BIOPHYSICS

The Department of Biological Sciences:

Department website: http://www.biology.columbia.edu
Office location: 600 Sherman Fairchild Center
Office contact: 212-854-4581, biology@columbia.edu
Director of Undergraduate Studies: Alice Heicklen, ah2289@columbia.edu
Undergraduate Administrator: Ellie Siddens, mes2314@columbia.edu

The Study of Biological Sciences

The department offers broad training in basic biological disciplines, with an emphasis in cell and molecular biology. Students have many opportunities to participate in ongoing projects in research laboratories. All the biology-related majors require one year of introductory biology, plus additional courses as detailed in the major requirements and listed on the websites provided above.

The usual one-year introductory biology sequence is BIOL UN2005 INTRO BIO I: BIOCHEM,GEN,MOLEC-BIOL UN2006 INTRO BIO II:CELL BIO,DEV/PHYS, taken in the sophomore year, after one year of general chemistry. For more details, see Introductory Courses under Requirements—Major in Biology. All students interested in biology are encouraged to take BIOL UN1908 First Year Seminar in Biology in the fall semester of their first year.

Online Resources:

- FAQs for first-year students, prospective & current majors, and transfer students
- Checklist of major requirements
- Additional course information
- Undergraduate research & job opportunities

Student Advising

Consulting Advisers

Peer Mentors - Login to Lionmail to access this Google sheet. Any current or prospective student may contact a peer mentor with questions about classes, professors, research experience, or anything related to your current or prospective bio-related major.

Before contacting an advisor, check whether your question has been answered in our undergraduate FAQs.

For a list of current biology, biochemistry, biophysics, and neuroscience and behavior advisers, please visit http://biology.columbia.edu/content/advisors

Biology Major (CC) and Minor Advisers (CC & GS):
For students with last names beginning with:

- A-N: Dr. Mary Ann Price; map2293@columbia.edu
- O-Z: Dr. Michelle Attner; ma3325@columbia.edu

Biology Major Adviser (GS):
Dr. Deborah Mowshowitz; dbm2@columbia.edu

Biochemistry Advisers (CC & GS):
Chemistry: Dr. Vesna Gasperov; vg2231@columbia.edu

Biology: Dr. Ava Brent; aeb28@columbia.edu

Biophysics Adviser (CC & GS):
Dr. Josh Abrams; jma2278@columbia.edu

Computational Biology Advisor (CC & GS):
Biology: For students with last names beginning with:

- A-N: Dr. Harmen Bussemaker; hjb2004@columbia.edu
- O-Z: Dr. Simon Tavare; st3193@columbia.edu

Computer Science: For students with last names beginning with:

- A-N: Dr. Itsik Pe'er; ip2169@columbia.edu
- O-Z: Dr. David Knowles; dak2173@columbia.edu

Neuroscience and Behavior Advisers (CC):
Biology: Dr. Erin Barnhart, eb3305@columbia.edu

Psychology: Dr. Alfredo Spagna; as5559@columbia.edu

Neuroscience and Behavior Advisers (GS):
Biology: Dr. Deborah Mowshowitz; dbm2@columbia.edu

Psychology: Dr. Alfredo Spagna, as5559@columbia.edu

Enrolling in Classes

Registration for each term occurs within designated periods. Within these periods, you will be assigned specific registration appointment times. For continuing students, your appointment times will generally be available on Student Services Online (SSOL) two weeks prior to the registration period, but specific registration instructions are announced by each school in advance of each registration period.

- Check appointment times
- Register

Students can also check the Directory of Classes by looking for “B” under Departments and selecting “Biological Sciences”.

Preparing for Graduate Study

Advisor for students applying to graduate school or looking for bio-related jobs. (Students applying to medical school should consult the pre-professional office.)

Dr. Molly Przeworski; mp3284@columbia.edu

Coursework Taken Outside of Columbia

Advanced Placement

If you got a 5 on the AP biology test, you get 3 points of credit toward graduation. Students with a 5 on the AP should take BIOL UN2005 INTRO BIO I: BIOCHEM,GEN,MOLEC and BIOL UN2006 INTRO BIO II:CELL BIO,DEV/PHYS.

BIOL UN2005-UN2006 is not a repeat of AP bio. It demands not only more detail but more thought and application of knowledge to problem-solving than the usual AP course. It is narrower but deeper than the usual introductory biology course. You may review this exam from a previous year of UN2005 and compare your answers with the exam key. This will give you an idea of what makes UN2005/6 a unique Intro Bio sequence. If you still feel that you are sufficiently prepared, please consult a biology advisor who on rare occasions can give permission to place out of Intro Bio I and

II. You will still be required to take 6 biology courses at Columbia if you place out of Intro Bio.

Barnard College Courses

Barnard courses may not be substituted for the required Columbia courses without advance permission from the advisor. Students may not use Barnard courses for the biology minor.

Transfer Courses

Transfer credits for the majors, concentrators, and the biology minor are not automatically granted. Students should email their Biology advisor with a transcript and the syllabi from their previous institution to request transfer credit. Transfer credit for Introductory Biology is rarely granted. You can read more about transfer credits in this FAQ. Students may not use transfer courses for the biology minor.

Study Abroad Courses

If you are planning to study abroad, please meet with your Advisor before you go. You'll need prior approval for any majors, concentrators, and biology minor courses that you take abroad. Students may not use study abroad courses for the biology minor.

Summer Courses

The Department of Biological Sciences offers limited summer courses. Check the Directory of Classes for Summer course information.

Core Curriculum Connections

Unfortunately, most biology courses are not suitable for most nonscience majors. There are two biology courses in the dept that are designed primarily for nonscientists: Science and Society (BIOL UN1360), and Interpreting Scientific Evidence (BIOL UN2300).

Undergraduate Research and Senior Thesis

Undergraduate Research in Courses

SURF

First-year students, sophomores, and juniors are eligible for the department's paid internship program (SURF). This program is competitive; the department cannot assure every eligible student a place in any given summer.

A faculty committee headed by Dr. Alice Heicklen then matches selected students to appropriate labs. The deadline for SURF applications is at the beginning of the spring semester.

SURF students must submit a report on their work at the end of the summer session and participate in the following year's annual Undergraduate Research Symposium. Although it does not carry any academic credit, SURF can be used toward the lab requirement for majors and toward graduation with honors.
Current detailed descriptions of the SURF program and the application procedure are available at SURF's website, https://biology.columbia.edu/content/surf.
For more information on the Amgen Scholarship Program, please visit https://biology.columbia.edu/content/amgen-scholars-program. Applications to all of these programs are through SURF.

UN3500

Students can get academic credit for working in a lab, by registering for BIOL UN3500 Independent Research. This is not to be confused with SURF or the Amgen Scholars Program, which fulfill the biology major lab requirement but does not confer academic credit. Generally students register for 3 or 4 credits. A general rule is 4 hours lab time/week/credit, i.e. register for 3 credits for 12 hours of lab time/week and 4 credits from 16 hours of lab time/week. You will need to find a lab to work in. Please make it clear to the head of the lab whether you need to work 12 or 16 hours/week. If you are taking this class for a lab requirement, you need to take it for a letter grade. You will be required to write a research paper at the end of the semester. (See UN3500 requirements.)

While it's nice to be able to get credit for your lab experience, keep in mind that this means that you're making a commitment to work there for the entire semester.

Senior Thesis Coursework and Requirements

The biology-related majors in the Department of Biological Sciences do not include a Senior Thesis.

Undergraduate Research Outside of Courses

Please see the Undergraduate Research page on the department website for advice and information on undergraduate research.

Department Honors and Prizes

Department Honors

Students must apply for departmental honors. Applications are due no later than one day before spring break of their senior year. For details, please visit the departmental website at https://biology.columbia.edu/content/honors-biological-sciences.

Academic Prizes

Bridges and Sturtevant Prize

This prize results from an anonymous donation in 2011 establishing an endowment for the prize. Bridges and Sturtevant were certainly amazing Columbia undergrads who were true pioneers of modern genetics. Alfred Sturtevant is recounted to have taken time off from studying for classes one weekend to work on understanding some crosses. The result was his figuring out that genes were arranged in a row on a chromosome.

The prize description reads: "Columbia shall .... award an annual prize to be known as the Bridges and Sturtevant Prize in Biological Sciences in honor of Calvin Bridges and Alfred Sturtevant. Their pioneering studies as Columbia College undergraduates - using the fruit fly Drosophila melanogaster in Thomas Hunt Morgan's laboratory - laid the basis for our understanding of genes and the way they behave. Each year the prize will be awarded to one or more graduating seniors whose experimental or computational research is deemed to have been both highly original and fruitful by a committee of faculty to be selected by the Chair of Biological Sciences."

Faculty members in the Dept. of Biological Sciences can nominate student(s) for the prize. A committee of faculty members decide who will receive the award.

It is awarded yearly, just before graduation.

Awarded to a graduating senior whose research has been deemed highly original and fruitful.

Each student is awarded a monetary prize.

Professors

Peter Andolfatto

Harmen Bussemaker

Martin Chalfie

Stuart Firestein

Joachim Frank

Iva Greenwald

Oliver Hobert

John Hunt

Songtao Jia

Daniel Kalderon

Darcy Kelley

Laura Landweber

James Manley

Carol Prives

Ronald Prywes

Molly Przeworski

Ozgur Sahin

Brent Stockwell

Simon Tavare

Saeed Tavazoie

Liang Tong

Jian Yang

Rafael Yuste

Associate Professors

Lars Dietrich

Guy Sella

Assistant Professors

Ishmail Abdus-Saboor

Erin Barnhart
Laura Duvall

Jellert Gaublomme

Marko Jovanovic

Raju Tomer
Maria Tosches

Lecturers

Joshua Abrams

Michelle Attner

Ava Brent

Alice Heicklen

Mary Ann Price

Lili Yamasaki

Adjunct Faculty

Lewis Brown
Ronald Guido

Nam Ho

Donald Kirsch

John Loike

Alan Morrison

Deborah Mowshowitz

Vincent Racaniello

David Sable

Christian Schindler

Harold Varmus

Guidance for Undergraduate Students in the Department

Program Planning for all Students

Students majoring or minoring in Biology or Related Fields:

1. Review the requirements for your desired major/minor detailed in the links below. Please email Ellie Siddens (mes2314@columbia.edu) to go over the progress of your major completion.
2. Fill out a major planning form as far as you can, using the checklist and the information in the bulletin. Include both courses you have completed AND courses you plan to take to complete your major.
3. Consult the appropriate departmental adviser to discuss any variances from the normal guidelines. Your adviser will then email any approved variances from the normal requirements to the biology departments administrator, Ellie Siddens, who will approve your major completion for graduation.
4. Visit the Major Declaration Page during the Major Declaration Period (usually Spring Break of your Sophomore year) to officially declare your major.

For students majoring in Biochemistry or Neuroscience & Behavior (joint majors), you should consult advisers in both departments to plan your program, each regarding their specific courses (e.g. biology course exceptions will need to be approved by a biology adviser, chemistry course exceptions will need to be approved by a chemistry adviser).

Returning students should check the departmental website for any last-minute changes and/or additional information. See especially undergraduate updates and list of department courses. All major and minor requirements are detailed on the website and links provided below.

Double Majoring/Minoring

The Department of Biological Sciences offers five undergraduate majors (Biology, Biophysics, Biochemistry, Computational Biology, and Neuroscience and Behavior), along with a Biology Minor, across two schools: Columbia College and General Studies. Students can only choose one major/minor within the Department. You may not major in Biology/ Biochemistry/ Biophysics/ Computational Biology/ Neuroscience & Behavior and have a Biology Minor.

You cannot major in:

- Biochemistry & also major / minor in chemistry
- Biophysics & also major / minor in physics
- Computational biology & also major / minor in computer science or major/minor in math
- Neuroscience & also major / minor in psychology

Students can only double count two of the following fundamental courses for both a biology-related major/minor and any other major / minor they pursue: General Chemistry I & II or Calc I & II.

Biochemistry (BIOL UN3300 or BIOL GU4501) cannot be counted for a biology-related major / minor and for any other major / minor.

Course Numbering Structure

NOTE: Numbering does not reflect difficulty but rather whether UGs & graduate students have different requirements:

3000 – Only UGs register

4000 – UGs and graduate students perform the same

5000 – Only graduate students register, requires additional work beyond the 3000 course; 3000 (UGs) & 5000 (Grad.) are different versions of the same course, i.e. same time, location, and lectures

Guidance for First-Year Students

Please see the FAQs for First-Year Students.

Guidance for Transfer Students

Please see the FAQs for Transfer Students.

Undergraduate Programs of Study

Required Coursework for all Programs

All majors and the minor should start with General Chemistry 1 & 2 in their first year at Columbia. This is a required prerequisite before you may begin the Introductory Biology sequence.

All biology-related majors: at least 4 biology or biochemistry courses and at least 18 credits of the total (biology, biochemistry, math, physics, and chemistry) must be taken at Columbia. Barnard courses may not be substituted for the required Columbia courses without advance permission from the adviser. The two required core courses should be taken at Columbia. Courses covering the same topics as Bio dept core courses, but taken elsewhere, are counted as electives, not as core courses.

Exceptions to Requirements

Students must get written permission in advance for any exceptions to the requirements listed below. For the exceptions to be applied toward graduation, the student must get the exception approved by the faculty adviser, who will then send an e-mail explaining the exceptions to mes2314@columbia.edu.

Grade Requirements for the Major

A grade of C- or higher must be earned and revealed on your transcript for any course – including the first – to be counted toward the major, minor, or concentration requirements. The grade of P is not acceptable. A course that was taken Pass/D/Fail may be counted if and only if the P is uncovered by the Registrar's deadline.

Please note that a few exceptions are applicable for the following terms:

- All courses in Spring 2020 were taken with mandatory Pass/Fail grades.
- Further exceptions are allowed for 2020-2021, when students can opt to take one course Pass/Fail during the Fall 2020, Spring 2021, and Fall 2021 semesters, without any restrictions - this can be in a course required for their major or minor.
- In Spring 2024, students could opt to take two major/minor courses Pass/Fail.

If you are concerned about a P grade counting for the major, please consult with your adviser.

COURSES

Non-Major Courses

The following biology-related courses do not count towards the major or as one of the 4 courses that all biology majors must take at Columbia University. This list is not exhaustive, and you should discuss your major courses with your biology adviser.

- BIOL UN1004 Foundations of Biology
- BIOL UN1130 Genes and Development
- BIOL UN1360 Science and Society
- BIOL UN1908 First-year seminar in biology
- BIOL UN2300 Interpreting Scientific Evidence
- BIOL UN3920 Ignorance
- BIOL UN3995 Topics in Biology: Crossroads in Bioethics
- BIOL GU4305 Seminar in Biotechnology
- BIOL GU4506 Biochemistry in XR: Mixed Reality
- BIOT GU4160 Biotechnology Law
- BIOT GU4180 Entrepreneurship in Biotech
- BIOT GU4200 Biopharmaceutical Development & Regulation
- BIOT GU4201 Seminar in Biotech Development & Regulation
- BIOT GR5170 Intro to Management Principles
- CMLS UN3965 Precision Medicine: Biology
- Any course beginning with the HPSC, SCNC, or BIOT prefix
- All Barnard Courses

Repeating Biology Courses

Introductory biology I & II (BIOL UN2005/6 & BIOL UN2401/2) may only be taken twice, this includes taking two exams, W, D and F. You may petition to take intro bio I or II a third time. 3000 & 4000 level biology courses may only be taken once. You may petition to take the same course a second time.

Prerequisites

Course prerequisites are strictly enforced. Prerequisites must be taken before the course, not after or concurrently. Biology courses taken before the completion of any of its prerequisites, even with instructor approval, are not counted toward the major, minor, or interdepartmental majors. Exemptions from a prerequisite requirement may only be made, in writing, by the department's director of undergraduate studies. Credits from a course taken prior to the completion of its prerequisites are not counted towards the major requirements. As a consequence, students are required to complete additional, specific courses in biology at the direction of the director of undergraduate studies.

4+1 Programs

A B- or better in both introductory biology I & II (BIOL UN2005 & BIOL UN2006) are required to be eligible for any 4+1 programs.

Major in Biology

General Information

The requirements for the biology major include courses in biology, chemistry, physics, and mathematics.

The required biology courses are one year of introductory biology, two core courses in biology, two 3-point electives in biology, and an appropriate lab experience. See below for details.

The required courses outside the biology department are chemistry through organic (plus labs), one year of college-level physics (plus lab), and the completion of one year of college-level mathematics (usually calculus).

Alternative sequences to the above may be arranged in special circumstances, but only with the permission of a departmental adviser or the director of undergraduate studies obtained in advance. For example, selected courses at the Columbia-Presbyterian Medical Center are open to advanced undergraduates with adviser approval. Credit toward the major for courses not listed in the Columbia College Bulletin must be discussed in advance with a departmental adviser or the director of undergraduate studies. Students are responsible for notifying the department of all exceptions either in writing or by e-mail as explained above.

Students planning graduate work in biology should keep in mind that physical chemistry and statistics are important for many graduate programs.

Introductory Courses

The usual one-year introductory biology sequence is BIOL UN2005 INTRO BIO I: BIOCHEM,GEN,MOLEC-BIOL UN2006 INTRO BIO II:CELL BIO,DEV/PHYS, taken in the sophomore year.

Other sequences require permission in advance from a departmental adviser or the director of undergraduate studies. Students with a strong background in chemistry or molecular biology may take BIOL UN2005 INTRO BIO I: BIOCHEM,GEN,MOLEC-BIOL UN2006 INTRO BIO II:CELL BIO,DEV/PHYS in their first year; the permission of one of the instructors is required.

Premedical students usually take BIOL UN2005 INTRO BIO I: BIOCHEM,GEN,MOLEC-BIOL UN2006 INTRO BIO II:CELL BIO,DEV/PHYS after a year of general chemistry.

Students with advanced placement in biology are expected to take BIOL UN2005 INTRO BIO I: BIOCHEM,GEN,MOLEC as their initial biology course, because BIOL UN2005 INTRO BIO I: BIOCHEM,GEN,MOLEC-BIOL UN2006 INTRO BIO II:CELL BIO,DEV/PHYS is taught at a level of detail and depth not found in most advanced placement courses.

Core Courses

Two out of the following six departmental core courses are required:

BIOL UN3022	DEVELOPMENTAL BIOLOGY
BIOL UN3031	GENETICS
BIOL UN3041	CELL BIOLOGY
BIOL GU4501	Biochemistry
or BIOL UN3300	Biochemistry
BIOL GU4512	Molecular Biology
BIOL GU4560	EVOL IN THE AGE OF GENOMICS

Laboratory Courses

A laboratory experience in biology is required. It may be fulfilled by completing any one of the following options:

Option 1:	
Select one of the following 5-point laboratory courses:	
BIOL UN3058	PROJECT LAB IN MICROBIOLOGY
BIOL UN3052	PROJECT LAB-MOLECULAR GENETICS
Option 2:	
BIOL UN2501	CONTEMPORARY BIOLOGY LAB
Select an additional 3-point lab such as BIOL UN3040, a 5-point project lab, or a Barnard lab. Barnard labs must be approved by a Biology Major Adviser.	
Option 3:	
Two terms of BIOL UN3500 (3 or 4 credits per term), including the submission of a satisfactory research report at the end of each semester	
Option 4:	
Completion of all the requirements for one session of the Summer Undergraduate Research Fellowship (SURF). An additional semester of BIOL UN3500 in the same research lab is recommended but not required. Summer lab work under other auspices may not be substituted for the SURF Program.	

Upper-Level Elective Courses

Select two additional courses, carrying at least 3 points each, from any of the 3000- or 4000- level lecture courses. BIOL UN3500 INDEP BIOLOGICAL RESEARCH cannot be used as one of the courses to satisfy the upper-level elective course requirement. Any course not listed below must be approved by a biology adviser to count toward the major.

Two additional 3000 or 4000 level biology lecture courses from the following:	
BIOL UN3004	NEUROBIO I:CELLULAR # MOLECULR
BIOL UN3005	NEUROBIO II: DEVPT # SYSTEMS
BIOL UN3006	PHYSIOLOGY
BIOL UN3019	Brain Evolution
BIOL UN3022	DEVELOPMENTAL BIOLOGY
BIOL UN3025	NEUROGENETICS
BIOL UN3031	GENETICS
BIOL UN3041	CELL BIOLOGY
BIOL UN3073	CELLULAR/MOLECULAR IMMUNOLOGY
BIOL UN3300	Biochemistry
BIOL UN3320	Regulation of Behaviors for Survival
BIOL UN3404	The Global Threat of Antimicrobial Resistance
BIOL UN3560	EVOL IN THE AGE OF GENOMICS
or BIOL GU4560	EVOL IN THE AGE OF GENOMICS
BIOL UN3799	MOLECULAR BIOLOGY OF CANCER
or BIOL GU4799	MOLECULAR BIOLOGY OF CANCER
BIOL GU4001	ADVANCED GENETIC ANALYSIS
BIOL GU4002	Macromolecular Structure # Interactions
BIOL GU4034	BIOTECHNOLOGY
BIOL GU4035	SEMINAR IN EPIGENETICS
BIOL GU4036	Transformative Concepts in Systems Biology
BIOL GU4075	BIOLOGY AT PHYSICAL EXTREMES
BIOL GU4080	ANCIENT AND MODERN RNA WORLDS
BIOL GU4193	Stem Cell Biology and Applications
BIOL GU4290	BIOLOGICAL MICROSCOPY
BIOL GU4300	DRUGS AND DISEASE
BIOL GU4310 - Virology	
BIOL GU4323	BIOPHYSICAL CHEMISTRY I
CHEM GU4324	BIOPHYSICAL CHEMISTRY II
BIOL GU4402	Biological Image Computing
BIOL GU4501	Biochemistry
BIOL GU4510	Genomics of Gene Regulation
BIOL GU4512	Molecular Biology
BIOL GU4551	A Structural View of Biology
BIOL GU4600	CELL SIGNALING
BIOL GU4777	From Curiosity to Cure – Case Studies in Cool Biochemistry

Note: SCNC, HPSC & BIOT (many of which are listed on the biology website) courses do not count towards the Major.

Chemistry

All majors must take chemistry through organic including labs. One of the following three groups of chemistry courses is required:

Option 1:	
CHEM UN1403 & CHEM UN1404	GENERAL CHEMISTRY I-LECTURES and GENERAL CHEMISTRY II-LECTURES
CHEM UN1500 & CHEM UN1501	GENERAL CHEMISTRY LABORATORY and GENERAL CHEMISTRY LAB-LECTURE
CHEM UN2443 & CHEM UN2444	ORGANIC CHEMISTRY I-LECTURES and ORGANIC CHEMSTRY II-LECTURES
CHEM UN2493 & CHEM UN2494	ORGANIC CHEM. LAB I TECHNIQUES and ORGANIC CHEM. LAB II SYNTHESIS
Option 2:	
For students who qualify for intensive chemistry	
CHEM UN1604	2ND TERM GEN CHEM (INTENSIVE)
CHEM UN1507	INTENSVE GENERAL CHEMISTRY-LAB
CHEM UN2444 & CHEM UN2443	ORGANIC CHEMSTRY II-LECTURES and ORGANIC CHEMISTRY I-LECTURES
CHEM UN2495 & CHEM UN2496	ORGANIC CHEM. LABORATORY I and ORGANIC CHEM. LABORATORY II
Option 3:	
For students who qualify for first year organic chemistry	
CHEM UN1507	INTENSVE GENERAL CHEMISTRY-LAB
CHEM UN2045 & CHEM UN2046	INTENSVE ORGANIC CHEMISTRY and INTENSVE ORG CHEM-FOR 1ST YEAR
CHEM UN2495 & CHEM UN2496	ORGANIC CHEM. LABORATORY I and ORGANIC CHEM. LABORATORY II
OR	
CHEM UN2545	INTENSIVE ORGANIC CHEM LAB

Physics

Students must take two terms of physics including the accompanying labs. The usual choices are PHYS UN1201-PHYS UN1202 GENERAL PHYSICS II and PHYS UN1291-PHYS UN1292 GENERAL PHYSICS II LABORATORY. Higher-level physics sequences are also acceptable. The *1400*-level sequence is recommended for students who plan to take three terms of physics.

Mathematics

Two semesters of calculus or honors mathematics are required. Students may substitute one semester of statistics (STAT UN1101 or STAT UN1201) for one semester of calculus. For students with AP credit, completion of MATH UN1102 CALCULUS II, MATH UN1201 CALCULUS III, or MATH UN1207 HONORS MATHEMATICS A is sufficient. However, students with AP credit are encouraged to take additional courses in mathematics or statistics at Columbia.

For more details on the biology major requirements, visit http://biology.columbia.edu/pages/biology-major-requirements.

Major in Biochemistry

The required basic courses for the biochemistry major are chemistry through organic, including laboratory, and one year each of physical chemistry, physics, calculus, biology, and biochemistry/molecular biology. The required additional courses are three lecture courses chosen from mathematics, chemistry, and biology, and two upper-level laboratory courses.

Questions regarding the major in general and chemistry requirements should be addressed to the chemistry adviser and questions regarding biology requirements should be addressed to the biology adviser.

For more details, see the Chemistry section in this Bulletin. For additional information visit the Department of Biological Sciences website: http://biology.columbia.edu/pages/biochemistry-major-requirements.

Major in Biophysics

The requirements for the biophysics major are as follows:

BIOLOGY COURSES	
One year of introductory biology:	
BIOL UN2005 & BIOL UN2006	INTRO BIO I: BIOCHEM,GEN,MOLEC and INTRO BIO II:CELL BIO,DEV/PHYS
Select at least one of the following laboratory courses:	
BIOL UN3052	PROJECT LAB-MOLECULAR GENETICS
or BIOL UN3058	PROJECT LAB IN MICROBIOLOGY
or BIOL UN3500	INDEP BIOLOGICAL RESEARCH
or RSRH C0001	FULL-TIME SUMMER RESEARCH PROG
One course in biochemistry or molecular biology:	
BIOL GU4501	Biochemistry
or BIOL UN3300	Biochemistry
or BIOL GU4512	Molecular Biology
Select one of the following core courses:	
BIOL GU4002	Macromolecular Structure # Interactions
or BIOL GU4075	BIOLOGY AT PHYSICAL EXTREMES
or BIOL GU4323	BIOPHYSICAL CHEMISTRY I
or CHEM GU4324	BIOPHYSICAL CHEMISTRY II
or BIOL GU4551	A Structural View of Biology
PHYSICS COURSES	
Select one of the following sequences to be completed at the end of sophomore year:	
PHYS UN1401 & PHYS UN1402 & PHYS UN1403 & PHYS UN1494	INTRO TO MECHANICS # THERMO and INTRO ELEC/MAGNETSM # OPTCS and INTRO-CLASSCL # QUANTUM WAVES and INTRO TO EXPERIMENTAL PHYS-LAB
PHYS UN1601 & PHYS UN1602 & PHYS UN2601 & PHYS UN1494	PHYSICS I:MECHANICS/RELATIVITY and PHYSICS II: THERMO, ELEC # MAG and PHYSICS III:CLASS/QUANTUM WAVE and INTRO TO EXPERIMENTAL PHYS-LAB
PHYS UN2801 & PHYS UN2802 & PHYS UN3081	ACCELERATED PHYSICS I and ACCELERATED PHYSICS II and INTERMEDIATE LABORATORY WORK
Select any two physics courses at the 3000-level or above, chosen in consultation with the adviser.	
MATH COURSES	
Calculus I-IV or Ordinary Differential Equations:	
MATH UN1101 & MATH UN1102 & MATH UN1201 & MATH UN1202	CALCULUS I and CALCULUS II and CALCULUS III and CALCULUS IV
or MATH UN3027	Ordinary Differential Equations
CHEMISTRY COURSES	
CHEM UN1403 & CHEM UN1404	GENERAL CHEMISTRY I-LECTURES and GENERAL CHEMISTRY II-LECTURES
BIOLOGY/PHYSICS ELECTIVE COURSE	
Select one additional course at the 3000- or 4000-level, in either physics or biology. The following are some suggested courses:	
BIOL UN3004	NEUROBIO I:CELLULAR # MOLECULR
or BIOL UN3005	NEUROBIO II: DEVPT # SYSTEMS
or BIOL UN3022	DEVELOPMENTAL BIOLOGY
or BIOL UN3031	GENETICS

For more details, see the *Physics* section in this Bulletin or visit the Department of Biological Sciences website: http://biology.columbia.edu/pages/biophysics-major-requirements.

Major in Neuroscience and Behavior

In addition to one year of college general chemistry, eleven courses are required to complete the major in neuroscience and behavior—six in biology and five in psychology.

NOTE: For students entering in Fall 2024 or later, two biology elective courses will be required. For students entering prior to Fall 2024, one biology elective course will be required.

For the five courses required in Psychology, see the Psychology section in this Bulletin or visit http://biology.columbia.edu/pages/neuroscience-and-behavior-major-requirements.

CHEMISTRY COURSES	
One year of college chemistry is required prior to taking Introductory Biology.	
BIOLOGY COURSES	
One year of introductory biology.	
BIOL UN2005 & BIOL UN2006	INTRO BIO I: BIOCHEM,GEN,MOLEC and INTRO BIO II:CELL BIO,DEV/PHYS
One year of Neurobiology	

BIOL UN3004 & BIOL UN3005	NEUROBIO I:CELLULAR # MOLECULR and NEUROBIO II: DEVPT # SYSTEMS
Two additional 3000 or 4000 level biology lecture courses from the list of Upper Level Electives under the Biology Major.	
AN ADDITIONAL 5 COURSES IN PSYCHOLOGY ARE REQUIRED FOR THE MAJOR	
Please see the Psychology Bulletin linked above.	

Major in Computational Biology

The Computational Biology major program combines a strong foundation in computer science/data science and basic biology with advanced courses in a variety of subfields. Particular emphasis is placed on laboratory and computational techniques, including genomics, network modeling, and bioinformatics.

Alternative sequences to the above may be arranged in special circumstances with the permission of the departmental adviser or director of undergraduate studies obtained in advance. All exceptions granted by computer science or biology advisers should be forwarded to Ellie Siddens (mes2314@columbia.edu) in biological sciences.

Questions regarding biology requirements should be addressed to the biology adviser and questions regarding computer science or math requirements should be addressed to the computer science advisers.

The required courses are listed below. For details about the Major in Computational Biology, see here: https://biology.columbia.edu/content/undergraduate-major-requirements

Mathematics foundations (4 classes, 12-17 credits)

The following calculus courses are required:	
MATH UN1101	CALCULUS I can be placed out of with AP/IB credit
MATH UN1102	CALCULUS II Calculus III does NOT depend on Calculus II.
or MATH UN1201	CALCULUS III
All students must complete computer-science-directed mathematical foundations classes.	
MATH UN2010	LINEAR ALGEBRA
or APMA E3101	APPLIED MATH I: LINEAR ALGEBRA
or APMA E2101	INTRO TO APPLIED MATHEMATICS
or COMS W3251	COMPUTATIONAL LINEAR ALGEBRA
and	
STAT GU4001	INTRODUCTION TO PROBABILITY AND STATISTICS
or STAT UN1201	CALC-BASED INTRO TO STATISTICS

Chemistry Foundations (2 classes, 8 credits)

Option 1: General Chemistry	
CHEM UN1403 & CHEM UN1404	GENERAL CHEMISTRY I-LECTURES and GENERAL CHEMISTRY II-LECTURES
Option 2: For students who qualify for intensive general chemistry	
CHEM UN1604	2ND TERM GEN CHEM (INTENSIVE)

Introductory Computer Sciences (3 classes, 9-11 credits)

All students must complete sequentially three courses in computer science:	
COMS W1002	COMPUTING IN CONTEXT (with Biology Context)
or ENGI E1006	INTRO TO COMP FOR ENG/APP SCI
or COMS W1004	Introduction to Computer Science and Programming in Java
COMS W3132	Intermediate Computing in Python
or COMS W3136	ESSENTIAL DATA STRUCTURES
or COMS W3134	Data Structures in Java
or COMS W3137	HONORS DATA STRUCTURES # ALGOL
Note: COMS 3134 and 3137 should be taken after COMS 1004 or with previous knowledge of Java	
COMS W3157	ADVANCED PROGRAMMING
or COMS W3107	Clean Object-Oriented Design
or COMS W4111	INTRODUCTION TO DATABASES

Biology (3 classes, 11-12 credits)

All students must take the two introductory biology courses:	
BIOL UN2005 & BIOL UN2006	INTRO BIO I: BIOCHEM,GEN,MOLEC and INTRO BIO II:CELL BIO,DEV/PHYS
Students must take one course from this list of core biology courses	
BIOL UN3031	GENETICS
or BIOL UN3041	CELL BIOLOGY
or BIOL UN3022	DEVELOPMENTAL BIOLOGY
or BIOL GU4501	Biochemistry
or BIOL UN3300	Biochemistry
or BIOL GU4512	Molecular Biology
or BIOL UN3005	NEUROBIO II: DEVPT # SYSTEMS

Lab/research (1 class, 4 credits)

All students must fulfill a laboratory/research experience. This can only be done after completing Intro Bio (BIOL UN2005 + BIOL UN2006). A research report must be submitted to either the course instructor or the lab research mentor at the end of each semester, and they must in turn confirm to the compbio major advisor that the report was satisfactory. Each project must require the student to (i) formulate a computational strategy to solve a particular biological question, (ii) develop dedicated software code or adapt existing code, (iii) use this code to analyze a suitable data set, and (iv) interpret the results from both a statistical and biological perspective. One option is to perform a research project as part of one these courses:	
COMS W4995	TOPICS IN COMPUTER SCIENCE ((LAB COMPUTATIONAL BIOLOGY))
or COMS W3998	UNDERGRAD PROJECTS IN COMPUTER SCIENCE
or COMS W4901	Projects in Computer Science
The other option is to perform lab research for credit using one of these courses:	
BIOL UN3500	INDEP BIOLOGICAL RESEARCH
or RSRH C0001	FULL-TIME SUMMER RESEARCH PROG
BIOL UN3500 Independent Biological Research (must be taken for four credits) in a pre-approved lab RSRH 0001 Summer Undergraduate research fellowship (SURF) in a pre-approved lab	
Pre-approved labs include Peter Andolfatto, Elham Azizi, Andrew Blumberg, Harmen Bussemaker, Bianca Dumitrascu, Jellert Gaublomme, David Knowles, Itsik Pe'er, Molly Przeworski, Guy Sella, Simon Tavare, Saeed Tavazoie. Other labs may be allowable if the project satisfies the conditions above, but only with prior approval from the compbio major advisor.	

Advanced Electives (2 classes, 6-8 credits)

A biology course at the 3000 or 4000 level from the list of biology major approved core and elective courses.	
One of the following computational biology courses:	
COMS W4762	Machine Learning for Functional Genomics
or CBMF W4761	COMPUTATIONAL GENOMICS

or BMEN E4480	Statistical machine learning for genomics
or COMS W4995 - computational biology section	

Minor in Biology

Students who wish to minor in biology must design their programs in advance with the director of undergraduate studies or a departmental adviser.

The minor would require 7 courses (25 credits), at least 2 are general chemistry [8 credits] and at least 5 biology [17 credits].

The requirements for the minor in biology are as follows:

CHEMISTRY COURSES	
CHEM UN1403 & CHEM UN1404	GENERAL CHEMISTRY I-LECTURES and GENERAL CHEMISTRY II-LECTURES
BIOLOGY COURSES	
BIOL UN2005 & BIOL UN2006	INTRO BIO I: BIOCHEM,GEN,MOLEC and INTRO BIO II:CELL BIO,DEV/PHYS
Select at least one of the following core courses:	
BIOL UN3022	DEVELOPMENTAL BIOLOGY
BIOL UN3031	GENETICS
BIOL UN3041	CELL BIOLOGY
BIOL GU4501	Biochemistry
or BIOL UN3300	Biochemistry
BIOL GU4512	Molecular Biology
BIOL GU4560	EVOL IN THE AGE OF GENOMICS
Two additional 3000 or 4000 level biology lecture courses from the list of Upper Level Electives under the Biology Major.	
No lab is required for the biology minor. However, only one biology lab can count towards the 5 biology course requirements. The biology lab options consists of the following:	
BIOL UN2501	CONTEMPORARY BIOLOGY LAB
or BIOL UN3040	LAB IN MOLECULAR BIOLOGY
or BIOL UN3058	PROJECT LAB IN MICROBIOLOGY
or BIOL UN3052	PROJECT LAB-MOLECULAR GENETICS
or BIOL UN3500	INDEP BIOLOGICAL RESEARCH
or RSRH C0001	FULL-TIME SUMMER RESEARCH PROG

For students who entered Columbia in or before the 2023-24 academic year

Concentration in Biology

The concentration in Biology is only available for students who entered CU in or before the 23-24 academic year.

Students who wish to concentrate in biology must design their programs in advance with a departmental adviser or the director of undergraduate studies.

The requirement for the concentration is 22 points in biology or biochemistry, with at least five courses chosen from the courses listed in the Biological Sciences section of the Bulletin. Additional courses in physics, chemistry, and mathematics are required as detailed below.

Students may not use transfer credits, Barnard courses or courses taken abroad for the biology minor biology course requirements. Please contact Vesna Gasperov (vg2231@columbia.edu) regarding using either transfer credits or courses taken while studying abroad to substitute for the general chemistry course requirements.

The requirements for the concentration in biology are as follows:

BIOL UN2005	INTRO BIO I: BIOCHEM,GEN,MOLEC
BIOL UN2006	INTRO BIO II:CELL BIO,DEV/PHYS
Select at least one of the following core courses:	
BIOL UN3022	DEVELOPMENTAL BIOLOGY
BIOL UN3031	GENETICS
BIOL UN3041	CELL BIOLOGY
BIOL GU4501	Biochemistry
or BIOL UN3300	Biochemistry
BIOL GU4512	Molecular Biology
Plus additional biology elective courses (see electives listed under biology major) to reach a total of 22 points in biology courses.	
No biology lab is required for the concentration. Of the 22 points, a maximum of 5 of the points can come from lab courses. SURF counts as 5 points of lab credit.	
Chemistry through organic including labs; see biology major for options	
One year of physics, including laboratory; see biology major for options	
One year of college-level mathematics (ordinarily this should be calculus); see biology major for options	

Fall 2024

BIOL UN1360	Science and Society
BIOL UN1908	First Year Seminar in Biology
BIOL UN2005	INTRO BIO I: BIOCHEM,GEN,MOLEC
BIOL UN2300	Interpreting Scientific Evidence
BIOL UN2401	CONTEMPORARY BIOLOGY I
BIOL UN2501	CONTEMPORARY BIOLOGY LAB
BIOL UN3004	NEUROBIO I:CELLULAR # MOLECULR
BIOL UN3005	NEUROBIO II: DEVPT # SYSTEMS
BIOL UN3022	DEVELOPMENTAL BIOLOGY
BIOL UN3025	NEUROGENETICS
BIOL UN3040	LAB IN MOLECULAR BIOLOGY (Lab in Molecular Biology)
BIOL UN3041	CELL BIOLOGY
BIOL UN3073	CELLULAR/MOLECULAR IMMUNOLOGY
BIOL UN3300	Biochemistry
BIOL UN3320	Regulation of Behaviors for Survival
BIOL UN3404	The Global Threat of Antimicrobial Resistance
BIOL UN3500	INDEP BIOLOGICAL RESEARCH
BIOL GU4034	BIOTECHNOLOGY
BIOL GU4260	PROTEOMICS LABORATORY
BIOL GU4300	DRUGS AND DISEASE
BIOC GU4323	Biophysical Chemistry I
BIOL GU4501	Biochemistry
BIOL GU4560	EVOL IN THE AGE OF GENOMICS

Spring 2025

BIOL UN1004	Foundations of Biology
BIOL UN2006	INTRO BIO II:CELL BIO,DEV/PHYS
BIOL UN2402	CONTMP BIO II:CELL BIO,DEV,PHYS
BIOL UN2501	CONTEMPORARY BIOLOGY LAB
BIOL UN3005	NEUROBIO II: DEVPT # SYSTEMS
BIOL UN3006	PHYSIOLOGY
BIOL UN3031	GENETICS
BIOL UN3052	PROJECT LAB-MOLECULAR GENETICS

BIOL UN3058	PROJECT LAB IN MICROBIOLOGY
BIOL UN3300	Biochemistry
BIOL UN3500	INDEP BIOLOGICAL RESEARCH
BIOL UN3995	TOPICS IN BIOLOGY
BIOL GU4001	ADVANCED GENETIC ANALYSIS
BIOL GU4080	ANCIENT AND MODERN RNA WORLDS
BIOL GU4290	BIOLOGICAL MICROSCOPY
BIOL GU4305	SEMINAR IN BIOTECHNOLOGY
BIOL GU4310	Virology
CHEM GU4324	BIOPHYSICAL CHEMISTRY II
BIOL GU4510	Genomics of Gene Regulation
BIOL GU4512	Molecular Biology
BIOL GU4551	A Structural View of Biology
BIOL GU4799	MOLECULAR BIOLOGY OF CANCER

All Courses

BIOL UN1002 Theory and Practice of Science: Biology. *4 points*.
CC/GS: Partial Fulfillment of Science Requirement

Lecture and recitation. By analysis and example from the primary literature of evolution and genetics, examines how scientific theories are invented and how they come to be accepted, verified, and in some cases rejected. Papers begin with Darwin and Mendel and end with Watson. Ordinarily does not fulfill biology major or concentration requirements. Normally may not be taken for credit by any student who has previously completed any biology course numbered 2000 or above. BIOL UN1015 should be taken first then BIOL UN1002 for nonscience majors.

BIOL UN1004 Foundations of Biology. *2.00 points*.
General Chemistry I is a pre-requisite; General Chemistry II is a pre/co-requisite. In this course, we will introduce basic terminology, important concepts, and basic problem-solving skills in order to prepare biology and pre-health students for the challenging Biology courses they will take at Columbia. We will do a deep dive into a small number of topics and use these as access points to teaching skills that will aid students in future STEM courses. Classes will include time for problem solving. Recitations will involve problem solving and student presentations of solutions to problems

Spring 2025: BIOL UN1004

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 1004	001/13282	M W 4:10pm - 5:25pm 601 Fairchild Life Sciences Bldg	Mary Ann Price	2.00	42/60

BIOL UN1130 GENES AND DEVELOPMENT. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: one year of high school or college biology.
Prerequisites: one year of high school or college biology. This course covers selected topics in genetics and developmental biology, with special emphasis on issues that are relevant to contemporary society. Lectures and readings will cover the basic principles of genetics, how genes are expressed and regulated, the role of genes in normal development, and how alterations in genes lead to abnormal development and disease. We will also examine how genes can be manipulated in the laboratory, and look at the contributions of these manipulations to basic science and medicine, as well as some practical applications of these technologies. Interspersed student-run workshops will allow students to research and discuss the ethical and societal impacts of specific topics (e.g. in vitro fertilization, uses and misuses of genetic information, genetically modified organisms, steroid use, and cloning). SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

BIOL UN1201 Engineered Mouse Models and Identifying Phenotypes In Vivo. *1.50 point*.
This undergraduate lecture course will introduce how transgenic and mutant mouse models are generated and their utility in defining the functional roles of genes in vivo. Classically, the function of a gene is tested in vivo by either overexpressing or inactivating its expression, leading to a gain-of-function or loss-of-function phenotype from which is inferred a gene's normal role in homeostasis. Here we will explore the classic strategies for the generation of transgenic and knockout mice, comparing and contrasting their individual strengths and weaknesses, while exploring the phenotypes that have resulted from these changes in gene expression. Using a subset of primary papers, students will be introduced to research analysis to become more versed in the layers of experimental design needed to identify a gene's function in vivo. The theoretical timing and the strategy needed to design such experiments with these transgenic and mutant mouse models, and the power of stem cell experiments will be discussed. In addition, to develop critical and additional analytical skills, students will become versed in basic tissue histology and immunohistochemistry, using processed paraffin-embedded mouse tissues from wild-type and engineered mutant mouse lines. Students will learn how to recognize numerous, normal adult tissues with light microscopy and to identify proliferative zones vs. fully differentiated layers within each. In addition, they will analyze the development of mid-to-late gestational embryos in serial sections, to underscore the coordinated transformation of tissues required for normal embryonic development. Finally, serial sections from well-defined mutant mouse models will used to identify and characterize abnormal phenotypes resulting from the knock-out of genes encoding cell cycle regulators or tumor suppressors. Live animal handling or experimentation is not a component of this course

BIOL UN1360 Science and Society. *3.00 points*.
This course, which has been given at another institution for the past five years, uses a seminar discussion format to examine the relationship between science and society from numerous perspectives, using examples from many fields of science, mostly biology and medicine, including the Covid-19 pandemic. We welcome undergraduates from all classes who are concentrating in any field of sciences, humanities, or the arts; there are no prerequisites, other than an interest in how the scientific enterprise works. The course addresses a wide array of topics: why do people choose a scientific career; why do governments and other funders support scientific work; how does science fail; why is there widespread skepticism about science; how is it represented in the arts; how are results disseminated, evaluated, and legally protected; and many other subjects. Assignments-- mainly short articles (from newspapers and journals) and book chapters, but also a few films and novels --will be provided for each class, and every student will undertake a term project of their own choosing, after consultations with the instructor

BIOL UN1440 DNA Diversity and You. *3.00 points*.
This seminar focuses on the biochemistry, biology, and sociology of DNA and its use and potential for misuse. Even before the discovery of the human genome, the DNA that is the lattice of each human being has been thought to be static and determinative. More recently, with advances in sequencing that DNA, the emerging picture is much more complex. Even so, deeply held beliefs about being solely “my DNA” have persisted affecting our entire species. Students in this seminar are expected to critically discuss and examine the ethical and societal impacts of several topics related to DNA (e.g., artificial reproductive techniques, eugenics, bodily autonomy, definitions and treatment of diseases, neuroscience, epigenetics and the microbiome), as well as the underlying biology and biochemistry of DNA. Human identity and its relationship to DNA is examined using an interdisciplinary framework of perspectives, including those originating from biology, genetics, medicine, public health, psychiatry, religion, and the law. Students are expected to draw from their own experiences as an individual in reflection through the readings to complete the written coursework and participate each week in class discussion. This seminar also allows for expression in other modalities (e.g., visual or aural), in a two-part final class project consisting of a media component in addition to a final written assignment

BIOL UN1908 First Year Seminar in Biology. *1.00 point*.
If you are interested in biology, come hear Columbia University professors discuss their biology-related research. Find out how the body works, the latest therapies for disease and maybe even find a lab to do research in. http://www.columbia.edu/cu/biology/courses/UN1908/index.htm

Fall 2025: BIOL UN1908

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 1908	001/10707	Th 3:00pm - 3:55pm 601 Fairchild Life Sciences Bldg	Alice Heicklen	1.00	0/70

BIOL UN2005 INTRO BIO I: BIOCHEM,GEN,MOLEC. *4.00 points*.
Prerequisites: one year of college chemistry, or a strong high school chemistry background.
Prerequisites: one year of college chemistry is required. Lecture and recitation. Recommended as the introductory biology course for biology and related majors, and for premedical students. Fundamental principles of biochemistry, molecular biology, and genetics. SPS, Barnard, and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Fall 2025: BIOL UN2005

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 2005	001/10686	T Th 10:10am - 11:25am Room TBA	Marko Jovanovic, Michelle Attner	4.00	0/400
BIOL 2005	002/10687	T Th 4:10pm - 5:25pm Room TBA	Michelle Attner, Marko Jovanovic	4.00	0/400

BIOL UN2006 INTRO BIO II:CELL BIO,DEV/PHYS. *4.00 points*.
Prerequisites: *EEEB W2001* or *BIOL C2005*, or the instructor's permission.
Prerequisites: BIOL UN2005, or the instructors permission. Lecture and recitation. Recommended second term of biology for majors in biology and related majors, and for premedical students. Cellular biology and development; physiology of cells and organisms. SPS, Barnard, and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf . Students must register for a recitation section BIOL UN2016

Spring 2025: BIOL UN2006

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 2006	001/11652	T Th 10:10am - 11:25am 417 International Affairs Bldg	Alice Heicklen, Mary Ann Price, Jellert Gaublomme	4.00	148/400
BIOL 2006	002/11653	T Th 4:10pm - 5:25pm 417 International Affairs Bldg	Alice Heicklen, Mary Ann Price, Jellert Gaublomme	4.00	116/400

BIOL UN2015 INTRO BIO I: BIOCHEM,GEN,MOLEC. *0.00 points*.
Lecture and recitation. Recommended as the introductory biology course for biology and related majors, and for premedical students. Fundamental principles of biochemistry, molecular biology, and genetics. SPS, Barnard, and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Fall 2025: BIOL UN2015

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 2015	001/10690	M 6:10pm - 8:00pm Room TBA		0.00	0/27
BIOL 2015	002/10691	M 6:10pm - 8:00pm Room TBA		0.00	0/27
BIOL 2015	003/10692	T 8:10am - 10:00am Room TBA		0.00	0/27
BIOL 2015	004/10693	T 12:10pm - 2:00pm Room TBA		0.00	0/27
BIOL 2015	005/10694	T 12:10pm - 2:00pm Room TBA		0.00	0/27
BIOL 2015	006/10695	T 6:10pm - 8:00pm Room TBA		0.00	0/27
BIOL 2015	007/10696	W 12:10pm - 2:00pm Room TBA		0.00	0/27
BIOL 2015	008/10697	W 12:10pm - 2:00pm Room TBA		0.00	0/27
BIOL 2015	009/10698	W 2:10pm - 4:00pm Room TBA		0.00	0/27
BIOL 2015	010/10700	W 2:10pm - 4:00pm Room TBA		0.00	0/27
BIOL 2015	011/10701	W 4:10pm - 6:00pm Room TBA		0.00	0/27
BIOL 2015	012/10702	W 4:10pm - 6:00pm Room TBA		0.00	0/27
BIOL 2015	013/10703	W 7:10pm - 9:00pm Room TBA		0.00	0/27
BIOL 2015	014/10704	Th 12:10pm - 2:00pm Room TBA		0.00	0/27

BIOL UN2016 INTRO BIO II:CELL BIO,DEV/PHYS. *0.00 points*.
Corequisites: BIOL UN2006
Prerequisites: Prerequisites: Course does not fulfill Biology major requirements or premedical requirements. Enrollment in laboratory limited to 16 students per section. Corequisites: BIOL UN2006
Prerequisites: Course does not fulfill Biology major requirements or premedical requirements. Enrollment in laboratory limited to 16 students per section. Exploration of the major discoveries and ideas that have revolutionized the way we view organisms and understand life. The basic concepts of cell biology, anatomy and physiology, genetics, evolution, and ecology will be traced from seminal discoveries to the modern era. The laboratory will develop these concepts and analyze biological diversity through a combined experimental and observational approach

Spring 2025: BIOL UN2016

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 2016	001/11726	M 6:10pm - 8:00pm 607 Hamilton Hall	Mary Ann Price	0.00	23/24
BIOL 2016	002/11727	M 6:10pm - 8:00pm 1000 Fairchild Life Sciences Bldg	Mary Ann Price	0.00	19/24
BIOL 2016	003/11728	T 8:10am - 10:00am 407 Mathematics Building	Mary Ann Price	0.00	22/27
BIOL 2016	004/11729	T 12:10pm - 2:00pm 337 Seeley W. Mudd Building	Mary Ann Price	0.00	30/30
BIOL 2016	005/11730	T 12:10pm - 2:00pm 707 Hamilton Hall	Mary Ann Price	0.00	21/24
BIOL 2016	006/11731	T 6:10pm - 8:00pm 233 Seeley W. Mudd Building	Mary Ann Price	0.00	30/30
BIOL 2016	007/11732	W 12:10pm - 2:00pm 301m Fayerweather	Mary Ann Price	0.00	16/24
BIOL 2016	008/11733	W 12:10pm - 2:00pm 329 Uris Hall	Mary Ann Price	0.00	9/27
BIOL 2016	009/11734	W 2:10pm - 4:00pm 337 Seeley W. Mudd Building	Mary Ann Price	0.00	27/27
BIOL 2016	010/11735	W 2:10pm - 4:00pm 603 Hamilton Hall	Mary Ann Price	0.00	16/24
BIOL 2016	011/11736	W 4:10pm - 6:00pm 307 Uris Hall	Mary Ann Price	0.00	25/24
BIOL 2016	013/11738	W 8:10pm - 10:00pm 317 Hamilton Hall	Mary Ann Price	0.00	9/24
BIOL 2016	014/11740	Th 12:10pm - 2:00pm 302 Fayerweather	Mary Ann Price	0.00	19/24

BIOL UN2300 Interpreting Scientific Evidence. *3.00 points*.
This class focuses on how we gather reliable scientific evidence about human biology and public health. The aim is to help students better interpret and evaluate the scientific evidence that they will encounter throughout their lifetime, in primary papers but also as presented in news, advertisement, and politics. To these ends, students will be introduced to basic definitions and concepts in statistics and epidemiology, including point estimates and measures of uncertainty, p-values, error rates, association and causation, different study designs, and selection bias. Readings will draw from a textbook as well as the primary literature. The second half of the course will turn to dissecting the representation and misrepresentation of scientific evidence presented in different venues. It will draw primarily from the textbook “Calling Bullshit” and include discussions of timely examples from the news

BIOL UN2401 CONTEMPORARY BIOLOGY I. *3.00 points*.
Prerequisites: a course in college chemistry or the written permission of either the instructor or the premedical adviser.
Prerequisites: one year of college chemistry or the written permission of either the instructor or the premedical adviser is required. Recommended as the introductory biology course for science majors who have completed a year of college chemistry and premedical students. The fundamental principles of biochemistry, molecular biology, and genetics. SPS and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Fall 2025: BIOL UN2401

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 2401	001/10688	T Th 10:10am - 11:25am Room TBA	Marko Jovanovic, Michelle Attner	3.00	0/200
BIOL 2401	002/10689	T Th 4:10pm - 5:25pm Room TBA	Marko Jovanovic, Michelle Attner	3.00	0/200

BIOL UN2402 CONTMP BIO II:CELL BIO,DEV,PHYS. *3.00 points*.
Prerequisites: a course in college chemistry and *BIOL C2005* or *F2401*, or the written permission of either the instructor or the premedical adviser.
Prerequisites: a course in college chemistry and BIOL UN2005 or BIOL UN2401, or the written permission of either the instructor or the premedical adviser. Cellular biology and development; physiology of cells and organisms. Same lectures as BIOL UN2006, but recitation is optional. For a detailed description of the differences between the two courses, see the course web site or http://www.columbia.edu/cu/biology/ug/advice/faqs/gs.html. SPS, Barnard, and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Spring 2025: BIOL UN2402

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 2402	001/11654	T Th 10:10am - 11:25am 417 International Affairs Bldg	Alice Heicklen, Mary Ann Price, Jellert Gaublomme	3.00	35/400
BIOL 2402	002/11655	T Th 4:10pm - 5:25pm 417 International Affairs Bldg	Alice Heicklen, Mary Ann Price, Jellert Gaublomme	3.00	23/400

BIOL UN2501 CONTEMPORARY BIOLOGY LAB. *3.00 points*.
Enrollment per section limited to 28. Lab Fee: $150.
Fee: Lab Fee - 150.00

Prerequisite or corequisite: BIOL UN2005 or BIOL UN2401. Contemporary Biology Lab is designed to provide students with hands-on exploration of fundamental and contemporary biological tools and concepts. Activities include in depth study of mammalian anatomy and physiology through dissection and histology, as well as a series of experiments in genetics and molecular biology, with emphasis on data analysis and experimental technique

Spring 2025: BIOL UN2501

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 2501	001/11635	M 1:10pm - 5:00pm 922 Schermerhorn Hall	Ava Brent	3.00	11/30
BIOL 2501	002/11636	T 1:10pm - 5:00pm 922 Schermerhorn Hall	Joshua Abrams	3.00	12/30
BIOL 2501	003/11637	W 1:10pm - 5:00pm 922 Schermerhorn Hall	Ava Brent	3.00	13/30
BIOL 2501	004/11638	Th 5:40pm - 9:30pm 922 Schermerhorn Hall	Joshua Abrams	3.00	17/30

Fall 2025: BIOL UN2501

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 2501	001/10477	M 1:10pm - 5:00pm 922 Schermerhorn Hall	Ava Brent	3.00	0/30
BIOL 2501	002/10478	T 1:10pm - 5:00pm 922 Schermerhorn Hall	Joshua Abrams	3.00	0/30
BIOL 2501	003/10479	W 1:10pm - 5:00pm 922 Schermerhorn Hall	Ava Brent	3.00	0/30
BIOL 2501	004/10480	Th 5:40pm - 9:30pm 922 Schermerhorn Hall	Joshua Abrams	3.00	0/30
BIOL 2501	005/10481	F 1:10pm - 5:00pm 922 Schermerhorn Hall	Ava Brent	3.00	0/30

BIOL UN2502 Foundations for Lab Biology. *3.00 points*.
Due to COVID-19 related restrictions on in-person laboratory work, this course acts as a replacement for BIOL UN2501. This course will act as a virtual introduction to the practice of contemporary biology, with an emphasis on common laboratory methods, online tools, statistical analysis, styles of scientific reasoning, and science communication. Students will be expected to watch a weekly lecture, either in-person or via recording. Lab activities are designed to be highly interactive and collaborative to reflect the realities of biological research. Small groups of students will work together on in-class activities, as well as on a long-term student-designed biological research project

BIOL UN2700 Past and future of the human genome. *3 points*.
CC/GS: Partial Fulfillment of Science Requirement

We can now determine the genetic makeup of any person in a matter of days and at a cost already within reach for many millions of people. For the past few years a movement has emerged to provide detailed genetic information directly to ordinary people, in some cases with the explicit aim of helping prospective parents to “eliminate preventable genetic disease” or, as one newspaper put it, to promote “genetically flawless babies.”

But our technical capacity to both interrogate and manipulate the human genome has raced far ahead of serious consideration of the societal implications of doing so. This course will provide students with the background necessary to understand what has and will be done with the human genome and ultimately to help society formulate appropriate policies for wise stewardship of the human genome.

To help illustrate the information available in the human genome and how it may influence individuals' lives, the instructors' will share and discuss their own and other public genomes in ways both molecular and personal.

BIOL UN3004 NEUROBIO I:CELLULAR # MOLECULR. *4.00 points*.
Prerequisites: one year of biology; a course in physics is highly recommended. Lecture and recitation. This is an advanced course intended for majors providing an in depth survey of the cellular and molecular aspects of nerve cell function. Topics include: the cell biology and biochemistry of neurons, ionic and molecular basis of electrical signals, synaptic transmission and its modulation, function of sensory receptors. Although not required, it is intended to be followed by Neurobiology II (see below). The recitation meets once per week in smaller groups and emphasizes readings from the primary literature

BIOL UN3005 NEUROBIO II: DEVPT # SYSTEMS. *4.00 points*.
Prerequisites: *BIOL W3004*, one year of biology, or the instructor's permission.
Prerequisites: One year of biology, BIOL UN3004 or instructors permission in case the student hasn't take it. This course is the capstone course for the Neurobiology and Behavior undergraduate major at Columbia University. It is designed for advanced undergraduate and graduate students. Knowledge of Cellular Neuroscience (how an action potential is generated and how a synapse works) will be assumed. It is recommended that students take BIOL UN3004 Neurobiology I: Molecular and Cellular Neuroscience, or a similar course, or obtain instructors permission. Website for BIOLUN3005: https://blogs.cuit.columbia.edu/rmy5/files/2022/01/syllabus.UN3005.2022.v4-lab.pdf

Spring 2025: BIOL UN3005

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3005	001/11796	T Th 10:10am - 11:25am 207 Mathematics Building	Darcy Kelley	4.00	96/150

BIOL UN3006 PHYSIOLOGY. *3.00 points*.
Prerequisites: (BIOL UN2005 and BIOL UN2006) or (BIOL UN2401 and BIOL UN2402) *BIOL C2005* & *BIOL C2006* or *BIOL F2401* & *BIOL F2402*, or the instructor's permission.
In this primarily human physiology course, we will discuss how the major organ systems function, with an emphasis on cellular, molecular, and physical mechanisms. Organ systems covered include musculoskeletal, cardiovascular, respiratory, urinary, and digestive systems. Traditional lectures focus primarily on the normal functioning of organ systems, while pathophysiology is introduced through five case studies during the semester. After this course, students should be able to 1) describe the basic functioning of the major organ systems and how they contribute to homeostasis and health, 2) apply key concepts in physics and chemistry, such as flow, pressure/volume relationships, and mass action, to physiological systems, 3) use key concepts in molecular and cell biology to gain a mechanistic understanding of physiological processes, explain how organ systems work in an integrated way to achieve homeostasis and health, and 4) predict changes in organ function upon drug treatment, genetic mutation, or disease conditions

Spring 2025: BIOL UN3006

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3006	001/11657	T Th 1:10pm - 2:25pm 601 Fairchild Life Sciences Bldg	Ava Brent	3.00	50/60

BIOL UN3008 The Cellular Physiology of Disease. *3 points*.
This course will present a quantitative description of the cellular physiology of excitable cells (mostly nerve and muscle). While the course will focus on examining basic mechanisms in cell physiology, there will be a thread of discussion of disease mechanisms throughout. The end of each lecture will include a discussion of the molecular mechanisms of selected diseases that relate to the topics covered in the lecture. The course will consist of two lectures per week. This course will be of interest to advanced (3000-4000 level) undergraduates that aim to pursue careers in medicine as well as those that will pursue careers in biomedical research. This course will also be of interest to graduate students desiring an introduction to the cellular physiology of nerve and muscle.

BIOL UN3014 Neurobiology I Recitation. *0.00 points*.
Discussion/recitation section for BIOL UN3004 Neurobiology I

BIOL UN3015 Neurobiology II Recitation. *0.00 points*.
Discussion/recitation section for BIOL UN3005 Neurobiology II

Spring 2025: BIOL UN3015

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3015	001/11799	M 6:00pm - 7:10pm 601b Fairchild Life Sciences Bldg	Abhishek Shah	0.00	25/25
BIOL 3015	002/11802	T 9:10am - 10:00am 800 Fairchild Life Sciences Bldg		0.00	30/30
BIOL 3015	004/11804	W 6:10pm - 7:10pm 301m Fayerweather		0.00	27/25
BIOL 3015	005/11805	Th 5:00pm - 6:10pm 222 Pupin Laboratories		0.00	13/25

BIOL UN3016 Neurobiology I Recitation. *0.00 points*.
Discussion/recitation section for BIOL UN3004 Neurobiology I section 002

BIOL UN3019 Brain Evolution. *3.00 points*.
If an engineer were to build “the brain”, they would not be able to reproduce any of the brains that exist on Earth. Our brains were not designed to be perfect, but are a result of millions of years of evolution and adaptation. The goal of this course is to provide an overview of brain evolution, ranging from the evolution of the first neurons to the origin of the human brain. Specifically, the course will focus on recent insights emerging from studies of development, gene expression, and neural circuit architecture. The evolutionary perspective on commonly used terms, such as “neuron” and “brain”, and general principles of brain organization and function emerging from comparative studies will be discussed

BIOL UN3022 DEVELOPMENTAL BIOLOGY. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: BIOL UN2005 and BIOL UN2006 *BIOL C2005-C2006* or equivalent.
Prerequisites: BIOL UN2005 and BIOL UN2006 or equivalent. Come discover how the union of egg and sperm triggers the complex cellular interactions that specify the diverse variety of cells present in multicellular organisms. Cellular and molecular aspects of sex determination, gametogenesis, genomic imprinting, X-chromosome inactivation, telomerase as the biological clock, stem cells, cloning, the pill and cell interactions will be explored, with an emphasis on humans. Original research articles will be discussed to further examine current research in developmental biology. SPS and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Fall 2025: BIOL UN3022

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3022	001/10091	T Th 1:10pm - 2:25pm 601 Fairchild Life Sciences Bldg	Alice Heicklen	3.00	0/60

BIOL UN3025 NEUROGENETICS. *3.00 points*.
Prerequisites: (BIOL UN2005 and BIOL UN2006)
Prerequisites: (BIOL UN2005 and BIOL UN2006) This course provides an introduction to Neurogenetics, which studies the role of genetics in the development and function of the nervous system (https://en.wikipedia.org/wiki/Neurogenetics). The course will be focused on teaching classic and contemporary concepts in genetics and neuroscience, rather than cataloguing mere facts. The course will emphasize the discovery processes, historical figures involved in these processes and methodologies of discovery. Primary research papers will be discussed in detail. A central organizational theme of the course is the presence of a common thread and narrative throughout the course. The common thread is an invertebrate model system, the roundworm Caenorhabditis elegans, which serves as a paradigm to show how simple genetic model systems have informed our view on the genetics of nervous system development and function. The ultimate goal of this course is to gain an understanding of the underlying principles of how the nervous system of one specific animal species forms, from beginning to end. The course is intended for neuroscience-inclined students (e.g. neuroscience majors) who want to learn about how genetic approaches have informed our understanding of brain development and function and, vice versa, for students with an interest in molecular biology and genetics, who want to learn about key problems in neuroscience and how genetic approaches can address them

Fall 2025: BIOL UN3025

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3025	001/10125	M W 8:40am - 9:55am 601 Fairchild Life Sciences Bldg	Oliver Hobert	3.00	0/40

BIOL UN3031 GENETICS. *3.00 points*.
Students may receive credit for *BIOL W3031* or *BIOL C3032*, but not both due to overlap in course content.

Prerequisites: BIOL UN2005 and BIOL UN2006 or *BIOL C2005-C2006* or the equivalent.
Prerequisites: BIOL UN2005 and BIOL UN2006. General genetics course focused on basic principles of transmission genetics and the application of genetic approaches to the study of biological function. Principles will be illustrated using classical and contemporary examples from prokaryote and eukaryote organisms, and the experimental discoveries at their foundation will be featured. Applications will include genetic approaches to studying animal development and human diseases. SPS and TC students must obtain the written permission from the instructor, by filling out a Registration Adjustment Form (Add/Drop form). https://www.registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Spring 2025: BIOL UN3031

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3031	001/11666	T Th 10:10am - 11:25am 601 Fairchild Life Sciences Bldg	Iva Greenwald, Michelle Attner	3.00	54/70

BIOL UN3034 Biotechnology. *3 points*.
CC/GS: Partial Fulfillment of Science Requirement
For upper-level undergraduates.

Prerequisites: genetics or molecular biology.
The course covers techniques currently used to explore and manipulate gene function and their applications in medicine and the environment. Part I covers key laboratory manipulations, including DNA cloning, gene characterization, association of genes with disease, and methods for studying gene regulation and activities of gene products. Part II also covers commercial applications, and includes animal cell culture, production of recombinant proteins, novel diagnostics, high throughput screening, and environmental biosensors. SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

BIOL UN3040 LAB IN MOLECULAR BIOLOGY. *3.00 points*.
Enrollment limited to 12. Lab fee: $150.

Prerequisites: one year of biology (*C2005-C2006*) and Contemporary Biology Laboratory (*C2501*).
Prerequisites: one year of biology (BIOL UN2005 and BIOL UN2006) and Contemporary Biology Laboratory (BIOL UN2501). Prerequisites: one year of biology (UN2005-UN2006) and Contemporary Biology Laboratory (UN2501). This lab will explore various molecular biology techniques frequently utilized in modern molecular biology laboratories. The lab will consist of four modules: 1) Molecular verification of genetically modified organisms (GMOs); 2) Site-directed mutagenesis; 3) gDNA extraction, PCR amplification, sequencing and GenBank analysis of the COI genes from diverse fish species and 4) protein gel analysis of fish muscle components. SPS and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at: http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Fall 2025: BIOL UN3040

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3040	001/10739	W 1:10pm - 5:00pm 743 Seeley W. Mudd Building	Joshua Abrams	3.00	0/12
BIOL 3040	001/10739	M 2:40pm - 3:55pm 900 Fairchild Life Sciences Bldg	Joshua Abrams	3.00	0/12

BIOL UN3041 CELL BIOLOGY. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: one year of biology, normally *BIOL C2005-C2006*, or the equivalent.
Prerequisites: one year of biology, normally BIOL UN2005-BIOL UN2006, or the equivalent. Cell Biology 3041/4041 is an upper-division course that covers in depth all organelles of cells, how they make up tissues, secrete substances important for the organism, generate and adapt to their working environment in the body, move throughout development, and signal to each other. Because these topics were introduced in the Intro Course (taught by Mowshowitz and Chasin), this course or its equivalent is a pre-requisite for W3041/4041. Students for whom this course is useful include biology, biochem or biomedical engineering majors, those preparing to apply for medical school or graduate school, and those doing or planning to start doing research in a biology or biomedical lab. SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Fall 2025: BIOL UN3041

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3041	001/10087	M W 10:10am - 11:25am 601 Fairchild Life Sciences Bldg	Erin Barnhart	3.00	0/40

BIOL UN3050 Project Laboratory In Protein Biochemistry. *5 points*.
This course provides an intensive introduction to professional biomedical laboratory research. Students conduct a portion of an ongoing biochemical research project and write-up their results in a format suitable for publication in a peer-reviewed scientific research journal. Techniques in molecular biology and protein biochemistry are used to address a problem in mechanistic biochemistry or molecular pharmacology. Students are exposed to the full spectrum of techniques used in contemporary protein biochemistry, including molecular sequence analysis of genomic databases, molecular cloning and manipulation of recombinant DNA, protein expression in E. coli, protein purification, and biophysical characterization (typically including crystallization for x-ray structure determination). The couse emphasizes the use of critical thinking skills in scientific research while giving students the opportunity to apply the basic knowlegde learned in a wide variety of biology and chemistry lecture courses to a real research project. Examples of past projects can be found on the course website: https://www1.columbia.edu/sec/cu/biology/courses/w3050/class/index.html (cunix account required to login).

BIOL UN3052 PROJECT LAB-MOLECULAR GENETICS. *5.00 points*.
Enrollment limited to approximately 12. Fee: $150.

Prerequisites: one year of introductory biology and the instructor's permission.
Multicellular animals contain a diverse array of cell types, yet start from a single cell. How do cells decide what kind of cell to be? In this lab course, we will use the tools of molecular biology and genetics to explore this fascinating question. We will use the nematode Caenorhabditis elegans, a powerful model organism used in hundreds of research labs. The course will be divided into three modules: C. elegans genetics, molecular cloning, and genetic screening. Laboratory techniques will include PCR, gel electrophoresis, restriction digest, ligation, transformation, RNAi, and C. elegans maintenance. Students will pursue original projects; emphasis will be placed on scientific thinking and scientific communication. SPS and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). Prerequisites: UN2005/UN2401 and UN2006/UN2402, or the equivalent at a different institution

Spring 2025: BIOL UN3052

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3052	001/11704	M W 12:10pm - 4:00pm 743 Seeley W. Mudd Building	Michelle Attner	5.00	11/12

BIOL UN3058 PROJECT LAB IN MICROBIOLOGY. *5.00 points*.
Lab fee: $150.

Prerequisites: one year of Intro Bio. An introductory biology or chemistry lab is recommended.
Prerequisites: one year of Intro Bio. An introductory biology or chemistry lab is recommended. Bacteria are not just unicellular germs. This lab course will broaden your awareness of the amazing world of microbiology and the diverse capabilities of microbes. The focus will be on bacterial multicellularity, pigment production, and intercellular signaling. Pigment-producing bacteria will be isolated from the wild (i.e. Morningside Campus or your skin), and characterized using standard genetic tools (PCR, DNA gel electrophoresis, transformation, screen) and microbiology techniques (isolation of bacteria and growth of bacterial colonies, media preparation, enrichment techniques for pigments). These techniques will also be applied in the study of bacterial multicellularity and signaling in the standard lab strain Pseudomonas aeruginosa. SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Spring 2025: BIOL UN3058

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3058	001/11660	T Th 1:10pm - 5:00pm 601c Fairchild Life Sciences Bldg	Lars Dietrich	5.00	13/12

BIOL UN3073 CELLULAR/MOLECULAR IMMUNOLOGY. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: two semesters of a rigorous, molecularly-oriented introductory biology course (such as *C2005* and *C2006*), or the instructor's permission.
Prerequisites: two semesters of a rigorous, molecularly-oriented introductory biology course (such as UN2005 and UN2006), or the instructors permission. This course will cover the basic concepts underlying the mechanisms of innate and adaptive immunity, as well as key experimental methods currently used in the field. To keep it real, the course will include clinical correlates in such areas as infectious diseases, autoimmune diseases, cancer immunotherapy and transplantation. Taking this course wont turn you into an immunologist, but it may make you want to become one, as was the case for several students last year. After taking the course, you should be able to read the literature intelligently in this rapidly advancing field. SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

BIOL UN3190 STEM CELLS: BIOL,ETHICS,APPLIC. *3.00 points*.

BIOL UN3193 STEM CELL BIOL # APPLICATIONS. *3.00 points*.
Prerequisites: three semesters of Biology or the instructors permission. The course examines current knowledge and potential medical applications of pluripotent stem cells (embryonic stem cells and induced pluripotent stem cells), direct conversions between cell types and adult, tissue-specific stem cells (concentrating mainly on hematopoietic and gut stem cells as leading paradigms). A basic lecture format will be supplemented by presentations and discussions of research papers. Recent reviews and research papers, together with extensive instructor notes, will be used in place of a textbook. SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

BIOL UN3208 Introduction to Evolutionary Biology. *3 points*.
Introduction to principles of general evolutionary theory, both nomological and historical; causes and processes of evolution; phylogenetic evolution; species concept and speciation; adaptation and macroevolution; concepts of phylogeny and classification.

BIOL UN3300 Biochemistry. *3.00 points*.
Prerequisites: 1 year of Introductory Biology, 1 year General Chemistry, and 1st semester Organic Chemistry. Biochemistry is the study of the chemical processes within organisms that give rise to the immense complexity of life. This complexity emerges from a highly regulated and coordinated flow of chemical energy from one biomolecule to another. This course serves to familiarize students with the spectrum of biomolecules (carbohydrates, lipids, amino acids, nucleic acids, etc.) as well as the fundamental chemical processes (glycolysis, citric acid cycle, fatty acid metabolism, etc.) that allow life to happen. The course will end with a discussion of diseases that have biochemical etiologies. In particular, this course will employ active learning techniques and critical thinking problem-solving to engage students in answering the question: how is the complexity of life possible? NOTE: While only the 1st semester of Organic Chemistry is listed as a pre-requisite, it is highly recommended that you take all of Organic Chemistry beforehand

Spring 2025: BIOL UN3300

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3300	001/11744	T 7:00pm - 9:30pm 602 Hamilton Hall	Danny Ho	3.00	75/80

Fall 2025: BIOL UN3300

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3300	001/10089	T 7:00pm - 9:30pm Room TBA	Danny Ho	3.00	0/60

BIOL UN3310 Virology. *3 points*.
Prerequisites: two semesters of a rigorous, molecularly-oriented introductory biology course (such as *C2005*), or the instructor's permission.
The course will emphasize the common reactions that must be completed by all viruses for successful reproduction within a host cell and survival and spread within a host population. The molecular basis of alternative reproductive cycles, the interactions of viruses with host organisms, and how these lead to disease are presented with examples drawn from a set of representative animal and human viruses.

BIOL UN3320 Regulation of Behaviors for Survival. *4.00 points*.
To maximize their survival animals must regulate their behavior in response to external environmental cues and their own internal state. A fundamental goal of neuroscience is to understand how neural circuits in the brain function to influence behavior. The aim of this course is to highlight the neural basis of neuropeptide regulation of innate behaviors that are critical for survival and discuss modern approaches to study the neuronal control of classically studied aspects of behavior. We will explore motor control (escape responses), sensory systems (vision, taste, and olfaction), and survival behaviors (feeding, drinking, mating, and aggression). Focus will be on recent and current research, the diversity of approaches for studying it, and how this knowledge can be applied to solve scientific questions. Students will read primary scientific literature and a significant portion of the course will be presentation and discussion-based

Fall 2025: BIOL UN3320

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3320	001/10085	W 10:10am - 12:00pm Room TBA	Laura Duvall	4.00	0/18

BIOL UN3387 BIOLOGY TEST. *3 points*.
ABCDE

BIOL UN3404 The Global Threat of Antimicrobial Resistance. *3.00 points*.
Prerequisites: (biol un2005 and biol un2006) or (biol un2401 and biol un2402)
Antimicrobial resistant bacterial infections were estimated to account for 1.27 million deaths worldwide in 2019. The goal of the seminar is to provide an in-depth analysis of this ongoing threat. Discussions will include the molecular mechanisms, epidemiology of transmission and the consequences of antimicrobial resistant infections. It will also cover current efforts to reduce the spread and emergence of these difficult to treat pathogens, both in the community and the healthcare setting

Fall 2025: BIOL UN3404

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3404	001/11129	T 2:10pm - 4:00pm Room TBA	Franklin Lowy	3.00	0/20

BIOL UN3500 INDEP BIOLOGICAL RESEARCH. *2.00-4.00 points*.
Fee: $150. Students must register for a recitation section, *BIOL W3510*.
Fee: Lab Fee - 150

Prerequisites: Concurrent with registering for this course, a student must register with the department and provide a written invitation from a mentor; details of this procedure are available at http://www.columbia.edu/cu/biology/courses/w3500/index.htm.
Corequisites: BIOL UN3510
Prerequisites: Concurrent with registering for this course, a student must register with the department and provide a written invitation from a mentor; details of this procedure are available at http://www.columbia.edu/cu/biology/courses/w3500/index.htm. Students must register for recitations UN3510 or consult the instructor.
Corequisites: BIOL UN3510 The course involves independent study, faculty-supervised laboratory projects in contemporary biology. Concurrent with registering for this course, a student must register with the department, provide a written invitation from a mentor and submit a research proposal; details of this procedure are available at http://www.columbia.edu/cu/biology/courses/w3500/index.htm. A paper summarizing results of the work is required by the last day of finals for a letter grade; no late papers will be accepted. See the course web site (above) for more details. Students can take anywhere from 2-4 points for this course

Spring 2025: BIOL UN3500

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3500	001/11634		Ron Prywes, Ellie Siddens	2.00-4.00	101/100

Fall 2025: BIOL UN3500

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3500	001/10738		Ron Prywes	2.00-4.00	0/100

BIOL UN3510 INDEP BIOLOGICAL RESEARCH - REC. *0.00 points*.

Spring 2025: BIOL UN3510

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3510	001/11860	T 5:40pm - 6:30pm 800 Fairchild Life Sciences Bldg	Ron Prywes, Ellie Siddens	0.00	23/35
BIOL 3510	002/11861	W 5:40pm - 6:30pm 800 Fairchild Life Sciences Bldg	Ron Prywes, Ellie Siddens	0.00	29/35
BIOL 3510	003/11862	T 4:10pm - 5:00pm 800 Fairchild Life Sciences Bldg	Ron Prywes, Ellie Siddens	0.00	30/35

BIOL UN3560 EVOL IN THE AGE OF GENOMICS. *4.00 points*.
Prerequisites: introductory genetics or the instructor's permission.
Prerequisites: Introductory Biology I and II, or the instructors permission. This course introduces basic concepts in evolutionary biology, from speciation to natural selection. While the lectures incorporate a historical perspective, the main goal of the class is to familiarize students with topics and tools of evolutionary genetics as practiced today, in the era of genomics. Thus, the focus will be on evidence from molecular evolution and genetics and exercises will assume a basic background in genetics. Examples will be drawn from across the tree of life, but with a primary focus on humans

BIOL UN3700 INDEPENDENT CLINICAL RESEARCH. *2.00-4.00 points*.
Prerequisites: concurrent with registering for this course, a student must register with the department, provide a written invitation from a mentor, and submit a research proposal.
Prerequisites: concurrent with registering for this course, a student must register with the department, provide a written invitation from a mentor, and submit a research proposal. BIOL 3700 will provide an opportunity for students interested in independent research work in a hospital or hospice setting. In these settings, where patients and their needs are paramount, and where IRB rules and basic medical ethics make "wet-lab biology research" inappropriate, undergraduates may well find a way nevertheless, to assist and participate in ongoing clinical research. Such students, once they have identified a mentor willing to provide support, participation, and advising, may apply to the faculty member in charge of the course for 2-4 points/semester in BIOL W3700. This course will closely follow procedures already in place for BIOL 3500, but will ask potential mentors to provide evidence that students will gain hands-on experience in a clinical setting, while participating in a hospital- or hospice-based research agenda. A paper summarizing results of the work is required by the last day of finals for a letter grade; no late papers will be accepted

BIOL UN3799 MOLECULAR BIOLOGY OF CANCER. *3.00 points*.
Prerequisites: three terms of biology (genetics and cell biology recommended).
Prerequisites: three terms of biology (genetics and cell biology recommended). Cancer is one of the most dreaded common diseases. Yet it is also one of the great intellectual challenges in biology today. How does a cell become cancerous? What are the agents that cause this to occur? How do current findings about genes, cells, and organisms ranging from yeast cells to humans inform us about cancer? How do findings about cancer teach us new biological concepts? Over the past few years there have been great inroads into answering these questions which have led to new ways to diagnose and treat cancer. This course will discuss cancer from the point of view of basic biological research. We will cover topics in genetics, molecular and cell biology that are relevant to understanding the differences between normal and cancer cells. These will include tumor viruses, oncogenes, tumor suppressor genes, cell cycle regulation, programmed cell death and cell senescence. We will also study some current physiological concepts related to cancer including angiogenesis, tumor immunology, cancer stem cells, metastasis and new approaches to treatment that are built on recent discoveries in cancer biology. SPS and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

BIOL UN3995 (Section 1) Topics in Biology: Crossroads in Bioethics. *1-2 points*.
Prerequisites: at least one introductory course in biology or chemistry. This two credit multidisciplinary and interactive course will focus on contemporary issues in bioethics. Each topic will cover both the underlying science of new biotechnologies and the subsequent bioethical issues that emerge from these technologies. Classroom time will be devoted to student discussions, case presentations, and role playing. Topics include human trafficking, stem cell research, human reproductive cloning, neuroethics, genetic screening, human-animal chimeras, synthetic biology, bioterrorism, and neuroimaging.

BIOL UN3995 TOPICS IN BIOLOGY. *2.00 points*.
Enrollment limited to 18.

Topics in Biology: Crossroads in Bioethics. This two credit multidisciplinary and interactive course will focus on contemporary issues in bioethics and medical ethics. Each topic will cover both the underlying science of new biotechnologies and the subsequent bioethical issues that emerge from these technologies. Each topic will introduce a bioethical principle that will be explored using case studies. Students are expected to prepare for each class based on the assignment so that classroom time will be devoted to discussion, case presentations, and role playing rather than merely lectures. Topics include stem cell research, human reproductive cloning, bioterrorism, neuroethics, genetic screening, medical stem cell tourism, patents and science, forensic science and the interface of science and culture/religion

Spring 2025: BIOL UN3995

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 3995	001/11812	T 1:10pm - 2:25pm 644 Seeley W. Mudd Building	John Loike	2.00	30/40

BIOL GU4001 ADVANCED GENETIC ANALYSIS. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement
Enrollment limited to 25.

Prerequisites: for undergraduates: Introductory Genetics (*W3031*) and the instructor's permission.
Prerequisites: for undergraduates: Introductory Genetics (W3031) and the instructors permission. This seminar course provides a detailed presentation of areas in classical and molecular genetics for advanced undergraduates and beginning graduate students. Topics include transmission genetics, gain and loss of function mutations, genetic redundancy, suppressors, enhancers, epistasis, expression patterns, using transposons, and genome analysis. The course is a mixture of lectures, student presentations, seminar discussions, and readings from the original literature

Spring 2025: BIOL GU4001

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4001	001/11639	M 1:10pm - 4:00pm 1000 Fairchild Life Sciences Bldg	Martin Chalfie	3.00	14/25

BIOL GU4002 Macromolecular Structure # Interactions. *4.00 points*.
Open to PhD candidates in the biomedical and chemical sciences, and to other qualified graduate, undergraduate, and continuing education students with the instructor's permission.

This course has three interrelated goals: (i) to develop an intuitive understanding of the thermodynamic forces that control the structure of biological macromolecules and the evolution of life, (ii) to learn how to apply that understanding to experimental analyses of macromolecular interactions, and (iii) to master the use of molecular graphics software for understanding and interpreting macromolecular structures and interactions. The lectures develop the essential thermodynamic theory from the ground up, starting from a review of the relevant physical forces (Newton's and Coulomb's Laws) and culminating with an intuitive explanation of how complex biological organisms can evolve spontaneously, in a universe in which all natural processes are driven by increasing randomness or entropy, as specified by the 2nd Law of Thermodynamics. Subsequent lectures elaborate how these thermodynamic principles govern the formation and interaction of macromolecular structures, which represent the physical foundation for the evolution of life, and how the same principles are applied to analyze related experimental data. The problem sets for the course focus on practical applications of these principles to the analysis of data from common experiments used by molecular biologists to characterize macromolecular interactions. Extensive use is made of molecular graphics software throughout the semester, including in the problem sets, based on instruction provided in both the lectures and recitation sections. The course is designed to develop a deep understanding of the physical mechanisms controlling macromolecular interactions while simultaneously empowering students to critically read related literature and rigorously design and analyze related experiments themselves

BIOL GU4004 NEUROBIO I:CELLULAR # MOLECULR. *4.00 points*.
Prerequisites: one year of biology; a course in physics is highly recommended. Lecture and recitation. This is an advanced course intended for majors providing an in depth survey of the cellular and molecular aspects of nerve cell function. Topics include the cell biology and biochemistry of neurons, ionic and molecular basis of electrical signals, synaptic transmission and its modulation, function of sensory receptors. Although not required, it is intended to be followed by Neurobiology II (see below). The recitation meets once per week in smaller groups and emphasizes readings from the primary literature

BIOL GU4008 The Cellular Physiology of Disease. *3 points*.
Prerequisites: one 3000-level course in Cell Biology or Biochemistry or the instructor's permission.
Corequisites: BIOL GU4009
This course will present a quantitative description of the cellular physiology of excitable cells (mostly nerve and muscle). While the course will focus on examining basic mechanisms in cell physiology, there will be a thread of discussion of disease mechanisms throughout. The end of each lecture will include a discussion of the molecular mechanisms of selected diseases that relate to the topics covered in the lecture. The course will consist of two lectures per week. This course will be of interest to advanced (3000-4000 level) undergraduates that aim to pursue careers in medicine as well as those that will pursue careers in biomedical research. This course will also be of interest to graduate students desiring an introduction to the cellular physiology of nerve and muscle.

BIOL GU4009 Cellular Physiology of Diseases Laboratory. *1 point*.
See department for details

BIOL GU4013 ADV SEMINAR IN NEUROBIOLOGY. *3.00 points*.

BIOL GU4022 DEVELOPMENTAL BIOLOGY. *3.00 points*.
Prerequisites: BIOL C2005-C2006 or equivalent. Come discover how the union of egg and sperm triggers the complex cellular interactions that specify the diverse variety of cells present in multicellular organisms. Cellular and molecular aspects of sex determination, gametogenesis, genomic imprinting, X-chromosome inactivation, telomerase as the biological clock, stem cells, cloning, the pill and cell interactions will be explored, with an emphasis on humans. Original research articles will be discussed to further examine current research in developmental biology. SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

BIOL GU4031 Genetics. *3 points*.
Open to Biotech M.A. students and other graduate students.

Prerequisites: *BIOL C2005-C2006* or the equivalent.
Corequisites: Recommended: one term of organic chemistry.
Prerequisites: BIOL UN2005 and BIOL UN2006 or the equivalent. General genetics course focused on basic principles of transmission genetics and the application of genetic approaches to the study of biological function. Principles will be illustrated using classical and contemporary examples from prokaryote and eukaryote organisms, and the experimental discoveries at their foundation will be featured. Applications will include genetic approaches to studying animal development and human diseases. SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar.http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pd

BIOL GU4034 BIOTECHNOLOGY. *3.00 points*.
Prerequisites: genetics or molecular biology. The course covers techniques currently used to explore and manipulate gene function and their applications in medicine and the environment. Part I covers key laboratory manipulations, including DNA cloning, gene characterization, association of genes with disease, and methods for studying gene regulation and activities of gene products. Part II also covers commercial applications, and includes animal cell culture, production of recombinant proteins, novel diagnostics, high throughput screening, and environmental biosensors

Fall 2025: BIOL GU4034

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4034	001/10084	M W 4:10pm - 5:25pm 601 Fairchild Life Sciences Bldg	Songtao Jia, Daniel Kalderon	3.00	0/50

BIOL GU4035 SEMINAR IN EPIGENETICS. *3.00 points*.
Prerequisites: Genetics (3032/4032) or Molecular Biology (3512/4512), and the instructor's permission.
This is a combined lecture/seminar course designed for advanced undergraduates and graduate students. The focus is on understanding the mechanisms underlying epigenetic phenomena: the heritable inheritance of genetic states without change in DNA sequence. Epigenetic mechanisms play important roles during normal animal development and oncogenesis. It is an area under intensive scientific investigation and the course will focus on recent advances in understanding these phenomena. In each class, students will present and discuss in detail recent papers and background material concerning each individual topic, followed by an introductory lecture on the following week's topic. This course will emphasize critical analysis of the scientific literature and help students understand how to identify important biological problems and how to address them experimentally.

BIOL GU4036 Transformative Concepts in Systems Biology. *3.00 points*.
Systems biology approaches are rapidly transforming the technological and conceptual foundations of research across diverse areas of biomedicine. In this course we will discuss the fundamental developments in systems biology with a focus on two important dimensions: (1) the unique conceptual frameworks that have emerged to study systems-level phenomena and (2) how these approaches are revealing fundamentally new principles that govern the organization and behavior of cellular systems. Although there will be much discussion of technologies and computational approaches, the course will emphasize the conceptual contributions of the field and the big questions that lie ahead. Lectures and discussions of primary literature will enable students to scrutinize research in the field and to internalize systems biology thinking in their own research. To make this a concrete endeavor, the students will develop mini-NIH-style grant proposals that aims to study a fundamental problem/question using systems biology approaches. The students will then convene an in-class NIH-style review panel that will assess the strengths and weaknesses of these proposals. In addition, the students will have the opportunity to defend their proposals in a live presentation to the class. The course is open to graduate students in Biological Sciences. Advanced undergraduates in biological sciences, and other graduate students with background in biology from other disciplines, including physics, chemistry, computer science, and engineering may also attend after consulting with the instructor

Fall 2025: BIOL GU4036

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4036	001/10476	W 2:40pm - 4:30pm 1000 Fairchild Life Sciences Bldg	Saeed Tavazoie	3.00	0/15

BIOL GU4041 Cell Biology. *3 points*.
Prerequisites: one year of biology, normally *BIOL C2005-C2006*, or the equivalent.
Cell Biology 3041/4041 is an upper-division course that covers in depth all organelles of cells, how they make up tissues, secrete substances important for the organism, generate and adapt to their working environment in the body, move throughout development, and signal to each other. Because these topics were introduced in the Intro Course (taught by Mowshowitz and Chasin), this course or its equivalent is a pre-requisite for W3041/4041. Students for whom this course is useful include biology, biochem or biomedical engineering majors, those preparing to apply for medical school or graduate school, and those doing or planning to start doing research in a biology or biomedical lab. SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

BIOL GU4065 Molecular Biology of Disease. *3 points*.
Enrollment limited to 30.

Molecular and cellular basis of infectious diseases and inherited propensities. Mechanisms of disease examined in discussions based on current research papers. Lectures, discussions, and student presentations. Essay required in lieu of final examination.

BIOL GU4070 The Biology and Physics of Single Molecules. *3 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: calculus, chemistry, physics, one year of biology, or the instructor's permission.
This course will examine the fundamental mechanisms underlying the behavior of biological molecules, at the single molecule level. The course will cover the methods used to track single molecules: optical tweezers, single molecule AFM, Magnetic tweezers, Optical techniques and Fluorescence energy transfer (FRET) probes. The course will cover the mechanism of action of mechanical motors, such as myosin dyneyin, kinesin. It will cover the action of DNA binding enzymes such as topoisomerases, helicases, etc. We will also discuss the function of large motors such as the ATP Synthase and the bacterial AAA ATPases. We will discuss the mechanical properties of DNA, RNA, and proteins. The course will consist mainly of reviewing classical experiments in each category, and developing the background physical theories to promote a deep understanding of biological mechanisms at the mesoscopic level.

BIOL GU4073 Cellular and Molecular Immunology. *3 points*.
Prerequisites: two semesters of a rigorous, molecularly-oriented introductory biology course (such as *C2005* and *C2006*), or the instructor's permission.
This course will cover the basic concepts underlying the mechanisms of innate and adaptive immunity, as well as key experimental methods currently used in the field. To keep it real, the course will include clinical correlates in such areas as infectious diseases, autoimmune diseases, cancer, and transplantation. Taking this course won't turn you into an immunologist, but it may make you want to become one, as was the case for several students last year. After taking the course, you should be able to read the literature intelligently in this rapidly advancing field.

Fall 2025: BIOL GU4073

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4073	001/12356	M W 1:10pm - 2:25pm Room TBA	Christian Schindler	3	0/60

BIOL GU4075 BIOLOGY AT PHYSICAL EXTREMES. *3.00 points*.
Prerequisites: one year each of biology and physics, or the instructor's permission.
Prerequisites: one year each of biology and physics, or the instructor's permission. This is a combined lecture/seminar course designed for graduate students and advanced undergraduates. The course will cover a series of cases where biological systems take advantage of physical phenomena in counter intuitive and surprising ways to accomplish their functions. In each of these cases, we will discuss different physical mechanisms at work. We will limit our discussions to simple, qualitative arguments. We will also discuss experimental methods enabling the study of these biological systems. Overall, the course will expose students to a wide range of physical concepts involved in biological processes

BIOL GU4080 ANCIENT AND MODERN RNA WORLDS. *3.00 points*.
Prerequisites: BIOC UN3512
RNA has recently taken center stage with the discovery that RNA molecules sculpt the landscape and information contained within our genomes. Furthermore, some ancient RNA molecules combine the roles of both genotype and phenotype into a single molecule. These multi-tasking RNAs offering a possible solution to the paradox of which came first: DNA or proteins. This seminar explores the link between modern RNA, metabolism, and insights into a prebiotic RNA world that existed some 3.8 billion years ago. Topics include the origin of life, replication, and the origin of the genetic code; conventional, new, and bizarre forms of RNA processing; structure, function and evolution of key RNA molecules, including the ribosome, and RNA therapeutics including vaccines. The format will be weekly seminar discussions with presentations. Readings will be taken from the primary literature, emphasizing seminal and recent literature. Requirements will be student presentations, class participation, and a final paper

Spring 2025: BIOL GU4080

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4080	001/11640	W 10:10am - 12:00pm 1000 Fairchild Life Sciences Bldg	Laura Landweber	3.00	21/24

BIOL GU4082 Theoretical Foundations and Applications of Biophysical Methods. *4 points*.
Rigorous introduction to the theory underlying biophysical methods, which are illustrated by practical applications to biomedical research. Emphasizes the approach used by physical chemists to understand and analyze the behavior of molecules, while also preparing students to apply these methods in their own research. Course modules cover: (i) statistical analysis of data; (ii) solution thermodynamics; (iii) hydrodynamic methods; (iv) light-scattering methods; and (v) spectroscopic methods, especially fluorescence. Recitations focus on curve-fitting analyses of experimental data.

BIOL GU4088 Seminar in Neurobiochemistry and Neurological Diseases. *3.00 points*.
Students will read and discuss classical as well as contemporary research papers on the molecular and cellular mechanisms of membrane excitability, synaptic transmission and sensory transduction, and the pathogenic mechanisms and therapeutics of certain neurological diseases related to these processes. Focus will be on intellectual creativity, conceptual breakthroughs, and technical advances. A key goal of the course is to help students become a critical reader and thinker. Graduate students in all disciplines are welcome. Advanced undergraduate students can enroll with instructor’s permission. For PhD students in the Biological Sciences Program, this is a tier 3 course

BIOL GU4193 Stem Cell Biology and Applications. *3 points*.
The course examines current knowledge and potential medical applications of pluripotent stem cells (embryonic stem cells and induced pluripotent stem cells), direct conversions between cell types and adult, tissue-specific stem cells (concentrating mainly on hematopoietic and gut stem cells as leading paradigms). A basic lecture format will be supplemented by presentations and discussions of research papers. Recent reviews and research papers together with extensive instructor notes will be used in place of a textbook.

BIOL GU4260 PROTEOMICS LABORATORY. *3.00 points*.
Lab Fee: $150.

This course deals with the proteome: the expressed protein complement of a cell, organelle, matrix, tissue, organ or organism. The study of the proteome (proteomics) is broadly applicable to life sciences research, and is increasingly important in academic, government and industrial research through extension of the impact of advances in genomics. These techniques are being applied to basic research, exploratory studies of cancer and other diseases, drug discovery and many other topics. Emphasis will be on mastery of practical techniques of sample preparation, liquid chromatography/ mass spectrometry (LC/MS) with electrospray ionization, and Matrix-Assisted Laser Desorption and Ionization (MALDI-TOF) mass spectrometry. Database searching and interpretation for identification of proteins will be intensively studied, and practiced supported by background tutorials and exercises covering other techniques used in proteomics. Open to students in M.A. in Biotechnology Program (points can be counted against laboratory requirement for that program), Ph.D. and advanced undergraduate students with background in genetics or molecular biology. Students should be comfortable with basic biotechnology laboratory techniques as well as being interested in doing computational work in a Windows environment

Fall 2025: BIOL GU4260

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4260	001/10564	Th 12:30pm - 3:30pm 900 Fairchild Life Sciences Bldg	Lewis Brown	3.00	0/12

BIOL GU4290 BIOLOGICAL MICROSCOPY. *3.00 points*.
Prerequisites: (biol un2005 or biol un2401) or
Prerequisites: (biol un2005 or biol un2401) or BIOL UN2005 or BIOL UN2401 or equivalent This is an advanced microscopy course aimed at graduates and advanced undergraduate students, who are interested in learning about the foundational principles of microscopy approaches and their applications in life sciences. The course will introduce the fundamentals of optics, light-matter interaction and in-depth view of most commonly used advanced microscopy methods, explore important practical imaging parameters, and also introduce digital images and their analysis

Spring 2025: BIOL GU4290

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4290	001/11701	T Th 11:40am - 12:55pm 601 Fairchild Life Sciences Bldg	Raju Tomer	3.00	29/36

BIOL GU4300 DRUGS AND DISEASE. *3.00 points*.
Prerequisites: four semesters of biology with a firm foundation in molecular and cellular biology.
Prerequisites: four semesters of biology with a firm foundation in molecular and cellular biology. Introduces students to the current understanding of human diseases, novel therapeutic approaches and drug development process. Selected topics will be covered in order to give students a feeling of the field of biotechnology in health science. This course also aims to strengthen students' skills in literature comprehension and critical thinking

Fall 2025: BIOL GU4300

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4300	001/10594	M W 2:40pm - 3:55pm 601 Fairchild Life Sciences Bldg	Lili Yamasaki	3.00	0/55

BIOL GU4305 SEMINAR IN BIOTECHNOLOGY. *3.00 points*.
Prerequisites: BIOL W4300 or the instructors permission. A weekly seminar and discussion course focusing on the most recent development in biotechnology. Professionals of the pharmaceutical, biotechnology, and related industries will be invited to present and lead discussions

Spring 2025: BIOL GU4305

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4305	001/11651	W 2:10pm - 4:00pm 601 Fairchild Life Sciences Bldg	Lili Yamasaki	3.00	31/40

BIOL GU4310 Virology. *3 points*.
The basic thesis of the course is that all viruses adopt a common strategy. The strategy is simple: 1. Viral genomes are contained in metastable particles. 2. Genomes encode gene products that promote an infectious cycle (mechanisms for genomes to enter cells, replicate, and exit in particles). 3. Infection patterns range from benign to lethal; infections can overcome or co-exist with host defenses. Despite the apparent simplicity, the tactics evolved by particular virus families to survive and prosper are remarkable. This rich set of solutions to common problems in host/parasite interactions provides significant insight and powerful research tools. Virology has enabled a more detailed understanding of the structure and function of molecules, cells and organisms and has provided fundamental understanding of disease and virus evolution. The course will emphasize the common reactions that must be completed by all viruses for successful reproduction within a host cell and survival and spread within a host population. The molecular basis of alternative reproductive cycles, the interactions of viruses with host organisms, and how these lead to disease are presented with examples drawn from a set of representative animal and human viruses, although selected bacterial viruses will be discussed.

Spring 2025: BIOL GU4310

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4310	001/11647	M W 4:10pm - 5:25pm 209 Havemeyer Hall	Vincent Racaniello	3	108/110

BIOL GU4323 BIOPHYSICAL CHEMISTRY I. *4.00 points*.
This course provides a rigorous introduction to the theory underlying widely used biophysical methods, which will be illustrated by practical applications to contemporary biomedical research problems. The course has two equally important goals. The first goal is to explain the fundamental approaches used by physical chemists to understand the behavior of molecules and to develop related analytical tools. The second goal is to prepare students to apply these methods themselves to their own molecular biology research projects. The course will be divided into seven modules: (i) solution thermodynamics with an emphasis on application to analysis of protein structure, folding, and binding interactions; (ii) hydrodynamic methods; (iii) statistical analysis of experimental data; (iv) molecular dynamics calculations; (v) optical spectroscopy with an emphasis on fluorescence; (vi) nuclear magnetic resonance spectroscopy; and (vii) light-scattering and diffraction methods including an overview of cryogenic electron microscopy reconstruction methods. In each module, the underlying physical theories and models will be presented and used to derive the mathematical equations applied to the analysis of experimental data. Weekly recitations will emphasize the analysis of real experimental data and understanding the applications of biophysical experimentation in published research papers. The problem sets emphasize use of PyMOL for analysis of macromolecular structures and use of standard curve-fitting software for analysis of protein binding data; detailed tutorials on the related methods are provided in the recitation sections. The first three modules will be covered in Biophysical Chemistry I during the fall term, while the final three will be covered in Biophysical Chemistry II during the spring term, and treatment of molecular dynamics calculations will be divided between the two terms

BIOL GU4402 Biological Image Computing. *3.00 points*.
We will aim for practical understanding of the fundamentals of Python programming, image visualization # rendering tools and common image processing tasks, including image segmentation, measurements of features and registration

BIOL GU4501 Biochemistry. *3.00 points*.
In this course, we will explore the basic biochemistry of living systems and how this knowledge can be harnessed to create new medicines. We will learn how living systems convert environmental resources into energy through metabolism, and how they use this energy and these materials to build the molecules required for the diverse functions of life. We will discuss the applications of this biochemical knowledge to mechanisms of disease and to drug discovery. We will look at examples of drug discovery related to neurodegeneration, cancer, and the SARS-CoV-2 COVID19 pandemic. This course satisfies the requirement of most medical schools for introductory biochemistry, and is suitable for advanced undergraduates, and beginning graduate students. This course is equivalent to and replaces the prior course named UN3501, and is equivalent to the course offered in the summer.

Fall 2025: BIOL GU4501

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4501	001/10086	T Th 2:40pm - 3:55pm Room TBA	Mary Ann Price	3.00	0/200

BIOL GU4505 Biochemistry I Recitation in VR: Leveraging Virtual Reality. *0.00 points*.
In this course, we will use virtual reality to explore the basic biochemistry of living systems and how this knowledge can be harnessed to create new medicines. We will learn how living systems convert environmental resources into energy through metabolism, and how they use this energy and these materials to build the molecules required for the diverse functions of life. We will discuss the applications of this biochemical knowledge to mechanisms of disease and to drug discovery. We will look at examples of drug discovery related to neurodegeneration, cancer, and the SARS-CoV-2 COVID19 pandemic. This course satisfies the requirement of most medical schools for introductory biochemistry, and is suitable for advanced undergraduates, and beginning graduate students. This course is equivalent to and replaces the prior course named UN3501, and is equivalent to the course offered in the Fall semester. This course is a co-requisite to GU4501. We will meet twice each week in Zoom (Tuesday and Thursday 2:30-5:15, GU4501) to discuss the course material. We will then meet Friday 9:30-10:30 each week in virtual reality, using the Spatial.io platform and an Oculus Quest headset. In VR, we will examine the 3D spatial concepts relevant to biochemistry, where you will be able to examine molecular structures in an immersive format

BIOL GU4506 Biochemistry I in XR: Mixed Reality. *1.00 point*.
In this course, we will use mixed reality to explore the basic 3D aspects of biochemistry of living systems and how this knowledge can be harnessed to create new medicines. Students may register for this course alongside of GU4501 or independent of GU4501. Professor Stockwell will meet each week with a group of 4 students to discuss protein structures using Oculus Quest Pro Mixed Reality headsets in the XR app Nanome. Students will rotate through in person meetings but can join all weekly sessions using a virtual live stream. We will examine 3D spatial concepts relevant to biochemistry, where you will be able to examine molecular structures in an immersive format in real time with other students and with the instructor

BIOL GU4510 Genomics of Gene Regulation. *4 points*.
Prerequisites: one year of Biology, Chemistry, and Physics. Courses taken at CU are recommended, but AP courses may be sufficient with the instructor's permission.
This course will provide students with a quantitative understanding of the ways in which molecular interactions between nucleotides and proteins give rise to the behavior of gene regulatory networks. The key high-throughput genomics technologies for probing the cell at different levels using microarrays and next-generation sequencing will be discussed. Strategies for interpreting and integrating these data using statistics, biophysics, and genetics will be introduced. In computer exercises, student will learn the basics of the R language, and use it to perform analyses of genomics data sets. No prior computer programming experience is assumed. This highly interdisciplinary course is intended for advanced undergraduates as well as beginning graduate students in Biology, Chemistry, Physics, Engineering, and Computer Science. Offered in previous years as CHBC W4510.

Spring 2025: BIOL GU4510

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4510	001/11752	M W 2:40pm - 3:55pm 328 Uris Hall	Harmen Bussemaker	4	15/25

BIOL GU4511 Biochemistry I recitation: Structure and Metabolism. *0.00 points*.
This is the recitation for GU4501. How does life work on a molecular level? Why do we succumb to disease, and how can we create new cures? This course will explore the biochemistry of life and how this knowledge can be harnessed to create new medicines. You will learn how cells convert environmental resources into energy through metabolism, how cellular molecules function, and how to use this biochemical knowledge for drug discovery related to neurodegeneration, cancer, and the current SARS-CoV-2 COVID19 pandemic. At the conclusion of the course, you will be able to diagram the major metabolic pathways and compare how these pathways are dysregulated in normal tissues in and in disease states. In addition, you will know what techniques are used to uncover biochemical knowledge and how to interpret relevant experiments. You will be capable of collaborating with other people in the analysis and interpretation of biochemical data, and be able to communicate, defend and refute interpretations of data. Having completed one year of college-level biology and one year of organic chemistry will be helpful to maximally benefit from this course. This course satisfies the requirement of most medical schools for introductory biochemistry, and is suitable for advanced undergraduates, and beginning graduate students; this replaces the previous UN3511 course

BIOL GU4512 Molecular Biology. *3.00 points*.
Prerequisites: one year of biology. This is a lecture course designed for advanced undergraduates and graduate students. The focus is on understanding at the molecular/biochemical level how genetic information is stored within the cell, how it is replicated and expressed, and how it is regulated. Topics covered include genome organization, DNA replication and repair, transcription, RNA processing, and translation. This course will also emphasize the critical analysis of the scientific literature and help students understand how to identify important biological problems and how to address them experimentally. SPS and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Spring 2025: BIOL GU4512

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4512	001/11705	M 2:40pm - 3:55pm 601 Fairchild Life Sciences Bldg	Alice Heicklen	3.00	49/60
BIOL 4512	001/11705	W 2:40pm - 3:55pm 141 Uris Hall	Alice Heicklen	3.00	49/60

BIOL GU4551 A Structural View of Biology. *3.00 points*.
The course covers a general introduction to the theory and experimental techniques of structural biology (protein expression and purification, protein crystallography, cryo-electron microscopy, nuclear magnetic resonance) and then how to use the structural information to understand biochemical and biological processes. The first part of the course will cover the general introduction to structural biology. The second part of the course will involve discussions and explorations of various structures, led by the instructor but with substantial participation from the students, to understand the molecular mechanisms of selected biochemical and biological processes. In the final part of the course, each student will select and lead discussions on a primary structural biology paper. The overall goal of the course is to increase the understanding of how protein structures are determined, what protein structures look like, and how to use the structures to understand biology

Spring 2025: BIOL GU4551

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4551	001/11641	T Th 10:10am - 11:25am 800 Fairchild Life Sciences Bldg	Liang Tong	3.00	19/20

BIOL GU4560 EVOL IN THE AGE OF GENOMICS. *4.00 points*.
Prerequisites: introductory genetics or the instructor's permission. This course introduces basic concepts in evolutionary biology, from speciation to natural selection. While the lectures incorporate a historical perspective, the main goal of the class is to familiarize students with topics and tools of evolutionary genetics as practiced today, in the era of genomics. Thus, the focus will be on evidence from molecular evolution and genetics and exercises will assume a basic background in genetics. Examples will be drawn from across the tree of life, but with a primary focus on humans.

BIOL GU4600 CELL SIGNALING. *3.00 points*.
Prerequisites: A strong background in molecular and cellular biology. Generally students with four or more courses are accepted. Cell Signaling is a graduate course for Ph.D. students open to advanced undergraduate and masters students. The basic molecular mechanism of signal transduction pathways will be discussed related to cell growth and stress systems. There will be an emphasis on specific categories of signaling components. Students will read the literature and give presentations. Topics include the pathways by which cells respond to extracellular signals such as growth factors and the mechanisms by which extracellular signals are translated into alterations in the cell cycle, morphology, differentiation state, and motility of the responding cells. For stress pathways we will discuss how cells respond to survive the stress or induce their own death. In many cases these pathways will be related to human diseases

BIOL GU4777 From Curiosity to Cure – Case Studies in Cool Biochemistry. *4.00 points*.
Course overview: The goal of this course is to engage upper-level undergraduates and beginning graduate students in an immersive intellectual experience at the intersection of rigorous scientific inquiry and the history of innovation in molecular biology. The central theme will be curiosity and critical thinking as the twin drivers of both technological innovation and scientific discovery. The course will be divided into a series of modules focused on analysis and presentation of original research papers related to one important breakthrough in molecular biology that occurred during the past century. A prominent theme of the course will be the persistently unpredictable trajectory linking technical research and methodological developments to breakthrough science. Approximately six-to-eight original research papers will be covered in each module, spanning topics from the development of the methods that made the breakthrough possible through practical application of the resulting knowledge. Three or four of the following breakthroughs will likely be covered in 2023: Discovery and clinical application of insulin by Banting # Best. Development of the Trikafta triple drug treatment for cystic fibrosis. Development of CRISPR for human genetic engineering. Genetics and pharmacological treatment of human hyperlipidemia. Development of the Gleevec tyrosine kinase inhibitor to cure Ph leukemias. Development of "next-generation" nucleic acid sequencing methods

BIOL GU4799 MOLECULAR BIOLOGY OF CANCER. *3.00 points*.
Tracing the discovery of the role of DNA tumor viruses in cancerous transformation. Oncogenes and tumor suppressors are analyzed with respect to their function in normal cell cycle, growth control, and human cancers. SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Spring 2025: BIOL GU4799

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOL 4799	001/11827	T Th 2:40pm - 3:55pm 601 Fairchild Life Sciences Bldg	Carol Prives, Ron Prywes	3.00	30/50

BIOT GU4160 BIOTECHNOLOGY LAW. *3.00 points*.
Prerequisites: at least 4 college-level biology or biotechnology courses. This course will introduce students to the interrelated fields of patent law, regulatory law, and contract law that are vital to the biotech and biopharmaceutical sectors. The course will present core concepts in a way that permits students to use them throughout their corporate, academic, and government careers. SCE and TC students may register for this course, but they must first obtain the written permission of the instructor, by filling out a paper Registration Adjustment Form (Add/Drop form). The form can be downloaded at the URL below, but must be signed by the instructor and returned to the office of the registrar. http://registrar.columbia.edu/sites/default/files/content/reg-adjustment.pdf

Fall 2025: BIOT GU4160

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOT 4160	001/10090	W 6:10pm - 8:00pm Room TBA	Alan Morrison	3.00	0/25

BIOT GU4161 ETHICS IN BIOPHARM PAT/REG LAW. *3.00 points*.
Prerequisites: BIOT GU4160 BIOTECHNOLOGY LAW (BIOT W4160)
This course – the first of its kind at Columbia – introduces students to a vital subfield of ethics focusing on patent and regulatory law in the biotech and pharmaceutical sectors. The course combines lectures, structured debate, and research to best present this fascinating and nuanced subject. Properly exploring this branch of bioethics requires an in-depth understanding of biotech and pharmaceutical patent and regulatory law. Students can gain this understanding by first completing Biotechnology Law (BIOT GU4160), formerly the prerequisite for this course. Now, they can also gain it by reading the appropriate chapters of Biotechnology Law: A Primer for Scientists (the textbook for BIOT GU4160 published earlier this year) prior to each class. A number of students in the biotechnology fields (such as those in biotechnology, biomedical engineering, and bioethics programs) have shown a keen interest over the years in taking this course, yet were unable to do so because they hadn't taken BIOT GU4160. Given the recent publication of Biotechnology Law and the desirability of making BIOT GU4161 accessible to more students having the appropriate science background, BIOT GU4160 has been removed as a prerequisite

BIOT GU4180 ENTREPRENEURSHIP IN BIOTECH. *3.00 points*.
Prerequisites: the instructors permission. The course examines the entrepreneurial process in biotechnology from idea generation through economic viability. Biotechnology companies are unique in that they need a years-to-decades long period of incubation prior to becoming self-sustaining. Students will be introduced to the steps needed to start and nurture a company, and gain an ability to assess the health of potential collaborators, partners or employers. Topics include an overview of the global biotechnology industry, idea generation, business plan formulation, intellectual property protection, funding, personnel management including board composition, regulatory body interaction, and company exits. Course website: http://biot4180.weebly.com/

BIOT GU4200 BIOPHARMACEUTICAL DEV # REG. *3.00 points*.
The program aims to provide current life sciences students with an understanding of what drives the regulatory strategies that surround the development decision making process, and how the regulatory professional may best contribute to the goals of product development and approval. To effect this, we will examine operational, strategic, and commercial aspects of the regulatory approval process for new drug, biologic, and biotechnology products both in the United States and worldwide. The topics are designed to provide a chronological review of the requirements needed to obtain marketing approval. Regulatory strategic, operational, and marketing considerations will be addressed throughout the course. We will examine and analyze the regulatory process as a product candidates are advanced from Research and Development, through pre-clinical and clinical testing, to marketing approval, product launch and the post-marketing phase. The goal of this course is to introduce and familiarize students with the terminology, timelines, and actual steps followed by Regulatory Affairs professionals employed in the pharmaceutical or biotechnology industry. Worked examples will be explored to illustrate complex topics and illustrate interpretation of regulations

Fall 2025: BIOT GU4200

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOT 4200	001/10709	Th 4:10pm - 6:00pm Room TBA	Ron Guido	3.00	0/155

BIOT GU4201 SEM-BIOTECH DEVPT # REGULATION. *3.00 points*.
Prerequisites: BIOT W4200 (OK without prerequisite). This course will provide a practical definition of the current role of the Regulatory Professional in pharmaceutical development, approval and post-approval actions. This will be illustrated by exploration, and interactive discussion of regulatory history, its evolution, current standards, and associated processes. The course will seek to clarify the role of Regulatory in development and lifecycle opportunities, demonstrating the value Regulatory adds by participation on research, development and commercial teams. The course will utilize weekly case studies and guest lecturers to provide color to current topical events related to the areas

Spring 2025: BIOT GU4201

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
BIOT 4201	001/11643	Th 4:10pm - 6:00pm 301 Uris Hall	Ron Guido	3.00	246/235

Of Related Interest

Chemistry	
CHEM UN1403	GENERAL CHEMISTRY I-LECTURES
CHEM UN1404	GENERAL CHEMISTRY II-LECTURES
CHEM UN1500	GENERAL CHEMISTRY LABORATORY
CHEM UN2443	ORGANIC CHEMISTRY I-LECTURES
CHEM UN2444	ORGANIC CHEMSTRY II-LECTURES
CHEM UN2493	ORGANIC CHEM. LAB I TECHNIQUES
CHEM UN2494	ORGANIC CHEM. LAB II SYNTHESIS
CHEM UN3079	PHYSICAL CHEMISTRY I-LECTURES
CHEM UN3080	PHYSICAL CHEMISTRY II-LECTURES
CHEM UN3085	PHYSICL-ANALYTICL LABORATORY I
CHEM UN3086	PHYSICL-ANALYTCL LABORATORY II
Ecology, Evolution, and Environmental Biology	
EEEB UN2001	ENVIRONMENTAL BIOLOGY I
EEEB GU4321	HUM NATURE:DNA,RACE # IDENTITY
History and Philosophy of Science	
HPSC W3201	Philosophy and History of Evolutionary Biology
Psychology	
PSYC UN1010	Mind, Brain and Behavior