A graduate program

Molecular and Cell Biology

Courses of Study:
Master of Science
Doctor of Philosophy

Objectives

The graduate program in molecular and cell biology, leading to the degree of Doctor of Philosophy, is designed to provide each student with the theoretical foundations and research experience needed to become an independent and original investigator of basic biological phenomena. Preparation is achieved through the combination of (1) a flexible curriculum of required and elective courses tailored for each student's specific needs, (2) a set of laboratory rotations that acquaints each entering student with current research techniques and permits exploration of possible research areas, and (3) a proseminar specifically for first-year students and a series of journal clubs that keep students abreast of significant research findings and develop confidence with reading research literature and giving oral presentations. First-year students participate in all three aspects of our graduate program and are thus quickly integrated into the biological research community at Brandeis. A strength of our program is frequent interaction between students and faculty, formal and informal.

Thesis research leading to the PhD degree is carried out under the personal direction of a faculty member. A complete list of faculty research interests and recent publications can be viewed online at www.bio.brandeis.edu. Potential applicants are urged to obtain this information. As a general orientation, the following areas of research are among those represented in the program: molecular biology of the regulation of gene expression; chromosome structure and chromosomal rearrangements; mechanisms of recombination; developmental genetics; behavioral genetics and neural development; biophysics of single nerve cells; learning and memory; integration of neural function; immunogenetics; immune cell differentiation and development; molecular biology of the immune system; regulation of muscle contraction; molecular and cell architecture; organization of subcellular structures; structure and function of proteins; mammalian embryogenesis and the biotechnology of DNA diagnostics.

How to Be Admitted to the Graduate Program

The general requirements for admission to the Graduate School, given in an earlier section of this *Bulletin*, apply to candidates for admission to this area of study. The student's undergraduate record should ordinarily include courses equivalent to those required of undergraduates concentrating in biology at this institution. Applicants to the PhD program who are deficient in some of these subjects, but whose records are otherwise superior, may make up their deficiencies while they are enrolled as graduate students. In exceptional cases, students may be excused from some of these requirements. Students with serious deficiencies must, however, expect to add additional time to their graduate program in order to satisfy the deficiencies.

Applicants must take the Graduate Record Examination.

Since the summer months provide an important opportunity for uninterrupted laboratory work, the molecular and cell biology program provides twelve-month stipend support for all full-time PhD students.

Faculty

Jeffrey Agar (Rosenstiel Center; Volen National Center for Complex Systems)
Mass spectrometry.

Susan Birren (National Center for Behavioral Genomics; Volen National Center for Complex Systems)
Developmental neurobiology.

Carolyn Cohen (Rosenstiel Center)
Structural molecular biology.

Paul Garrity (National Center for Behavioral Genomics; Volen National Center for Complex Systems)
Neural development and behavior.

Bruce Goode (Rosenstiel Center)
Biochemistry and genetics of yeast cytoskeleton.

Leslie Griffith (National Center for Behavioral Genomics; Volen National Center for Complex Systems)
Biochemistry of synaptic plasticity.

James Haber (Director, Rosenstiel Center)
Genetics and molecular biology of yeast meiotic and mitotic recombination. Mating-type switching. Repair of broken chromosomes.

Jeffrey Hall (Volen National Center for Complex Systems)
Neurogenetics and molecular neurobiology of higher behaviors in *Drosophila*.

Kenneth Hayes (Director, Foster Animal Lab)
Comparative nutritional pathophysiology in man and animals. Lipoprotein metabolism and atherogenesis, cholelithiasis.

Susan Lovett (Rosenstiel Center)
Genetics and molecular biology of bacteria and yeast. DNA repair. Recombination and mutogenesis.

Daniela Nicastro (Rosenstiel Center)
Electron tomography of cellular and macromolecular structures.

Gregory Petsko (Rosenstiel Center)
X-ray crystallographic analysis of protein structure and enzyme mechanisms.

Joan Press (Rosenstiel Center)
Developmental immunology and immunogenetics.

Ruibao Ren (Rosenstiel Center)
Signal transduction.

Michael Rosbash (National Center for Behavioral Genomics)
RNA processing and molecular neurobiology.

Piali Sengupta (National Center for Behavioral Genomics; Volen National Center for Complex Systems), Graduate Advising Head
Developmental neurobiology in *C. elegans*.

Neil Simister (Rosenstiel Center)
Molecular immunology. Antibody transport.

Lawrence Wangh
Mammalian embryogenesis, gene expression in single cells, DNA amplification and *in vitro* DNA diagnostics.

Requirements for the Degree of Master of Science

Program of Study
The program is designed to guide each student toward realizing her or his potential as an independent research biologist. Students are encouraged to become experts in the theory and practice of their chosen area of research, as well as to obtain breadth in other areas strongly represented in the program. Research areas include genetics, molecular biology, developmental biology, cell biology, structural biology, immunology, and neurobiology. Graduate courses are available in all of these areas. A total of six graduate-level courses, which must include BIOL 103b, BIOL 105b, and one laboratory or research-based course, with the balance to be agreed upon with the program advisor, are required for the degree. The laboratory or research component can be met by BIOL 300, BIOL 155, BIOL 298, or BIOL 299 and is typically taken in the spring. All students are required to take CONT 300b (Ethical Practice in Health-Related Sciences), usually offered in the spring. The student must receive grades of B– or better in all courses and may be terminated at the end of the first semester if the student's record is unsatisfactory.

Residence Requirement
The minimum residence requirement is one year.

Requirements for the Degree of Doctor of Philosophy

Program of Study
Students are expected to obtain a knowledge of the principles and techniques of three of the areas represented in the program, i.e., genetics, developmental biology, molecular biology, neurobiology, immunology, cell biology, and structural biology. The background a student is expected to have in these areas will be covered in courses given by the program. Entering students also participate together in a proseminar, an introduction to the research literature of biology. Students take two courses each semester in the first year, with a total of six required for the degree. Required courses are BIOL 103b, BIOL 105b, and BIOL 200a. In the first year, students will complete four nine-week rotations in at least four different laboratories. Throughout the graduate years, students remain involved in seminar courses, journal clubs, presentations of research, colloquia, and research courses.

Each student will choose his/her specific field of interest and will apply for a permanent advisor to be agreed upon by the program at the end of the first year. The advisor will assist the student in planning a well-balanced program in his/her specific field of interest. In addition, the advisor will ordinarily serve as the chair of the student's dissertation examining committee.

Teaching Requirement
At least one year of teaching experience (or equivalent) is required of all degree candidates.

Residence Requirement
The minimum residence requirement is three years.

Language Requirement
There is no foreign language requirement for the PhD degree. However, students for whom English is a second language are strongly recommended to take remedial English courses.

Qualifying Examination
The qualifying examination consists of two research propositions in which the student identifies an important and interesting research problem and then proposes the experiments to attack it. The propositions are written and the student gives an oral defense. The first proposition, which is taken by the end of the first year, must be in an area outside the student's area of thesis research. The second proposition constitutes a thesis proposal and is taken by the end of the second year.

Advancement in the Program
To pass into the second year of graduate studies, the student must have grades of B– or better in all courses, must have a satisfactory evaluation of the first proposition, and must have found a laboratory in which to carry out thesis research.

To pass into the third year and be admitted to candidacy, the student must have grades of B– or better in all six courses, have performed satisfactorily on both propositions, and be in good standing in the thesis-research laboratory.

Dissertation and Defense
Each student will conduct an original investigation. After submission of the dissertation, the candidate will be expected to present the principal results of his or her work and its significance during an examination in defense of the dissertation. The examining committee must include one faculty member from outside the university. A public seminar to the university community is also required.

Requirements for the Degree of Doctor of Philosophy in Molecular and Cell Biology with Specialization in Quantitative Biology

Program of Study
Students wishing to obtain the specialization must first gain approval of the graduate program chair. This should be done as early as possible, ideally during the first year of graduate studies. In order to receive the PhD in molecular and cell biology with additional specialization in quantitative biology, candidates must complete (a) the requirements for the PhD described above and (b) the course requirements for the quantitative biology specialization that are described in the quantitative biology section of this *Bulletin*.

Any alteration to the quantitative biology course requirements must be approved by the graduate program chair and by the quantitative biology program faculty advisory committee.

Courses of Instruction

(100–199) For Both Undergraduate and Graduate Students

BIOL 101a Molecular Biotechnology
[sn]
Prerequisite: BIOL 22a.
A study of the molecular basis of DNA replication, RNA transcription, RNA processing and editing, protein synthesis, and structure function relationships with emphasis on DNA and protein manipulation and molecular biology techniques. Usually offered every year.
Ms. Kosinski-Collins

BIOL 102b Structural Molecular Biology
[sn]
Prerequisites: BIOL 22a and BIOL 22b, or permission of the instructor.
Cells are filled with machines that carry materials about the cell, that chemically transform molecules, that transduce energy, and much more. Our understanding of how these machines work depends on understanding their structures. This introduction to the structural basis of molecular biology examines the designs of proteins and nucleic acids, their assembly into macromolecular complexes, and the means whereby we visualize these structures. Considers the physical and chemical basis for specificity in molecular recognition. Usually offered every second year.
Staff

BIOL 103b Mechanisms of Cell Functions
[sn]
Prerequisite: BIOL 22b or permission of the instructor.
An advanced course focusing on a mechanistic understanding of cell biological processes and the methods by which these processes are elucidated. Papers are chosen to illustrate a variety of experimental approaches including biochemistry, genetics, and microscopy. Topics include cell cycle, signal transduction, cytoskeleton and cell movement, membrane traffic, and intercellular transport. Usually offered every year.
Mr. Goode and Ms. Nicastro

BIOL 105b Molecular Biology
[sn]
Prerequisites: BIOL 22a and BIOL 22b.
Examination of molecular processes in replication and expression of genetic information and techniques by which this understanding has been achieved. Topics include recombinant DNA and other molecular biological techniques, structure and organization of DNA in chromosomes, DNA replication, transcription and regulation of gene expression, RNA structure and processing, mRNA stability, and other mechanisms of post-translational control. Usually offered every year.
Ms. Lovett and Mr. Rosbash

BIOL 111a Developmental Biology
[sn]
Prerequisite: BIOL 22b.
How do complex organisms build themselves starting from single cells? Examines how processes such as fertilization, embryogenesis, cell differentiation, and tissue-specific gene expression occur; what is known about the key molecules and genes that orchestrate these processes; and how genetic changes affecting these processes underlie the evolution of body form. Usually offered every second year.
Ms. Birren

BIOL 122a Molecular Genetics
[sn]
Prerequisite: BIOL 22a.
A lecture- and literature-based course emphasizing strategies of genetic analysis in understanding complex processes such as the control of DNA replication or the regulation of the cell cycle and cell differentiation. A second emphasis is on the mechanisms that preserve genetic stability and ensure accurate transmission of genetic information from generation to generation in both somatic and germ cells. Classical genetic methods and molecular genetic and genomic approaches are examined. Research papers of current and historical interest are discussed. Usually offered every second year.
Mr. Haber

BIOL 125a Immunology
[sn]
Prerequisites: BIOL 22a and BIOL 22b.
Topics include properties, functions of cells involved in innate and adaptive immunity; genes, structure, function of immunoglobins and T cell receptors; cell interactions; lymphocyte differentiation; genetic regulation; MHC restriction; cell interactions and signaling; tolerance and autoimmunity; vaccines; viral immunity; AIDS. Usually offered every year.
Ms. Press

BIOL 126b Protein Structure and Disease
[sn]
Prerequisites: BIOL 22a and BIOL 22b, or the equivalent, or permission of the instructor.
Reviews the basic principles of protein structure so that the functional aspects of different protein designs may be understood. Examines various protein mutations related to certain molecular diseases and the architecture of some key viruses and their infectivity. Consideration of drug design is an integral part of the course. Student presentations are essential to the course. Usually offered every second year.
Ms. Cohen

BIOL 128a Human Genetics
[sn]
Prerequisites: BIOL 22a and BIOL 22b.
Survey of topics, including: mutation and polymorphism; molecular methodology; single-gene inheritance and complexities thereof; multifactorial conditions, risk assessment and Bayesian analysis; cytogenetics; hemoglobinopathies; population genetics; gene mapping; cancer genetics; ethical considerations in genetics; immunogenetics; pharmacogenetics; genetics of development; biochemistry of selected genetic diseases; gene therapy, genomics, proteomics, and bioinformatics. Usually offered every year.
Ms. Hiller

BIOL 132a General Microbiology
[sn]
Prerequisites: BIOL 22a and BIOL 22b, CHEM 25a and 25b.
A survey of the physiology of bacteria and other microorganisms. Concentrates on those aspects of cell structure and function that are important for diverse microbial lifestyles. In addition, pays special attention to the biology of disease-causing organisms and microbiological problems facing medicine today. Usually offered every second year.
Ms. Press

BIOL 134b Tropical Ecology
[sn oc]
Prerequisite: BIOL 23a or permission of the instructor.
Offers an in-depth look at tropical ecology focusing on the question: why are tropical regions ecologically so different from temperate and polar regions? Usually offered every second year.
Mr. D.L. Perlman

NBIO 136b Computational Neuroscience
[sn]
Prerequisite: MATH 10a or PHYS 10a or approved equivalents.
An introduction to concepts and methods in computer modeling of neural systems. Topics include the basic biophysics of ion conduction, single and multicompartment neuron models, information representation and processing in the visual system, and models of synaptic plasticity, working memory, and decision making. Usually offered every second year.
Mr. Miller

NBIO 139b The Neurobiology of Brain Disorders
[sn]
Prerequisite: NBIO 140b.
Explores the basic mechanisms underlying some of the major mental illnesses that have provided insight into normal brain functioning. Primary sources are used to compare ideas about the bases and treatments of these diseases. Special one-time offering, spring 2008.
Ms. Grashow

NBIO 140b Principles of Neuroscience
[sn]
Prerequisite: BIOL 22b or permission of the instructor.
Examines the basic principles of neuroscience. Topics include resting potentials, action potentials, synaptic transmission, sensory systems, motor systems, learning, neural circuits underlying behavior, neurological diseases, and mental illness. Usually offered every year.
Mr. Lisman

BIOL 141b Molecular Pathophysiology
[sn]
Prerequisite: BIOL 42a, BCHM 100a, or NBIO 140b, or permission of the instructor.
An in-depth investigation of the molecular mechanisms by which the body's organ systems maintain health/homeostasis and succumb to genetic diseases (e.g. cystic fibrosis, Parkinson's disease, ALS), with additional emphasis on understanding how the body adapts to physical exertion and exercise. Usually offered every second year.
Mr. Dore

NBIO 143b Developmental Neurobiology
[sn]
Prerequisite: BIOL 22b or permission of the instructor.
Discusses the mechanisms used in the development of the nervous system. Topics include determination of neuronal cell fates, neuronal differentiation and pattern formation, neuron survival and growth, and mechanisms responsible for generation of connectivity in the nervous system. Usually offered every second year.
Ms. Sengupta

NBIO 145b Systems Neuroscience
[sn]
Prerequisite: NBIO 140b.
A fundamental question in neuroscience is how our brains extract and compute features and functions—such as direction of motion from visual stimuli—and how experience allows the microcircuits within our brains to become better tuned to such features. Understanding these processes requires insight into the cellular and network mechanisms that give rise to them. We will begin by examining the classical literature, and then we will move on to recent advances in understanding the cellular and network properties of brain microcircuits. The course emphasizes reading from original papers, and extensive class discussion. Usually offered every year.
Ms. Turrigiano

NBIO 146a The Neurobiology of Human Disease
[sn]
Prerequisite: NBIO 140b.
A lecture- and literature-based overview of the neurobiological underpinnings of neurological and psychiatric disorders including autism, mental retardation, schizophrenia, bipolar disorder, Alzheimer's disease, Parkinson's disease, and other neurodevelopmental and neurodegenerative disorders. Usually offered every second year.
Mr. Nelson

NBIO 147a Neurogenetics
[sn]
Prerequisites: BIOL 18a and BIOL 22a.
Development and function of the nervous system and responses of excitable cells studied in neurological and behavioral mutants. Characterization and manipulation of genes, defined by these mutations and using molecular biological tools. Organisms: microbes, roundworms, fruit flies, mammals. Neurobiological areas: embryonic neural development, nerve cell differentiation and pattern formation, membrane excitability, responses to visual and chemical stimuli, biological rhythms, and reproductive behavior. Usually offered every third year.
Staff

NBIO 148b Cellular Neuroscience
[sn]
Prerequisite: NBIO 140b or permission of the instructor. May be taken concurrently with NBIO 140b.
Focuses on cellular and molecular mechanisms of excitability and synaptic plasticity. Students examine classic experiments on action potentials and synaptic transmission and the original research literature dealing with the cellular mechanisms of developmental and learning-related plasticity. Usually offered every year.
Mr. Nelson

BIOL 149b Molecular Pharmacology
[sn]
Prerequisites: BIOL 22b and CHEM 25a and b. NBIO 140b strongly recommended.
Covers the essentials of pharmacology and the study of the actions of chemical agents (drugs, toxins, neurotransmitters, and hormones) that interact with living systems. Emphasizes molecular mechanisms of neuropharmacology. Topics include pharmacokinetics, hormone action, autonomic pharmacology, and the psychopharmacology of drugs of abuse and mental disorders. Usually offered every third year.
Ms. Griffith

NBIO 150a Autism and Human Developmental Disorders
[sn]
Prerequisite: BIOL 22b.
Autism and other developmental disorders are characterized by abnormal brain development resulting in cognitive and behavioral deficits. Takes an integrative approach to investigate the biological, behavioral, medical, and social aspects of human developmental disorders. Usually offered every second year.
Ms. Birren

BIOL 155a Project Laboratory in Genetics and Genomics
[sn]
Prerequisites: BIOL 18a,b and 22a,b.
This small, laboratory-based course provides a unique opportunity for students to pursue an independent research project. Each year focuses on a specific topic, such as bacterial genetics, epigenetic mechanisms of gene regulation, or microbial diversity, and students will design and carry out original experiments. Students will learn basic molecular biology techniques, genetic and genomic analysis, and experimental design. Usually offered every year.
Ms. Lovett and Mr. Morris

BIOL 160b Human Reproductive and Developmental Biology
[sn]
Prerequisites: BIOL 22a and BIOL 22b.
Course deals with hormonal, cellular, and molecular aspects of gametogenesis, fertilization, pregnancy, and birth. Pathological and abnormal variations that occur and the available medical technologies for intervention, correction, and facilitation of these processes are discussed. Usually offered every year.
Ms. Jackson

BIOL 172b Growth Control and Cancer
[sn]
Prerequisites: BIOL 22a and 22b.
Covers the fundamental rules of behavior of cells in multicellular organisms. Examines cellular and molecular mechanisms that govern cell growth, and differentiation and survival in normal cells, as well as how this regulation is disrupted in cancer. Usually offered every second year.
Mr. Ren

BIOL 174b Stem Cells
[sn]
Prerequisites: BIOL 22a and BIOL 22b.
Stem cells are cells that can both undergo self-renewal and give rise to all cells or special cell types of the body. They have the potential for the restoration of lost organ function that cannot be achieved through traditional drug therapies. Covers stem cell biology, cell differentiation and transdifferentiation, cell lineage commitment, gene expression regulation, signal transduction, cell identity memory, and cell therapies. Provides a unique way to gain insights into developmental biology, molecular and cell biology, cancer biology, biology of aging, and regenerative medicine, as well as bioethics and health and public policies. Usually offered every second year.
Mr. Ren

BIOL 175b Advanced Immunology: Topics in Infectious Disease
[sn]
Prerequisites: BIOL 125a and permission of the instructor.
An advanced lecture- and literature-based course that focuses on a select group of microorganisms (bacteria, viruses, etc.) considered important in human disease. Topics include mechanisms/determinants of pathogenicity, immune evasion, host immune responses, vaccines, public health issues, and bioterrorism agents. Usually offered every second year.
Ms. Press

(200 and above) Primarily for Graduate Students

BIOL 200a Proseminar
For first-year PhD students. Emphasizes the reading, analysis, and presentation of scientific papers. There is considerable emphasis on oral presentations and writing. Students will be guided toward preparing research papers and grant applications, presenting talks and posters at scientific meetings, and writing and defending PhD qualifying exams. Also examines how scientists frame important questions and design appropriate experiments. Papers will be chosen by the instructor for discussions and exercises. Papers focus on one specific research topic while encompassing a broad range of molecular biological, genetic, structural, and biochemical approaches. Usually offered every year.
Ms. Sengupta

BIOL 202d Introduction to Genetic Counseling
A two-semester sequence that provides the historical and theoretical foundations for the practice of genetic counseling and the role of genetic services within the health care delivery system. Introduces students to some of the practical aspects of genetic counseling, including case preparation, pedigree construction/interpretation, and medical documentation. Usually offered every year.
Ms. McIntosh

BIOL 203a Proseminar: The Molecular Basis of Genetic Diseases
Covers the molecular basis of muscular dystrophy, fragile X syndrome, cystic fibrosis, Huntington's disease, and several inherited cancer syndromes. A historical perspective is used for each topic; molecular diagnostics and genetic counseling issues are addressed as well. Usually offered every year.
Ms. Tsipis

BIOL 204b Clinical Genetics I
Introduction to basic concepts of biochemical genetics, cytogenetics, and clinical molecular genetics. Makes use of clinical cases ranging from single gene disorders to multifactorially determined conditions and includes problems in dysmorphology, inborn errors of metabolism, and cancer genetics. A problem-solving approach is emphasized. Usually offered every year.
Ms. Schneider and Ms. Stoler

BIOL 205b Counseling Theory and Technique
A comprehensive overview of counseling theory and practice. Topics include listening, observation, and interview skills and strategies; family dynamics and development; coping and adaptation processes; referral and consultation procedures; and ethical principles. Students are provided an opportunity to integrate clinical experiences with the coverage of topics. Usually offered every year.
Mr. Rintell

BIOL 206d Genetic Counseling Journal Club
Noncredit.
Informal biweekly meeting of students and faculty at which recent papers are discussed. Usually offered every year.
Staff

BIOL 207a Genetic Counseling: Case Conferences and Family Counseling
Taught by a team of health care professionals. Case studies provide the basis for discussion of a variety of genetic disorders and the application of counseling modalities. Students have an opportunity to share experiences gained during clinical internships. Discussions emphasize the interplay of medical, psychological, ethical, legal, social, and cultural factors in genetic counseling. Usually offered every year.
Ms. McIntosh and Mr. Rintell

BIOL 211a Genetic Counseling Fieldwork Placement: Part I
Students work one day per week in a community-based health service organization, school, clinic, or public health agency to develop awareness of disability-related issues and the variety of community-based services for individuals with special needs. Students also observe in a genetics clinic twenty to thirty hours over the course of the semester to gain exposure to concepts learned in BIOL 202d (Introduction to Genetic Counseling). Periodic course discussions supplement the fieldwork experience.
Ms. Rosen-Sheidley

BIOL 211b Genetic Counseling Fieldwork Placement: Part II
To begin preparing for clinical genetics internships, students participate in a variety of experiences that serve to foster and integrate the concepts introduced in courses and presentations. Students are exposed to procedures in clinical labs through lectures, site visits, and/or lab work. In addition, students continue observations in a genetics clinic and meet several times with a family with a child with a disability. Periodic course discussions supplement the fieldwork experience.
Ms. Rosen-Sheidley

BIOL 212a Genetic Counseling Internship I
Starting in the summer and continuing through the fall semester, students work two to three days a week under the supervision of a genetic counselor or clinical geneticist in a prenatal, pediatric, general, cancer, or specialty genetics clinic. Usually offered every year.
Ms. McIntosh

BIOL 212e Genetic Counseling Internship II
Students work two to three days a week under the supervision of a genetic counselor or clinical geneticist in a prenatal, pediatric, general, cancer, or specialty genetics clinic and meet once a week to discuss cases and develop counseling protocols for some common genetic disorders. Usually offered every year.
Ms. McIntosh

BIOL 213d Genetic Counseling Research Project
Students are introduced to the basic techniques of social science research and their grounding principles in a series of seminars. In consultation with the program's research coordinator, each student designs and carries out a project under the supervision of a research committee. Usually offered every year.
Ms. Rosen-Sheidley

BIOL 214c Genetic Counseling Process Group
In this small group setting, students can share and learn from their collective experiences in their field placements, courses, and individual lives and have the opportunity to process and integrate the experience of becoming a genetic counselor. Usually offered every semester.
Mr. Cunningham

BIOL 215b Readings in Molecular Biology
A combination of readings and clinical laboratory work to provide students with an in-depth understanding of the molecular biology of several human genetic diseases and the techniques used for their diagnosis. Usually offered every year.
Ms. Tsipis

BIOL 220a Clinical Genetics II
Prerequisite: Completion of BIOL 204b or permission of the instructor.
Continuation of BIOL 204b with emphasis on the genetic and developmental disorders of most major organ systems. A case-based, problem-solving approach is emphasized. Usually offered every year.
Ms. Schneider and Ms. Stoler

BIOL 224b The RNA World
Prerequisite: BCHM 100a, BIOL 105b or permission of the instructor.
This course employs seminars and lectures to approach a wide range of topics in RNA research. Topics include RNA enzymes, RNA structure, protein-RNA interactions, pre-mRNA splicing, and RNA localization.
Staff

BIOL 236b Genetics, Law, and Social Policy
Explores advances in human genetics, the clinical and economic benefits promised by new tests, and problems generated by our new ability to manipulate our biological future. Analyzes the role of government in regulating technological development and the legal doctrines of privacy, informed consent, and professional liability. Usually offered every second year.
Ms. Roche

BIOL 298a Readings in Molecular and Cell Biology
Usually offered every year.
Staff

BIOL 299a Master's Research Project
Usually offered every year.
Staff

BIOL 300a Biological Research
Primarily for the first-year student with the purpose of introducing him or her to biological research and to the work in progress in the laboratories of a number of faculty members. In consultation with the graduate advisor, the student plans a sequence of such tenures, each comprising nine weeks, and then carries out experimental investigations under the guidance of the faculty members involved. Usually offered every year.
Staff

BIOL 300b Biological Research
Primarily for the first-year student with the purpose of introducing him or her to biological research and to the work in progress in the laboratories of a number of faculty members. In consultation with the graduate advisor, the student plans a sequence of such tenures, each comprising nine weeks, and then carries out experimental investigations under the guidance of the faculty members involved. Usually offered every year.
Staff

BIOL 305d Topics in Molecular Genetics and Development
Usually offered every year.
Staff

NBIO 306d Topics in Neurobiology
Usually offered every year.
Mr. Katz

BIOL 316d Mechanisms of Recombination
Usually offered every year.
Mr. Haber and Ms. Lovett

NBIO 340d Systems/Computational Neuroscience Journal Club
Usually offered every year.
Mr. Miller

BIOL 350d Graduate Student Research Seminar
Usually offered every year.
Mr. Ren

BIOL 401d Dissertation Research
Independent research for PhD candidates. Specific sections for individual faculty members as requested.
Staff

Required First-Year Graduate Health-Related Science Programs Course

CONT 300b Ethical Practice in Health-Related Sciences
Required of all first-year graduate students in health-related science programs. Not for credit.
Ethics is an essential aspect of scientific research. This course, taught by university faculty from several graduate disciplines, covers major ethical issues germane to the broader scientific enterprise, including areas or applications from a number of fields of study. Lectures and relevant case studies are complemented by public lectures during the course. Usually offered every year.
Mr. Morris

Cross-Listed Courses

QBIO 110a
Numerical Modeling of Biological Systems

QBIO 120b
Quantitative Biology Instrumentation Laboratory