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An interdepartmental program

Courses of Study:  
Major (B.A./B.S.)

## General Science

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### Objectives

The general science program is designed for students planning to enter interdisciplinary fields; teach science in secondary schools; enter medicine, public health, dentistry, veterinary medicine, and their allied fields; enter the optometry profession or the field of biomedical engineering; or undertake other programs requiring a general scientific background or a particular mixture of science courses. Joint majors with other departments in the sciences are also possible. Students who intend to do graduate work in a specific scientific field are advised to fulfill the undergraduate requirements for the major in that field.

### How to Become a Major

Only students who entered Brandeis prior to the fall of 2003 are eligible to apply for the general science major.

### Committee

**Robert Meyer, Chair**  
(Physics)

### Requirements for the Major

**A.** Only students who entered Brandeis prior to the fall of 2003 are eligible to apply for the general science major.

**B.** Required of all candidates: BIOL 22a (formerly BIBC 22a); BIOL 22b; BIOL 18a,b; CHEM 10a or 11a with 18a, or CHEM 15a with 19a, and CHEM 10b or 11b with 18b, or 15b with 19b. MATH 10a,b or 11a,b and PHYS 10a,b or 11a,b with 18a,b or 19a,b. Satisfactory grades (C- or above) must be maintained in all of these required courses.

**C.** Elective courses: With the approval of the program's advising head, a candidate in the general science program must also offer the equivalent of six advanced semester courses from the offerings of the School of Science. Such courses must be selected from at least two and not more than four fields within the School of Science. The following courses may not be elected: all courses designed exclusively for the University Studies Program in Science and Mathematics such as biological science (BISC), physical science (PHSC), etc.; all courses numbered below 20 (except that BIOL 15b, COSI 10a and 11b, and MATH 8a and 15a may serve as electives), or 90 through 99; or NPSY above 100 but without a prerequisite within the School of Science that meets these general science requirements; or neuroscience courses below 100; or courses outside the School of Science. Candidates offering elective courses having laboratories (except physical chemistry) are required to enroll in any laboratories accompanying the course, e.g., students offering CHEM 25a must also complete CHEM 29a in order to fulfill one elective in organic chemistry, or a student offering COSI 21a must complete the associated lab course, COSI 22a, to fulfill one elective in computer science.

**D.** No course offered for the major requirements in general science may be taken pass/fail. No more than one unsatisfactory passing grade (below C-) in a semester course will be accepted among the elective courses offered to fulfill the requirements for this major.

**E.** Honors program: Majors in general science who wish to earn a degree with honors must satisfactorily complete an honors program. No later than September of the year in which honors are to be earned, the candidate petitions the general science committee to devise an honors program consisting of laboratory research, special courses, or both. Approval of this petition is required to admit a student to the honors program. Laboratory research is conducted under the sponsorship of a faculty member of the School of Science; the student enrolls in the 99 course offered by the department to which the sponsor belongs. If a student wishes to work with a research director outside the School of Science or outside of Brandeis, a faculty member of the Brandeis School of Science must consent to act as the local sponsor. On completion of the thesis, the sponsor (or outside research director and local sponsor) makes a recommendation for honors to the general science committee to accompany the submission of the thesis. The general science committee will then determine whether the student has successfully completed the honors program and will recommend the level of honors to be awarded.

A graduate program

Courses of Study:  
Master of Science

## Genetic Counseling

### Objectives

#### Graduate Program in Genetic Counseling

The Master's Degree Program in Genetic Counseling is a two-year course of study integrating coursework with clinical experience in an environment that encourages close student/faculty interaction. The program places a strong emphasis on human molecular genetics while providing in-depth coursework in counseling theory and technique as well as extensive clinical training. Graduates of the program are expected to have a clear understanding of human and medical genetics, recombinant DNA technology, gene mapping, and developmental biology; a familiarity with many genetic diseases and birth defects and the various techniques used to detect and/or treat them; a familiarity with a variety of counseling theory and techniques that work in short-term counseling settings; an understanding of how genetic counselors function in a variety of work settings and their roles and responsibilities within a medical team; the ability to present relevant genetic information to individuals and families from diverse cultural backgrounds in an informed, compassionate manner and to help families obtain the medical and social services they may need; a sensitivity to the needs and options of children and adults (including parents and potential parents) with mental retardation, developmental disabilities, and other genetic disorders; an awareness of the legal, ethical, and public policy issues raised as a result of new DNA and reproductive technologies and the Human Genome Project; an understanding of research methodology, experience in the design and execution of research projects, and in the preparation of completed projects for professional publication and presentation; and finally a familiarity with the relevant scientific literature and computer-based tools.

Ordinarily the program is completed in two academic years and the intervening summer. The program is accredited by the American Board of Genetic Counseling and prepares graduates for the certification examination in genetic counseling and employment as genetic counselors.

### 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 specific requirements for admission to this program are: one year of general chemistry, one year of biology, and one semester each of genetics (course should include Mendelian and molecular genetics), organic chemistry, biochemistry, psychology, and statistics. Applicants lacking one or more of these courses are invited to consult the program's director on how to fulfill these requirements. Volunteer or work experience in an area related to counseling, developmental disabilities, or genetics is recommended.

Applications should include three letters of reference, the results of the General Graduate Record Examination, and a personal statement describing your interest in the field of genetic counseling. After initial review of applications, potential candidates will be invited to Brandeis for a personal interview.

Partial scholarship assistance is available for a limited number of exceptional applicants.

### Faculty Advisory Committee

#### Judith Tsipis, Chair and Graduate Advising Head

(Biology)

#### Joseph Cunningham

(Psychology)

#### James Haber

(Biology)

#### Elaine Hiller

(Biology)

#### Judith Jackson

(Genetic Counseling)

#### Marty Wyngaarden Krauss

(The Heller School)

#### Nathalie McIntosh

(Biology)

#### David Rintell

(Biology)

#### Beth Rosen Sheidley

(Genetic Counseling)

#### Gretchen Schneider

(Genetic Counseling)

#### Joan Stoler

(Genetic Counseling)

#### Lawrence Wangh

(Biology)

#### Kalpana White

(Biology)

## Requirements for the Degree of Master of Science

### Program of Study

The academic component of the curriculum consists of the following: graduate-level courses in molecular biology, human genetics, medical genetics, human reproductive biology, counseling skills, research methodology, and biomedical law and ethics; two seminars in genetic counseling; and one or two electives chosen from the biological sciences, medical sociology, psychology, and health policy. Student participation in a proseminar and journal club are required as well.

Fieldwork and clinical internships are an important, integral part of the program. First-year students carry out rotations in genetics clinics, with genetic research teams and in clinical genetics laboratories. Students also participate in community-based education and healthcare programs and meet periodically with a family raising a child with a genetic disorder. Starting in the summer following the first year and continuing through the second year, students participate in three intensive clinical internships at prenatal, pediatric, general, cancer, or specialty genetic clinics. Satisfactory completion of the three clinical internships is required for graduation from the program. Attendance at two professional meetings is also required in the second year. Funds are available to defray costs.

### Residence Requirement

The residence requirement for this program is two years of full-time study.

### Language Requirement

There is no foreign language requirement for the master's degree.

### Project

A master's project is required. Students may work with a genetic counselor to design and evaluate an innovative educational tool or counseling strategy relevant to their clinical work. Or, should their interest lean toward basic research, they may pursue either a laboratory-based project or a qualitative or quantitative study in the field.

## Courses of Instruction

### BIOL 105b Molecular Biology

[ sn ]

*Prerequisites: BIOL 22a and BIOL 22b.*  
*Section 2 is open only to students in the Genetic Counseling Program. Class work for this section is supplemented by special readings and lectures with a clinical focus.* 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.  
Mr. Haber and Mr. Rosbash

### BIOL 128a Human Genetics

[ sn ]

*Prerequisites: BIOL 22a and BIOL 22b.* Survey of mutation and polymorphism; molecular techniques; single-gene inheritance and complexities thereof; risk assessment and Bayesian analysis; cytogenetics; hemoglobinopathies; population genetics; physical and genetic mapping strategies; cancer genetics; theical considerations; multifactorial inheritance; immunogenetics; pharmacogenetics; genetics of development; molecular and biochemical basis of genetic disease; genomics, proteomics, and bioinformatics; gene therapy; and computer databases in human genetics. Usually offered every year.  
Ms. Hiller

### BIOL 160b Human Reproductive and Developmental Biology

[ wi sn ]

*Prerequisites: BIOL 22a and BIOL 22b.* Course deals with hormonal, cellular, and molecular aspects of gametogenesis, fertilization, pregnancy, and birth. Discusses 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.  
Staff

### 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 healthcare 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 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 20-30 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. Lerner

**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. Lerner

**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. Lerner

**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.  
Mr. Korf or Staff

**BIOL 236b Genetics, Law, and Social Policy**

Explores advances in human genetics, the clinical and economic benefits promised by new tests, 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