BIOLOGY MAJOR

MAJOR DESCRIPTION

The major in Biology provides students with the skills to perform scientific inquiry using current experimental approaches as they pursue a deeper understanding of the interconnections among living things. We study how recent advances in the biological sciences are driving extraordinary new discoveries and innovations in areas such as evolution, ecology, cell biology, genetics/genomics, and neuroscience. Biological research provides essential information as we address urgent challenges of biodiversity conservation, global climate change, epidemiology, and human health and well-being. Increasingly, biological issues are playing a fundamental role in social and medical ethics, journalism, and public policy.

Biology students are curious, keen observers who seek answers about the natural world. Coursework requires analytical and critical thinking skills and a sense of imagination. Students are encouraged to nurture abilities to understand complex processes, follow detailed protocols, analyze data, and communicate about their research. As biology deals with living organisms and potentially sensitive research, the model biology student should possess strong ethics, respect for life, and a commitment to responsible practices.

A major in Biology can form the foundation of a career in research, medicine, conservation, public health, bioethics, sustainable resource use, and many other areas.

ADMISSION TO THE MAJOR

Students who begin the Biology Major their first year are able to take maximum advantage of upper-level biology courses and research opportunities in later years. The major can successfully be completed if begun during sophomore year. Biology students may consider taking a semester abroad.

The required introductory courses do not have prerequisites or corequisites, but it is recommended to have some chemistry background or to take General Chemistry (CHEM141/CHEM142 or CHEM143/CHEM144) concurrently.

MAJOR REQUIREMENTS

The Biology Major's required course of study includes:

- Two introductory courses with their associated labs:
    - BIOL181 with lab BIOL191 is offered every fall semester.
    - BIOL182 with lab BIOL192 is offered every spring.
- Two semesters of general chemistry (CHEM141-CHEM142 or CHEM143-CHEM144)
- Any three additional semesters of related courses from at least two different departments. These are courses that address approaches and methodologies applied in biology and include:
    - Organic Chemistry: CHEM251, CHEM252
    - Physics: PHYS111, PHYS112, PHYS113, or PHYS116 and PHYS207
    - Mathematics: MATH117 or higher
    - Statistics: MATH132, ECON300, PSYC200
    - Quantitative Analysis Center: QAC201, QAC231
    - Computer Science: BIOL265, BIOL266 (0.5 credit), BIOL271 (0.5 credit), COMP112, COMP114, COMP115, COMP211, or a course higher than COMP211
    - Earth and Environmental Science: BIOL242/E&ES270, E&ES280, E&ES380
    - Archaeology: ARCP350
- Six or more elective biology courses at the 200 and 300 levels, which must include:
    - One mid-level cell/molecular course (either MB&B208, BIOL210, BIOL212, or BIOL218)
    - One mid-level organismic/population course (either NS&B213/BIOL213, BIOL214, BIOL215, BIOL216, or BIOL217)
- One capstone experience

Important Notes:

- No more than three of the mid-level courses listed above may be counted towards the six advanced elective requirements.
- At least three elective courses (200-level and above) that are counted toward the Biology major cannot be simultaneously used to fulfill any other major.
- Biology majors are allowed to apply at most one elective course or one cognate course taken credit/unsatisfactory toward fulfilling the major requirements. However, this is discouraged because good performance in major courses is an important aspect of a student's transcript.
- A strong background in chemistry is recommended for students planning to enter graduate or medical school. Most medical and health-related graduate programs require two years of college-level chemistry, including laboratory components and a biochemistry course.
- Students planning to attend medical, dental, or other health professions graduate school should note that admission requires a year each of introductory biology, physics, and math (such as calculus or statistics) and two years of chemistry (general and organic), including any laboratory components.

Important Requirements for Double Majors:

- At least three elective courses (200-level and above) that are counted toward the Biology major cannot be simultaneously used to fulfill any other major.
- For double-major in Biology and Neuroscience and Behavior, NS&B/BIOL213 cannot count toward the six electives required for the Biology major; however, NS&B/BIOL213 will fulfill the Column 2 breadth requirement.
- Two Statistics courses, even from different departments, cannot both be counted as cognates.
- Students cannot use E&ES280 if they use QAC231 .

Electives may be chosen from among the following courses at the 200, 300, or 500 levels. See WesMaps for current course offerings. The courses are grouped thematically below for your convenience only.

CELL AND DEVELOPMENTAL BIOLOGY

Code	Title	Hours
BIOL/MB&B223	The Molecular Basis of Cancer	1
BIOL/MB&B228	Introductory Medical Biochemistry	1
BIOL/MB&B232	Immunology	1
BIOL/MB&B237	Signal Transduction	1
BIOL241	Cell-Cell Interactions in Development	1
BIOL/IDEA267	Engineering Biology: Cells and Tissues	1
BIOL295	Physiology and Cell Biology of Cancer	1
BIOL317	Genes and Mechanisms in Vertebrate Sex Determination	1
BIOL322	Cell Migration in Development and Disease	1
BIOL/NS&B325	Stem Cells: Basic Biology to Clinical Application	1
BIOL332	Genomics Era Cell and Development	1
BIOL334	Shaping the Organism	1
BIOL340	EvoDevo: Origins of Variation in the Phenotype	1
BIOL/NS&B343	Muscle and Nerve Development	1
BIOL/NS&B345	Developmental Neurobiology	1
MB&B375	The Cell-Division Cycle and Cancer	1

EVOLUTION, ECOLOGY, AND CONSERVATION BIOLOGY

Code	Title	Hours
BIOL/ENVS220	Conservation Biology	1
BIOL/ENVS226/ E&ES240	Invasive Species: Biology, Policy, and Management	1
BIOL/ENVS233/ E&ES234	Geobiology	1
BIOL235	Comparative Vertebrate Anatomy	1.5
BIOL290/ENVS286	Plant Form and Diversity	1
BIOL/E&ES312/ ENVS311	Global Change Biogeography	1
BIOL316	Plant-Animal Interactions	1
BIOL318	Nature and Nurture: The Interplay of Genes and Environment	1
BIOL/COMP/CIS327	Evolutionary and Ecological Bioinformatics	1
BIOL/ENVS337	The Origins of Bacterial Diversity	0.5
BIOL346/E&ES238/ ENVS340	The Forest Ecosystem	1
BIOL365	Calderwoods Seminar in Public Writing: 21st-Century Biology	1
ARCP/E&ES350/ ENVS348	Animals in Archaeology	1
BIOL368/ENVS369/ E&ES342	Ecological Resilience: The Good, the Bad, and the Mindful	1

GENETICS, GENOMICS, AND BIOINFORMATICS

Code	Title	Hours
MB&B/BIOL231	Microbiology	1
BIOL242	Quantitative Methods for the Biological and Environmental Sciences	1
BIOL/NS&B257	Neurogenetics	1
BIOL/CIS263	Demystifying Data: Introductory Data Analysis and Modeling	1
BIOL/MB&B/ CIS265/COMP113	Bioinformatics Programming	1
BIOL/CIS270	Systems Biology with Programming	1
MB&B306	Epigenetics	1
BIOL/CIS310/ MB&B311	Genomics Analysis	1
BIOL/CIS/COMP327	Evolutionary and Ecological Bioinformatics	1
MB&B/BIOL333	Gene Regulation	1
MB&B394	Advanced Laboratory in Molecular Biology and Genetics	1

NEUROBIOLOGY AND BEHAVIOR

Code	Title	Hours
BIOL/NS&B224	Hormones, Brain, and Behavior	1
BIOL/NS&B/ PSYC239	Functional Anatomy of the Human Brain	1
NS&B/BIOL243	Neurohistology	1
BIOL/NS&B244	Neuropharmacology	1
BIOL/NS&B245	Cellular Neurophysiology	1
BIOL/NS&B247	Laboratory in Neurophysiology	1
BIOL/NS&B250	Laboratory in Cellular and Behavioral Neurobiology	1
BIOL/NS&B251	Laboratory in Basic Practices in Neuroscience	1
BIOL/NS&B252	Cell Biology of the Neuron	1
BIOL/NS&B254	Comparative Animal Behavior	1
BIOL/NS&B299	Waves, Brains, and Music	1
NS&B302	Neurobiology of Aging	1
NS&B304	Glia: Not just neuronal glue!	1
NS&B/BIOL328	Chemical Senses	1
BIOL/NS&B345	Developmental Neurobiology	1
BIOL/NS&B347	Mammalian Cortical Circuits	1
BIOL/NS&B351	Neurobiology of Learning and Memory	1
NS&B/BIOL/ PSYC353	Neurobiology of Neurological Disorders	1
BIOL/NS&B/ PSYC356	Neurodevelopmental Disorders	1
BIOL/NS&B/ FGSS357	Sex and Gender: From Synapse to Society	1
BIOL/NS&B358	Neurobiology of Movement	1

NS&B/BIOL360	Neuroplasticity and Neurogenesis in Health and Disease: Molecules, Cells, and Circuits	1
BIOL/NS&B373	Exploring the Brain-Body Interface: The Neuroscience of Basic Survival	1

ADDITIONAL COURSES THAT CAN BE CREDITED TO THE ELECTIVE REQUIREMENT

With permission from the department, the following courses may be applied toward fulfilling the mid-level elective requirement for the Biology major.

Code	Title	Hours
ARCP/ENVS/SISP/IDEA203/ANTH212	The Secrets of Ancient Bones: Discovering Ancient DNA and Archaeology	1
ARCP/ENVS/ANTH/E&ES257	Environmental Archaeology	1
CHEM/NS&B323	Biochemistry of Neurodegenerative Disease	1
CHEM/MB&B325	Introduction to Biomolecular Structure	1
CHEM/MB&B383	Biochemistry	1

Additional notes on fulfilling the Biology major:

- Cross-listed courses that are included on the list above are automatically credited to the biology major.
- At least three elective courses (200-level and above) that are counted toward the biology major must be used to fulfill only the biology major and cannot be simultaneously used to fulfill another major.
- Depending on the student's specific program, and with prior permission of the chair, up to two biology courses from outside the department may be counted toward the major as electives. Wesleyan courses that fall into this category are: ARCP203 /ANTH212 , ARCP257 , CHEM323, CHEM325, and CHEM383 .
- Courses in the BIOL 400 series (such as research tutorials) contribute toward graduation but do not count toward the major, although they can be used to fulfill the capstone requirement (see below).

COURSES FOR NON-MAJORS

The following courses do not have prerequisites and, as such, are appropriate for non-majors.

Code	Title	Hours
BIOL106	The Biology of Sex	1
BIOL140	Classic Studies in Animal Behavior	1
BIOL146	Primate Behavior: The Real Monkey Business	1
BIOL173	Global Change and Infectious Disease	1
BIOL/MB&B181	Principles of Biology I: Cell Biology and Molecular Basis of Heredity	1
BIOL/MB&B182	Principles of Biology II	1
BIOL/ENVS/E&ES197	Introduction to Environmental Studies	1

STUDENT LEARNING GOALS

Biology majors acquire the following knowledge and competencies:

- A broad and integrative understanding of the theory and practice of biology
- Critical and quantitative thinking
- Creative problem solving
- Scientific reasoning
- Ethics of biological research
- Understanding of the role of biology in society and sustainability practices
- Designing and conducting original research
- Written and oral communication about scientific concepts and research findings
- Comprehension and critical interpretation of primary scientific literature

Students will use their biological knowledge and skills to become effective, scientifically-informed citizens and professionals.

Students will demonstrate their knowledge and abilities through research projects, critical analysis papers, participation in class discussions and collaborative group work, and presentations. Written exams, peer review, and self-assessment will also evaluate their class performance.

ADVANCED PLACEMENT

Students who have received a grade of 4 or 5 on the AP Biology exam may receive one University credit toward graduation.

Students with a score of 4 or 5 may place out of one of the two Introductory Biology courses (BIOL181 or BIOL182) but must first consult with an instructor teaching these courses.*

Students interested in placing out of MB&B181 in the fall semester should contact Professor Cori Anderson (canderson05@wesleyan.edu) regarding the placement exam.*

*Note: We recommend against "placing out" of MB&B181/BIOL181 for almost all students interested in the Biology major. Although some of the material from a high school AP course will be familiar, the depth and rigor of MB&B181/BIOL181 provide a strong foundation as you move forward to more advanced courses.

PRIZES

Dr. Neil Clendeninn Prize – Established in 1991 by George Thornton, Class of 1991, and David Derryck, Class of 1993, for the African American student

who has achieved academic excellence in biology and/or molecular biology and biochemistry. This student must have completed their sophomore year and should exemplify qualities of character, leadership, and concern for the Wesleyan community as shown by Dr. Neil Clendeninn, Class of 1971.

The Peirce Prize – Awarded in successive years for excellence in biology, chemistry, and geology.

TRANSFER CREDIT

Up to two outside credits for biology courses may also be applied from another institution (during a study abroad program, for example). Prior permission must be obtained from the departmental liaison, Professor Michael Singer (msinger@wesleyan.edu), to ensure creditability of specific courses from other institutions.

RELATED PROGRAMS OR CERTIFICATES

Environmental Studies Minor

The Environmental Studies (ENVS) program is interdisciplinary and offers both a minor and a linked major. The ENVS-linked major is a secondary major and requires a student also to have a primary major in another department, program, or college. ENVS majors write a senior thesis or essay in environmental studies that is mentored by a professor in another department, program, or college (e.g., biology). There is also an opportunity to earn an ENVS minor, which does not require a senior thesis or essay.

Informatics and Modeling Minor

The Integrative Genomic Science pathway within this minor will be of particular interest for life science majors. See wesleyan.edu/imcp/igs.html.

Neuroscience and Behavior Program

Several faculty members in the Biology and Psychology Departments also participate in the Neuroscience and Behavior Program that, at the undergraduate level, constitutes a separate major. Information about that program can be found at wesleyan.edu/nsb.

BA/MA PROGRAM

The BA/MA program provides an attractive option for life science majors to gain graduate level research experience. Students are advised to begin research by their junior year if they intend to pursue the BA/MA in biology. Admission is competitive and based on GPA, faculty recommendations, and research experience.

ADDITIONAL INFORMATION

The BIOL/MB&B 338/339 seminar series features distinguished scientists from other institutions who present lectures on their research findings. These seminars aim to relate material studied in courses, tutorials, and research to current scientific activity. These seminars are usually held on Wednesday at noon and are open to all University community members. Undergraduates are especially welcome.

HONORS

To be considered for departmental honors, a student must:

- Be a biology major and be recommended by a faculty member.
- Have at least a B average (GPA of 85 or above) in courses credited to the major.
- Submit a thesis based on laboratory research, computational research, or mathematical modeling. The thesis is carried out under the supervision of a department faculty member.

CAPSTONE EXPERIENCE

The Capstone Experience is required for Biology majors and students must complete at least one of the following:

- One semester of a 300-level seminar, lab, or field course
- One semester of BIOL338 or BIOL339
- One semester of a 500-level journal club: BIOL505, BIOL506, BIOL507, BIOL508, BIOL509, BIOL510 , BIOL547 or BIOL548
- Two semesters of a Senior Thesis tutorial
- One semester of a 400-level research tutorial (BIOL423 or BIOL424)
- A summer research internship in biology or a related life sciences area