape, sexual assault, sexual battery, and sexual coercion. The law covers sex-based discrimination against students, faculty, and staff."

"To ensure compliance with Title IX, Boston University has appointed a University Title IX Coordinator as well as deputy coordinators for key offices and within all schools." The Deputy Title IX Coordinators for Boston University Chobanian & Avedisian School of Medicine are:

1) Gwynneth Offner, Ph.D., Director, M.A. Medical Sciences Program (GMS)
goffner@bu.edu / (617) 358-9541
2) Karen Symes, Ph.D., Assistant Dean of Student Affairs (MED)
symes@bu.edu / (617) 358-4578

The information above is taken from the following website that includes additional information including Boston University Title IX contacts, BU's responsibilities under Title IX and disciplinary procedures:
http://www.bu.edu/safety/sexual-misconduct/title-ix-bu-policies/

3. PiBS Governance

The program is designed with a shared-governance philosophy that draws on faculty from all participating departments and programs. Included in the governance structure are the PiBS Program Director, the PiBS Executive Committee, the PiBS Admissions Committee, the PiBS Advising Committee and the PiBS Steering Committee. All work together to ensure that the program runs smoothly on a day to day basis, that new students are recruited annually, that students are properly guided through the program, that student progress is assessed, that new ideas are considered and new policies and initiatives disseminated to the home departments/programs and that the Associate Provost/Dean of GMS is kept abreast of program progress. This PiBS governance structure is designed to ensure that all 9 programs have representation and that open communication between the leadership, the faculty and the students is in place.

4. Academic Advisors

Upon entering the PiBS graduate program, each student is assigned a faculty member who will serve as the academic advisor. The academic advisor functions as the student's formal administrative advisor until a permanent research advisor is assigned at the end of the first academic year. The role of the academic advisor is to provide assistance and advice on all academic issues. The advisors are members of the PiBS Advising Committee.

5. Academic Requirements

The PiBS Ph.D. program requires 64 credits. Some of these credits are taken as formal didactic courses and the remainder are earned by performing research and/or attending and actively participating in department/program-related activities *e.g.* seminars. Required courses for students entering PiBS in 2023 are outlined in Table I (course descriptions can be found in Appendix #1). In addition, students choose elective coursework (course descriptions can be found in Appendix #2).

Core courses (16 credits)

Table I. PiBS COURSE REQUIREMENTS

Semester	Credits	Course
Fall	3	FC 712 Foundations in Biomedical Sciences: Structure and Function of the Genome
Fall	3	FC 711 Foundations in Biomedical Sciences: Protein Structure, Catalysis and Interaction
Fall	2	FC 764 Professional Skills
Spring	3	FC 713 Foundations in Biomedical Sciences: Architecture and Dynamics of the Cell
Spring	3	FC 714 Foundations in Biomedical Sciences: Mechanisms of Cell Communication
Spring	2	FC 708 Professional Development Skills

In addition to the specific courses listed above, all PiBS students must take a statistics class; for some PiBS-affiliated programs, there is a specific course that is required while for other programs, students can choose from a variety of courses offered. Students should consult with the director of graduate studies for the specific PiBS-affiliated program they join to learn more about this requirement.

It is important to note that the PiBS coursework and rotations do not necessarily adhere to the posted Boston University schedule. See Table II for the dates classes start and the last possible dates for administration of final examinations (ask professors of each class for specific final examination dates). The dates for the laboratory rotations are listed in the section on rotations below.

Table II. DATES TO REMEMBER

Event	Date
Orientation	September 1, 2023
Fall semester classes starts	September 5, 2023
*Fall semester final exams end (Boston University calendar)	December 21, 2023
*Spring semester classes start (Boston University calendar)	January 18, 2023 (but note that rotations start on January 8, 2024)
*Spring semester final exams end (Boston University calendar)	May 10, 2024

*Note that not all GMS classes adhere to the Boston University calendar so be sure to check with course directors for information on courses you plan to take.

During the first year in the program, it is expected that students will register for up to 12 didactic course credits per semester. This will consist of the PiBS required courses listed in Table I as well as elective courses. The latter are chosen in consultation with the advisor and may focus on a known area of interest or to explore a new area (which we strongly encourage)!

Once a student chooses a dissertation laboratory and a department/program of study, additional coursework will be dictated by the requirements of that department/program. All departments/programs require that the student submit, present and defend a dissertation based on original laboratory research performed under the direction of a member of the PiBS faculty (the faculty member must have a faculty appointment to one of the participating departments or programs as well as an appointment to the GMS faculty).

All graduate students are also required to attend Boston University's Program in Responsible Conduct of Research. See details at: https://www.bu.edu/researchsupport/compliance/responsible-conduct-of-research/.

Grading policies for GMS can be found at: https://www.bu.edu/academics/gms/policies/grades-and-course-credits/. Some of the policies are listed here.

Grades

GMS uses the following system of letter grades for evaluation.

A to B-	Pass with credit
C+ or below	Considered failure; no credit granted
P	Pass with credit
F	Fail
I	Incomplete, with additional work required
X	Unresolved status
J	Registration in a following semester necessary to complete requirements

AU	Audit
N	No credit granted toward a graduate degree
W	Withdrawal after grace period
MG	Missing grade

Incomplete Coursework and Failing Grades

When the expected coursework has not been completed within the semester of registration, a grade of I can be assigned if the student provides proof of extenuating circumstances. This automatically becomes an F unless coursework is completed within a specific timeframe to be determined in consultation with the course manager; this timeframe cannot exceed 1 year (12 months) from the time the grade of I is assigned. Grades of I or C+ or lower are interpreted as failures. A student receiving such grades in total of 8 credit hours is terminated.

Additional Requirements and Guidelines

PiBS students are required to maintain a minimum cumulative grade point average (GPA) of B (3.0) or better in their courses. Students must maintain this GPA throughout their matriculation in graduate school; this includes the first year as well as subsequent years when the student joins a specific PiBS-affiliated program. Students who fail to maintain a 3.0 grade point average will be placed on academic probation. The student has one year to remediate the deficiency and bring the total GPA to 3.0. If this is not achieved, the student will be dismissed from the program. Students on academic probation are not allowed to take qualifying or dissertation defense examinations. Financial assistance is dependent upon the student remaining in good standing within the program.

All students are required to complete three laboratory rotations prior to choosing a laboratory in which to perform the dissertation research work. Students must be accepted into a dissertation laboratory and a department or program by June 30th of the first year in the program. Students who fail to do so will be dismissed from the program.

All students are required to be registered every semester at Boston University unless on an approved leave of absence as per GMS and University guidelines. Prior to assignment of a dissertation advisor, students' leave policies are dictated by the schedule of classes and rotations.

It is expected that all students conduct themselves in a professional manner. Prompt attendance is expected at all lectures and other events as arriving late is disruptive to others. Cell phones must be turned off and put away while in class. The opinions of all others (students, staff and faculty) should be respected. Criticism of different opinions is embraced but should be delivered in a caring and constructive manner.

Any accusations of academic misconduct will be subject to deliberation and potential sanctions as dictated by the GMS Academic Conduct Code and Disciplinary Procedures.

6. Rotations

Experience in a range of laboratory research environments is an essential part of a graduate student's education. Thus, the process of having students rotate through several laboratories is an integral part of PiBS. Rotations expose students to a range of techniques and approaches used within the various biomedical science disciplines. The rotations also serve to allow students the opportunity to get a first-hand view of laboratories in which they might eventually conduct their dissertation research.

Students are expected to complete three laboratory rotations (one in the fall semester and two in the spring semester). The rotation dates are listed below (Table III). Students may petition to conduct one additional rotation after the third rotation (with approval of the PiBS Executive Committee). The faculty members hosting rotation students should be selected from the list of laboratories that have available positions for new students. No laboratory will host more than two PiBS students at any given time.

Table III. PiBS ROTATION DATES

Rotation	Start date	End date
#1	October 23, 2023	December 8, 2023
#2	January 8, 2024	February 23, 2024
#3	March 18, 2024	May 3, 2024

The student is expected to spend 15-20 hours per week in the rotation laboratories, including attending laboratory meetings whenever possible. During the rotations, it is expected that students will participate in a research project and will keep proper documentation consistent with the policies of the host laboratory. Students may be asked to present the results of their rotation work to the laboratory group at the end of the rotation period. In addition, students will be expected to give a presentation to the PiBS community that will be planned at the end of each rotation. After the completion of each rotation, the faculty will evaluate, in writing, the student's performance during the laboratory rotation (see Appendix #3). The faculty member is expected to go over the evaluation with the student prior to submitting it to the PiBS Advising Committee. The Rotation Evaluation report will become part of the student's permanent record. In addition, it will contribute to the final grade for the student's "research" credits (FC 951, FC 952) during the semester(s) in which the rotations are performed.

7. Dissertation Advisor Assignment

The final assignment will be determined by the student, dissertation mentor and the director of graduate studies/department chair of the sponsoring program or department.

8. Qualifying Examinations

All students must pass a written and oral qualifying examination. The qualifying examinations are designed and administered by the participating departments/programs which dictate the expectations for allowing a student to take these exams in keeping with GMS guidelines.

9. Dissertation and Graduation

An advisory committee will be assembled as per the guidelines of each department/program. The roles of the dissertation advisory committees are to both advise students and assess their progress throughout the dissertation research portion of the Ph.D. program. Expectations for the dissertation are dictated by each department/program in keeping with GMS guidelines.

Appendices

Appendix #1

PROGRAM IN BIOMEDICAL SCIENCES (PiBS) REQUIRED CLASSES

Fall semester

NOTE: FC 712 will precede FC 711.

GMS FC 712 Foundations in Biomedical Sciences II: Structure and Function of the Genome
The first module of the Foundations in Biomedical Sciences course will focus on the mechanisms of biological processes that influence the inheritance, regulation, and utilization of genes. Genetic and genomic, molecular, cell biological, and biochemical experimental approaches to understanding these processes will be explored. In addition, we will discuss the possibilities of utilizing these technologies in medical treatments. This course is part of a series of four core integrated courses and additional elective courses aimed towards first year Ph.D. students in Graduate Medical Sciences. The four cores will be integrated in content and structure, and they are intended to be taken as a complete, progressive sequence. Dasgupta. 3 cr, Fall sem. Sept. 5-Oct. 20; Tue, Thu, Fri 10:00am-11:50am.

GMS FC 711 Foundations in Biomedical Sciences I: Protein Structure, Catalysis and Interaction
The second module of the Foundations in Biomedical Science course will provide students with a quantitative understanding of protein structure, function, posttranslational modification, and turnover in the cell. In addition, students will gain facility with thermodynamics, catalysis, kinetics and binding equilibria as they apply to proteins and to other molecules in biological systems (e.g., nucleic acids, lipids, vitamins). This course is part of a series of four core integrated courses and additional elective courses aimed towards first-year Ph.D. students in Graduate Medical Sciences. The four cores will be integrated in content and structure, and they are intended to be taken as a complete, progressive sequence. Gursky, Spencer. 3 cr, Fall sem. Oct. 24-Dec.15; Tue, Thu, Fri 10:00am-11:50am.

GMS FC 764 Professional Skills
The goal of this course is to develop skills in writing and oral presentations that students need for their professional lives. Students will be exposed to different forms of oral presentations and give weekly talks. Sessions are highly interactive. Gabel. 2 cr, Fall sem. Mon 10:00am-11:50am.

GMS FC 951 Res Cell & Mol
Directed study. Schreiber. Var cr, Fall sem.

Spring semester

GMS FC 713 Foundations in Biomedical Sciences III: Architecture & Dynamics of the Cell
The third module of the Foundations in Biomedical Sciences course will focus on the movement of proteins and membranes within the cell, the secretory process, the cytoskeletal framework of the cell and the resulting cell-cell interaction and communication with the matrix. Molecular, cell biological, and biochemical experimental approaches to understanding these processes will be explored. Machine learning will be introduced. In addition, we will discuss the possibilities of utilizing these technologies in medical treatments. This course is part of a series of four core integrated courses and additional elective courses aimed towards first year Ph.D. students in Graduate Medical Sciences. The four cores will be integrated in content and structure, and they are intended to be taken as a complete, progressive sequence. Trinkaus-Randall. 3 cr, Spring sem. Jan. 18-Mar. 8; Tue, Thu, Fri 10:00am-11:50am.

GMS FC 714 Foundations in Biomedical Sciences IV: Mechanisms of Cell Communication
The fourth module of the Foundations in Biomedical Sciences course will focus on the mechanisms of cell communication. This module will begin by discussing overarching concepts before examining the specific types of molecules that initiate and transduce signals. Examples of cell signaling and subsequent cellular responses will then be considered in different contexts to provide a framework on which future learning can be applied. As the module progresses, the complexity of the systems explored will increase from individual cells to multicellular environments such as tissues, organs, and organisms. In addition, normal processes as well as the dysregulation of cell-cell communication is disease will be studied. This course is part of a series of four core integrated courses and additional elective courses aimed towards first year Ph.D. students in Graduate Medical Sciences. The four cores will be integrated in content and structure, and they are intended to be taken as a complete progressive sequence. Symes. 3 cr, Spring sem. Mar. 19-May 7; Tue, Thu, Fri 10:00am-11:50am.

GMS FC 708 Professional Development Skills
This course proposes to extend the students' education beyond the traditional biomedical course content. Today's world of science is complex and today's student is faced with a wide variety of options to consider. The course begins to expose students to basic skills that all scientists must master (*e.g.* presentation skills), to issues of compliance/ethics & the law as well as to their personal professional development, the latter highlighted by students' working on an individual development plan by participating in the "myIDP" project. The course draws on a wide variety of experts throughout the university. Schreiber. 2 cr, Spring sem. Wed 10:00am-11:50am.

GMS FC 952 Res Cell & Mol
Directed study. Schreiber. Var cr, Spring sem.

Appendix #2

PROGRAM IN BIOMEDICAL SCIENCES (PiBS) ELECTIVE CLASSES

The following classes are scheduled to be offered as first year PiBS electives. In some cases, enrollment might impact whether the course is actually held. Certain classes may be requirements for some of the participating departments/programs. Each department/program has designed a curriculum that will allow students who enter the program at the end of the first year in PiBS to complete these requirements after acceptance into a dissertation laboratory and department or program *i.e.* the choice of department or program isn't dictated by the program-specific requirements fulfilled during the first year.

Fall semester

GMS BI 777 Techniques in Biomedical Research
This course will complement the Foundations in Biomedical Sciences Ph.D. curriculum and focus on both fundamental and advanced experimental approaches employed in biomedical research laboratories. Specific topics covered in include: scientific and experimental design, cell culture/gene transfer, protein isolation and analysis, DNA and cloning, PCR/CRISPR technologies, DNA-protein interactions & chromatin, quantitative PCR, lipids, transgenic and knockout mice, mass spectrometry and applications, flow cytometry, microarray & next generation sequencing, and histology/confocal microscopy. Lyons. 2 cr, Fall sem. Wed 9:00am-10:50am.

GMS BY 776 Macromolecular Assemblies I
This graduate level course covers the concepts of the assembly of biomacromolecules, their structure and stabilizing forces, and biological function as related to structure. Examples are drawn from protein and protein-nucleic acid assemblies, and membrane proteins. Atkinson. 2 cr, Fall sem. Wed 1:00pm-2:50pm.

GMS FC 721 Statistical Reasoning for the Basic Biomedical Sciences
Statistics is a key competency in scientific research—never more so than today—but too often is presented in a dry and detached manner, leaving the impression that statistics is an unfortunate but necessary hurdle to clear after the real science is done. In contrast to this view, we will approach the subject from the broader perspective of *reasoning under uncertainty* as an integral part of scientific research, and statistics as essential formalizations of foundational scientific methods. In addition to building up the relevant concepts, intuitions, and theory, we will engage in hands-on exercises in class using R Studio on Shared Computing Cluster and best data-analytical practices using R Markdown. Zhang. 4 cr, Fall sem. Tue, Thu 2:00pm-4:00pm.

GMS GE 701 Principles of Genetics and Genomics
This course will serve as a foundation for understanding the heritable basis of numerous biological traits, the relationships among genes, and the regulation of their expression. Focus on the ability to use genetic systems to probe these problems, and therefore will heavily explore the experimental aspects of these investigations. Includes discussion of the impact of the genome sequences' availability on the practice of modern science. Use of case study approach to investigate the rich variety of scientific insights gained through genetic studies of cell-cell communication, aging, addiction, obesity, and others. Dasgupta. 4 cr, Fall sem. Tue, Thu 1:00pm-2:50pm.

GMS MI 713 Comprehensive Immunology
Comprehensive introduction to immunologic principles and application to current problems. This course consists of both interactive lectures and discussion sessions often involving contemporary literature. Emphasis is placed on the integration of innate and adaptive immune systems. While formal prior immunology training is not required, a sound basis in genetics and biochemistry is strongly recommended. Browning. 4 cr, Fall sem. Mon, Wed 4:00pm-5:50pm.

GMS NU 755 Molecular, Biochemical and Physiologic Bases of Nutrition I: Energy Balance and Micronutrients
This is the first semester of a 2 semester sequence (that can be taken in either order) that focuses on the Physiological, Biochemical and Molecular Bases of Nutrition. This semester will cover concepts of essential nutrients and methods for determining their requirements (DRIs), body composition, nutrition and growth, energy expenditure, regulation of energy intake, vitamins and macro-mineral metabolism (Ca, P) and micronutrients. Functions and roles of micronutrients in signaling from gene to whole organism will be discussed. Implications for nutrient requirements through the life cycle and in health and disease will be addressed. A discussion session will teach students to critically evaluate cutting-edge and seminal papers addressing each topic, and introduce students to state of the art research approaches and methodologies - basic (cell and molecular), clinical and epidemiological. Weekly writing assignments on the papers will provide experience and hone skills with scientific writing. Deeney. 4 cr, Fall sem. Tue, Thu 4:00pm-5:50pm.
Note: Prereq: at least one semester each of Biochemistry and Physiology (or equivalent) and permission of instructor required.

GMS NU 757 Molecular, Biochemical and Physiologic Bases of Nutrition: Regulation of Energy Balance **(first half of semester along with NU 755)**
This course examines mechanisms regulating body weight, body composition and food intake. Weekly discussion sessions will teach students to critically evaluate cutting-edge and seminal papers in the field, and introduce students to state of the art research approaches and methodologies - both basic (cell and molecular) and translational perspectives. Weekly writing assignments on the papers will provide experience and hone skills with scientific writing. Deeney 2 cr, Fall sem. Tue, Thu 4:00pm-5:50pm.
Note: permission of instructor required.

GMS OB 763 Basic Processes in Oral Biology
This course examines biological processes at the cellular and molecular levels. Provides a basis to understand the events that regulate inflammation; wound healing; bone formation and resorption; salivary proteins, the relevance to mineral homeostasis and anti-microbial activity; tooth development, eruption, and movement; and oral immune system and oral immunology protective and destructive aspects of oral tissues. Mochida. 2 cr, Fall sem. (followed by the 2 cr, Spring sem. class; OB 764) Mon 5:30pm-7:20pm.

GMS PA 932 Histopathology

The goal of the course is to give students a fundamental knowledge and practical experience of human and animal histology and pathology that students need to prepare for a career in pathology and laboratory medicine. This course familiarizes students with biospecimen processing and management at the organ, tissue, cellular and molecular levels. By studying different organs and organ systems, students develop an understanding of the normal and diseased state at the macro and microscopic levels. The course is reinforced with applied, hands-on laboratory sessions that would provide practical experience in the topics covered in the preceding lectures. The students learn how to dissect, preserve, process, section, and stain tissue. The teaching faculty will include "board certified pathologists" as well as experienced members of the pathology department. Andry, Duffy, 4 cr, Fall sem. Thu 3:00pm-6:50pm.

Spring semester

GMS BY 762 Foundations of Biophysics and Structural Biology I
This graduate level course provides a thorough grounding in the theory and major experimental methods of Biophysics and Structural Biology. The course covers x-ray diffraction, crystallography, electron microscopy and image processing. Atkinson. 2 cr, Spring sem. Mon 1:00pm-2:50pm.

GMS BY 777 Macromolecular Assemblies II
This graduate level course covers the concepts of the assembly of biomacromolecules, their structure and stabilizing forces, and biological function as related to structure. Examples are drawn from assemblies of lipoproteins, phospholipids, and membrane proteins. Atkinson. 2 cr, Spring sem. Wed 1:00pm-2:50pm.

GMS FC 706 Molecular Metabolism
This optional module of the Foundations in Biomedical Sciences curriculum focuses on the biochemical, cellular and molecular mechanisms that regulate cell and tissue-specific fuel metabolism. The course will present an integrated view of biochemistry and the control of cellular and organismal functions with regard to nutrient utilization. Classes include small group discussions of key papers. Mechanisms that allow cells to survive variations in nutrient supply (starvation, feeding, nutrient excess/stress) and how these mechanisms contribute to metabolic derangements and to disease pathogenesis (*e.g.* diabetes, obesity, cancer) will be discussed. This class is taught in conjunction with NU756; students registered for FC706 participate in a portion of the lectures. Deeney. 2 cr, Spring sem. Tue, Thu 4:00pm-5:50pm.
Note: permission of instructor required.

GMS FC 762 Critical Thinking in Cell and Molecular Biology
Successful biomedical research requires proposing and testing novel hypotheses. This is a difficult endeavor and requires understanding the science that came before and the proper experimental design that will enable proving a new hypothesis. To develop the critical thinking skills needed to do the research, this course will examine published research findings to understand what constitutes "good science" as well as to recognize potential inconsistencies, biases, and faulty logic in published studies. Topics discussed are selected by students and often include those that were awarded Nobel prizes, Lasker awards, or otherwise contributed significantly to our understanding of biology and disease. The course objectives include developing analytical skills, developing hypothesis statements, and refining experimental design strategies through both presentation and scientific writing exercises. Layne. 2 cr, Spring sem. Mon 9:00am-10:50am.
Note: permission of instructor required.

GMS GE 706 Deconstructing Systemic Bias: Where Biology Ends and Bias Begins
This new course will help students explore the relationship between race, ethnicity, ancestry, and identity. Students will also gain understanding of the fundamentals of human population variation at the genetic level and will demonstrate how this information has been misused in the form of "scientific racism." These principles will be used to examine the impact of underrepresentation in scientific studies and cases in which scientific racism has caused harm to marginalized groups. To integrate this knowledge, students will debunk misapplication of these concepts in examples of racism where biological principles are misrepresented. Dasgupta. 2 cr, P/F, Spring sem. Tues 1:00 – 2:50 pm.

GMS MI 701 Concepts in Virology
The goal of this course is to provide a fundamental understanding of virus molecular biology. The course will follow the replication cycle of animal viruses, focusing in detail on the molecular mechanisms that they utilize to enter cells and generate their progeny. The course will not attempt to cover all different types of viruses, but instead will examine key concepts in molecular virology, including virus structure, how viruses can attach and enter cells, express, and replicate their genomes, take advantage of the host cell translation machinery, and package and release virus progeny. There will also be lectures on antivirals and how viruses can be manipulated and used as tools. Fearns. 2 cr, Spring sem. (1st half). Mon, Thu 2:00 pm-3:50 pm.

GMS MI 823 Special Topics in Microbiology
The goals of this course are to provide a fundamental understanding of pathogen-host interactions. The course will build on prior understanding of cellular and molecular biology (e.g. the FiBS modules) and focus on host defense mechanisms that restrict pathogen invasion, pathogen mechanisms of evasion from innate and cell-intrinsic host defenses, description of virulence factors, and understanding mechanisms of bacterial and viral pathogenesis. Prior exposure to a virology or bacteriology course is beneficial. The classes will be interactive sessions consisting of a combination of PowerPoint presentations and discussion of primary research papers. The course will be aimed towards 1st and 2nd year Ph.D. students in the Division of Graduate Medical Sciences and taught by Microbiology Department faculty with expertise in viral and bacterial pathogenesis. Students will be assessed on their fundamental understanding of the course content, and their analytical and critical thinking skills. Students will be evaluated on their performance in class participation and in a written examination. Gummuluru. 2 cr. Spring sem. (2nd half). Mon, Thu 2:00 pm-3:50 pm.

GMS MM 707 Organ System Diseases
This course will address current topics in the molecular basis of nonmalignant and nonimmunologic diseases of man in the fields of Cardiovascular Disease; Hemostasis; Metabolic and Endocrine Diseases; Genetics of Renal Disease; Pulmonary Disease; Reproductive Disorders; and Dermal Diseases. Examples of topics that will be covered include the Molecular Basis of Atherosclerotic Heart Disease and Cardiomyopathy; Molecular Basis of Pre-Thrombotic Disorders (such as Factor V Leyden); Leptins and Obesity; Mitochondrial Dysfunction and Cystic Fibrosis. Jones. 2 cr, Spring sem. Tue 1:00pm-2:50pm.

GMS MM 710 Stem Cells and Regenerative Medicine
This course is designed to teach basic research and translational research skills to students in the Molecular Medicine Curriculum, using general principles of stem cells and their potential use in regenerative medicine. Students will first be exposed to the basic concepts and definitions of stem cells, the detailed study of different types of adult vs. pluripotent stem cells, and discuss ethical and practical considerations. Students will also learn about stem cell manipulation by novel gene editing techniques, recent advances in disease modeling, and the potential use of stem cells in tissue and organ regeneration. Mostoslavsky. 2 cr, Spring sem. Thu 1:00pm-2:50pm.

GMS NU 756 Molecular, Biochemical and Physiologic Bases of Nutrition: Macronutrients
Regulation of lipid, carbohydrate, and protein digestion, absorption, transport, tissue and cellular metabolism. Integration of macronutrient metabolism in response to alteration in nutritional status (*e.g.* starvation, obesity) on a whole body and tissue-specific basis. Mechanism regulating macronutrient metabolism in response to stresses such as exercise and aging and disease. A discussion session will teach students to critically evaluate research papers, provide knowledge of seminal papers in the field, and introduce students to research approaches and state of the art methods (*e.g.* assessment of metabolic flux using stable isotopes, euglycemic clamps, metabolomics). Deeney. 4 cr, Spring sem. Tue, Thu 4:00pm-5:50pm.
Note: Prereq: at least one semester each of Biochemistry and Physiology (or equivalent) and permission of instructor required.

GMS OB 764 Basic Processes in Oral Biology
This course examines biological processes at the cellular and molecular levels. Provides a basis to understand the events that regulate inflammation; wound healing; bone formation and resorption; salivary proteins, the relevance to mineral homeostasis and anti-microbial activity; tooth development, eruption, and movement; and oral immune system and oral immunology protective and destructive aspects of oral tissues. Mochida. 2 cr, Spring sem. (follows the 2 cr, Fall sem. class; OB 763) Mon 5:30pm-7:20pm.

GMS PA 910 Human Biospecimens for Research
The objective of this course is to introduce students to the creation, maintenance and efficient use of an indispensible component of translational research in medicine – human tissue and its derivatives. Lectures from invited speakers with extensive experience in human bio-specimens generation, maintenance, and utilization, will provide students with knowledge how to successfully obtain and utilize human bio-specimens. Topics will include logistics and legal aspects of creating and sustaining bio-banks, federal and institutional regulatory and funding mechanisms, and concrete examples of human bio-specimens use to generate break-through data in specific field of biomedical research. Special attention will be given to human biospecimens used in neuroscience as four neuropathologists/neuroscientists from Harvard, Yale, Columbia and Boston University are enlisted as speakers to give comprehensive overview of biospecimens utilized in neurodegenerative diseases and brain tumors. Andry, Duffy, 2 cr, Spring sem. Mon 2:00pm-3:50pm.

Appendix #3

Program in Biomedical Sciences (PiBS)
Rotation Evaluation Form

Student:_____.

Faculty Member:_____.

Rotation Dates: _____.

The purpose of this evaluation is to facilitate and document a conversation between the student and rotation faculty advisor on the success and/or potential shortcomings of the rotation. The goal is to generate honest constructive feedback on the student's performance during the lab rotation and assess the possibility of the student joining the lab for their dissertation research. Please note the lab rotations are pass/fail so this evaluation does not dictate a specific grade. Rather, it is important to identify both the student's strengths as well as areas to improve upon in the future. Likewise, the student has a chance to give feedback on the rotation if they so desire. The rotation faculty advisor and PiBS student should fill out the following form, discuss and sign it. The student will then submit it to the PiBS Advising Committee (*i.e.* their PIBS Faculty Advisor and the Chair of PiBS Advising).

Rotation Faculty Advisor Section:
(To be filled out by the Rotation Faculty Advisor)

Please rate the student's performance on a 1 to 5 scale (1 being the best) in the following areas:
*Knowledge of the field:*_____
Work ethic: _____
Ability to learn (new techniques, analyses etc): _____
Communication skills: _____
Ability to work with others: _____
Overall performance: _____

What are the strengths that the student should aim to continue to enhance?

***What areas should the student try to improve*?**

What new techniques did the student learn?

Evaluation of presentation/final report:

Would you consider having the student join your lab?

Is there anything else you want to add about the student's overall performance in the laboratory rotation?

Student Section:
(To be filled out by the rotation student; this section is optional. Concerns can also be reported directly to the student's PiBS Faculty Advisor)

What new techniques did you learn?

Did you receive adequate guidance, training and support from the lab members?

Please comment on the clarity about the lab opening (i.e. was it clear how much funding there is to support graduate students, number of graduate student openings, number of students rotating in the lab this year etc.?)

Would you consider joining this lab for your dissertation work?

_____.
(Rotation Advisor signature) (Date)

_____.
(Student signature) (Date)

This form was submitted to the PiBS Advising Committee_____.
(Date)