BIOLOGICAL CHEMISTRY

Department Website: http://chemistry.uchicago.edu/kb (http://chemistry.uchicago.edu/kb/)

PROGRAM OF STUDY

The Department of Chemistry, in conjunction with the Department of Biochemistry and Molecular Biology (BCMB) in the Division of the Biological Sciences, offers a BS degree in Biological Chemistry. The program is designed to prepare students to enter a variety of interdisciplinary fields in biochemical and biophysical sciences. Undergraduate research is strongly encouraged. By combining resources of both departments, students in this program are given the opportunity to study chemistry and physics of macromolecules, mechanisms of actions of enzymes and hormones, molecular and cellular biology, biotechnology, and other related fields.

SUMMARY OF REQUIREMENTS

GENERAL EDUCATION

CHEM 11100-11200 Comprehensive General Chemistry I-II  
One of the following sequences:  
MATH 15100-15200 Calculus II  
MATH 16100-16200 Honors Calculus I-II  
MATH 13100-13200 Elementary Functions and Calculus I-II (requires grade of A- or higher)  
BIOS 20186 Fundamentals of Cell and Molecular Biology  
BIOS 20187 Fundamentals of Genetics (or AP credit, if an AP 5 Fundamentals Sequence is completed)

Total Units 600

MAJOR

One of the following:  
CHEM 11300 Comprehensive General Chemistry III  
CHEM 12300 Honors General Chemistry III  
MATH 18300-18400-18500 Mathematical Methods in the Physical Sciences I-II-III  
CHEM 20100 Inorganic Chemistry I  
PHYS 12100-12200-12300 General Physics I-II-III (or higher)  
One of the following sequences:  
CHEM 22000-22100-22200 Organic Chemistry I-II-III  
CHEM 23000-23100-23200 Honors Organic Chemistry I-II-III  
CHEM 26100 & CHEM 26200 Quantum Mechanics and Thermodynamics  
CHEM 26700 Experimental Physical Chemistry  
One of the following:  
CHEM 20200 Inorganic Chemistry II  
CHEM 23300 Introduction to Chemical Biology  
CHEM 26300 Chemical Kinetics and Dynamics  
BIOS 20200 Introduction to Biochemistry  
BIOS 21317 Topics in Biological Chemistry  
One of the following:  
BIOS 21229 Genome Informatics: How Cells Reorganize Genomes  
BIOS 21237 Developmental Mechanisms  
BIOS 21238 Cell Biology II  
BIOS 21249 Organization, Expression, and Transmission of Genome Information  
BIOS 21306 Human Genetics and Evolution  
BIOS 21328 Biophysics of Biomolecules  
BIOS 21349 Protein Structure and Functions in Medicine  
BIOS 21358 Simulation, Modeling, and Computation in Biophysics  
BIOS 21360 Advanced Molecular Biology  
BIOS 21510 Chromatin & Epigenetics
One approved 30000-level Biochemistry or Chemistry course \( \dagger \)

Total Units 1900

\( \dagger \) Credit may be granted by examination.

\( \dagger \) CHEM 10100-10200 Introductory General Chemistry I-II and CHEM 12100-12200 Honors General Chemistry I-II also satisfy this requirement. Enrollment into a particular sequence is based on chemistry placement or AP score.

\( * \) See Advanced Placement and Accreditation Examinations sections of this catalog. **Note that no credit is given for IB chemistry.**

\( ** \) Chemistry and Biological Chemistry majors can take these courses without the Biological Sciences prerequisites (BIOS 20153-20151), unless they pursue a double major in the Biological Sciences. They are expected to show competency in mathematical modeling of biological phenomena covered in BIOS 20151.

\( + \) Students with a score of 5 on the AP Biology exam receive one credit. They are eligible to register for a three-quarter AP 5 Fundamentals Sequence. Upon completion of the sequence, students receive an additional AP credit, for a total of two, to meet the general education requirement. Students majoring in Biological Chemistry will count the AP 5 Fundamentals Sequence as three electives.

\( \S \) The sequence MATH 18300-18400-18500 Mathematical Methods in the Physical Sciences I-II-III is the recommended course of study for Chemistry majors. Students who switch into the major later in their studies may also substitute MATH 15300/16300, MATH 19620, MATH 20250, or STAT 24300 for MATH 18300.

Students who wish to double major or minor in Mathematics may consider alternative substitutions. The three-quarter sequence MATH 20300-20400-20500 (http://collegecatalog.uchicago.edu/search/?P=MATH%2020300-20400-20500) Analysis in Rn I-II-III or the honors variation of this sequence (MATH 20700-20800-20900 Honors Analysis in Rn I-II-III) may be substituted for MATH 18400 (http://collegecatalog.uchicago.edu/search/?P=MATH%2018400)-MATH 18500 Mathematical Methods in the Physical Sciences II-III; please note that MATH 20250 (http://collegecatalog.uchicago.edu/search/?P=MATH%2020250) Abstract Linear Algebra or STAT 24300 (http://collegecatalog.uchicago.edu/search/?P=STAT%2024300) Numerical Linear Algebra is a prerequisite for MATH 20400. MATH 18600 (http://collegecatalog.uchicago.edu/search/?P=MATH%2018600) is recommended for Chemistry majors who plan to pursue advanced study in physical chemistry.

\( \pm \) These courses must be chosen in consultation with the Director of Undergraduate Studies; their approval must be conveyed to the student's College adviser for proper documentation. These are graduate-level courses. In Chemistry, these include any course with a 30000-level designation. In Biology, the course must be at the graduate level, or have sufficient differentiation between undergraduate- and graduate-level work to qualify as a graduate-level course for courses which have both undergraduate and graduate students enrolled. In general, this course must have a significant molecular or chemical component.

**OPTIONAL CHEMISTRY ADVANCED PLACEMENT EXAMS**

First-year and transfer students with a strong Chemistry background (i.e., those who place into CHEM 12100 Honors General Chemistry I) will be automatically enrolled into an optional advanced placement exam to qualify for direct placement into more advanced courses such as CHEM 22000 (http://collegecatalog.uchicago.edu/search/?P=CHEM%2022000) Organic Chemistry I, CHEM 20100 (http://collegecatalog.uchicago.edu/search/?P=CHEM%2020100) Inorganic Chemistry I, or CHEM 26100 (http://collegecatalog.uchicago.edu/search/?P=CHEM%2026100) Quantum Mechanics. If a student is approved to pursue this option, they may substitute quality grades earned in any three of the following courses for their required General Chemistry course credit: CHEM 23300 Intermediate Organic Chemistry, CHEM 26100-26200-26300 Quantum Mechanics; Thermodynamics; Chemical Kinetics and Dynamics, CHEM 20100-20200 Inorganic Chemistry I-II, CHEM 26700 Experimental Physical Chemistry, CHEM 22700 Advanced Organic/Inorganic Laboratory, or CHEM 26800 Quantum Molecular and Materials Modeling. This advanced placement track may fast-track well-prepared students who wish to advance their studies into the various sub-fields of Chemistry, those who wish to double major or minor in Chemistry, or non-Chemistry majors who wish to enroll in advanced courses that require General Chemistry as a prerequisite.

**ADVANCED PLACEMENT CREDIT**

Students who earn a score of 5 on the AP exam in chemistry are given credit for CHEM 11100 Comprehensive General Chemistry I. Students with CHEM 11100 Comprehensive General Chemistry I credit may join CHEM 11200 Comprehensive General Chemistry II in the Winter Quarter. A score of 5 on the AP exam also permits students to take CHEM 12100-12200-12300 Honors General Chemistry I-II-III; students may opt to begin with CHEM 12100 Honors General Chemistry I in the Autumn Quarter or CHEM 12200 Honors General Chemistry II in the Winter Quarter. Students who complete the first quarter of Comprehensive General Chemistry or Honors General Chemistry forgo the AP credit. Note that no credit is given for IB chemistry.

**GRADING**

Students majoring in Biological Chemistry must earn (1) a major GPA of 2.0 or higher and (2) a C- or higher in all courses required by the Biological Chemistry major, including those courses counting toward general
education requirements in the mathematical, biological, and physical sciences. Nonmajors may take Chemistry courses on a P/F basis; only grades of C- or higher constitute passing work.

**HONORS AND UNDERGRADUATE RESEARCH**

By students’ third year, students majoring in Biological Chemistry are strongly encouraged to participate in research with a faculty member. To participate in undergraduate research, a student is required to have the consent of a faculty sponsor and the Director of Undergraduate Studies (DUS) (chem-dus@lists.uchicago.edu), and to submit the College Reading/Research Course Form (https://humanities-web.s3.us-east-2.amazonaws.com/college-prod/%3Fs-public/documents/College%20Reading%20&%20Research%20Form%20Fillable.pdf). For more information on research opportunities, the Honors Program in Biological Chemistry, and/or how to fill out the College Reading/Research Course Form, please visit the Department of Chemistry website (https://chemistry.uchicago.edu/undergraduate-chemistry-major-and-research/).

Excellent students who pursue a substantive research project with a faculty member in the Department of Chemistry or the Department of Biochemistry and Molecular Biology should plan to submit an honors thesis based on their work. Students usually begin this research program during their third year, and they continue their research activities through the following summer and their fourth year. To be considered for honors, students are expected to complete their arrangements with the the Director of Undergraduate Studies (DUS) (chem-dus@lists.uchicago.edu) before the end of their third year and to register for one quarter of CHEM 29900 Advanced Research in Chemistry or one year of CHEM 29600 Research in Chemistry during their third or fourth years.

A BS with honors in Biological Chemistry requires students to write a creditable honors paper describing their research. The paper must be approved by the Director of Undergraduate Studies (DUS) (chem-dus@lists.uchicago.edu) in the Department of Chemistry and the program advisors in Department of Biochemistry and Molecular Biology. It must be submitted before the deadline established by the departments. In addition, an oral presentation of the research is required.

To earn a BS degree with honors in Biological Chemistry, students must also have an overall GPA of 3.0 or higher.

**JOINT DEGREE PROGRAM**

A four-year joint degree program leading to a concurrent award of the BS in (https://chemistry.uchicago.edu/joint-bsms-degree-program/) Biological Chemistry and the MS in Chemistry (https://chemistry.uchicago.edu/joint-bsms-degree-program/) is available for a select group of students who have achieved advanced standing through their performance on placement or on accreditation examinations. Special programs are developed for such students. For more information, consult Vera Dragisich at vdragisi@uchicago.edu or the Chemistry Department at chem-dus@lists.uchicago.edu.