

GENETICS MAJOR: GENOMICS OPTION (B.S.)

<https://colsa.unh.edu/molecular-cellular-biomedical-sciences/program/bs/genetics-major-genomics-option>

Description

The **Genetics and Genetics:Genomics programs (GEN)** explore the world of genetics and genomics in plants, animals, and microbes. Genetics majors are interested in understanding how DNA, along with the environment, encodes traits as simple as hair color, to more complex traits like high blood pressure, diabetes, and mental illness. The Genetics faculty strongly value hands-on learning and many GEN students conduct undergraduate research under the supervision of our faculty. GEN graduates are prepared for successful careers in the biotechnology fields or for entry into graduate school or health professional programs.

The Genetics program includes course work and laboratories in:

- molecular genetics
- bioinformatics
- human genetics
- comparative genomics
- plant genetics
- microbial genetics and evolution

Students in the Genetics program may participate in a variety of experiential learning activities including:

- independent research experiences in laboratories of UNH genetics faculty
- work at the Hubbard Center for Genome Studies (<https://hcgs.unh.edu>) or Research Computing Center (<https://www.unh.edu/research/support-units/research-computing-center>)
- internships at biotechnology companies in the Greater Boston area
- internships with genetics counselors at area medical centers

GEN graduates have been successful in attaining careers as:

- research scientists and laboratory technicians in
 - biotechnology and pharmaceutical companies
 - academic research programs
 - forensics
 - biomedical research centers & medical schools
- educators

GEN graduates are prepared for further education in:

- professional health programs
 - genetic counseling
 - medical school (<http://www.unh.edu/uac/premed-advising/explore-medicine>)
 - dental school

- allied health programs (physician assistant (<http://www.unh.edu/uac/premed-advising/explore-physician-assistant>), pharmacist (<http://www.unh.edu/uac/premed-advising/explore-pharmacy>), nursing (<https://chhs.unh.edu/nursing/direct-entry-masters-nursing>) or pathologist's assistant (<http://www.pathassist.org>) programs)
- graduate programs
 - Genetics and Genomics
 - Integrative Biology
 - Neurogenomics
 - Molecular Biology
 - Microbiology
 - Environmental Sciences
 - Public Health
 - Computer Science

Requirements

Students majoring in Genetics with the Genomics option take seven Foundation courses, six Bioscience Core courses, four Genetics Core courses and five Major Elective courses. One capstone experience, supervised and approved within the major, is required of all seniors. The capstone explores areas of interest based on the integration of prior learning. In addition, all other University requirements must be completed, including those for the Discovery Program (<http://www.unh.edu/undergrad-catalog/gi.cfm?thisid=242&masterid=27&headingid=27/#242>) and the University Writing Requirement (<http://www.unh.edu/undergrad-catalog/gi.cfm?thisid=28&masterid=27&headingid=27/#28>).

A grade of C-minus or better required in statistics and all Biological Science Foundation, GEN Core, and Major Elective courses.

Foundation Courses

| Code | Title | Credits |
|---------------------|---|---------|
| CHEM 403 | General Chemistry I | 4 |
| CHEM 404 | General Chemistry II | 4 |
| CHEM 545 & CHEM 546 | Organic Chemistry and Organic Chemistry Laboratory ¹ | 5 |
| MATH 424B | Calculus for Life Sciences | 4 |
| BIOL 528 | Applied Biostatistics I | 4 |
| PHYS 401 | Introduction to Physics I | 4 |
| PHYS 402 | Introduction to Physics II | 4 |

Bioscience Core Courses

| Code | Title | Credits |
|---------------------|---|---------|
| BIOL 411 | Introductory Biology: Molecular and Cellular | 4 |
| BIOL 412 | Introductory Biology: Evolution, Biodiversity and Ecology | 4 |
| GEN 604 | Principles of Genetics | 4 |
| BMS 503 & BMS 504 | General Microbiology and General Microbiology Laboratory | 5 |
| BMCB 605 | Eukaryotic Cell and Developmental Biology | 4 |
| BMCB 658 & BMCB 659 | General Biochemistry and General Biochemistry Lab | 5 |

Genetics Core Courses

| Code | Title | Credits |
|------------------------------|---|---------|
| GEN 401 | Professional Perspectives in Genetics | 1 |
| GEN 606 | Genetics Lab | 4 |
| GEN 711 | Genomics and Bioinformatics | 4 |
| Select one of the following: | | |
| GEN 704 | Genetics of Prokaryotic Microbes ² | 5 |
| GEN 771 | Molecular Genetics ² | 4 |

Major Electives

A total of five **unique** major electives is required: GEN 712, GEN 721, two courses from the population or evolutionary genetics elective group, and one course from the bioscience major elective group.

Required Major Electives

| Code | Title | Credits |
|---------|--------------------------------|---------|
| GEN 712 | Programming for Bioinformatics | 5 |
| GEN 721 | Comparative Genomics | 4 |

Population or Evolutionary Genetics Major Electives (Select Two)

| Code | Title | Credits |
|---------|--------------------------------------|---------|
| GEN 705 | Population and Quantitative Genetics | 4 |
| GEN 713 | Microbial Ecology and Evolution | 4 |
| GEN 715 | Molecular Evolution | 4 |
| GEN 772 | Evolutionary Genetics of Plants | 4 |

Bioscience Major Electives (Select One)

| Code | Title | Credits |
|----------|---|---------|
| GEN 704 | Genetics of Prokaryotic Microbes ² | 5 |
| GEN 705 | Population and Quantitative Genetics | 4 |
| GEN 706 | Human Genetics | 4 |
| GEN 712 | Programming for Bioinformatics | 5 |
| GEN 713 | Microbial Ecology and Evolution | 4 |
| GEN 715 | Molecular Evolution | 4 |
| GEN 717 | Molecular Microbiology | 5 |
| GEN 721 | Comparative Genomics | 4 |
| GEN 771 | Molecular Genetics ² | 4 |
| GEN 772 | Evolutionary Genetics of Plants | 4 |
| GEN 774 | Techniques in Plant Genetic Engineering and Biotechnology | 4 |
| GEN 795 | Investigations in Genetics (4 credit minimum) | 1-4 |
| GEN 795W | Investigations in Genetics (4 credit minimum) | 1-4 |
| GEN 799 | Senior Thesis (4 credit minimum) | 1-4 |
| GEN 799H | Honors Senior Thesis (4-credit minimum) | 1-4 |
| ANSC 602 | Animal Rights and Societal Issues | 4 |
| ANSC 701 | Physiology of Reproduction | 4 |
| BIOL 702 | Techniques in Plant Physiology and Biochemistry | 4 |
| BIOL 704 | Plant-Microbe Interactions | 3 |
| BIOL 711 | Applied Biostatistics II | 4 |
| BIOL 752 | Mycology | 4 |
| BMCB 750 | Physical Biochemistry | 3 |
| BMCB 753 | Cell Culture | 5 |

| | | |
|---------------------|--|-----|
| BMCB 754 | Molecular Biology Research Methods | 5 |
| BMCB 760 | Pharmacology | 4 |
| BMCB 763 | Biochemistry of Cancer | 4 |
| BMCB #783 | Proteomics for Biological Discoveries | 4 |
| BMCB 794 | Protein Structure and Function | 4 |
| BMS 650 | Molecular Diagnostics | 4 |
| BMS 702 | Endocrinology | 4 |
| BMS 705 | Immunology | 3 |
| BMS 706 | Virology | 3 |
| BMS 718 | Mammalian Physiology | 4 |
| INCO 790 | Advanced Research Experience (4-credit minimum) | 1-4 |
| NR 706 | Soil Ecology | 4 |
| ZOOL 625 & ZOOL 626 | Principles of Animal Physiology and Animal Physiology Laboratory | 5 |
| ZOOL 690 | Evolution | 4 |
| ZOOL 777 | Neuroethology | 3 |

Approved GEN Capstone Courses

The capstone explores areas of interest based on the integration of prior learning. The capstone requirement may be satisfied through a course, created work or product, or some form of experiential learning (e.g., honors thesis, mentored research project, or other approved student activity). The capstone requirement can only be fulfilled once a student has senior standing in the major. Submit a Capstone Approval form prior to beginning the experience.

| Code | Title | Credits |
|----------|---|---------|
| GEN 704 | Genetics of Prokaryotic Microbes | 5 |
| GEN 705 | Population and Quantitative Genetics | 4 |
| GEN 715 | Molecular Evolution | 4 |
| GEN 717 | Molecular Microbiology | 5 |
| GEN 790 | Undergraduate Teaching Experience (4 credit minimum; classroom presentation required) | 1-4 |
| GEN 795 | Investigations in Genetics (4-credit minimum) | 1-4 |
| GEN 795W | Investigations in Genetics (4-credit minimum) | 1-4 |
| GEN 799 | Senior Thesis (4-credit minimum) | 1-4 |
| GEN 799H | Honors Senior Thesis (4-credit minimum) | 1-4 |
| INCO 790 | Advanced Research Experience (4-credit minimum) | 1-4 |

¹ Students applying to health profession schools need a full year of English, a full year of Introductory Biology, and a full year of Organic Chemistry. ENGL 502 or ENGL 503 should be taken in addition to ENGL 401; CHEM 651/CHEM 653 and CHEM 652/CHEM 654 should be taken in place of CHEM 545/CHEM 546. See Pre-Professional Health Program Advising (<http://www.unh.edu/uacc/premed-advising/advising>).

² Can be used as a Genetic Core course or Bioscience Major Elective but not both.

Degree Plan

SAMPLE Course Sequence for Genomics

| Course | Title | Credits |
|------------------------------------|---|---------|
| First Year | | |
| Fall | | |
| GEN 401 | Professional Perspectives in Genetics | 1 |
| BIOL 411 | Introductory Biology: Molecular and Cellular | 4 |
| ENGL 401 | First-Year Writing | 4 |
| CHEM 403 | General Chemistry I | 4 |
| Discovery course | | 4 |
| Credits | | 17 |
| Spring | | |
| BIOL 412 | Introductory Biology: Evolution, Biodiversity and Ecology | 4 |
| MATH 424B | Calculus for Life Sciences | 4 |
| CHEM 404 | General Chemistry II | 4 |
| Discovery course | | 4 |
| Credits | | 16 |
| Second Year | | |
| Fall | | |
| GEN 604 | Principles of Genetics | 4 |
| CHEM 545 & CHEM 546 | Organic Chemistry and Organic Chemistry Laboratory | 5 |
| BIOL 528 | Applied Biostatistics I | 4 |
| Discovery course | | 4 |
| Credits | | 17 |
| Spring | | |
| GEN 606 | Genetics Lab | 4 |
| BMS 503 & BMS 504 | General Microbiology and General Microbiology Laboratory | 5 |
| Major Elective (Bioscience) | | 4 |
| Discovery course | | 4 |
| Credits | | 17 |
| Third Year | | |
| Fall | | |
| BMCB 658 & BMCB 659 | General Biochemistry and General Biochemistry Lab | 5 |
| PHYS 401 | Introduction to Physics I | 4 |
| Discovery course | | 4 |
| Elective (any course) | | 4 |
| Credits | | 17 |
| Spring | | |
| Genetics Core course | | 4 |
| PHYS 402 | Introduction to Physics II | 4 |
| BMCB 605 | Eukaryotic Cell and Developmental Biology | 4 |
| Discovery course | | 4 |
| Credits | | 16 |
| Fourth Year | | |
| Fall | | |
| Major Elective (Pop/Evol Genetics) | | 4 |
| GEN 711 | Genomics and Bioinformatics | 4 |

| | | |
|------------------------------------|--------------------------------|-----|
| GEN 712 | Programming for Bioinformatics | 4 |
| Elective (any course) | | 4 |
| Credits | | 16 |
| Spring | | |
| GEN 721 | Comparative Genomics | 4 |
| Major Elective (Pop/Evol Genetics) | | 4 |
| Elective (any course) | | 4 |
| Credits | | 12 |
| Total Credits | | 128 |