CHEMISTRY

608 Altschul Hall
212-854-8460
212-280-2012 (fax)
Department Administrator: Laura Hendrickson (608 Altschul Hall)

The Department of Chemistry

The department aims to provide Barnard College students with a working knowledge of chemistry—the study of matter and its transformations, particularly at the molecular scale—within a vibrant community of students, faculty, and staff. Students gain familiarity with the core areas of the field: inorganic, physical, organic, analytical, and biological chemistry; while developing broadly applicable skills in problem solving and critical thinking. Through extensive laboratory work, students apply chemical concepts and theories to the tangible world, and there are ample opportunities for independent research with faculty members.

Mission

The department strives to prepare majors and non-majors alike to meet post-graduation goals, including graduate study in chemistry, employment in chemistry or related technical fields, science teaching, and professional school (particularly in the health-related professions). The department is an important contributor to Barnard’s effort to produce scientifically literate graduates and to be a source of distinguished women scientists.

Student Learning Objectives for Majors in Chemistry and Biochemistry

Students who graduate from Barnard College with a major in chemistry or biochemistry will be able to attain the following objectives:

- Demonstrate a thorough grounding in the core areas of chemistry: inorganic, physical, organic, biological, and analytical;
- Work effectively and safely in the chemistry laboratory, designing and conducting experiments, analyzing experimental results, and drawing conclusions from that data;
- Access, search, and interpret the chemical literature to obtain and critically evaluate scientific information;
- Clearly communicate scientific ideas and results both in writing and orally;
- Conduct themselves professionally and ethically as members of the scientific community;
- Pursue careers that require a high degree of technical expertise, including those in chemistry, science teaching, and the health professions.

Chemistry is the study of the nature of substances and their transformations. In a sequence of core courses, a chemistry or biochemistry major gains familiarity with the basic areas of the field: inorganic, organic, physical, analytical, and biological chemistry. In addition, she acquires sufficient skill in laboratory work that she is prepared for research.

The laboratories of the department are modern and well-equipped for both coursework and independent projects. Students may undertake research projects under the guidance of members of the department during the academic year or the summer. Opportunities are also available for research with Columbia faculty as well as staff members of the many medical schools and research institutions in New York City.

AP Credit

Students with scores of 4 or 5 on the Chemistry AP test or a 5, 6 or 7 on the IB chemistry exam can receive 3 credits of unspecified chemistry credit. Students may not “place out” of CHEM BC2001 unless they have taken the equivalent course(s) in college.

Pre-Medical Program

Non majors who are interested in the pre-health professions should work with the pre-health adviser to determine the best selection of chemistry courses for their goals. Information about the topics covered in each chemistry course is available through the prehealth professions office to facilitate student choice.

Introductory Course Selection

Based on their preparation and background in chemistry, most students begin their study with CHEM BC2001 GENERAL CHEMISTRY I, an integrated lecture and laboratory course. Some students will also take CHEM BC1003 CHEMICAL PROBLEM SOLVING, which is a one point corequisite of General Chemistry. Consult the department regarding this choice.

Regardless of a student’s background in chemistry, students may also take CHEM BC1050 THE JAZZ OF CHEMISTRY. This 3.0-point seminar is limited to 24 students per section.

Chair: Marisa Buzzo (Professor)
Assistant Chair: Rachel Narehood Austin (Professor)
Professors: Rachel Narehood Austin, Marisa Buzzo, Dina Merrer, Christian Rojas
Assistant Professors: Michael Campbell, Andrew Crowther, Christina Vizcarra
Term Assistant Professor: Subhasish Chatterjee, Jonelle White
Senior Lecturer: Meenakshi Rao, Jean Vadakkan
Senior Associate Laboratory Director: SuQing Liu
Laboratory Instructional Support Specialists: Craig Allen, Grace Lee, Judith Kamm
Director of General Chemistry Laboratories: SuQing Liu
Director of Organic Chemistry Laboratories: Meenakshi Rao (Senior Lecturer)
Laboratory and Facilities Administrator: Maisha Rahman

Requirements for the Major

Two majors are offered by the department: Chemistry and Biochemistry. There is also a special track within chemistry for students who are interested in pursuing graduate study in chemical engineering.

A student interested in chemistry or biochemistry should consult any member of the department during her first year. In the first year they should take CHEM BC2001 GENERAL CHEMISTRY I, CHEM BC3328...
INTRO ORGANIC CHEMISTRY-LAB, and CHEM BC3230 ORGANIC CHEMISTRY I-LEC and start or continue the study of calculus.

In addition to required coursework, research experience is strongly recommended and may begin as early as the sophomore year. Interested students should consult with individual faculty members about research opportunities.

Rising seniors making good progress towards the degree may be invited by the faculty to participate in the senior honors thesis program in which students carry out a year-long research project leading to a thesis. Students who do not perform thesis research will satisfy the senior capstone requirement by taking a single semester of research their senior year.

Chemistry

The courses required for the chemistry major are:

### Core
- CHEM BC2001 GENERAL CHEMISTRY I 5
- CHEM BC3230 ORGANIC CHEMISTRY I-LEC
- CHEM BC3328 INTRO ORGANIC CHEMISTRY-LAB
- CHEM BC3231 ORGANIC CHEMISTRY II-LEC 3
- CHEM BC3333 MODERN TECH-ORGANIC CHEM LAB 3
- CHEM BC3242 QUANTITATIVE ANALYSIS 3
- CHEM BC3338 QUANTITATIVE-INSTRMNTL TECH-LAB 3
- CHEM BC3253 QUANTUM CHEMISTRY 3
- CHEM BC3252 THERMODYNAMICS-KINETICS 3
- CHEM BC3348 Advanced Spectroscopy, Measurement, and Analysis Laboratory 3
- CHEM BC3271 INORGANIC CHEMISTRY 3
- CHEM BC3358 Advanced Chemical Synthesis and Reactivity Laboratory 5
- MATH UN1101 CALCULUS I * 3
- MATH UN1102 or MATH UN1201 CALCULUS II 3
- PHYS BC2001 or PHYS BC2002 MECHANICS - LECTURE LAB and ELECTRICITY#MAGNETISM-LEC LAB 9

### Elective
Select one of the following:
- CHEM BC3254 METHODS, APPLCTNS PHYSICAL CHEMISTRY
- CHEM BC3282 BIOLOGICAL CHEMISTRY
- CHEM BC3280 ADVANCED ORGANIC CHEMISTRY
- CHEM GU4103 ORGANOMETALLIC CHEMISTRY

### Senior Requirement
Select one of the following:
- Senior Honors Thesis:
  - CHEM BC3901 SENIOR HONORS THESIS
  - CHEM BC3902 SENIOR HONORS THESIS SEM (by invitation of the department)
  - CHEM BC3348 Advanced Spectroscopy, Measurement, and Analysis Laboratory
  - CHEM BC3358 Advanced Chemical Synthesis and Reactivity Laboratory

### Recommended
- CHEM BC3597 PROBLEMS IN CHEMISTRY
- CHEM BC3599 PROBLEMS IN CHEMISTRY

* For Class 2021 and beyond:

1. Two semesters of math taken at college
2. Completion of Calculus through Calculus II.

Further mathematics experience is always encouraged strongly for Chemistry and Biochemistry majors.

† Students having advanced placement credit for one or two semesters of calculus may fulfill the two-semester requirement with additional mathematics, statistics, or computer science courses. Any calculus-based statistics course is acceptable. Also, many computer science courses are acceptable (e.g., COMS W1004 Intro to Programming in Java, COMS W3101 Program Languages (Python), ENV BC3050 Working with Big Data), although COMS W1002 Computing in Context is not.

‡ For the major in Chemistry, at least 61.5 credits are required (46.5 credits in chemistry + 6.0 in math + 9.0 in physics).

A list of major requirements, several possible course sequences, and information about the senior requirement can be obtained from any member of the department.

Biochemistry

The courses required for the biochemistry major are:

### Core
- CHEM BC2001 GENERAL CHEMISTRY I 5
- CHEM BC3230 ORGANIC CHEMISTRY I-LEC
- CHEM BC3231 ORGANIC CHEMISTRY II-LEC 3
- CHEM BC3333 MODERN TECH-ORGANIC CHEM LAB 3
- CHEM BC3242 QUANTITATIVE ANALYSIS 3
- CHEM BC3338 QUANTITATIVE-INSTRMNTL TECH-LAB 3
- MATH UN1101 or MATH UN1201 CALCULUS II 3
- MATH UN1102 or MATH UN1201 CALCULUS III 3
- PHYS BC2001 or PHYS BC2002 MECHANICS - LECTURE LAB and ELECTRICITY#MAGNETISM-LEC LAB 9
- BIOL BC1502 INTRO CELL AND MOLECULAR BIOL 3
- BIOL BC1503 INTRO LAB CELLULAR#MOLEC BIO 3
- CHEM BC3282 BIOLOGICAL CHEMISTRY 3
- CHEM BC3283 BIOLOGICAL CHEMISTRY II 3
- CHEM BC3355 BIOCHEMISTRY LAB TECHNIQUES 5

### Elective
An elective course from the following list:
- CHEM BC3271 INORGANIC CHEMISTRY
- CHEM BC3280 ADVANCED ORGANIC CHEMISTRY
- CHEM BC3252 THERMODYNAMICS-KINETICS
- CHEM BC3254 METHODS, APPLCTNS PHYSICAL CHEMISTRY
- CHEM BC3348 Advanced Spectroscopy, Measurement, and Analysis Laboratory
- CHEM BC3358 Advanced Chemical Synthesis and Reactivity Laboratory

### Senior Requirement
Select one of the following:
- Senior Honors Thesis:
Courses required for the Chemistry minor are:

**CHEM BC2001**  GENERAL CHEMISTRY I  5.00

**CHEM BC3230**  ORGANIC CHEMISTRY I-LEC  3.00

**CHEM BC3328**  INTRO ORGANIC CHEMISTRY-LAB  2.50

**CHEM BC3231**  ORGANIC CHEMISTRY II-LEC  3.00

**CHEM BC3333**  MODERN TECH-ORGANIC CHEM LAB  3.00

**CHEM BC3242**  QUANTITATIVE ANALYSIS  3.00

**CHEM BC3338**  QUANTITATIVE-INSTRMNTL TECH-LAB  3.00

**CHEM BC3253**  QUANTUM CHEMISTRY  3.00

**CHEM BC3348**  Advanced Spectroscopy, Measurement, and Analysis Laboratory  3.00

**CHEN E4230**  REACTOR KINETICS/REACTOR DESIGN  3.00

**CHEN E3810**  CHEM ENG # APPLIED CHEM LAB  3.00

**PHYS BC2001**  MECHANICS - LECTURE LAB  4.50

**PHYS BC2002**  ELECTRICITY#MAGNETISM-LEC LAB  4.50

**MATH UN1101**  CALCULUS I  3.00

**MATH UN1102**  CALCULUS II  3.00

**MATH UN2038**  ORDINARY DIFFERENTIAL EQUATIONS  3.00

**APMA E2000**  MULTV. CALC. FOR ENGI # APP SCI  4.00

**CHEM BC3338**  QUANTITATIVE-INSTRMNTL TECH-LAB  3

Select one of the following:

- CHEM BC3232  Descriptive Inorganic Chemistry  3
- CHEM BC3242  QUANTITATIVE ANALYSIS  3
- CHEM BC3252  THERMODYNAMICS-KINETICS  3
- CHEM BC3271  INORGANIC CHEMISTRY  3
- CHEM BC3282  BIOLOGICAL CHEMISTRY  3

Students whose major requires in excess of 40 points, including CHEM BC2001 GENERAL CHEMISTRY I, CHEM BC3328 INTRO ORGANIC CHEMISTRY-LAB, and/or CHEM BC3230 ORGANIC CHEMISTRY I-LEC may count up to two of these courses towards the Chemistry minor with a petition from the Chemistry Department Chair. There is no minor in Biochemistry.

Transfer students who took CHEM BC2001 General Chemistry I and II at another institution can complete the minor by taking any one of the following courses on the list EXCEPT CHEM BC3232, which is not an acceptable course for students who have already had a two semester sequence of introductory chemistry elsewhere.

**CHEM BC1003 CHEMICAL PROBLEM SOLVING. 1.00 point.**

Prerequisites: Barnard students only. Permission of instructor required. 
Corequisites: CHEM BC2001 
BC1003 Chemical Problem Solving is designed to help students develop strong chemical problem solving skills and succeed in CHEM BC2001, General Chemistry lecture and lab. Students enrolled in General Chemistry are not required to take Chemical Problem Solving but may elect to. Please contact the instructor regarding this choice. Co-requisite: CHEM BC2001

**CHEM BC1004 Special Topics in Chemistry. 0.50 points.**

CHEM BC1004 Special Topics in Chemistry is designed to give students the opportunity to explore their interests in chemistry while simultaneously taking CHEM BC2001, General Chemistry lecture and lab. Only students currently enrolled in CHEM BC2001 are eligible to take the course and students must select one of the FIVE topics. The topics included are: MONDAY Chemistry and Racism, TUESDAY The Chemistry of Color, WEDNESDAY The Chemistry of Covid-19, THURSDAY An Introduction to Chemical Engineering, FRIDAY The Chemistry of Lead. Students who have previously taken CHEM BC2001 may enroll with special permission of the instructor but priority will be given to current CHEM BC2001 students

**CHEM BC1050 THE JAZZ OF CHEMISTRY. 3.00 points.**

The contribution of chemistry to everyday life is immense. The applications of chemistry in medicine, petrochemicals, cosmetics, and fertilizers are readily apparent. However, the knowledge and applications of chemistry come in handy in many other fascinating fields, some of which may be less than obvious. Examples of areas in which chemistry plays a key role include forensic science; art restoration and forgery detection; and flavors and fragrances in food, beverages and other consumer products. The goal of this course is to provide insights and spur discussion of several areas and applications of chemistry, while gaining hands-on experience in techniques used in these fields.
CHEM BC2001 GENERAL CHEMISTRY I. 5.00 points.
Students enrolled in CHEM BC2001 must also register for a section of CHEM BC2012.

Corequisites: CHEM BC2012
Atoms; elements and compounds; gases; solutions; equilibrium; acid-base, precipitation, and oxidation-reduction reactions; thermochemistry. Laboratory one day a week. Laboratory experience with both qualitative and quantitative techniques. Counts towards Lab Science Requirement.

CHEM 2012
Fall 2023: CHEM BC2001
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
CHEM 2001  001/0059  T Th 8:40am - 9:55am  202 Altschul Hall  Rachel Austin  5.00  74/75
CHEM 2001  002/00560  T Th 10:10am - 11:25am  504 Diana Center  Marisa Buzzo  5.00  61/65
CHEM 2001  003/00561  T Th 11:40am - 12:55pm  L002 Milstein Center  Michael Campbell  5.00  80/80

CHEM BC2012 GENERAL CHEMISTRY I LAB. 0.00 points.
Corequisite: CHEM BC2001
CHEM 2012
Fall 2023: CHEM BC2012
Course Number  Section/Call Number  Times/Location  Instructor  Points  Enrollment
CHEM 2012  001/00564  M 8:30am - 9:30am  805 Altschul Hall  Suqing Liu, Marina Orman  0.00  27/26
CHEM 2012  001/00564  M 9:30am - 10:40am  813 Altschul Hall  Suqing Liu, Marina Orman  0.00  27/26
CHEM 2012  002/00565  M 1:30pm - 2:10pm  805 Altschul Hall  Romina Mancuso, Bu Fei  0.00  26/26
CHEM 2012  003/00565  M 2:10pm - 5:00pm  813 Altschul Hall  Romina Mancuso, Bu Fei  0.00  26/26
CHEM 2012  003/00566  T 1:30pm - 2:10pm  805 Altschul Hall  Jean Vadakkan, Bu Fei  0.00  23/26
CHEM 2012  003/00566  T 2:00pm - 5:00pm  813 Altschul Hall  Jean Vadakkan, Bu Fei  0.00  23/26
CHEM 2012  004/00571  W 8:30am - 9:30am  805 Altschul Hall  Grace Lee, Craig Allen  0.00  28/26
CHEM 2012  004/00571  W 9:30am - 10:40am  813 Altschul Hall  Grace Lee, Craig Allen  0.00  28/26
CHEM 2012  005/00567  W 1:30pm - 2:10pm  805 Altschul Hall  Romina Mancuso, Marina Orman  0.00  30/28
CHEM 2012  005/00567  W 2:10pm - 5:00pm  813 Altschul Hall  Romina Mancuso, Marina Orman  0.00  30/28
CHEM 2012  006/00568  Th 1:30pm - 2:10pm  805 Altschul Hall  Grace Lee, Bu Fei  0.00  28/26
CHEM 2012  006/00568  Th 2:10pm - 5:00pm  813 Altschul Hall  Grace Lee, Bu Fei  0.00  28/26
CHEM 2012  007/00569  F 8:30am - 9:30am  805 Altschul Hall  Romina Mancuso, Craig Allen  0.00  27/26
CHEM 2012  007/00569  F 9:30am - 12:20pm  813 Altschul Hall  Romina Mancuso, Craig Allen  0.00  27/26
CHEM 2012  008/00570  F 1:30pm - 2:10pm  805 Altschul Hall  Bu Fei  0.00  27/26
CHEM 2012  008/00570  F 2:10pm - 5:00pm  813 Altschul Hall  Bu Fei  0.00  27/26

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

CHEM BC3230 ORGANIC CHEMISTRY I-LEC. 3.00 points.
Prerequisites: CHEM BC2001 or equivalent. Credit will not be given for any course below the 3000 level after completing CHEM BC3230 or its equivalent. Lecture: MWF 10:00 - 10:50 AM
Corequisites: With lab, counts towards Lab Science requirement.
Prerequisites: CHEM BC2001 or equivalent. Credit will not be given for any course below the 3000 level after completing CHEM BC3230 or its equivalent. Corequisites: With lab, counts towards Lab Science requirement. Atomic and molecular structure; stereochemistry of organic molecules; introduction to organic reactions, reaction mechanisms, and synthesis.

CHEM BC3231 ORGANIC CHEMISTRY II-LEC. 3.00 points.
Prerequisites: CHEM BC2320. Lecture: MWF 10:00-10:50. Extension of concepts from Organic Chemistry I to conjugated systems; chemistry of the carbonyl group; NMR and IR spectroscopy; biorganic chemistry.
CHEM BC3232 Descriptive Inorganic Chemistry. 3.00 points.
Prerequisites: Organic Chemistry I. Optional parallel laboratory work:
CHEM BC3338. CHEM C1404 is not an acceptable equivalent for CHEM
BC3232; students who have taken even a single semester of organic
chemistry will not receive subsequent credit for C1404. Lecture: MWF
10:00-10:50.
Prerequisites: CHEM BC2001. This course explores the periodic table
in ways that deepen appreciation of the chemistry of the elements. It
extends tools introduced in general chemistry with a particular focus on
the rich and varied chemistry of the transition metal elements. Requiring
only general chemistry, this course is open to students with interests in
the role that metal ions play in biology, biochemistry, neuroscience and
environmental science

Spring 2024: CHEM BC3232

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3232</td>
<td>001/00270</td>
<td>M W 8:40am - 9:55am</td>
<td>Rachel Austin</td>
<td>3.00</td>
<td>63/80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L002 Milstein Center</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHEM BC3242 QUANTITATIVE ANALYSIS. 3.00 points.
Prerequisites: CHEM BC321, MATH UN1101, and permission of
instructor. Survey of topics appropriate for a student majoring in
chemistry or biochemistry, including examinations of uncertainty
analysis and data processing, use of basic laboratory equipment,
complex equilibria (pH, solubility, etc.), advanced solution chemistry
and chemical activity, and the theoretical foundations of modern techniques
in electrochemistry, chromatography and analytical experimental
techniques

Spring 2024: CHEM BC3242

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3242</td>
<td>001/00269</td>
<td>M W 10:10am - 11:25am</td>
<td>Rachel Austin</td>
<td>3.00</td>
<td>36/40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>805 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHEM BC3252 THERMODYNAMICS-KINETICS. 3.00 points.
Prerequisites: CHEM BC3231, PHYS BC2001, PHYS BC 2002, MATH
UN1102 or MATH UN1201. Introduction to the laws of thermodynamics;
adoption primarily to ideal systems. Free energy and equilibrium.
Kinetics: rate laws and mechanisms, experimental techniques

Spring 2024: CHEM BC3252

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3252</td>
<td>001/00272</td>
<td>M W 10:10am - 11:25am</td>
<td>Marisa Buzzeo</td>
<td>3.00</td>
<td>7/20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>202 Milbank Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHEM BC3253 QUANTUM CHEMISTRY. 3.00 points.
Prerequisites: 2 semesters of calculus-based introductory physics,
Calculus II, BC3242 Quantitative Analysis, or permission of instructor.
Exact and approximate solutions to the Schrodinger equation. The
structure of atoms and molecules. Chemical bonding and spectroscopy.
Computer-based molecular modeling

Fall 2023: CHEM BC3253

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3253</td>
<td>001/00575</td>
<td>M W F 11:00am - 11:50am</td>
<td>Marisa Buzzeo</td>
<td>3.00</td>
<td>18/30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>805 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHEM BC3254 METHODS, APPLCTNS PHYSICAL CHEMISTRY. 3.00 points.
Prerequisites: (CHEM BC3253) CHEM BC3253 or permission of instructor.
Lecture: MWF 11:00-11:50.
Prerequisites: (CHEM BC3253) CHEM BC3253 or permission of
instructor. Lecture: MWF 11:00-11:50. Advanced topics in physical
chemistry, including statistical mechanics, reaction dynamics, materials
science, catalysis, and nanotechnology. Particular emphasis will be
placed on topics related to climate and energy

CHEM BC3271 INORGANIC CHEMISTRY. 3.00 points.
Prerequisites: CHEM BC3231 or Permission of Instructor. Structure,
bonding and spectroscopy in inorganic compounds: applications of
group theory to chemistry; ligand field theory; vibrational and electronic
spectroscopy of transition metal complexes; selected topics from
coordination chemistry, organometallics, bioinorganic chemistry, solid
state and materials chemistry, mineralogy, and biogeochemistry

Spring 2024: CHEM BC3271

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3271</td>
<td>001/00273</td>
<td>T W F 11:40am - 12:55pm</td>
<td>Michael Campbell</td>
<td>3.00</td>
<td>40/40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>805 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHEM BC3272 ADVANCED INORGANIC CHEMISTRY. 3.00 points.
Prerequisites: CHEM BC3271 Inorganic Chemistry
Prerequisites: CHEM BC3271 Inorganic Chemistry This course combines
builds on the foundation developed in Inorganic Chemistry (CHEM
BC3271) and applies inorganic chemical concepts and techniques to
specific applications. A particular focus will be on understanding the
roles of the transition metals in biological systems

CHEM BC3280 ADVANCED ORGANIC CHEMISTRY. 3.00 points.
Prerequisites: One year of organic chemistry
Prerequisites: One year of organic chemistry. Survey of topics in
structural, mechanistic, and synthetic organic chemistry, including
molecular orbital treatment of structure, bonding, and chemical reactivity;
elucidation of organic reaction mechanisms; pericyclic reactions;
stereoelectronic effects; reactive intermediates; asymmetric reactions;
and natural product total synthesis

CHEM BC3282 BIOLOGICAL CHEMISTRY. 3.00 points.
Prerequisites: (CHEM BC3230) and (CHEM BC3231) BIOL BC1502.
Introduction to biochemical building blocks, macromolecules, and
metabolism. Structures of amino acids, lipids, carbohydrates, nucleic
acids. Protein structure and folding. Enzyme mechanisms, kinetics,
allostery. Membranes and biosignaling. Catabolism and anabolism with
emphasis on chemical intermediates, metabolic energy, catalysis by
specific enzymes, regulation

Fall 2023: CHEM BC3282

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3282</td>
<td>001/00576</td>
<td>T W F 11:40am - 12:55pm</td>
<td>Rebecca Donegan</td>
<td>3.00</td>
<td>48/48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>903 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Spring 2024: CHEM BC3282

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3282</td>
<td>001/00274</td>
<td>T W F 11:40am - 12:55pm</td>
<td>Romina Mancuso</td>
<td>3.00</td>
<td>44/40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>903 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### CHEM BC3283 BIOLOGICAL CHEMISTRY II. 3.00 points.
Prerequisites: CHEM BC3282 or equivalent. Advanced topics in the field of biochemistry, including enzyme mechanisms, pharmaceutical drug design, and disease therapies. Emphasis will be placed on discussion of current scientific literature.

**Spring 2024: CHEM BC3283**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3283</td>
<td>001/00275</td>
<td>M W 10:10am - 11:25am 325 Milbank Hall</td>
<td>Christina Vizcarra</td>
<td>3.00</td>
<td>17/25</td>
</tr>
</tbody>
</table>

### CHEM BC3284 CURRENT TOPICS BIOCHEMISTRY. 3.00 points.
Prerequisites: CHEM BC3282 and CHEM BC3355 or instructor approval. This course is designed to expose students to a range of current research topics in the field of biochemistry and develop their ability to understand and evaluate primary scientific literature. The first half of the course will focus on current research on fundamental biochemistry systems and processes; the second half will address biomedical application and advances.

**Fall 2023: CHEM BC3284**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3284</td>
<td>001/00580</td>
<td>T Th 10:10am - 11:25am 912 Milstein Center</td>
<td>Christina Vizcarra</td>
<td>3.00</td>
<td>6/15</td>
</tr>
</tbody>
</table>

### CHEM BC3328 INTRO ORGANIC CHEMISTRY-LAB. 2.50 points.
Prerequisites: (CHEM BC2001) General Chemistry I with lab. Corequisites: CHEM BC3230

**Fall 2023: CHEM BC3328**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3328</td>
<td>001/00581</td>
<td>Th 8:30am - 9:30am 530 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>5/20</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>001/00581</td>
<td>Th 9:30am - 12:30pm 716 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>5/20</td>
</tr>
</tbody>
</table>

**Spring 2024: CHEM BC3328**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3328</td>
<td>001/00282</td>
<td>M 1:10pm - 2:00pm 530 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>24/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>001/00282</td>
<td>M 2:00pm - 3:00pm 716 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>24/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>002/00284</td>
<td>T 1:10pm - 2:00pm 805 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>24/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>002/00284</td>
<td>T 2:00pm - 3:00pm 716 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>24/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>003/00339</td>
<td>W 1:10pm - 2:00pm 530 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>24/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>003/00339</td>
<td>W 2:00pm - 3:00pm 716 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>24/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>004/00340</td>
<td>Th 1:10pm - 2:00pm 805 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>23/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>004/00340</td>
<td>Th 2:00pm - 3:00pm 716 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>23/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>005/00341</td>
<td>F 1:10pm - 2:00pm 805 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>23/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>005/00341</td>
<td>F 2:00pm - 3:00pm 716 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>23/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>006/00342</td>
<td>Th 8:30am - 9:30am 805 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>17/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>006/00342</td>
<td>Th 9:30am - 10:30am 716 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>17/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>007/00343</td>
<td>Th 8:30am - 9:30am 805 Altschul Hall</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>8/23</td>
</tr>
<tr>
<td>CHEM 3328</td>
<td>007/00343</td>
<td>Th 9:30am - 12:50pm Room TBA</td>
<td>Meenakshi Rao</td>
<td>2.50</td>
<td>8/23</td>
</tr>
</tbody>
</table>
CHEM BC3333 MODERN TECH-ORGANIC CHEM LAB. 3.00 points.
Prerequisites: (CHEM BC3328) or (CHEM BC3230) CHEM BC3328 with a grade of C- or better and CHEM BC3230.
Corequisites: CHEM BC3231, CHEM BC3334
Prerequisites: (CHEM BC3328) or (CHEM BC3230) CHEM BC3328 with a grade of C- or better and CHEM BC3230. Corequisites: CHEM BC3231, CHEM BC3334 Advanced experimental organic techniques and introduction to qualitative and quantitative organic analysis. Emphasis on instrumental and chromatographic methods. Selected reactions. Students enrolling in this course must register for CHEM BC334x.

### Fall 2023: CHEM BC3333

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3333</td>
<td>001/00577</td>
<td>M 1:10pm - 2:10pm</td>
<td>Meenakshi Rao, Craig Allen</td>
<td>3.00</td>
<td>13/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>530 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 3333</td>
<td>001/00577</td>
<td>M 2:10pm - 5:30pm</td>
<td>Meenakshi Rao, Craig Allen</td>
<td>3.00</td>
<td>13/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>716 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 3333</td>
<td>002/00578</td>
<td>W 1:10pm - 2:10pm</td>
<td>Meenakshi Rao, Craig Allen</td>
<td>3.00</td>
<td>12/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>530 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 3333</td>
<td>002/00578</td>
<td>W 2:10pm - 5:30pm</td>
<td>Meenakshi Rao, Craig Allen</td>
<td>3.00</td>
<td>12/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>716 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 3333</td>
<td>003/00579</td>
<td>Th 1:10pm - 2:10pm</td>
<td>Meenakshi Rao, Jean Vadaikan, Craig Allen</td>
<td>3.00</td>
<td>12/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>903 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 3333</td>
<td>003/00579</td>
<td>Th 2:10pm - 5:30pm</td>
<td>Meenakshi Rao, Jean Vadaikan, Craig Allen</td>
<td>3.00</td>
<td>12/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>716 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CHEM BC3338 QUANTITATIVE-INSTRMNAL TECH-LAB. 3.00 points.
Prerequisites: (CHEM BC3231 and CHEM BC3333) Co-require for students not majoring in chemistry or biochemistry. CHEM BC3232. For students majoring in chemistry or biochemistry, CHEM BC3242.
Corequisites: CHEM BC3232, CHEM BC3242
Prerequisites: CHEM BC3231 and CHEM BC3333 Quantitative techniques in volumetric analysis, pH measurement, UV-Visible, absorption, and fluorescence spectroscopy, and chromatographic separations. Data analysis with spreadsheets.

### Spring 2024: CHEM BC3338

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3333</td>
<td>001/00334</td>
<td>T 1:10pm - 2:00pm</td>
<td>Romina Mancusso, Bu Fei</td>
<td>3.00</td>
<td>12/12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>813 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 3333</td>
<td>001/00334</td>
<td>T 2:00pm - 5:30pm</td>
<td>Romina Mancusso, Bu Fei</td>
<td>3.00</td>
<td>12/12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Room TBA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 3333</td>
<td>002/00337</td>
<td>Th 1:10pm - 2:00pm</td>
<td>Romina Mancusso, Bu Fei</td>
<td>3.00</td>
<td>12/12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>813 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 3333</td>
<td>002/00337</td>
<td>Th 2:00pm - 5:30pm</td>
<td>Romina Mancusso, Bu Fei</td>
<td>3.00</td>
<td>12/12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Room TBA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CHEM BC3346 ADV SPECTROS CHEMISTRY - LECT. 0.00 points.
Prerequisites: CHEM BC3333 and CHEM BC3253
Corequisites: CHEM BC3348
This course combines chemical synthesis, inorganic chemistry, physical chemistry, and nanoscience into experiments with an emphasis using spectroscopy to determine chemical structure and reactivity. You will gain experience with a range of instruments, techniques, calculations, and theories. Instrumentation will include UV-Visible, infrared, near-infrared, fluorescence, and Raman spectroscopy.

### Spring 2024: CHEM BC3346

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3346</td>
<td>001/00333</td>
<td>M 1:10pm - 2:00pm</td>
<td>Christina Vizcarra, Michael Campbell</td>
<td>3.00</td>
<td>0/6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>514 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CHEM BC3348 Advanced Spectroscopy, Measurement, and Analysis Laboratory. 3.00 points.
Prerequisites: CHEM BC3333 or 3338 and CHEM BC3253 Corequisites: CHEM BC3271 This course combines chemical synthesis, inorganic chemistry, physical chemistry, and nanoscience into experiments with an emphasis using spectroscopy to determine chemical structure and reactivity. You will gain experience with a range of instruments, techniques, calculations, and theories. Instrumentation will include UV-Visible, infrared, near-infrared, fluorescence, and Raman spectroscopy.

### Spring 2024: CHEM BC3348

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3348</td>
<td>001/00333</td>
<td>M 2:10pm - 6:00pm</td>
<td>Christina Vizcarra, Michael Campbell</td>
<td>3.00</td>
<td>0/6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>606 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 3348</td>
<td>002/00332</td>
<td>W 1:10pm - 5:00pm</td>
<td>Christina Vizcarra, Michael Campbell</td>
<td>3.00</td>
<td>0/6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>606 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CHEM BC3355 BIOCHEMISTRY LAB TECHNIQUES. 5.00 points.
Prerequisites: Organic II lab (CHEM BC3333, BC3335, or equivalent); Quantitative analysis lab (BC3338, BC3340, or equivalent); Biochemistry (CHEM BC3282y, CHEM C3501, or equivalent). Lecture: T 1:10-12:50; Laboratory two afternoons: T 2:10-6:00 / TH 1:10-5:00.
Prerequisites: Organic II lab (CHEM BC3333, BC3335, or equivalent); Quantitative analysis lab (BC3338, BC3340, or equivalent); Biochemistry (CHEM BC3282y, CHEM C3501, or equivalent). Theory and application of fundamental techniques for the isolation, synthesis and characterization of biological macromolecules including proteins, lipids, nucleotides and carbohydrates. Techniques include spectroscopic analysis, gel electrophoresis, chromatography, enzyme kinetics, immunoblotting, PCR, molecular cloning and cell culture, as well as modern laboratory instrumentation, such as UV-Vis, GC-MS and HPLC.

### Spring 2024: CHEM BC3355

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 3355</td>
<td>001/00330</td>
<td>T 1:00pm - 5:00pm</td>
<td>Rebecca Donegan</td>
<td>5.00</td>
<td>0/12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>606 Altschul Hall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHEM BC3358 Advanced Chemical Synthesis and Reactivity Laboratory. 5.00 points.
Prerequisites: CHEM BC3333, CHEM BC3271, and CHEM BC3338
Corequisites: CHEM BC3253 Multistep and multi-day experiments in organic and inorganic synthesis via advanced synthetic methods.
Experiments include solution phase, solid state, and photochemical syntheses. Products will be analyzed and characterized by a variety of methods, including: IR, NMR, and UV-Vis spectroscopy, and also by polarimetry, chiral GC, and GC/MS.

CHEM BC3597 PROBLEMS IN CHEMISTRY. 2.00 points.
Prerequisites: CHEM BC3328 and permission of instructor.
Individual research projects at Barnard or Columbia, culminating in a comprehensive written report.

CHEM BC3901 SENIOR HONORS THESIS. 4.00 points.
Weekly seminar to accompany Senior Honors Thesis Lab (CHEM BC3903). Focus is on scientific presentation and writing skills and research conduct.

CHEM BC3902 SENIOR HONORS THESIS SEM. 4.00 points.
Weekly seminar to accompany Senior Honors Thesis Lab (CHEM BC3903). Focus is on scientific presentation and writing skills and research conduct.
CHEM BC3903 SENIORS HONORS THESIS LAB. 0.00 points.
Corequisites: CHEM BC3901 Guided research in Chemistry or Biochemistry, under the sponsorship of a faculty member, leading to the senior thesis. A minimum of 8 hours of research per week, to be arranged

CHEM BC3904 SENIOR HONORS THESIS LAB. 0.00 points.
Corequisites: CHEM BC3902 Guided research in Chemistry or Biochemistry, under the sponsorship of a faculty member, leading to the senior thesis. A minimum of 8 hours of research per week, to be arranged

Cross-Listed Courses
Chemistry
CHEM GU4071 INORGANIC CHEMISTRY. 4.50 points.
CC/GS: Partial Fulfillment of Science Requirement
Prerequisites: (CHEM UN1403 and CHEM UN1404) or (CHEM UN1604) or (CHEM UN2405 and CHEM UN2406), or the equivalent.
Prerequisites: (CHEM UN1403 and CHEM UN1404) or (CHEM UN1604) or (CHEM UN2405 and CHEM UN2406), or the equivalent. Principles governing the structure and reactivity of inorganic compounds surveyed from experimental and theoretical viewpoints. Topics include inorganic solids, aqueous and nonaqueous solutions, the chemistry of selected main group elements, transition metal chemistry, metal clusters, metal carbonyls, and organometallic chemistry, bonding and resonance, symmetry and molecular orbitals, and spectroscopy

CHEM GU4147 ADVANCED ORGANIC CHEMISTRY I. 4.50 points.
Prerequisites: Elementary organic and physical chemistry.
Prerequisites: elementary organic and physical chemistry. The mechanisms of organic reactions, structure of organic molecules, and theories of reactivity. How reactive intermediates are recognized and mechanisms are deduced using kinetics, stereochemistry, isotopes, and physical measurements

CHEM GU4172 Biorganic Topics. 4.5 points.
Not offered during 2023-2024 academic year.
Prerequisites: elementary physical and organic chemistry. Recommended preparation: elementary biochemistry.
Tactics and techniques for the study of large molecules of biological importance; analysis of the conformation of proteins and nucleic acids, hydrodynamic, scattering, and spectroscopic techniques for examining macromolecular structure.

CHEM GU4221 QUANTUM CHEMISTRY I. 4.50 points.
Prerequisites: elementary physical chemistry. Basic quantum mechanics: the Schrodinger equation and its interpretation, exact solutions in simple cases, methods or approximations including time-independent and time-dependent perturbation theory, spin and orbital angular momentum, spin-spin interactions, and an introduction to atomic and molecular structure

CHEM GU4103 ORGANOMETALLIC CHEMISTRY. 4.50 points.
Prerequisites: (CHEM UN2443 and CHEM UN2444), or the equivalent. Some background in inorganic and physical chemistry is helpful but not required.
Main group and transition metal organometallic chemistry: bonding, structure, reactions, kinetics, and mechanisms.