

GENETICS MAJOR: GENOMICS OPTION (B.S.)

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

Description

The **Genetics:Genomics program (GEN)** explores the world of genetics and genomics in plants, animals, and microbes. Genomics is the study of genomes and includes topics like DNA structure and function, high-throughput sequencing, and computational comparison of the genomes of different organisms. 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 biotechnology fields or for entry into a variety of graduate school or health professional programs.

The Genetics program offers course work and laboratories in:

- molecular genetics
- bioinformatics
- human genetics
- comparative genomics
- plant genetics
- microbial genetics
- population and evolutionary genetics

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

- independent research experiences in laboratories of UNH faculty
- work at the [Hubbard Center for Genome Studies](#) or [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
 - government agencies
- genetic counselors
- educators
- technical support associates

GEN graduates are prepared for further education in:

- professional health programs
 - genetic counseling
 - [medical school](#)
 - dental school
 - allied health programs ([physician assistant](#), [pharmacist](#), [nursing](#) or [pathologist's assistant](#))
 - [vet school](#)
- graduate programs such as
 - 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](#) and the [University Writing Requirement](#).

A grade of C-minus or better is required in statistics and all Bioscience Core, Genetics Core, and Major Elective courses.

Foundation Courses

Code	Title	Credits
CHEM 403	General Chemistry I ¹	4
CHEM 404	General Chemistry II	4
CHEM 545 & CHEM 546	Organic Chemistry and Organic Chemistry Laboratory ²	5
MATH 424B	Calculus for Life Sciences ³	4
BIOL 528	Applied Biostatistics I	4
PHYS 401	Introduction to Physics I	4
PHYS 402	Introduction to Physics II	4

- ¹ Fulfills Physical Science Discovery requirement
- ² Students applying to health profession schools need a full year of Organic Chemistry, a full year of introductory Biology, and a full year of English. CHEM 651/CHEM 653 and CHEM 652/CHEM 654 should be taken in place of CHEM 545/CHEM 546; ENGL 502 or ENGL 503 should be taken in addition to ENGL 401. See [Pre-Professional Health Program advising](#).
- ³ Fulfills Quantitative Reasoning Discovery requirement

Bioscience Core Courses

Code	Title	Credits
BIOL 411	Introductory Biology: Molecular and Cellular ⁴	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	Principles of Cell Biology	4

2 Genetics Major: Genomics Option (B.S.)

BMCB 658 & BMCB 659	General Biochemistry and General Biochemistry Lab	5
---------------------	---	---

4 Fulfills Biological Science Discovery requirement, Discovery Inquiry requirement, and Discovery laboratory requirement

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	5
GEN 771	Molecular Genetics	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

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 & GEN 725	Population Genetics and Population Genetics Lab ⁵	5
GEN 713	Microbial Ecology and Evolution ⁵	4
GEN 715	Molecular Evolution ⁵	4
GEN 772	Evolutionary Genetics of Plants ⁵	4

Bioscience Major Electives (Select One)

Code	Title	Credits
GEN 704	Genetics of Prokaryotic Microbes ⁵	5
GEN 705 & GEN 725	Population Genetics and Population Genetics Lab ⁵	5
GEN 706	Human Genetics	4
GEN 713	Microbial Ecology and Evolution ⁵	4
GEN 715	Molecular Evolution ⁵	4
GEN 717	Molecular Microbiology	5
GEN 771	Molecular Genetics ⁵	4
GEN 772	Evolutionary Genetics of Plants ⁵	4
GEN 774	Techniques in Plant Genetic Engineering and Biotechnology	4
GEN 795	Investigations in Genetics (4 credit minimum) ⁶	1-4
GEN 795W	Investigations in Genetics (4 credit minimum) ⁶	1-4
GEN 799	Senior Thesis (4 credit minimum) ⁶	1-4
GEN 799H	Honors Senior Thesis (4-credit minimum) ⁶	1-4
ANSC 602	Animal Rights and Societal Issues	4
ANSC 701	Physiology of Reproduction	4
BIOL #702	Lab Techniques in Plant Physiology and Biochemistry	4
BIOL 704	Plant-Microbe Interactions	3
BIOL 711	Experimental Design & Analysis	4
BIOL 752	New England Mushrooms: a Field and Lab Exploration	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 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
BMS 719	Host-Microbe Interactions	4
BMS 740	Human Microbiome	4
INCO 790	Advanced Research Experience (4-credit minimum) ⁶	1-4
MEFB 750	Marine Ecological Genomics	4
NR 706	Soil Ecology	4
ZOOL 625 & ZOOL 626	Principles of Animal Physiology and Animal Physiology Laboratory	5
ZOOL 690	Evolution	4
ZOOL 736	Genes and Behavior	4
ZOOL 777	Neuroethology	4

⁵ Where listed, this course can also count as a Bioscience Major Elective IF students take one additional Bioscience Major Elective.

⁶ Must be a research project with a genetics focus

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 special student activity). Students may take more than one capstone course. Capstone completion is never displayed on Degree Works; your advisor will certify capstone completion at the time of graduation. Students must have 90 credits or more when completing their capstone requirement. See your advisor for questions about capstones.

Code	Title	Credits
GEN 704	Genetics of Prokaryotic Microbes	5
GEN 705 & GEN 725	Population Genetics and Population Genetics Lab	5
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) ⁶	1-4
GEN 795W	Investigations in Genetics (4-credit minimum) ⁶	1-4
GEN 799	Senior Thesis (4-credit minimum) ⁶	1-4
GEN 799H	Honors Senior Thesis (4-credit minimum) ⁶	1-4
INCO 790	Advanced Research Experience (4-credit minimum) ⁶	1-4

⁶ Must be a research project with a genetics focus

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
BMCB 605	Principles of Cell Biology	4
BIOL 528	Applied Biostatistics I	4
Discovery course		4
	Credits	16
Spring		
GEN 606	Genetics Lab	4
BMS 503 & BMS 504	General Microbiology and General Microbiology Laboratory	5
CHEM 545 & CHEM 546	Organic Chemistry and Organic Chemistry Laboratory	5
Discovery course		4
	Credits	18
Third Year		
Fall		
GEN 712	Programming for Bioinformatics	5
BMCB 658 & BMCB 659	General Biochemistry and General Biochemistry Lab	5
PHYS 401	Introduction to Physics I	4
Discovery course		4
	Credits	18
Spring		
GEN 711	Genomics and Bioinformatics	4
PHYS 402	Introduction to Physics II	4
Discovery course		4
Major Elective (Bioscience)		4
	Credits	16
Fourth Year		
Fall		
Genetics Core course		4
Major Elective (Pop/Evol Genetics)		4
Elective (any course)		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	129