



University of California, Santa Barbara  
Program Learning Outcomes

**B.S. or B.A. in Chemistry and Biochemistry – CCS**

The learning outcomes in the College of Creative Studies, Chemistry and Biochemistry program match those for the Chemistry and Biochemistry degrees in the College of Letters and Science. The rationale is that students with a degree in chemistry and biochemistry should have a common set of skills and knowledge. However, students in the CCS program may follow a non-traditional path through the curriculum based upon the students' interest and needs. For example, a student interested in materials chemistry may choose, in consultation with their faculty advisor, to take physical chemistry courses in their sophomore year rather than the traditional junior year. This allows the student to access upper division elective courses in their area of interest earlier in their careers and offers them an opportunity to add a degree of specialization to their curriculum.

***Students graduating with a B.S. or B.A. in Chemistry and Biochemistry should be able to:***

1. Master a broad set of chemical knowledge concerning the fundamentals in the basic areas of the discipline (organic, inorganic, analytical, physical and biochemistry (biochemistry is optional for students receiving a B.A. in chemistry and biochemistry)) as outlined below:
  - a. Organic:
    - i. Solve problems involving the nomenclature, reactivity, stereochemistry, mechanisms, and synthesis of the various classes of organic compounds;
    - ii. Solve problems involving carbohydrates, amino acids, enzymes, coenzymes, nucleic acids, and synthetic polymers.
  - b. Inorganic:
    - i. Name and recognize symmetry in inorganic complexes;
    - ii. Solve problems involving Lewis acids/bases, group theory, and molecular orbital theory for inorganic compounds.
  - c. Analytical:
    - i. Explain when and how to use the techniques of spectrophotometry, electroanalytical methods, and separation processes;
    - ii. Analyze spectrophotometric results.
  - d. Physical:
    - i. Solve problems involving thermodynamics, quantum mechanics, and kinetics.
  - e. Biochemistry (***required for B.S. degree students only***):
    - i. List the physical and chemical properties of proteins, nucleic acids, and carbohydrates;
    - ii. Characterize, describe how to synthesize, and state methods of degradation for biomolecules.
2. Apply critical thinking to solve area specific word problems by being able to take written text and identify variables and useful equations.

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**Program Learning Outcomes, continued**

3. Employ modern library search tools to locate and retrieve scientific information about a topic, chemical, chemical technique, or an issue relating to chemistry.
4. Successfully pursue their career objectives in advanced education in professional and/or graduate schools, in a scientific career in government or industry, in a teaching career in the school systems, or in a related career following graduation.

***In the laboratory, students graduating with a B.S. or B.A. in Chemistry and Biochemistry should be able to:***

1. Describe the objective of their chemical experiments, carry out the experiments, and record and analyze the results.
2. Collect, process, and analyze data using computer software.
3. Use standard laboratory equipment, modern instrumentation, and classical techniques to carry out experiments.
4. Communicate the concepts and results of their laboratory experiments through writing and oral communication skills.
5. Use and analyze results (when appropriate) from a minimum of 5 of the following :
  - a. Optical spectroscopy (e.g., UV-vis, FT-IR, fluorescence, atomic absorption and emission, Raman, laser)
  - b. Mass spectrometry (e.g., MS, GC-MS)
  - c. Structure determination methods (e.g., NMR, X-ray diffraction)
  - d. Chromatography and separations (e.g., HPLC, GC, electrophoresis)
  - e. Electrochemistry (e.g., potentiometry, voltammetry)
  - f. Vacuum and inert-atmosphere systems (e.g., Schlenk line, dry box)
  - g. Thermal analysis (e.g., DSC, TGA)