BIOLOGICAL SCIENCES

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The Field of Biology

Biology explores the structure, function, and evolution of diverse living systems. It addresses some of the most important issues of our time—genetic engineering, stem cell research, obesity, cancer, and the effects of global warming. Majoring in Biology prepares students to pursue a career in research, teaching, or the allied health sciences. It is also relevant to careers as diverse as environmental policy, law, public health, creative writing, and textbook development.

Mission

The mission of the Biology major is to provide students with a broad education in biology. To this end, students are offered a range of lecture courses that span the molecular, physiological, and ecological levels of organization. Students also complete laboratory courses that help them learn how to design and test hypotheses, use cutting edge equipment, and interpret data. Students learn scientific communication skills by critiquing research articles, writing laboratory reports and research papers, and participating in oral presentations and debates. The department encourages students to become involved in a research project under the guidance of a faculty member at Barnard or elsewhere in New York City.

Student Learning Outcomes

- Demonstrate an appreciation of the many different life forms on planet Earth.
- Discuss a biological phenomenon from many different levels of organization (e.g., discuss HIV from the perspective of structure to host immune response to evolutionary and epidemiological issues).
- Describe the basic features of Mendelian genetics and the central dogma of molecular biology.
- Understand the basic physiological processes of at least one organism.
- Demonstrate an understanding of population-level processes.
- Make an oral presentation on either an original research project or a published primary research paper.
- Generate a testable hypothesis and develop and execute a controlled experimental design.
- Write an original scientific paper and/or a review article.

Programs of Study

Major in Biology

There are five major tracks (i.e. concentrations):
- General Biology
- Cellular and Molecular Biology
- Physiological and Organismal Biology
- Ecological and Evolutionary Biology
- Computational Biology

Minor in Biology

Student Advising

Advising Resources

- To ask questions about the biology major or minor, contact the associate chair.
- To join the BiologyStudents mailing list, contact the department administrator.
- To view a summary and side by side comparison of the major tracks, view this document.
- To see which courses commonly fulfill major and minor requirements, view the biology major and minor checklists or check the major requirements page of the biology website.
- To learn more about major advising, visit the advising page of the biology website.
- To learn more about informational and celebratory events hosted by the biology department, visit the news and events page of the biology website.
- To access various forms relevant to advising, view the Links to Slate Forms page on the Barnard website.

Guidance for First-Year Students

What biology course should I take as a first-year?

- First-year students who have prior experience in biology or who wish to fulfill major, minor, or pre-health requirements should take the 1500-level sequence of courses (BIOL BC1500-1503) starting either in the fall or the spring.
- First-year students who do not have prior experience in biology may take non-majors courses such as the 1000-level sequence (BIOL BC1001-1002) or Human Anatomy and Movement (BIOL BC2573-2574).

How do I find a biology major advisor?

- When a student declares the biology major, they are assigned an advisor by the associate chair.
- If you haven't yet declared the major and have questions for a major advisor, reach out to the associate chair.

Enrolling in Courses

- In all lab courses, students who register are automatically placed on a waitlist. The instructor admits students off the waitlist.
- Students who wish to obtain credit for research by enrolling in BIOL BC3591-4 or BIOL BC3597 must consult the instructor.
- Upper level courses generally have prerequisites. Common prerequisites include BIOL BC1500-1503 and BIOL BC2100.
Preparation for Graduate Study
For more information about graduate study, consult a biology major advisor or the associate chair.

Coursework taken outside of Barnard
Advanced Placement Credit
AP credit neither fulfills the science GER nor exempts a student from any introductory course. More detailed information about AP credit is listed on the Barnard website at more detailed information about AP credit on the Barnard website at https://barnard.edu/apscores.

Columbia College Courses
- View a list of Columbia College courses accepted toward the biology major at this link.
- To submit additional Columbia courses for consideration, email the associate chair with the syllabus and fill out a degree audit change request form on Slate.

Transfer Credit
- When students wish to transfer credit to Barnard from other institutions, their coursework is first evaluated for college elective credit by the Registrar's Office. If they are approved, departments can consider these courses for credit toward the major or minor.
- To submit transfer courses for consideration, email the associate chair with the syllabus and fill out a degree audit change request form on Slate.
- According to the Barnard website, "a minimum of six semester (non-summer) courses towards the major must be completed while the student is in residence at Barnard."

Study Abroad Credit
- Classes taken abroad through Columbia-led programs (i.e., those administered by Columbia’s Center for Global Engagement) are treated as Columbia courses, equivalent to those taken on the Morningside Heights campus.
- Classes taken abroad through other institutions or programs are treated as transfer credit and are subject to the same policies as other transfer courses. Accordingly, there will be a limit on the number of study abroad courses taken at other institutions that can be counted toward the major or minor.
- To receive credit toward the major or minor for a study abroad course (whether taken through a Columbia program or another institution/program), students must submit a Study Abroad Approval form through Slate and obtain the approval of the associate chair.

Summer Credit
- Summer courses at Barnard are equivalent to those taken during the academic year. Courses that have been approved for the fulfillment of departmental requirements will automatically count toward the major.
- Courses taken at other institutions (including Columbia) are considered transfer credit and are subject to the same policies governing other transfer courses. To receive major or minor credit for a summer course taken at another institution, students must submit a Summer Course form through Slate and have it approved by both the Registrar’s Office and the Chair or department representative.

Research in Biology and the Senior Capstone Project
Academic Credit for Independent Research
Students involved in independent research projects under the guidance of a faculty member at Barnard or another local institution may enroll in one of the following courses for academic credit. Before enrolling, students must consult the Barnard course instructors.
- BIOL BC3591 / BIOL BC3592 Guided Research & Seminar is a year-long course that fulfills two upper-level laboratory requirements for the biology major. This course is open to junior and senior biology majors and minors and cannot be taken at the same time as BIOL BC3593 / BIOL BC3594.
- BIOL BC3593 / BIOL BC3594 Senior Thesis Research & Seminar is a year-long course that fulfills the senior capstone requirement for the biology major. This course is open to senior biology majors and cannot be taken at the same time as BIOL BC3591 / BIOL BC3592.
- BIOL BC3597 GUIDED RESEARCH is a semester-long, variable-credit course that does not fulfill major or minor requirements. It is open to students of all class years regardless of major.

Other Research Opportunities
- Barnard students engaging in research in NYC over the summer may apply to the Summer Research Institute (SRI).
- Barnard students engaging in research outside of NYC over the summer may apply for a Barnard Biology Mini Summer Research Grant.

The Senior Capstone Project
Students complete the Senior Capstone Experience with either of the following two options:
- Senior Seminar in Biology (BIOL BC3590), a one-semester course
- Senior Thesis Research and Seminar (BIOL BC3593 & BIOL BC3594), a yearlong course

Note: Seniors who aim to fulfill two upper-level lab requirements with BIOL BC3591 & BIOL BC3592 Guided Research and Seminar cannot take Senior Thesis Research and Seminar at the same time. Instead, they must take BIOL BC3590 Senior Seminar to complete their senior capstone experience.

Departmental Honors and Prizes
Departmental Honors
Seniors whose biology major GPAs lie within the top 20% of the graduating class may earn departmental honors.

Academic Prizes
The Spiera Family Prize
Award to a student majoring in Biology who is considered to show a promise of excellence in the field of Biology.

The Herrman Botanical Prize
Award to one or more students "toward the tuition in Botany or Botanical research."

The Constance Von Wahl Prize
Award to member of the graduating class with high qualities of character, devotion to high ideals of duty and helpfulness and effective service to fellow students and College.

OR

Prize to a student for excellence in zoology on the understanding that it be used to advance her knowledge in the field.

**The Excellence in Biology Award**

Prize for continued excellence in biology.

**Chair:** Elizabeth Bauer (Professor)

**Associate Chair:** Jonathan Snow (Associate Professor)

**Professors:** Elizabeth Bauer, Hilary Callahan (on leave 2024-2025), John Glendinning, Jennifer Mansfield, Brian Morton

**Associate Professors:** JJ Miranda, Jonathan Snow

**Assistant Professors:** Alison Pischedda, Emlyn Resetarits, Allison Lopatkin (on leave)

**Senior Lecturer and Introductory Lab Director:** Jessica Goldstein

**Lecturers:** Jordan Balaban, Rishita Shah

**Term Assistant Professor:** Vincent FitzPatrick

**Term Lecturers:** Gabrielle Corradino, Stephen Sturley

**Adjunct Lecturers:** Cecelia Fontanesi, Chisa Hidaka

**Department Administrator:** Sylvia Niemann

**Senior Laboratory Manager:** Basil Perkins

**Introductory Lab Senior Associate Director:** Henry Truong

**Introductory Lab Associate Director:** Abigail Gutierrez

**Laboratory Specialists:** Olivia Anastasio, Colin Flanagan, and Jesse Graves

**Laboratory Assistants:** Ava Brent, Tiffany Flores, Avigayil Lev, Parker Parrella

**Requirements for the Major**

To declare a major in biology, submit a major declaration form via Slate.

There are five ways to complete a biology major. These are called “tracks.”

1. **General Biology**
2. **Cellular and Molecular Biology**
3. **Physiological and Organismal Biology**
4. **Ecological and Evolutionary Biology**
5. **Computational Biology**

All tracks within the major must fulfill common foundational and senior capstone requirements. Tracks 2-4 concentrate on a specific level of biological organization. Please refer to the biology major checklists to see a list of requirements for each version of the biology major.

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**Introductory Biology & Genetics**

Every biology major must complete ALL of the following introductory biology and genetics courses.

**Introductory Biology Fall Offerings:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL BC1500</td>
<td>INTRO ORGANISMAL/EVOL BIOL</td>
<td>3.00</td>
</tr>
<tr>
<td>BIOL BC1510</td>
<td>BIOL BC1500 DISCUSSION SECTION (This is a co-requisite for BIOL BC1500.)</td>
<td></td>
</tr>
<tr>
<td>BIOL BC1501</td>
<td>INTRO LAB/ORGANISMAL#EVOL BIO</td>
<td>2</td>
</tr>
</tbody>
</table>

**Introductory Biology Spring Offerings:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL BC1502</td>
<td>INTRO CELL AND MOLECULAR BIOL</td>
<td>3.50</td>
</tr>
<tr>
<td>BIOL BC1512</td>
<td>BIOL BC1502 DISCUSSION SECTION (This is a co-requisite for BIOL BC1502.)</td>
<td></td>
</tr>
<tr>
<td>BIOL BC1503</td>
<td>INTRO LAB CELLULAR#MOLEC BIO</td>
<td>2</td>
</tr>
<tr>
<td>BIOL BC1513</td>
<td>BIOL BC1503 RECITATION (This is a co-requisite for BIOL BC1503. It is asynchronous.)</td>
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</table>

**Genetics Requirement (Offered Fall & Spring)**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOL BC2110</td>
<td>MOLECULAR # MENDELIAN GENETICS</td>
<td>3</td>
</tr>
</tbody>
</table>

It is recommended, but not required, that Genetics be taken immediately after completing the 1500-level introductory sequence. Though it is a pre-requisite for many upper-level courses, it is not required for all. For example, sophomores interested in pursuing the Organismal & Physiological or Ecology & Evolutionary tracks are encouraged to take BIOL BC2280 Animal Behavior, BIOL BC2840 Plant Evolution and Diversity, or BIOL BC3360 Physiology even if they have not yet taken genetics.

**Five Upper-Level Lecture Courses**

Students must complete five upper-level lecture courses.

Requirements for each track are listed below:

1. **General Biology (GB):** Five upper-level lecture courses with at least one course from each of the three categories (C&M, P&O, and E&E).
2. **Cell & Molecular Biology (C&M):** Four upper-level lecture courses from the C&M category + one from another category (P&O or E&E).
3. **Physiology & Organismal Biology (P&O):** Four upper-level lecture courses from the P&O category + one from another category (C&M or E&E).
4. **Ecology & Evolutionary Biology (E&E):** Four courses from the E&E category + one from another category (C&M or P&O).
5. **Computational Biology (CB):** Four computing courses from the CB-COMP category + one course from the CB-BIOL category.

**Please Note:**

1. Although some courses are listed in multiple categories, a student can only use a course toward one of the categories.
2. If a student completes courses that make them eligible for more than one of the five major tracks, then they may select which track is reflected on their transcript. (A student can list only one track on their transcript.)

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**Here is a list of courses related to each track/category:**

**Cellular & Molecular Biology (C&M)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL BC2278</td>
<td>EVOLUTION</td>
<td>3</td>
</tr>
<tr>
<td>BIOL BC2490</td>
<td>CODING IN BIOLOGY</td>
<td>3</td>
</tr>
<tr>
<td>BIOL BC3304</td>
<td>TOPICS IN MOLECULAR GENETICS</td>
<td>3</td>
</tr>
<tr>
<td>BIOL BC3308</td>
<td>INTRODUCTION TO MICROBIAL GENOMICS</td>
<td>3</td>
</tr>
<tr>
<td>BIOL BC3310</td>
<td>CELL BIOLOGY</td>
<td>3</td>
</tr>
<tr>
<td>BIOL BC3320</td>
<td>MICROBIOLOGY</td>
<td>3</td>
</tr>
<tr>
<td>BIOL BC3352</td>
<td>DEVELOPMENT</td>
<td>3</td>
</tr>
<tr>
<td>BIOL BC3362</td>
<td>MOLECULAR # CELLULAR NEUROSCIENCE</td>
<td>3</td>
</tr>
<tr>
<td>CHEM BC3282</td>
<td>BIOLOGICAL CHEMISTRY</td>
<td>3</td>
</tr>
</tbody>
</table>

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BIOL UN3004  NEUROBIO I:CELLULAR & MOLECULAR  4
BIOL UN3034  Biotechnology  3
BIOL UN3073  CELLULAR/MOLECULAR IMMUNOLOGY  3
BIOL UN3310  Virology  3

**Physiology & Organismal Biology (P&O)**

BIOL BC2262  Vertebrate Biology (Physiology & Organismal Biology)  3
BIOL BC2280  ANIMAL BEHAVIOR  3
BIOL BC2286  Statistics and Research Design  3
BIOL BC3320  MICROBIOLOGY  3
BIOL BC3352  DEVELOPMENT (OR BIOL UN3022 Developmental Biology)  3
BIOL BC3360  PHYSIOLOGY (OR BIOL UN3006 General Physiology)  3
BIOL UN3005  NEUROBIO II: DEVPT # SYSTEMS  4
EEEB UN3011  BEHAVIOR BIOL-LIVING PRIMATES (EEEB UN1011 is NOT equivalent.)  3
EEEB UN3208  EXPLORATIONS IN PRIM ANATOMY  3
EEEB W4112  

**Ecology & Evolutionary Biology (E&E)**

BIOL BC2240  PLANT EVOLUTION # DIVERSITY  3
BIOL BC2262  Vertebrate Biology  3
BIOL BC2272  ECOLOGY  3
BIOL BC2278  Evolution  3
BIOL BC2280  ANIMAL BEHAVIOR  3
BIOL BC2286  Statistics and Research Design  3
BIOL BC2851  Plants and Profits: The Global Power of Botany  4
BIOL BC3320  MICROBIOLOGY  3
BIOL BC3380  Applied Ecology and Evolution  3
EEEB UN3005  INTRO-STAT-ECOLOGY # EVOL BIO  3
EEEB UN3087  CONSERVATION BIOLOGY  3
EEEB UN3220  THE EVOL OF HUM GROWTH # DEVPT  3
EWE W4110  Coastal and Estuarine Ecology  4
EWE GU4111  Ecosystem Ecology and Global Change  3

**Computational Biology - Computing (CB-COMP)**

BIOL BC2490  CODING IN BIOLOGY  3
BIOL BC2500  Programming for Scientists  3
BIOL BC2841  LAB-PLANT EVOLUTION # DIVERSITY  3
BIOL BC2851  Plants and Profits: The Global Power of Botany  4
BIOL BC3308  INTRODUCTION TO MICROBIAL GENOMICS  3
BIOL BC3590  SR SEM IN BIOLOGY (See note at bottom of list)*  4
EESCC BC3050  BIG DATA WITH PYTHON  3
EESCC GU4050  GLOBAL ASSMT-REMOTE SENSING  3
COMS W3134  Data Structures in Java  3
CBMF W4761  COMPUTATIONAL GENOMICS  3

*Different topics for this course are taught each semester. Only Bacteria by Design will fulfill this requirement. This class may count as either an upper-level elective course or the senior capstone experience.

**Computational Biology - Biology (CB-BIOL)**

BIOL BC3304  Topics in Molecular Genetics  3
BIOL BC3310  CELL BIOLOGY  3
BIOL BC3320  MICROBIOLOGY  3

BIOL BC3352  DEVELOPMENT  3
BIOL BC3360  PHYSIOLOGY  3
BIOL BC3362  MOLECULAR & CELLULAR NEUROSCIENCE  3
BIOL BC3380  Applied Ecology and Evolution  3

Ask an advisor about new or less frequently taught 3000-level courses at Barnard or Columbia, or about transfer or study-abroad credit.

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**Three Upper-Level Laboratory Courses**

Students pursuing the Computational Biology track are required to take only ONE upper-level lab from the following list.

**Upper-Level Lab Courses for the Computational Biology Track**

BIOL BC3303  LAB IN MOLECULAR BIOLOGY  3
BIOL BC3305  PROJECT LAB IN MOLECULAR GENETICS  3
BIOL BC3306  PROJECT LAB MOLECULAR GENETICS  3
BIOL BC3311  LABORATORY IN CELL BIOLOGY  3
BIOL BC3321  LABORATORY IN MICROBIOLOGY  3
BIOL BC3361  LABORATORY IN PHYSIOLOGY  3
BIOL BC3363  LAB IN MOLECULAR & CELL NEUROSCI  3

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Students pursuing the GB, C&M, P&O, or E&E track are required to take THREE upper-level lab courses (beyond the 1500 level).

These students may take ANY upper-level Barnard Biology lab courses for which they meet the pre- or co-requisites.

**Commonly Offered Upper-Level Lab Courses**

BIOL BC2281  LABORATORY IN ANIMAL BEHAVIOR  3
BIOL BC2490  CODING IN BIOLOGY (*)  3
BIOL BC2500  Programming for Scientists (**)  3
BIOL BC2801  Laboratory in Genetics  3
BIOL BC2841  LAB-PLANT EVOLUTION # DIVERSITY  3
BIOL BC2873  Laboratory in Ecology  3
BIOL BC3303  LAB IN MOLECULAR BIOLOGY  3
BIOL BC3305  PROJECT LAB IN MOLECULAR GENETICS (Yearlong course with BIOL BC3306)  3
BIOL BC3306  PROJECT LAB MOLECULAR GENETICS (Yearlong course with BIOL BC3305)  3
BIOL BC3311  LABORATORY IN CELL BIOLOGY  3
BIOL BC3321  LABORATORY IN MICROBIOLOGY  3
BIOL BC3354  LABORATORY IN EMBRYOLOGY  3
BIOL BC3361  LABORATORY IN PHYSIOLOGY  3
BIOL BC3363  LAB IN MOLEC & CELL NEUROSCI  3
BIOL BC3591  GUIDED RESEARCH # SEMINAR (Yearlong course with BIOL BC3592)  3
BIOL BC3592  GUIDED RESEARCH # SEMINAR (Yearlong course with BIOL BC3591)  3

*Coding in Biology can count either as an upper-level lab for the GB, C&M, P&O, and E&E tracks, or as an upper-level elective in the C&M or CB-COMP categories.

**MATLAB for Scientists can count either as an upper-level lab for the GB, C&M, P&O, E&E, and CB-COMP categories, but cannot fulfill a breadth requirement.
Please Note:
- Often, a lab course requires that a student have taken a prerequisite lecture offered in the opposite semester. Sometimes, the lecture may be offered as a co-requisite in the same semester.
- Students may take laboratory courses at Columbia (or other institutions) to satisfy the lab requirement, with permission from the Associate Chair.

Research Option: The year-long Guided Research & Seminar course (BIOL BC3591 followed by BIOL BC3592) can be used to fulfill up to two upper-level labs in all tracks except for Computational Biology. This course is only available as a fall to spring sequence. In Guided Research and Seminar, students complete an original research project in a lab, and both write a scientific paper and give a poster presentation of their work at the Annual Barnard Biology Research Symposium. Note: Seniors may not enroll in Guided Research and Seminar if they are enrolled in Senior Thesis Research and Seminar. For more information, visit the biology department's Undergraduate Research page.

Senior Capstone Experience

All Biology majors must complete the Senior Capstone Experience with either of the following two options:

1. One semester of BIOL BC3590 SR SEM IN BIOLOGY

   In Senior Seminar, students participate in a seminar focusing on primary literature, and both compose and give a presentation on a senior thesis in the format of a literature review. Topics vary from semester to semester. To fulfill the Computational Biology track senior capstone requirement, students must enroll in Professor Lopatkin's Bacteria by Design topic.

   Spring 2023 Topic: Bacteria by Design:
   In this course, students will explore in-depth the field of synthetic biology with a focus on engineered bacteria. Topics include fundamental design principles, environmental and clinical applications, as well as ethical implications.

   OR

2. The yearlong Senior Thesis Research and Seminar (BIOL BC3593 & BIOL BC3594)

   In Senior Thesis Research and Seminar, students complete an original research project in a lab, and both write a scientific paper and orally present their work at the Barnard Biology Research Symposium. This course is only available as a fall to spring sequence. For more information, visit our Undergraduate Research page.

Please Note: Seniors enrolled in Guided Research and Seminar to fulfill two upper-level labs for their major cannot take Senior Thesis Research and Seminar at the same time. Instead, they must complete their senior capstone experience with BIOL BC3590 Senior Seminar.

Chemistry Requirement (GB, C&M, P&O, and E&E)

Majors in the GB, C&M, P&O, and E&E tracks must complete at least one semester of General Chemistry (with laboratory) and at least one semester of Organic Chemistry (with laboratory). To see which courses will be offered this semester, we encourage students to visit the Directory of Classes for Chemistry at Barnard and at Columbia. Equivalent courses at Columbia may be taken in lieu of the Barnard Chemistry courses. This is an important topic to discuss early with your advisor.

- General Chemistry lecture (CHEM BC2001) and lab (CHEM BC2012) (offered in the fall only)
- Organic Chemistry lecture (CHEM BC3230) and lab (CHEM BC3328)

Introductory Computing/Statistics Requirement (Computational Biology Track)

Instead of completing the chemistry requirement, students on the computational biology track complete:

One of the following introductory computing courses to learn a coding language

- COMS W1004 Introduction to Computer Science and Programming in Java
- COMS BC1016 Introduction to Computational Thinking and Data Science
- ENGI E1006 INTRO TO COMP FOR ENG/APP SCI (taught in Python)

AND

One of the following introductory statistics courses

- STAT UN1010 Statistical Thinking For Data Science
- STAT UN1101 INTRODUCTION TO STATISTICS
- STAT UN1201 CALC-BASED INTRO TO STATISTICS
- STAT UN2102 Applied Statistical Computing
- NSBY BC2002 STATISTICS AND EXPERIMENTAL DESIGN
- EEEB UN3005 INTRO-STAT-ECOLOGY # EVOL BIOL

Requirements for the Minor

To declare a minor in biology, submit a minor declaration form via Slate.

Introductory biology lecture and lab courses (One year)

Introductory Biology Fall Offerings:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIOL BC1500</td>
<td>INTRO ORGANISMAL/EVOL BIOL</td>
<td>3.00</td>
</tr>
<tr>
<td>BIOL BC1510</td>
<td>BIOL BC1500 DISCUSSION SECTION (This is a co-requisite for BIOL BC1500.)</td>
<td></td>
</tr>
<tr>
<td>BIOL BC1501</td>
<td>INTRO LAB/ORGANISMAL#EVOL BIO</td>
<td>2</td>
</tr>
<tr>
<td>BIOL BC1511</td>
<td>BIOL BC1501 RECIATION (This is a co-requisite for BIOL BC1501. It is asynchronous.)</td>
<td></td>
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</table>

Introductory Biology Spring Offerings:

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL BC1502</td>
<td>INTRO CELL AND MOLECULAR BIOL</td>
<td>3.5</td>
</tr>
<tr>
<td>BIOL BC1512</td>
<td>BIOL BC1502 DISCUSSION SECTION (This is a co-requisite for BIOL BC1502.)</td>
<td></td>
</tr>
<tr>
<td>BIOL BC1503</td>
<td>INTRO LAB CELLULAR#MOLEC BIO</td>
<td>2</td>
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</table>
Biological Sciences

BIOL BC1513

BIOL BC 1503 RECITATION (This is a co-requisite for BIOL BC1503. It is asynchronous.)

Three biology lecture courses
Any lecture course at the 2100-level or higher counts.

Two biology laboratory courses
Any upper-level lab counts toward fulfilling this requirement.
The yearlong course, Guided Research & Seminar (BIOL BC3591 and BIOL BC3592), fulfills the requirement.

Note: Chemistry, environmental science, physics, and psychology majors need to take only one advanced laboratory instead of two. Check with your major advisor in order to determine whether a guided research course is a suitable selection for your major’s requirements.

HSPP BC1001 Research Apprenticeship Seminar. 3 points.
This year-long course is 3 pts (1.5/semester) Not offered during 2023-2024 academic year.

Prerequisites: This course is open to 16 first-year students who are also enrolled in an introductory lab science sequence; applications will be made available via the first-year class blog through the Dean of Studies Office.
The course will meet in a seminar format, and will discuss how research problems are defined, how scientists immerse themselves in the existing literature on a topic, how researchers craft experimental protocols and collect data, and how data can be used to test hypotheses. Students will also consider science stories in the New York Times and lead formal debates about ethical and social issues. Occasionally, the seminar period will be devoted to tours of faculty science labs to learn about the research that Barnard professors conduct and the research opportunities available on campus.

Additionally, students will participate in a month-long laboratory rotation each semester. During the rotation period, each student will spend 3 hours per week shadowing a Barnard junior or senior Research Intern who is conducting a year-long research project. In addition to this exposure to research at Barnard, students will discuss how to obtain summer science internships in laboratories off campus. Seminar assignments will include readings about the research process, as well as short library-based research projects about scientific claims in textbooks. In the fall, students will develop their presentation skills in a session with Barnard’s Speaking Fellows. In the spring, each student will deliver an oral presentation about the research career of a scientist of her choosing.

HSPP BC1002 Research Apprenticeship Seminar. 3 points.
This year-long course is 3 pts (1.5/semester) Not offered during 2023-2024 academic year.

Prerequisites: This course is open to 16 first-year students who are also enrolled in an introductory lab science sequence; applications will be made available via the first-year class blog through the Dean of Studies Office.
The course will meet in a seminar format, and will discuss how research problems are defined, how scientists immerse themselves in the existing literature on a topic, how researchers craft experimental protocols and collect data, and how data can be used to test hypotheses. Students will also consider science stories in the New York Times and lead formal debates about ethical and social issues. Occasionally, the seminar period will be devoted to tours of faculty science labs to learn about the research that Barnard professors conduct and the research opportunities available on campus.

Additionally, students will participate in a month-long laboratory rotation each semester. During the rotation period, each student will spend 3 hours per week shadowing a Barnard junior or senior Research Intern who is conducting a year-long research project. In addition to this exposure to research at Barnard, students will discuss how to obtain summer science internships in laboratories off campus. Seminar assignments will include readings about the research process, as well as short library-based research projects about scientific claims in textbooks. In the fall, students will develop their presentation skills in a session with Barnard’s Speaking Fellows. In the spring, each student will deliver an oral presentation about the research career of a scientist of her choosing.

BIOL BC1002 Global Health and Ecology. 4.5 points.
Not offered during 2023-2024 academic year.

Prerequisites: BIOL BC1012 lab enrollment is required. This lecture & lab course does not fulfill biology major nor pre-health requirements, but is recommended for prospective biology majors who lack a high-school level background in biology. For students fulfilling a Nine Ways of Knowing lab science requirement, this course may be taken with AP/IB credit OR with BIOL BC1502 & BIOL BC1503 in the spring. Students fulfilling a Foundations requirement may take BIOL BC1002/BIOL BC1012 as a one-semester course in addition to another science lecture, such as BIOL BC1001 Revolutionary Concepts in Biology, to fulfill the lab science requirement.

What disease is the number one killer worldwide? What will be the next pandemic? Fundamentals of human physiology and microbiology are explored in the context of major global health issues. Principles of ecology are outlined, with an emphasis on the bidirectional impact of the interactions of humans with the global environment. Lab exercises introduce biological techniques for studying these topics. Enrollment in BIOL BC1012 (BC1002 lab) is required, and limited to 16 students per section.
BIOL BC1012 BIOL BC1002 Lab. 0 points.
Not offered during 2023-2024 academic year.

Prerequisites: BIOL BC1002 Global Health & Ecology is a co-requisite. This lab course does not fulfill biology major nor pre-health requirements. Enrollment in each lab section is limited to 16 students per section. Students must attend the first lab to hold their place. Fundamentals of human physiology and microbiology are explored in the context of major global health issues. Principles of ecology are outlined, with an emphasis on the bidirectional impact of the interactions of humans with the global environment. Lab exercises introduce biological techniques for studying these topics.

BIOL BC1001 REVOLUTIONARY CONCEPTS IN BIOL. 3.00 points.
Prerequisites: This lecture course does not fulfill Biology major nor premedical requirements, but does count toward the Science Lecture GER requirement for students fulfilling a Foundations requirement. Exploration of the major discoveries and ideas that have revolutionized the way we view organisms and understand life. This is an introductory survey course that explores basic concepts of molecular and cellular biology, genetics and evolution. Students will focus on biological concepts, biotechnology and bioethics, which inundate contemporary society.

Fall 2024: BIOL BC1001
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
BIOL 1001  001/00801  T Th 10:10am - 11:25am  207 Milbank Hall  Vincent FitzPatrick  3.00  2/40

BIOL BC1500 INTRO ORGANISMAL/EVOL BIOL. 3.00 points.
Prerequisites: This course is suitable for majors & fulfillment of pre-health requirements. A high school biology background or equivalent preparation is highly recommended. For those without this background seeking to major in biology, BIOL BC1002 & BIOL BC1012 are recommended in the fall of their freshmen year, followed by the year-long 1500-level lecture & lab sequence. BIOL BC1500 & BIOL BC1502 do not have to be taken in a fall to spring sequence. Co-requisite: (strongly recommended) BIOL BC1501 This course is suitable for majors # fulfillment of pre-health requirements. A high school biology background or equivalent preparation is highly recommended. BIOL BC1500 & BIOL BC1502 form a 2-semester introductory biology series and do not have to be taken in a fall to spring sequence. Detailed introduction to biological phenomena above the cellular level; development, anatomy, and physiology of plants and animals; physiological, population, behavioral, and community ecology; evolutionary theory; analysis of micro-evolutionary events; and systematics.

Fall 2024: BIOL BC1500
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
BIOL 1500  001/00008  M W 8:40am - 9:55am  304 Barnard Hall  Emlyn Resetarits, Abigail Gutierrez, Henry Truong  3.00  110/220

BIOL BC1510 BIOL BC1500 DISCUSSION SECTION. 0.00 points.
The goals of these discussion sections include providing a space to build community during remote learning and promoting opportunities for active engagement with the lecture material. These discussion sections will also serve as a space for students to consider science from multiple perspectives beyond discipline-specific content in the lecture and text (e.g. hearing guest lectures from BiPOC scientists, considering racial disparities in health outcomes, etc.). Participation will include posting on discussion boards between sessions, delivering short presentations during discussion, working well with partners, and making thoughtful comments during the discussion period.

BIOL BC1008 HEALTHIER LIFE. 3 points.
Not offered during 2023-2024 academic year.

This is an introductory biology survey course which explores fundamentals of physiology in humans and other organisms, both in the context of global health and global ecological issues. It emphasizes reciprocal interactions between individual healthy humans and healthy societies, and the function of ecosystems in supporting humans and other biodiversity.
BIOL BC1501 INTRO LAB/ORGANISMAL#EVOL BIO. 2.00 points.
Prerequisites: BIOL BC1500 lecture is a pre- or co-requisite (preferred).
Students must also enroll for a section of BIOL BC1511 recitation. A high school biology background or equivalent preparation is highly recommended. This course is suitable for fulfillment of biology major and pre-health requirements. Enrollment is limited to 16 students per section. A laboratory-based introduction to the major groups of living organisms; anatomy, physiology, evolution, and systematics; and laboratory techniques for studying and comparing functional adaptations

BIOL BC1511 BIOL BC1501 RECITATION. 0.00 points.
Prerequisites: BIOL BC1500 lecture is a pre- or co-requisite (preferred). This recitation (BIOL BC1511) is a co-requisite course for enrollment in BIOL BC1501 Introductory Lab in Organismal & Evolutionary Biology. Each individual lab section is limited to 16 students per section, however all students must enroll in one of the two recitation sections offered. Prerequisites: BIOL BC1001 or equivalent preparation. Enrollment limited to 16 students per section. Course suitable for fulfillment of premedical requirements. BIOL BC1500 as prerequisite or corequisite. A laboratory-based introduction to the major groups of living organisms; anatomy, physiology, evolution, and systematics; and laboratory techniques for studying and comparing functional adaptations

BIOL BC1502 INTRO CELL AND MOLECULAR BIOL. 3.50 points.
Prerequisites: BIOL BC1002 or equivalent preparation. Course suitable for fulfillment of premedical requirements. Together with BIOL BC1500 this course is part of a yearlong introductory sequence. BIOL BC1500 and BIOL BC1502 do not need to be taken in sequence. Detailed introduction to cellular and subcellular biology: cell structures and functions, energy metabolism, biogenesis of cell components, biology of inheritance, molecular genetics, regulation of gene expression, and genes in development
BIOL 1503 INTRO LAB CELLULAR MOLEC BIO. 2.00 points.
Prerequisites: BIOL BC1502 lecture is a pre- or co-requisite (preferred). Students must also enroll for a section of BIOL BC1513 recitation. A high school biology background or equivalent preparation (such as BIOL BC1002 & BIOL BC1012) is highly recommended. This course is suitable for fulfillment of biology major and pre-health requirements. Enrollment is limited to 16 students per section; must attend first lab to hold place. A laboratory-based introduction to cell and molecular biology. Both classic and modern approaches are used to investigate principles of heredity as well as the structure and function of cells and their molecular components. Lab exercises introduce practical techniques and data analysis.

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<tr>
<th>Course Number</th>
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<td>001/00598</td>
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<td>Jessica Goldstein, Abigail Gutierrez, Henry Truong</td>
<td>2.00</td>
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<tr>
<td>BIOL 1503</td>
<td>002/00599</td>
<td>M 1:10pm - 4:00pm 912 Altschul Hall</td>
<td>Jessica Goldstein, Abigail Gutierrez, Henry Truong</td>
<td>2.00</td>
<td>15/16</td>
</tr>
<tr>
<td>BIOL 1503</td>
<td>003/00600</td>
<td>T 9:10am - 12:00pm 913 Altschul Hall</td>
<td>Jessica Goldstein, Abigail Gutierrez, Henry Truong</td>
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<td>16/16</td>
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<td>004/00601</td>
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<td>BIOL 1503</td>
<td>006/00603</td>
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<td>Jessica Goldstein, Abigail Gutierrez, Henry Truong</td>
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<td>BIOL 1503</td>
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BIOL BC1512 BIOL BC1502 DISCUSSION SECTION. 0.00 points.
The goals of these discussion sections include providing a space to build community during remote learning and promoting opportunities for active engagement with the lecture material. These discussion sections will also serve as a space for students to consider science from multiple perspectives beyond discipline-specific content in the lecture and text (e.g. hearing guest lectures from BIPOC scientists, considering racial disparities in health outcomes, etc.). Participation will include posting on discussion boards between sessions, delivering short presentations during discussion, working well with partners, and making thoughtful comments during the discussion period.

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<th>Course Number</th>
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**BIOL BC1513 BIOL BC 1503 RECITATION. 0.00 points.**
Prerequisites: BIOL BC1502 lecture is a pre- or co-requisite (preferred). This recitation (BIOL BC1513) is a co-requisite course for enrollment in BIOL BC1503 Introductory Lab in Cell & Molecular Biology. Each individual lab section is limited to 16 students per section, however all students must enroll in one of the two recitation sections offered. A laboratory-based introduction to cell and molecular biology. Both classic and modern approaches are used to investigate principles of heredity as well as the structure and function of cells and their molecular components. Lab exercises introduce practical techniques and data analysis.

Spring 2024: BIOL BC1513  
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**BIOL BC1599 SCIENCE JOURNAL CLUB. 1.00 point.**
Prerequisites: ) Limited to 16 students who are participating in the Science Pathways Scholars Program.
Prerequisites: ) Limited to 16 students who are participating in the Science Pathways Scholars Program. Students in this seminar course will be introduced to the scientific literature by reading a mix of classic papers and papers that describe significant new developments in the field. Seminar periods will be devoted to oral reports, discussion of assigned reading, and student responses. Section 1: Limited to students in the Science Pathways Scholars Program. Section 2: Limited to first-year students who received a 4 or 5 on the AP and are currently enrolled in BIOL BC1500.

Fall 2024: BIOL BC1599  
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<th>Course Number</th>
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<td>Sedelia Rodriguez</td>
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**BIOL BC2100 MOLECULAR # MENDELIAN GENETICS. 3.00 points.**
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503 or the equivalent. This course is a pre-requisite for most 3000-level courses. Mendelian and molecular genetics of both eukaryotes and prokaryotes, with an emphasis on human genetics. Topics include segregation, recombination and linkage maps, cytogenetics, gene structure and function, mutation, molecular aspects of gene expression and regulation, genetic components of cancer, and genome studies.

Spring 2024: BIOL BC2100  
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<th>Course Number</th>
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<th>Times/Location</th>
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<td>Brian Morton</td>
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Fall 2024: BIOL BC2100  
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<td>Jennifer Mansfield</td>
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**BIOL BC2240 PLANT EVOLUTION # DIVERSITY. 3.00 points.**
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503 or the equivalent.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503 or the equivalent. Survey of plant biology emphasizing evolutionary and ecological perspectives on mating and reproduction, physiology, anatomy, and morphology.

**BIOL BC2262 Vertebrate Biology. 3 points.**
Not offered during 2023-2024 academic year.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, and BIOL BC1503 or the equivalent. Systematic survey of the Phylum Chordata: fossil history, biogeography, systematics, natural history, body architecture, energetics, locomotion, feeding, and behavior.

**BIOL BC2272 ECOLOGY. 3.00 points.**
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503 or the equivalent. This course is a pre- or co-requisite for BIOL BC2873 Laboratory in Ecology. The definition of ecological problems in experimentally tractable ways; the design of experiments and analysis of ecological data; class projects on population ecology. Students conduct individual projects during last month of term.

Spring 2024: BIOL BC2272  
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<th>Course Number</th>
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<th>Times/Location</th>
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<td>Emlyn Resetarits</td>
<td>3.00</td>
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**BIOL BC2278 Evolution. 3 points.**
Not offered during 2023-2024 academic year.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, and BIOL BC1503 or the equivalent. Study of the process of evolution with an emphasis on the mechanisms underlying evolutionary change. Topics include the origins of life, rates of evolutionary change, phylogenetics, molecular evolution, adaptive significance of traits, sexual selection, and human evolution.

**BIOL BC2280 ANIMAL BEHAVIOR. 3.00 points.**
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, and BIOL BC1503 or the equivalent. This course is a pre-requisite for BIOL BC2281 Laboratory in Animal Behavior. Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503 or equivalent. This introduction to animal behavior takes an integrative approach to understand the physiological and genetic basis of behavior, the ecological context of behavior, and the evolutionary consequences of behavior. This course focuses on the process of scientific research, including current research approaches in animal behavior and practical applications of these findings.

Spring 2024: BIOL BC2280  
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<th>Course Number</th>
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<td>Alison Pischella</td>
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BIOL BC2281 LABORATORY IN ANIMAL BEHAVIOR. 3.00 points.
Prerequisites: (BIOL BC1500) and (BIOL BC1502) and (BIOL BC2280) and (BIOL BC1501) and (BIOL BC1503) This lab provides an introduction to animal behavior research, including current research approaches and practical applications of these findings. Students will complete two main projects. The first is a group project using the fruit fly, Drosophila melanogaster, which will involve observing, recording, and analyzing reproductive behaviors. The second is an independent project that will be designed, conducted, and analyzed by students using publicly available animal behavior resources and/or data. Both projects will incorporate critical thinking, problem solving and experimental design, with an emphasize on scientific writing and oral presentation skills

Fall 2024: BIOL BC2281

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<th>Course Number</th>
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BIOL BC2490 CODING IN BIOLOGY. 3.00 points.
An introduction to the basics of Python and R coding in the context of solving basic problems in molecular biology. Python will be used to write programs that analyze various features of DNA sequence data and R will be used to analyze output from RNA-seq experiments. No prior programming experience is necessary. The work will involve modifying existing code as well as developing simple programs from the ground up.

Spring 2024: BIOL BC2490

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BIOL BC2500 Programming for Scientists. 3.00 points.
Learning objectives: This course will provide a comprehensive foundation in programming methodology for quantitative biology applications that can be readily applied to any programming language. It is recommended for students interested in establishing or expanding their computational biology skillset. After completing this course, students should be able to:
1. Understand and explain the role of numerical and statistical methods in biology.
2. Execute numerical computations using a widely-used programming language.
3. Recognize common programming motifs that can be readily applied to other widely used languages.
4. Design and troubleshoot algorithms to analyze diverse biological data and implement them using functions and scripts.
5. Apply statistical programming techniques to model biological systems.
6. Generate and interpret diverse plots based on biological datasets.

Course overview: Once a small subfield of biology, computational biology has evolved into a massive field of its own, with computational methods fast becoming a vital toolkit leveraged by biologists across the discipline. As the size and complexity of biological datasets grows, computational methods allow scientists to make sense of these data, scaling quantitative methods to extract meaningful insights that help us better understand ourselves and the living world around us. In this course, we will learn the basics of computer programming in R, a powerful programming language with wide use in the biological sciences. Topics will include a basic introduction to R and the RStudio environment, data types and control structures, reading and writing files in R, data processing and visualization, manipulating common biological datasets; and statistical testing and modeling in R.

Spring 2024: BIOL BC2500

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Fall 2024: BIOL BC2500

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BIOL BC2801 Laboratory in Genetics. 3 points.
Not offered during 2023-2024 academic year.

Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503; and pre or corequisite, BIOL BC2100 and Enrollment limited to 16 students per section.

Exercises in genetics at both the Mendelian and molecular levels. Basic principles of genetic analysis will be studied using Drosophila and bacteria. A project in molecular genetics, involving such techniques as PCR, gel electrophoresis, and cloning, will be undertaken using plant genes.

BIOL BC2841 LAB-PLANT EVOLUTION # DIVERSITY. 3.00 points.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503 or equivalent. Enrollment is limited to 16; must attend first lab to hold place.
Prerequisites: () Enrollment is limited to 16; must attend first lab to hold place. Studies of the structure, ecology, and evolution of plants. Laboratory exercises include field problems, laboratory experiments, plant collections and identification, and examination of the morphology of plant groups.
BIOL BC2851 Plants and Profits: The Global Power of Botany. 4 points.
The course is part of the Barnard Teaches program. It will have a lab that will teach science and digital skills and on Thursdays two consecutive times are scheduled to allow lecture and lab to accommodate trips to NYBG. Not offered during 2023-2024 academic year.

Prerequisites: Strongly recommend prior enrollment in BIOL BC1001 or 1002, or in BIOL BC 1501 and 1502, or the equivalent. Students need to understand genetics and must be prepared to read professional science literature. Science students must be prepared for lengthy reading assignments. Sustaining complex human systems requires plants, which in turn depend on soils, geology, and climate. With that reality in the foreground, this course will foster fluency and expertise in classical and cutting edge botanical science: genetics, genomics, biogeography, conservation biology, and economic botany. At the center of its investigations will be the ongoing digital revolution, recognizing that natural history has been and will continue to be essential to all of the plant sciences. The course will encourage interdisciplinary perspectives, pushing students outside of their intellectual comfort zones and aiming to comprehend plant biodiversity from a multiplicity of human perspectives.

BIOL BC2873 Laboratory in Ecology. 3 points. Not offered during 2023-2024 academic year.

Prerequisites: BIOL BC2272 (which can be taken as a pre- or co-requisite). Enrollment is limited to 16; must attend first lab to hold place. The definition of ecological problems in experimentally tractable ways; the design of experiments and analysis of ecological data; class projects on population ecology. Students conduct individual projects during last month of term.

BIOL BC3303 LAB IN MOLECULAR BIOLOGY. 3.00 points.
Prerequisites: BIOL BC2100 (which can be taken as a pre- or co-requisite). Enrollment is limited to 16; must attend first lab to hold place. Introduction to the use of molecular techniques to answer questions about subcellular biological phenomena. Techniques include isolation of genomic and plasmid DNAs, restriction enzyme analysis, DNA and protein electrophoresis, bacterial transformation, and plasmid subcloning.

BIOL BC3305 PROJECT LAB IN MOLECULAR GENETICS. 3.00 points.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503, and BIOL BC2100 or permission of instructor. Enrollment limited to 16.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503, and BIOL BC2100 or permission of instructor. Enrollment limited to 16. Laboratory course in which students conduct original research projects in molecular genetics. Students will participate in experimental design, conduct and data analysis, and work with key techniques for studying gene structure, expression and function such as nucleic acid extraction and synthesis, cloning, bioinformatics analysis, PCR, and qPCR. Students will present their results orally and in writing. Enrollment in both semesters (BIOL BC3305 and BIOL BC3306) of this full-year course is required, and fulfills two upper-level lab courses for the Barnard Biology major. Must be taken in sequence, beginning in the fall. -B. Morton - J. Mansfield

BIOL BC3306 PROJECT LAB MOLECULAR GENETICS. 3.00 points.
Prerequisites: BIOL BC2100 or permission of the instructors. Enrollment is limited to 16; must attend first lab to hold place. Laboratory course in which students conduct original research projects in molecular genetics. Students will participate in experimental design, conduct data analysis, and work with key techniques for studying gene structure, expression and function such as nucleic acid extraction and synthesis, cloning, bioinformatics analysis, PCR, and qPCR. Students will present their results orally and in writing. Enrollment in both semesters (BIOL BC3305 and BIOL BC3306) of this full-year course is required, and fulfills two upper-level lab courses for the Barnard Biology major. Must be taken in sequence, beginning in the fall

BIOL BC3308 INTRODUCTION TO MICROBIAL GENOMICS. 3.00 points.
Prerequisites: (BIOL BC1500)(BIOL BC1501)(BIOL BC1502)(BIOL BC1503) and BIOL BC2100 or the equivalent. This course is an upper-level laboratory.
This course will focus on understanding, implementing, and using basic bioinformatic algorithms and tools to analyze microbial genomes and genomic information. Topics cover a history of genome sequencing methods, local and global alignment methods, sequence annotation tools, de novo genome assembly, multiple sequence alignments, and simple molecular phylogeny. Theoretical lectures will be taught in parallel with labs focused on hands-on analysis of real-world data so that students create tangible and applicable skills. Knowledge of a programming language is required to take this course. Class notes are intended to be self-contained for these topics.
BIOL BC3310 CELL BIOLOGY. 3.00 points.
Prerequisites: (BIOL BC1500)(BIOL BC1501)(BIOL BC1502)(BIOL BC1503) and BIOL BC2100 or equivalent.
This course explores the components, systems, and regulatory mechanisms involved in eukaryotic cellular function. Topics include: signal transduction, translational and protein quality control, organelar and cytoskeletal dynamics, and some coordinated responses such as proliferation and programmed cell death. Throughout the course we will see how general cell biology can be specialized to achieve specific cellular functions through regulation of the basic machinery. We will also explore the cellular and molecular bases for a variety of human pathologies, with an emphasis on cancer. In addition to lecture, we will spend some time discussing the material, including selected articles from the primary literature, and learning through group presentations.

BIOL BC3311 LABORATORY IN CELL BIOLOGY. 3.00 points.
Prerequisites: BIOL BC2100 Enrollment is limited to 16; must attend first lab to hold place.
Introduction to cell biological techniques used to investigate structural, molecular, and physiological aspects of eukaryotic cells and their organization into tissues. Techniques include light and electron microscopy, cell culture, isolation of cellular organelles, protein electrophoresis, and Western Blot analysis.

BIOL BC3320 MICROBIOLOGY. 3.00 points.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503, and BIOL BC2100 or the equivalent. This course is a pre-requisite for BIOL BC3321 Laboratory in Microbiology.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503 or the equivalent, and BIOL BC2100. Survey of the diversity, cellular organization, physiology, and genetics of the major microbial groups. Also includes aspects of applied microbiology and biotechnology, the function of microorganisms in the environment, and the role of microbes in human diseases.

BIOL BC3321 LABORATORY IN MICROBIOLOGY. 3.00 points.
Prerequisites: BIOL BC3320 (which can be taken as a pre- or co-requisite). Enrollment is limited to 16; must attend first lab to hold place.
Enrollment limited to 16. Provides experience in the isolation, cultivation, and analysis of pure cultures of microorganisms. Methods used for the study of cell structure, growth, physiology, and genetics of microbes will be incorporated into laboratory exercises.

BIOL BC3352 DEVELOPMENT. 3.00 points.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503, and BIOL BC2100 or the equivalent.
Introduction to animal developmental biology and its applications. This course will examine the basic mechanisms through which animal bodies organize themselves, from an integrative perspective at the levels of genes and gene networks, cell properties and behaviors, coordinated interactions of cells in developing tissues, organs and organ systems, and the role of developmental processes in morphological evolution. Topics include: fertilization, cleavage and gastrulation, establishment of body axes, neural development, organ formation, tissue and organ regeneration, stem cells and medical applications, evolution of developmental programs, and teratogenesis.

BIOL BC3354 LABORATORY IN EMBRYOLOGY. 3.00 points.
Not offered during 2023-2024 academic year.
This lab course will explore the foundational methods of vertebrate embryology. Using both classical and modern experimental approaches, we will identify and manipulate developmental processes such as gastrulation, neurulation, and organogenesis. Students will investigate molecular regulation of patterning and the importance of tissue-tissue interactions during early development. Utilizing modern genetic tools and imaging techniques, such as digital microscopy, students will have the opportunity to visualize embryogenesis in real-time. Prerequisite: Two terms of introductory biology (BIOL BC1500, BC1502 or equivalent) AND one term of Genetics (BIOL BC2100 or equivalent) AND at least one upper level lab course at the cell and molecular level. OR permission from the instructor.

BIOL BC3360 PHYSIOLOGY. 3.00 points.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, and BIOL BC1503 or the equivalent.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503 or the equivalent. This course examines how mammals carry out basic functions like manipulating objects, sensing the external world, oxygenating tissues, and processing food. Emphasis is placed on (a) how the body regulates itself through the integrated action of multiple organ systems and (b) what goes awry in disease.
BIOL BC3361 LABORATORY IN PHYSIOLOGY. **3.00 points.**
Not offered during 2023-2024 academic year.

Prerequisites: BIOL BC3360 (or equivalent, which can be taken as a pre- or co-requisite). Enrollment is limited to 16, must attend first lab to hold place.
Prerequisites: Pre- (or co-) requisite is a physiology lecture class (e.g. BIOL BC3360). Enrollment limited to 16. Provides a hands-on introduction to the different physiological systems in vertebrates and invertebrates. Emphasizes the operation of a variety of physiological monitoring devices and the collection and analysis of physiological data

**BIOL BC3362 MOLECULAR & CELLULAR NEUROSCIENCE. 3.00 points.**
Prerequisites: BIOL BC1502 BIOL BC1503, and either BIOL BC1500 BIOL BC1501 or NSBV BC1001 or permission from the instructor. Structure and function of neural membranes; ionic basis of membrane potential and action potential; synaptic transmission and neurochemistry; sensory transduction and processing; reflexes and spinal cord physiology; muscle structure and function; neuronal circuitry; and nervous system development.

**BIOL BC3363 LAB IN MOLEC & CELL NEUROSCI. 3.00 points.**
Prerequisites: BIOL BC3362 (which can be taken as a pre- or co-requisite). Enrollment is limited to 16; must attend first lab to hold place.
Prerequisites: BIOL BC3362 (or corequisite). Enrollment limited to 16. Introduction to techniques commonly used in current neurobiological research, including intracellular and extracellular recording of action potentials, neuroanatomical methods, and computer simulation of the action potential.

**BIOL BC3367 Ecophysiology. 3 points.**
Not offered during 2023-2024 academic year.

Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, and BIOL BC1503, or the equivalent. BIOL BC2280 is recommended.

Individuals, communities and ecosystems are composed of complex organism-environment interactions. We will examine these dynamic relationships in animals at the physiological level, covering basic concepts as they specifically relate to animal fitness. Course focus: how changes in stress and reproductive endocrinology and ecoinmunology relate to individual and population dynamics.

**BIOL BC3380 Applied Ecology and Evolution. 3 points.**
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503 or the equivalent.

Ecological and evolutionary models of populations (exponential and density-dependent growth; species interactions; genetic differentiation resulting from mating, random drift, and selection) applied to problems resulting from human-induced environmental change (endangered species; use of pesticides and antibiotics; escaping transgenic organisms; global climate change; emerging pathogens; other invaders; etc.).

**BIOL BC3400 MATHEMATICAL MODELING OF BIOLOGICAL SYSTEMS. 4 points.**
Not offered during 2023-2024 academic year.

This course will focus on building and analyzing dynamic mathematical models (models that study how processes change in time) to understand the behavior of different biological systems. We will focus on a variety of topics in population biology, physiology and the biomedical sciences such as single and competing species models, pharmacokinetic models of drugs and toxins, enzyme reaction kinetics, epidemiology, infectious diseases and cancer. We will use mathematical tools like difference equations, differential equations, linear algebra and nonlinear analysis to study these biological processes. MATLAB programming will be used to implement these mathematical models in search of answers to biological questions.

**BIOL BC3590 SR SEM IN BIOLOGY. 4.00 points.**
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, BIOL BC1503, and BIOL BC2100 or the equivalent. Enrollment is limited to 12; must attend first class to hold place.

Required for all majors who do not select the year-long Senior Thesis Research # Seminar (BIOL BC3593 # BC3594) to fulfill their senior capstone requirement. These seminars allow students to explore the primary literature in the Biological Sciences in greater depth than can be achieved in a lecture course. Attention will be focused on both theoretical and empirical work. Seminar periods are devoted to oral reports and discussion of assigned readings and student reports. Students will write one extensive literature review of a topic related to the central theme of the seminar section. Topics vary per semester and include, but are not limited to: Plant Development, Animal Development # Evolution, Molecular Evolution, Microbiology # Global Change, Genomics, Comparative # Reproductive Endocrinology, and Data Intensive Approaches in Biology.
BIOL BC3591 GUIDED RESEARCH # SEMINAR. 4.00 points.
Per Semester

This year-long course is open to junior and senior Biology majors and minors. Students will complete an independent research project in Biology under the guidance of a faculty mentor at Barnard or another local institution. Attendance at the weekly seminar is required. By the end of the year, students will write a scientific paper about their project and give a poster presentation about their research at the Barnard Biology Research Symposium. Completion of this year-long course fulfills two upper-level laboratory requirements for the Biology major or minor. This course must be taken in sequence, beginning with BIOL BC3591 in the Fall and continuing with BIOL BC3592 in the Spring. Acceptance into this course requires confirmation of the research project by the course instructors. A Barnard internal mentor is required if the research project is not supervised by a Barnard faculty member. This course cannot be taken at the same time as BIOL BC3593-BIOL BC3594

BIOL BC3592 GUIDED RESEARCH # SEMINAR. 4.00 points.
Per Semester

This year-long course is open to junior and senior Biology majors and minors. Students will complete an independent research project in Biology under the guidance of a faculty mentor at Barnard or another local institution. Attendance at the weekly seminar is required. By the end of the year, students will write a scientific paper about their project and give a poster presentation about their research at the Barnard Biology Research Symposium. Completion of this year-long course fulfills two upper-level laboratory requirements for the Biology major or minor. This course must be taken in sequence, beginning with BIOL BC3591 in the Fall and continuing with BIOL BC3592 in the Spring. Acceptance into this course requires confirmation of the research project by the course instructors. A Barnard internal mentor is required if the research project is not supervised by a Barnard faculty member. This course cannot be taken at the same time as BIOL BC3593-BIOL BC3594

BIOL BC3593 SENIOR THESIS RESEARCH # SEMINAR. 4.00 points.
Per Semester

Prerequisites: Permission of a faculty sponsor and the department. Cannot be taken concurrently with BIOL BC3591 or BIOL BC3592. This year-long course is open to senior Biology majors. Students will complete an independent research project in Biology under the guidance of a faculty mentor at Barnard or another local institution. Attendance at the weekly seminar is required. By the end of the year, students will write a scientific paper about their project and give an oral presentation about their research at the Barnard Biology Research Symposium. Completion of this year-long course fulfills the senior capstone requirement for the Biology major. This course must be taken in sequence, beginning with BIOL BC3593 in the Fall and continuing with BIOL BC3594 in the Spring. Acceptance into this course requires confirmation of the research project by the course instructors. A Barnard internal mentor is required if the research project is not supervised by a Barnard faculty member. This course cannot be taken at the same time as BIOL BC3591-BIOL BC3592

Spring 2024: BIOL BC3594

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Notes:
- BIOL BC3591 GUIDED RESEARCH # SEMINAR. 4.00 points.
- BIOL BC3592 GUIDED RESEARCH # SEMINAR. 4.00 points.
- BIOL BC3593 SENIOR THESIS RESEARCH # SEMINAR. 4.00 points.
BIOL BC3597 GUIDED RESEARCH. **1.00-4.00 points.**
Prerequisites: Permission of a faculty sponsor.
Similar to BIOL BC3591-BIOL BC3592, this is a one-semester course that provides students with degree credit for unpaid research without a seminar component. You may enroll in BIOL BC3597 for between 1-4 credits per semester. As a rule of thumb, you should be spending approximately 3 hours per week per credit on your research project. A Project Approval Form must be submitted to the department each semester that you enroll in this course. Your Barnard research mentor (if your lab is at Barnard) or internal adviser in the Biology Department (if your lab is elsewhere) must approve your planned research before you enroll in BIOL BC3597. You should sign up for your mentor’s section. This course does not fulfill any Biology major requirements. It is open to students beginning in their first year.

### Cross-Listed Courses

#### Anatomy (Barnard)

**ANAT BC2573 HUMAN ANATOMY AND MOVEMENT. 3.00 points.**
Corequisites: ANAT BC2574
Corequisites: ANAT BC2574 Dancers and other movers will acquire concrete, scientific information about anatomy and integrate this knowledge into their sensed experience of movement. Through readings, lecture/discussions and movement practice, students will explore: (1) structure and function of bones and joints, (2) muscles, neuromuscular function and coordination, (3) motor cognition and learning

#### Chemistry (Barnard)

**CHEM BC2900 Research Methods Seminar. 1 point.**
Instructor’s Permission Required
Prerequisites: Students must be sophomores with a strong interest in pursuing research in the biological or chemical sciences
Skills to facilitate into biology and chemistry research. Students will learn to think and work like scientists and to identify, apply for and gain entry to research lab groups. Focus on writing and oral presentation skills. Additional readings and discussions on laboratory safety, women in science, and scientific ethics.

**CHEM BC3282 BIOLOGICAL CHEMISTRY. 3.00 points.**
Prerequisites: (CHEM BC3230) and (CHEM BC3231) BIOL BC1502. Introduction to biochemical building blocks, macromolecules, and metabolism. Structures of amino acids, lipids, carbohydrates, nucleic acids. Protein structure and folding. Enzyme mechanisms, kinetics, allostery. Membranes and biosignaling. Catabolism and anabolism with emphasis on chemical intermediates, metabolic energy, catalysis by specific enzymes, regulation
CHEM BC3355 BIOCHEMISTRY LAB TECHNIQUES. 5.00 points.
Prerequisites: Organic II lab (CHEM BC3333, BC3335, or equivalent); Quantitative analysis lab (BC3338, BC3340, or equivalent); Biochemistry (CHEM BC3282y, CHEM C3501, or equivalent). Lecture: T 1:10-12:50; Laboratory two afternoons: T 2:10-6:00 / TH 1:10-5:00.
Prerequisites: Organic II lab (CHEM BC3333, BC3335, or equivalent); Quantitative analysis lab (BC3338, BC3340, or equivalent); Biochemistry (CHEM BC3282y, CHEM C3501, or equivalent). Theory and application of fundamental techniques for the isolation, synthesis and characterization of biological macromolecules including proteins, lipids, nucleotides and carbohydrates. Techniques include spectroscopic analysis, gel electrophoresis, chromatography, enzyme kinetics, immunoblotting, PCR, molecular cloning and cell culture, as well as modern laboratory instrumentation, such as UV-Vis, GC-MS and HPLC.

Spring 2024: CHEM BC3355

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CHEM BC3357 Biochemistry Laboratory Techniques. 3 points.
Fee: $45.
Prerequisites: four terms of chemistry and biology laboratory.
Corequisites: BIOC C3501 or BCHM G4021.
Lecture and lab. Same course as BC3355, but only one section of lab hours required.

Neuroscience and Behavior (Barnard)

NSBV BC2002 STATISTICS AND EXPERIMENTAL DESIGN. 4.00 points.
This course is for students interested in learning how to conduct scientific research. They will learn how to (i) design well-controlled experiments and identify "quack" science; (ii) organize, summarize and illustrate data, (iii) analyze different types of data; and (iv) interpret the results of statistical tests.

Spring 2024: NSBV BC2002

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Fall 2024: NSBV BC2002

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