BIOLOGICAL SCIENCES

Biological Sciences Department Office:
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biology.barnard.edu
Department Administrator: Sylvia Niemann (sniemann@barnard.edu)
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The Department of Biological Sciences

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 modern scientific equipment, and interpret data. Finally, 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

Students graduating with a major in Biology should be able to attain the following outcomes:

- Demonstrate an appreciation of the many different life forms on planet Earth.
- Have the ability to 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; and 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.

Research

Students are strongly encouraged to engage in research at Barnard. Either or both year-long courses, BIOL BC3591 GUIDED RESEARCH #
Requirements for the Major

There are four ways to complete a major within Biological Sciences, referred to as tracks. A student can obtain a general Biology Major or may complete one of the three tracks to specialize in a level of biological organization: Cellular and Molecular; Physiological and Organismal; or Ecological and Evolutionary. A minimum of 45.5 credits is required for the Biological Sciences major.

Introductory Biology
You may begin the introductory sequence with BIOL BC1002 Global Health and Ecology and the co-requisite lab BIOL BC1012 in the fall of your freshman year, but for the major you must then complete the entire 1500-level sequence the subsequent spring and fall. Please note that starting in Fall 2020, in order to enroll in BIOL BC1500 or BIOL BC1502, you will need to sign up for a co-requisite discussion section. With the exception of AY20-21, you will also need to enroll in a co-requisite recitation section in order to enroll in either BIOL BC1501 or BIOL BC1503 lab.

<table>
<thead>
<tr>
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<td>BIOL BC1510</td>
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<td>Introductory Lab in Organismal and Evolutionary Biology</td>
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<td>BIOL BC1511</td>
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<td>BIOL BC1513</td>
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Genetics
BIOL BC2100 Molecular and Mendelian Genetics

It is recommended, but not required, that this be taken immediately following the completion of the 1500-level courses since Genetics is a pre-requisite for many upper level electives and labs. Students should note that there are several courses that can be taken in their sophomore year WITHOUT completion of Genetics, including BIOL BC2280 Animal Behavior, BIOL BC2840 Plant Evolution and Diversity, and BIOL BC3360 Physiology, to name a few.

Five Upper Level Lecture Courses
Students must complete five courses from the three categories below. To select and complete one of the three tracks, at least four courses must be from the appropriate category and at least one from another category. To complete the Biology Major that is general rather than a specialized track, the five courses must include at least one course from each of the three categories. Although some courses are listed in multiple categories, a student can only use a course toward one of the categories. Additional Columbia courses that can be used to fulfill the major requirements are provided on the Biology website (biology.barnard.edu). If a student completes courses that make them eligible for more than one of the four majors, they may select which one is reflected on their transcript.

1. Cellular & Molecular Biology
   - BIOL BC2278 Evolution
   - BIOL BC2490 Coding in Biology
   - BIOL BC3304 Topics in Molecular Genetics
   - BIOL BC3308 INTRODUCTION TO MICROBIAL GENOMICS
   - BIOL BC3310 Cell Biology
   - BIOL BC3320 Microbiology
   - BIOL BC3352 Development
   - BIOL BC3362 MOLECULAR # CELLULAR NEUROSCIENCE
   - CHEM BC3282 BIOLOGICAL CHEMISTRY
   - BIOL UN3034 Biotechnology
   - BIOL UN3073 Cellular and Molecular Immunology
   - BIOL UN3310 Virology

2. Physiology & Organismal Biology
   - BIOL BC2262 Vertebrate Biology
   - BIOL BC2280 Animal Behavior
   - BIOL BC2286 Statistics and Research Design
   - BIOL BC3320 Microbiology
   - BIOL BC3352 Development
   - BIOL BC3360 Physiology
   - BIOL UN3005 Neurobiology II: Development & Systems
   - EEEB UN3011 Behavioral Biology of the Living Primates
   - EEEB UN3208 Explorations in Primate Anatomy
   - EEEB W4112 Ichthyology

3. Ecology & Evolutionary Biology
   - BIOL BC2240 Plant Evolution and Diversity
   - BIOL BC2262 Vertebrate Biology
   - BIOL BC2272 Ecology
   - BIOL BC2278 Evolution
   - BIOL BC2280 Animal Behavior
   - BIOL BC2286 Statistics and Research Design
   - BIOL BC2851 Plants and Profits: The Global Power of Botany
   - BIOL BC3320 Microbiology
   - BIOL BC3380 Applied Ecology and Evolution
   - EEEB UN3087 Conservation Biology
   - EEEB W4110 Coastal and Estuarine Ecology

Three Upper Level Laboratory Courses
Students must complete at least three Biology laboratories beyond the 1500 level. Laboratories may require a lecture course as a co-requisite or prerequisite; such requirements are specified in the Barnard catalogue. A year-long research-seminar course (BIOL BC3591 followed by BIOL BC3592) may substitute for lab courses. Students may also take lab courses at Columbia (or other institutions) to satisfy the lab requirement, with permission from the Chair.

Research Option
A student may count two consecutive semesters of Guided Research and Seminar (BIOL BC3591 followed by BIOL BC3592) as a laboratory course for the major. Guided Research (BIOL BC3597) counts for degree credit but does not count toward the major. A student may not receive credit for research that is paid.

Senior Capstone Experience
Students must enroll in one section of Senior Seminar (BIOL BC3590) or complete two semesters of Senior Thesis Research Seminar (BIOL BC3593 followed by BIOL BC3594). A student cannot take both Senior Thesis Research and Guided Research and Seminar at the same time.

**Chemistry Requirement**

One semester of General Chemistry (with laboratory) and one semester of Organic Chemistry (with laboratory) are required.

### Requirement for the Minor

A minor in biology includes:

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<td>BIOL BC1502</td>
<td>INTRO CELL AND MOLECULAR BIOL</td>
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</tr>
<tr>
<td>BIOL BC1503</td>
<td>Introductory Lab in Cell and Molecular Biology</td>
<td>2</td>
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Please note that students must enroll in the co-requisite discussion sections (beginning Fall 2020) and recitations (except for AY20-21) for the 1500-level sequence, as described above for the major.

Three additional lecture courses at the 2100 level or higher

Two additional laboratory courses **

* One of the lab courses may be replaced by two semesters of Guided Research and Seminar (BIOL BC3591 GUIDED RESEARCH # SEMINAR followed by BIOL BC3592 GUIDED RESEARCH # SEMINAR).

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

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**HSPP BC1001 Research Apprenticeship Seminar. 3 points.**

This year-long course is 3 pts (1.5/semester) Not offered during 2022-23 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.

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BIOL BC1008 HEALTHIER LIFE. 3 points.
Not offered during 2022-23 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 BC1002 Global Health and Ecology. 4.5 points.
Not offered during 2022-23 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 2022-23 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 Biology. 3 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 2022: BIOL BC1001
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
BIOL 1001 001/00178  T Th 10:10am - 11:25am  Gabrielle Corradino 3 31/40

BIOL BC1500 INTRO ORGANISMAL/EVOL BIOL. 3.50 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. Course suitable for fulfillment of premedical requirements. 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 2022: BIOL BC1500
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
BIOL 1500 001/00651  M W F 9:00am - 9:50am  John Glendinning, James Casey, Henry Truong 3.50 231/230
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 BC1510 (Introductory Lab in Organismal and Evolutionary Biology. 2 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.

<table>
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<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
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BIOL BC1511 BIOL BC1501 Recitation. 0 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. 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

Fall 2022: BIOL BC1511

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Spring 2022: BIOL BC1502

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</table>
BiOL BC1503 Introductory Lab in Cell and Molecular Biology. 2 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.

<table>
<thead>
<tr>
<th>Spring 2022: BIOL BC1503</th>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
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<tr>
<td>BIOL 1503</td>
<td>001/00086</td>
<td>M 1:10pm - 4:00pm</td>
<td>912 Altschul Hall</td>
<td>Jessica Goldstein, James Casey, Henry Truong</td>
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<td>BIOL 1503</td>
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<td>BIOL 1503</td>
<td>007/00299</td>
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<td>BIOL 1503</td>
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<td>BIOL 1503</td>
<td>010/00309</td>
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<td>913 Altschul Hall</td>
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BIOL BC1513 BIOL BC1503 Recitation. 0 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.

<table>
<thead>
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<th>Spring 2022: BIOL BC1513</th>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
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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.

<table>
<thead>
<tr>
<th>Fall 2022: BIOL BC1599</th>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
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<td>530 Altschul Hall</td>
<td>Sedelia Rodriguez</td>
<td>1.00</td>
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BIOL BC2100 Molecular and Mendelian Genetics. 3 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.

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<tr>
<th>Spring 2022: BIOL BC2100</th>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
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<td>001/00362</td>
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<td>903 Altschul Hall</td>
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Fall 2022: BIOL BC2100

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<td>903 Altschul Hall</td>
<td>Claudia Cosentino</td>
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</table>
BIOL BC2490 Coding in Biology. 3 points.
Not offered during 2022-23 academic year.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, and BIOL BC1503 or the equivalent.
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.

BIOL BC2500 MATLAB for Scientists. 3 points.
Prerequisites: BIOL BC1500, BIOL BC1502, and MATH UN1101
Introduction to MATLAB programming and numerical methods applied to the analysis of biological data. Topics range from foundational programming concepts and algorithms and an introduction to MATLAB, to more advanced concepts such as data visualization, curve fitting and data interpolation, basic statistical methods, modeling biological systems of ordinary differential equations, and image analysis.

BIOL BC2801 Laboratory in Genetics. 3 points.
Not offered during 2022-23 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 2022-23 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, economic and ethnobotany. 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 2022-23 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 Laboratory in Molecular Biology. 3 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 BC3304 Topics in Molecular Genetics. 3 points.
Not offered during 2022-23 academic year.

Prerequisites: BIOL BC1501, BIOL BC1501, BIOL BC1502, BIOL BC1502,
BIOL BC2100 or equivalent
Selected topics in molecular genetics and gene regulation, with a focus
on examples from human evolution, physiology, and disease. The course
will be organized into four modules with combined lecture and journal
club-style discussion. Module topics include molecular regulation of
transcription, epigenetic regulation of the genome, gene regulatory
networks, and genome architecture and evolution. We will draw from
examples in the current literature and explore current experimental
approaches in molecular genetics of humans and model organisms.

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 Laboratory in Molecular Genetics. 3 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 including 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 BC3306 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 3303

Spring 2022: BIOL BC3303
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
BIOL 3303 | 001/000364 | T: 1:10pm - 6:00pm | Sturley | 3 | 12/12
1316 Altschul Hall

Fall 2022: BIOL BC3303
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
BIOL 3303 | 001/00198 | W: 1:10pm - 6:00pm | Sturley | 3 | 3/12
1316 Altschul Hall

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

Spring 2022: BIOL BC3308
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
BIOL 3308 | 001/00367 | T: 1:00pm - 4:00pm | Lopatkin | 3 | 12/12
805 Altschul Hall
### BIOL BC3310 Cell Biology. 3 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.

<table>
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<th>Course</th>
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<td>Jonathan Snow</td>
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### BIOL BC3311 Laboratory in Cell Biology. 3 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.

<table>
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### BIOL BC3320 Microbiology. 3 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.
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.

<table>
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<tr>
<th>Fall 2022: BIOL BC3320</th>
<th>Course</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
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<td>JJ Miranda</td>
<td>3</td>
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</table>

### BIOL BC3321 Laboratory in Microbiology. 3 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.
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.

<table>
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<tr>
<th>Spring 2022: BIOL BC3321</th>
<th>Course</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
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<td>Gabrielle Corradino</td>
<td>3</td>
<td>11/12</td>
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### BIOL BC3352 Development. 3 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.

<table>
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<th>Spring 2022: BIOL BC3352</th>
<th>Course</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
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<td>Rishita Shah</td>
<td>3</td>
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### BIOL BC3354 LABORATORY IN EMBRYOLOGY. 3.00 points.
Not offered during 2022-23 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.

<table>
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<tr>
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<th>Course</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
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<td>W 1:10pm - 6:00pm</td>
<td>Rishita Shah</td>
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### BIOL BC3360 Physiology. 3 points.
Prerequisites: BIOL BC1500, BIOL BC1501, BIOL BC1502, and BIOL BC1503 or the equivalent.
This course examines the basic mechanisms through which animal bodies carry out basic functions like maintaining homeostasis, manipulating objects, sensing the external world, oxygenating tissues, and establishing body axes. We will explore the cellular and molecular bases for animal 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.

<table>
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<th>Section/Call Number</th>
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<td>T Th 11:40am - 12:55pm</td>
<td>John Glendinning</td>
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BIOL BC3361 Laboratory in Physiology. 3 points.
Not offered during 2022-23 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.

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.

Fall 2022: BIOL BC3361
<table>
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<th>Course Number</th>
<th>Section/Call Number</th>
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<td>Th 1:10pm - 6:00pm</td>
<td>Jordan</td>
<td>3</td>
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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.

Fall 2022: BIOL BC3362
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BIOL BC3363 Laboratory in Molecular and Cell Neuroscience. 3 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.

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.

Spring 2022: BIOL BC3363
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<th>Course Number</th>
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BIOL BC3367 Ecophysiology. 3 points.
Not offered during 2022-23 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 ecoimmunology relate to individual and population dynamics.

BIOL BC3380 Applied Ecology and Evolution. 3 points.
Not offered during 2022-23 academic year.

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 2022-23 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 Senior Seminar. 4 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.

Spring 2022: BIOL BC3590
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<th>Course Number</th>
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Fall 2022: BIOL BC3590
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BIOL BC3591 GUIDED RESEARCH # SEMINAR. 4.00 points.
Per Semester

The introductory biology sequence is a pre-requisite for this yearlong course (BIOL BC1500, BIOL BC1501, BIOL BC1502, and BIOL BC1503). An independent research project in Biology under the guidance of a faculty member and suiting the needs of the individual student. A 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 this year-long course. A Project Approval Form must be submitted to the department in the fall. Attendance at a weekly seminar is required. By the end of the year, students enrolled in BIOL BC3591-BIOL BC3592 will write a scientific paper and give a poster presentation of their work at the Barnard Biology Research Symposium. Completion of this year-long course fulfills two upper-level laboratory requirements for the major. Must be taken in sequence, beginning in the fall.

Fall 2022: BIOL BC3591

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<th>Course Number</th>
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<td>BIOL 3591</td>
<td>002/00207</td>
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<td>308 Diana Center</td>
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BIOL BC3592 GUIDED RESEARCH # SEMINAR. 4.00 points.
Per Semester

The introductory biology sequence is a pre-requisite for this yearlong course (BIOL BC1500, BIOL BC1501, BIOL BC1502, and BIOL BC1503). An independent research project in Biology under the guidance of a faculty member and suiting the needs of the individual student. A 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 this year-long course. A Project Approval Form must be submitted to the department in the fall. Attendance at a weekly seminar is required. By the end of the year, students enrolled in BIOL BC3591-BIOL BC3592 will write a scientific paper and give a poster presentation of their work at the Barnard Biology Research Symposium. Completion of this year-long course fulfills two upper-level laboratory requirements for the major. Must be taken in sequence, beginning in the fall.

Fall 2022: BIOL BC3593

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<th>Course Number</th>
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BIOL BC3594 Senior Thesis Research & Seminar. 4 points.
Per Semester

Prerequisites: Permission of a faculty sponsor and the department. Cannot be taken concurrently with BIOL BC3591 or BIOL BC3592. Same as BIOL BC3591-BIOL BC3592, including attendance at a weekly seminar. By the end of the year, students enrolled in BIOL BC3593-BIOL BC3594 will write a scientific paper and orally present their work at the Barnard Biology Research Symposium.

A 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 this year-long course. A Project Approval Form must be submitted to the department in the fall. Completion of this year-long course fulfills the senior capstone requirement for the major; it cannot be taken at the same time as BIOL BC3591-BIOL BC3592. Must be taken in sequence, beginning in the fall.

Spring 2022: BIOL BC3594

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<th>Course Number</th>
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</table>
BIOL BC3597 Guided Research. 4 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 points.
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.

Spring 2022: ANAT BC2573
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
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ANAT 2573 | 001/00645 | M W 10:10am - 11:25am | Chisa Hidaka | 3 | 26/24
Fall 2022: ANAT BC2573
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
ANAT 2573 | 001/00476 | M W 1:10pm - 2:25pm | Cecilia Fontanesi | 3 | 21/24

ANAT BC2574 Laboratory in Human Anatomy. 3 points.
Corequisites: ANAT BC2573
This new interdisciplinary laboratory course will introduce students to the practices of creative and scientific research in anatomy. The laboratory course will offer students “hands-on” opportunities to view cadaveric specimens, to collect, analyze and communicate scientific information/data related to anatomy and to explore the use of anatomical information to generate creative movement and choreography.

Spring 2022: ANAT BC2574
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
ANAT 2574 | 001/00076 | M 1:00pm - 3:00pm | Chisa Hidaka | 3 | 11/12
ANAT 2574 | 001/00076 | M 3:00pm - 5:00pm | Chisa Hidaka | 3 | 11/12

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.

Spring 2022: CHEM BC3282

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<th>Course Number</th>
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<tr>
<td>CHEM 3282</td>
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<td>M W 11:40am - 12:55pm 903 Altschul Hall</td>
<td>Jonelle White</td>
<td>3.00</td>
<td>37/45</td>
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CHEM BC3355 Biochemistry Laboratory Techniques. 5 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.
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 2022: CHEM BC3355

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<tr>
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<td>Jonelle White, Rebecca Donegan</td>
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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 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 2022: NSBV BC2002

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<td>NSBV 2002</td>
<td>001/00057</td>
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<td>John Glendinning</td>
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