

Admission Requirements For This Major

1. New freshmen admitted to USU in good standing qualify for admission to this major.
2. Transfer students from other institutions need a 2.2 transfer GPA and students transferring from other USU majors need a 2.0 total GPA for admission to this major in good standing.

The Program

Biochemistry is the basic science that addresses the molecular basis of life; it seeks to explain the chemical properties and changes that occur in living organisms. Biochemistry encompasses the study of the properties and functions of biological macromolecules, the mechanisms of action of enzymes, gene and protein regulation and expression, bioenergetics, and the metabolic pathways and processes that use and generate chemical and light energy. At its core, biochemistry recognizes and explains the unifying chemical principles that lie at the heart of the diverse expressions of life.

The core courses for the major are built around two-semester course sequences in the areas of general, organic, and biological chemistry; general biology; calculus; and general physics, along with associated laboratory courses. Students may choose from two physics tracks: (1) the life sciences track (typically preferred by students with a more biological inclination) and (2) the science- engineering track (typically preferred by students with a more mathematical/physical inclination). One-semester courses in analytical and biophysical chemistry and statistics round out the core of the program. To complete the additional 18 credits of coursework required for the major, students may choose elective courses from within the disciplines of chemistry, biochemistry, and biology. A wide range of advanced courses are available to meet the advanced electives requirement; students are encouraged to meet with their academic advisor to select courses that provide the best preparation for their intended career path. Representative courses (not all encompassing) include those in biology (e.g., human physiology, genetics, ecology, microbiology, plant physiology, cell biology); biochemistry (e.g., enzymology, structured biology, bioenergetics and metabolism, protein structure/function); and chemistry (e.g., intermediate and advanced inorganic, advanced organic).

The biochemistry major differs from the “chemistry major with biochemistry emphasis,” which is an American Chemical Society (ACS) certified degree that emphasizes specialization in biochemistry, but has a more chemical and mathematical

emphasis than the biochemistry major. The biochemistry major is more biologically inclined (as well as somewhat less physically and mathematically inclined) than the chemistry major and is designed to meet the standards for the curriculum proposed by the American Society for Biochemistry and Molecular Biology (ASBMB).

The requirements for the BS degree in biochemistry, along with University and University Studies requirements, are summarized in this program sheet. Students are encouraged to keep this program guide and to use it to record progress toward the completion of their degree requirements. Students are also urged to study this requirement sheet and to visit with their advisors on a regular basis about progress toward the completion of their degrees or for any questions regarding complementary courses, career goals, etc.

Career Opportunities

The major in Biochemistry is appropriate both for students who wish to terminate their studies at the bachelor’s degree and for those planning to continue their education at the graduate or professional level.

For those who terminate at the bachelor's degree, career opportunities are available in research and development, sales, quality control, and analysis within a range of biochemical, pharmaceutical, and biotechnological industries. For those planning to pursue a career in the health professions, the biochemistry major provides an excellent and well-rounded background for medical, dental, and veterinary school admission.

The biochemistry major also provides excellent preparation for students planning to pursue graduate work in a range of biological, environmental, and chemical sciences, including biochemistry, molecular biology, genetics, genomics, oncology, and bioinformatics. For those students interested in pursuing a legal career in areas such as patent law, bioethics, and environmental protection and regulation, the major is also excellent preparation for law school. For further information, students should contact their advisor.

Recommended High School Courses

Students interested in studying biochemistry should take high school mathematics courses that will enable them to start calculus during their first semester at USU. High school coursework in chemistry, biology, and physics is also desirable. AP credit in chemistry may be counted toward the degree.

Degrees and Programs Offered Through This Department

Chemistry:

Master of Science (MS) and Doctor of Philosophy (PhD)

Bachelor of Science (BS)

Emphases: Professional Chemistry, Biochemistry,
Environmental Chemistry, Chemical Education, Life
Science

Bachelor of Arts (BA)

Chemistry Teaching: BS

Composite Teaching—Physical Science (Chem): BS

Biochemistry: BS, MS, and PhD

Academic Advisement

All students should contact their academic advisor for assistance with course selection, program planning, and meeting graduation requirements.

Graduation Requirements:

BS Degree in Biochemistry

Minimum University Requirements*

Total credits	120
Grade point average (most majors require higher GPA)	2.00 GPA
Credits of C- or better	100
Credits of upper-division courses (#3000 or above)	40
USU credits	30
(20 of which must be upper division, including 10 required by major)	

Completion of approved major program of study See department

Credits in minor (if required by department) 12

Credits in American Institutions (ECN 1500; HIST 1700,
2700, or 2710; POLS 1100; or USU 1300). 3

University Studies requirements See below

*Colleges and departments may require more credits or a higher GPA. See requirements on this sheet.

University Studies Requirements for Biochemistry Major

Note: Approved University Studies courses and requirements are listed in the *General Catalog*. The most current listings are shown online at:

<http://www.usu.edu/generalcatalog/>

General Education Requirements (30-34 credits)

Competency Requirements (9-10 credits)

Communications Literacy (CL1 and CL2) (6 credits)

ENGL 1010 (CL1) (3 credits) or satisfactory AP,
CLEP, IBO, ACT, or SAT score

AND

ENGL 2010 (CL2) (3 credits) or satisfactory IBO score

Quantitative Literacy (QL) (3-4 credits)

MATH 1030 or 1050 or STAT 1040 (3-4 credits)

OR

One MATH or STAT course requiring MATH 1050
as a prerequisite

OR

Satisfactory AP, CLEP, IBO, ACT, or SAT score

Breadth Requirements (18-20 credits)

Select at least one approved course from each of the following six categories: **American Institutions (BAI), Creative Arts (BCA), Humanities (BHU), Life Sciences (BLS), Physical Sciences (BPS), and Social Sciences (BSS)**. At least two of the six breadth courses must be University Studies courses with a **USU prefix** (excluding USU1000, 1010, 1100, 3330, 4900, and 6900). (CLEP or AP credit may be used.) *CHEM 1220 will fulfill the Physical Sciences requirement for students in the Biochemistry Major.*

Exploration Requirement (3-4 credits)

Choose an additional class from one of the following General Education categories: QL, BAI, BCA, BHU, BLS, BPS, or BSS. PHYS 2120 (BPS) and/or BIOL 1620 (BLS) will fulfill the Exploration Requirement for students in the Biochemistry Major.

Depth Education Requirements

Communications Intensive (CI) (2 courses)

For most students, courses taken for the major will meet this requirement.

Quantitative Intensive (QI) (1 course)

For most students, a course taken for the major will meet this requirement.

Depth Course Requirements (4 credits minimum, including 2 credits minimum completed in each of two courses)

Complete at least 2 credits in approved 3000-level or above courses from each of the following two categories: **Humanities and Creative Arts (DHA) and Social Sciences (DSS)**.

Minimum College of Science Requirements for BS Degree

Students in the biochemistry degree program will meet the College of Science requirements by taking MATH 1210, 1220 (8 credits) and the PHYS 2110, 2120 sequence or the PHYS 2210, 2220 sequence (8 credits).

Biochemistry Limitations

No CHEM prefix course may be applied toward graduation with a major in biochemistry with an earned grade of less than C-. No CHEM prefix course may be taken on a *Pass/Fail* basis. No CHEM prefix course may be repeated more than one time to improve the grade to a C- or better. A student dropped from the biochemistry program for failure to meet this standard may appeal to the Curriculum Committee for readmission. Exceptions to this rule are not generally made.

However, a student may petition for permission to take a course a third time, which will normally be granted *only* in the event of documented extenuating circumstances, such as documented medical issues. Biochemistry Majors *cannot* declare a Chemistry Minor.

Changes in Graduation/Catalog Requirements

Students who can complete a baccalaureate degree within seven years of enrollment at USU can qualify for graduation by meeting (1) the General Education/ University Studies requirements in effect when they initially enrolled and (2) the major requirements in effect when they officially declared their major, even though there may have been changes in General Education/University Studies and major requirements since that time.

Students who have not completed the baccalaureate requirements within seven years of their initial enrollment at USU must have their General Education/University Studies and major requirements evaluated and approved by their department head and dean.

Undergraduate Course Expiration Policy

Coursework (including transfer credit) that is more than 10 years old and that is required by the major may be disallowed by the student's department. Students are given an opportunity to revalidate coursework that has been disallowed.

Biochemistry Major Requirements

The following curriculum is required for the BS degree in biochemistry. To complete the degree in eight semesters (four academic years), students must register for an average of 15-16 credits per semester.

Note: Students may satisfy the CHEM1210 requirement with an AP score of 3 or 4. *Both* CHEM 1210 *and* 1220 may be satisfied with an AP score of 5.

A. First Year (30-32 credits)

1. Fall Semester (15-16 credits) Credits

- CHEM 1210 Principles of Chemistry I 4
- CHEM 1215 Chemical Principles Laboratory I 1
- MATH 1210 (QL) Calculus I 4
- University Studies courses 6-7

2. Spring Semester (15-16 credits)

- CHEM 1220 (BPS) Principles of Chemistry II 4
- CHEM 1225 Chemical Principles Laboratory II 1
- MATH 1220 (QL) Calculus II 4
- University Studies courses 6-7

B. Second Year (32 credits)

1. Fall Semester (16 credits)

- CHEM 2310 Organic Chemistry I 4
- CHEM 2315 Organic Chemistry Laboratory I 1
- BIOL 1610 Biology I 4
- PHYS 2110 General Physics—Life Sciences I (4 cr)
or
- PHYS 2210 (QI) General Physics —Science and
Engineering I (4 cr) 4
- University Studies course(s) 3

2. Spring Semester (16 credits)

- CHEM 2320 Organic Chemistry II 4
- CHEM 2325 Organic Chemistry Laboratory II 1

- BIOL 1620 (BLS)2 Biology II 4
- PHYS 2120 (BPS) General Physics—Life Sciences II (4 cr)
or
- PHYS 2220 (BPS/QI) General Physics—Science and
Engineering II (4 cr) 4
- University Studies course(s) 3

C. Third Year (31-37 credits)

1. Fall Semester (15-18 credits)

- CHEM 3000 (QI)1 Quantitative Analysis 3
- CHEM 3005 Quantitative Analysis Laboratory 1
- CHEM 5700 General Biochemistry I 3
- Advanced Biology Electives (Approved by Dept) . . . 3-4
- University Studies courses 5-7

2. Spring Semester (16-19 credits) Credits

- CHEM 5710 General Biochemistry II 3
- CHEM 5720 General Biochemistry Laboratory 3
- STAT 3000 (QI) Statistics for Scientists 3
- Advanced Biology Electives (Approved by Dept) . . . 3-4
- University Studies courses 4-7

D. Fourth Year (29-34 credits)

1. Fall Semester (14-17 credits)

- CHEM 4890 (CI) Undergraduate Biochemistry Seminar . . . 2
- CHEM 5070 Biophysical Chemistry 3
- Advanced elective coursework 6-12
- University Studies course(s) 0-3

2. Spring Semester (12-15 credits)

- Advanced elective coursework 6-12
- University Studies course(s) 0-3

*Preapproved Course Options for Major Electives (18 credits required for major)

Of the 18 credits required, 14 must be at the 3000 level or higher. Other upper-division courses may be substituted if approved by the department. Prerequisites will *not* be waived. Only courses with a C- grade or better can be applied toward the electives requirement.

- | | Credits |
|--|---------|
| <input type="checkbox"/> ADVS 5350 Intro: Pharmacology and Pharmacokinetics (Sp)
(Prereq: BIOL 5600, CHEM 3700, permission of
instructor | 3 |
| <input type="checkbox"/> BIOL 2320 Human Anatomy (Sp,Su) | 4 |
| <input type="checkbox"/> BIOL 2420 Human Physiology (F,Sp,Su). | 4 |
| <input type="checkbox"/> BIOL 3060 (QI) Principles of Genetics (F,Sp,Su)
(Prereq: BIOL 1610, CHEM 1210) | 4 |
| <input type="checkbox"/> BIOL 3065 Genetics Laboratory (F) (Prereq: BIOL 3060,
which may be taken concurrently) | 2 |
| <input type="checkbox"/> BIOL 3300 General Microbiology (F,Sp) (Prereq:
BIOL 1610; CHEM 2310, which may be taken concurrently. | 4 |
| <input type="checkbox"/> BIOL 4000 Human Dissection (F) (Prereq: BIOL 2320). | 1 |

<input type="checkbox"/> BIOL 4400 (QI) Plant Physiology (F) (Prereq: BIOL 1620; and MATH 1050 or higher)	4
<input type="checkbox"/> BIOL 5100 Neurobiology (F) (Prereq: BIOL 1620; BIOL 2420, 5600, or 5620; CHEM 1220; and PHYS 2120 or 2220).	3
<input type="checkbox"/> BIOL 5150 Immunology (Sp) (Prereq: CHEM 1220; BIOL 3060; and BIOL 3300 or 5210)	3
<input type="checkbox"/> BIOL 5190 Molecular Genetics (Sp) (Prereq: BIOL 3060; and CHEM 3700 or 5700)	3
<input type="checkbox"/> BIOL 5210 Cell Biology (F) (Prereq: BIOL 1620, 3060; CHEM 2300 or 2320; CHEM 5700)	3
<input type="checkbox"/> BIOL 5230 Developmental Biology (Sp) (Prereq: BIOL 3060 and 5210; CHEM 5700 strongly recommended)	3
<input type="checkbox"/> BIOL 5250 (CI) Evolutionary Biology (F,Sp) (Prereq: BIOL 3060 or WILD 4880 or permission of instructor)	3
<input type="checkbox"/> BIOL 5330 Virology (Sp) (Prereq: BIOL 3060 and 3300)	3
<input type="checkbox"/> BIOL 5400 Environmental Toxicology (Sp).	3
<input type="checkbox"/> BIOL 5600 Comparative Animal Physiology (Sp) (Prereq: BIOL 1620 and CHEM 1220).	3
<input type="checkbox"/> BIOL 5620 Medical Physiology (F) (Prereq: BIOL 1620; BIOL 2420 or 5600; CHEM 5710).	3
<input type="checkbox"/> CHEM 4800 (CI) Research Problems: Undergraduate Research (F,Sp,Su) (Prereq: Permission of instructor)	3
<input type="checkbox"/> CHEM 6730 Principles of Enzymology (Sp) (Prereq: CHEM 5700)	3
<input type="checkbox"/> CHEM 6740 Cellular Communication by Small Molecules and Proteins (Sp) (Prereq: CHEM 5700).	3
<input type="checkbox"/> CHEM 6750 Principles of Structural Biology (F) (Prereq: CHEM 5700)	3
<input type="checkbox"/> CHEM 6760 Principles of Bioenergetics (F) (Prereq: CHEM 5700)	3

*Courses listed are subject to changes. See Department for most updated list.

BS Degree with Honors

A BS degree with honors can be earned by meeting the following requirements:

1. Minimum GPA of 3.50 in chemistry courses
2. Overall GPA of 3.30
3. Completion of 15 credits of honors work by successfully completing honors contracts in the following courses:

Credits

<input type="checkbox"/> CHEM 4800 (CI) Research Problems (F,Sp,Su).	3-6
<input type="checkbox"/> CHEM 4890 (CI) Undergraduate Biochemistry Seminar	2
<input type="checkbox"/> 3-6 credits selected from Honors courses numbered 3000 or higher in chemistry or related subjects, as appropriate. Three credits may be selected from chemistry courses numbered 6000 or higher	3-6
<i>In addition, select two courses from the following:</i>	
<input type="checkbox"/> CHEM 2320 Organic Chemistry II (Sp).	4
<input type="checkbox"/> CHEM 5070 Biophysical Chemistry (F)	3
<input type="checkbox"/> CHEM 5700 General Biochemistry I (F)	3
<input type="checkbox"/> CHEM 5710 General Biochemistry II (Sp)	3

Graduating seniors are required to take a final examination covering the content of their major. **The exam will not affect the graduation status of the student in any way, but will be used as an assessment tool.** The combined results of all the examinations will be used by the department to judge the effectiveness of the departmental curriculum, *not* the student.

Requirement Changes

Graduation requirements shown on this sheet are subject to change. Students should check with their assigned advisor concerning possible changes.

Materials for Persons with Disabilities

This requirement sheet is available in alternate formats upon request to the USU Disability Resource Center.

For information contact

Chemistry and Biochemistry Department;

Maeser Lab 140
Utah State University
0300 Old Main Hill
Logan UT 84322-0300
tel. (435) 797-1619
e-mail chem.undergrad@usu.edu

<http://www.chem.usu.edu/>

Prepared by Department of Chemistry and Biochemistry

Biochemistry Faculty Advisors

A-F	Doug Harris 797-1609, W335, doug.harris@usu.edu
G-M	Joan Hevel 797-1622, W235, jonie.hevel@usu.edu
N-Z	Lance Seefeldt 797-3964, W241, lance.seefeldt@usu.edu

Final Examination