Boston University Chobanian & Avedisian School of Medicine
Graduate Medical Sciences

Program in Biomedical Sciences (PiBS)

Graduate Handbook
2026-2027

* Approved by the PiBS Executive Committee

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1. Welcome

Welcome to the PhD Program in Biomedical Sciences (PiBS). at the Boston University Chobanian & Avedisian School of Medicine. This umbrella program embodies 9 participating departments/programs within the medical school (Biochemistry & Cell Biology, Biophysics, Genetics & Genomics, Virology, Immunology & Microbiology, Molecular & Translational Medicine, Nutrition & Metabolism, Orofacial & Skeletal Biology, Pathology and Physiology). 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 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 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
goffner@bu.edu / (617) 358-9541
2) Karen Symes, Ph.D., Assistant Dean of Student Affairs (MED)
symes@bu.edu / (617) 358-4578

Angie Harris is facilitator.

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:
https://www.bu.edu/eoo/

3. Disability and Access Services

Boston University Chobanian & Avedisian School of Medicine is committed to equal access for students with disabilities. If you require accommodations for a disability, note that you must be approved by Disability & Access Services before services can be provided so please be sure to apply early in the semester. Visit the GMS website for information to start the approval process. The central BU Disabilities Office can be contacted by phone (617-353-3658) or email (access@bu.edu). All discussions and written materials will be kept confidential.

4. 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 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.

5. 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.

6. Academic Requirements

The PiBS Ph.D. program requires a minimum of 64 units. Some of these units 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 2026 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 units)

Table I. PiBS COURSE REQUIREMENTS

Semester	Units	Course
Fall	3	FC 712 Foundations in Biomedical Sciences: Structure and Function of the Genome
Fall	3	FC 725 Foundations in Biomedical Sciences: Bioinformatics and Quantitative Biology
Fall	2	FC 764 Professional Skills
Spring	3	FC 711 Foundations in Biomedical Sciences: Protein Structure, Catalysis and Interaction
Spring	3	FC 713 Foundations in Biomedical Sciences: Architecture & Dynamics of the Cell
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 calendar. 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	August 31, 2026
Fall semester classes starts	September 3, 2026
*Fall semester final exams end (Boston University calendar)	December 18, 2026
*Spring semester classes start (Boston University calendar)	January 19, 2027 (but note that rotations start on January 6, 2027)
*Spring semester final exams end (Boston University calendar)	May 7, 2027

*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.

Prior to assignment of a dissertation advisor, students' on campus requirements are dictated by the schedule of classes and rotations.

During the first year in the program, it is expected that students will register for at least 10 didactic course units 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. Students also register for "research" units such that the total coursework requires at least 12 units/semester.

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 Graduate Educators and Mentors, GEMS).

All graduate students are also required to complete Boston University's Program in Responsible Conduct of Research (RCR) class. See details at: https://www.bu.edu/research/ethics-compliance/responsible-conduct-of-research/training-programs/rcr-for-doctoral-or-postdoctoral-researchers/

Grading policies for GMS can be found at: https://www.bu.edu/academics/gms/policies/grades-and-course-credits/.

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 units will be dismissed from the program.

Additional Requirements and Guidelines

During the first year in the program, students must successfully complete 12 course units/semester as described above (PiBS required courses listed in Table I as well as elective courses and "research" units). Failure to do so will result in the student being placed on academic probation.

In addition, 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.

Any student placed on academic probation has one year to remediate the deficiency and complete the coursework that resulted in the probationary status and/or 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.

Students must complete three laboratory rotations prior to choosing a laboratory in which to perform the dissertation research work. Moreover, students must be accepted by a faculty member into a dissertation laboratory and a department or program by June 30th of the first year in the program. Students who fail to complete the required rotations or to get accepted into a dissertation laboratory and PiBS-affiliated program will be dismissed.

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.

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 unless used for in-class polling. 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 policies and procedures for Master's and PhD programs.

7. Rotations

Home labs

Students will be assigned a "home lab" for the first part of the fall semester before formal rotations start. Home labs will run Sept 8 through Oct 2. Students will be assigned to their home lab by the PiBS executive committee. Home labs will be a place on campus where the student can go when not in class. It is meant to be informal and is not an official lab rotation. Students are encouraged to meet people in their lab and others outside the first-year PiBS cohort, as well as learn about the research in their home lab. Students should have desk space assigned to them in the lab as well as a lab mentor they can shadow. Students are expected to shadow a lab member and attend lab meetings for approximately 10 hours over the 4-week home lab period. No additional lab work is required. While in their home labs, students must adhere to the lab's safety protocols. At the end of the home lab period, students will give a brief 5 min presentation describing their home labs research in the FC 764 Professional Skills course.

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 13, 2026	December 9, 2026
#2	January 6, 2027	February 26, 2027
#3	March 15, 2027	April 30, 2027

Students are expected to spend a minimum of 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" units (FC 951, FC 952) during the semester(s) in which the rotations are performed.

8. 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.

9. 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.

10. 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

GMS FC 712 Foundations in Biomedical Sciences: 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, Symes. 3 cr, Fall sem. Sept. 8-Oct. 16; Tue, Thu, Fri 10:00am-11:50am.

GMS FC 725 Foundations in Biomedical Science: Bioinformatics and Quantitative Biology
This module will give students a introductory working knowledge of analysis and techniques in bioinformatics and quantitative biology. I topic per week will be covered. Each week will include ~15-30 minutes of lecture that will introduce the biological question addressed, the way that the data is generated, and the general concepts of data analysis. The remainder of the class sessions will be hands-on work on data analysis. We plan to primarily use R for analysis and data visualization but will also use the SCC/bash for some data analysis steps. The use of these programs will be interwoven throughout the classes as we introduce new concepts (no class will be entirely devoted to R or the SCC). The class will also include paper discussions where we pick a paper that uses some of the analysis that we have discussed. We will look at different ways that the same type of data is presented and emphasize an understanding of the methods in papers. Blower, 3 cr, Fall sem. Oct. 20-Dec. 8; 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, Jones. 2 cr, Fall sem. Mon 10:00am-11:50am.

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

Spring semester

GMS FC 711 Foundations in Biomedical Sciences I: Protein Structure, Catalysis and Interaction
This module of the Foundations in Biomedical Science course "Protein structure, catalysis and interactions" will provide students with a quantitative understanding of protein structure, function, posttranslational modification and the turnover of proteins in the cell. In addition, students will gain facility with thermodynamics, catalysis, kinetics and binding equilibria as they apply to proteins and also to other molecules in biological systems (e.g., nucleic acids, lipids, vitamins, etc.). This course is part of a series of four core integrated courses and additional elective courses aimed towards first year Ph.D. students in the Division of Graduate Medical Sciences. The four cores will be integrated in content and structure, and therefore are intended to be taken as a complete, progressive sequence. Gursky, Spencer. 3 cr, Spring sem. Jan. 19-Mar. 5; Tue, Thu, Fri 10:00am-11:50am.

GMS FC 713 Foundations in Biomedical Sciences: Architecture & Dynamics of the Cell
The third module of the Foundations in Biomedical Sciences course will focus on the movement of proteins and membranes with 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. 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 to-wards first year Ph.D. students in the Division of Graduate Medical Science. The four cores will be integrated in content and structure, and therefore are intended to be taken as a complete, progressive sequence. Trinkaus-Randall, Hagedorn 3 cr, Spring sem. Mar. 16-April 29; 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, Gabel 2 cr, Spring sem. Wed 10:00am-11:50am.

GMS FC 952 Res Cell & Mol
Directed study. Gabel. 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. Bullitt. 2 cr, Fall sem. Mon 1:00pm-2:50pm.

GMS FC 721 Statistical Reasoning for the Basic Biomedical Sciences
Biomedical research entails the inference of reliable knowledge from incomplete, noisy data. The ability to reason effectively in the midst of such uncertainty is a key component of success in the field. Students in FC721 will learn both judgment and technique. Judgment will be developed through discussion of key concepts in statistics while developing sound intuition through in-lecture short exercises. Technical skill will be acquired in the statistical computing language R using the powerful user interface R Studio. Topics covered will include Exploratory Data Analysis, estimation, probability, hypothesis testing, statistical modeling (linear regression, Logistic regression, non-linear regression), experimental design, and reproducibility. Zhang. 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 MM 730 Biological Core Technologies
The major goal of this course is to provide an overview of the principles and applications of modern techniques, which are regularly employed in academia and industry as tools for biomolecular and biomedical investigation. This course will focus on technologies that are available at Boston University Chobanian & Avedisian School of Medicine. Specific technologies include microscopy, FACS, IHC, qPCR, genomic (next gen sequencing and

microarrays), proteomics techniques, HTS, fluorescence molecular tomography, ultrasound, and metabolic phenotyping techniques. Gerstenfeld. 3 cr, Fall sem. Wednesdays 9:00am-11:50am.

GMS MM 725 Biology of the Lung and Pulmonary Disease
This course will cover topics in basic lung biology including cellular components and functions in the respiratory system and how the processes of immunity and development influence lung structure and function. The course will apply this basic biology to cutting edge developments in pulmonary diseases including the acute respiratory distress syndrome, pneumonia, asthma, pulmonary hypertension, pulmonary fibrosis, chronic obstructive pulmonary disease, and lung cancer. 2 cr. Fall sem. Wednesdays 1:00pm-2:50pm.

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. Writing assignments on the papers will provide experience and hone skills with scientific writing. Deeney. 4 cr, Fall sem. Tue 4:00pm-5:20pm, Thu 4:00pm-6:20pm.
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 4:00pm-5:20pm, Thu 4:00pm-6:20pm. Class meets during selected weeks in the fall semester. Contact instructor for details. Note: permission of instructor required.

GMS PA 932 Histopathology
This course provides students with a foundational understanding and hands-on experience in human and animal histology and pathology, with direct application to research. Students will become familiar with biospecimen processing and management at the organ, tissue, cellular, and molecular levels. Through the study of various organs and organ systems, students will gain insight into both normal and pathological states at macro- and microscopic scales. Lecture content is reinforced through applied laboratory sessions, where students will gain practical experience in tissue dissection, preservation, processing, sectioning, and staining. Andry, Duffy. 4 cr, Fall sem. Tu/Thu 2:00pm-3:50pm.

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.

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. Bullitt. 2 cr, Spring sem. Mon 1:00pm-2:50pm.

GMS FC 715 Translational Genetics and Genomics
Modern human genetics has evolved at a tremendous pace, with the promise of an affordable complete genome sequence for every individual just around the corner. While the raw information has increased exponentially, its translation to patient care has not kept pace. We will discuss exciting recent advances in human genetics and genomics, with illustrative examples of their translation into improvements in diagnosis and treatment of patients. We will also discuss ethical and societal challenges of this rapidly evolving field. Our course is aimed at first or second year Ph.D. students, and will be taught by faculty in a variety of departments through traditional lectures and discussion sections. Students will be evaluated on their ability to explain the translational research process and demonstrate how individual research findings build on one another to move a field forward to ultimately impact patient care. 3 cr, Spring sem. Mon 10:00am-12:00pm, Friday 1:00-3:00pm

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, Mon, Wed 1:00pm-2:50pm. consent of instructor

GMS GE 706 Deconstructing Systemic Bias: Where Biology Ends and Bias Begins
This course will help students explore the relationship between race, ethnicity, ancestry, sex, gender, ability status, 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 and bias have caused harm to marginalized groups. To integrate this knowledge, students will debunk misapplication of these concepts in examples of racism and other forms of bias where biological principles are misrepresented Dasgupta. 2 cr, P/F, Spring sem. Tue 1:00pm-2:50pm.

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 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 4:00pm-5:20pm, Thu 4:00pm-6:20pm.
Note: Prereq: at least one semester each of Biochemistry and Physiology (or equivalent) and permission of instructor required.

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 4:00pm-5:20pm, Thu 4:00pm-6:20pm.
Note: 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 FC 709 Research Design and Statistical Methods for Biomedical Sciences
This course is designed to provide students with an understanding of basic concepts in research design and data analysis for biomedical sciences using the SAS programming language. The course covers hypothesis generation, experimental designs (and to a lesser degree, non-experimental designs), bias and confounding, data description, parametric and non-parametric analyses, and the basics of univariable and multivariable modeling. Each class includes both a didactic session and in-class analytic exercises. Moore, 3 cr., Spring sem. Mon 10:00 - 11:50 am. Co-listed as NU709.

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)