

# BIOCHEMISTRY - MINOR

A minor is offered in biochemistry. Declaration of a biochemistry minor is open to any student enrolled at CU Boulder, regardless of college or school.

## Requirements

A minimum of 21 credits is required for the minor, at least 9 of which must be upper-division. The College of Arts & Sciences will allow a maximum of 9 hours of transfer credit, including 6 upper-division credit hours to count toward a minor. Students may transfer courses through organic chemistry only. All courses required for the minor must be completed with a grade of C- or better, and the overall GPA in all BCHM and CHEM courses taken must be a 2.00.

Students who have taken CHEN 1211/CHEM 1221 may substitute them for CHEM 1113/CHEM 1114.

| Code                                      | Title                                                                                                          | Credit Hours |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------|
| <b>General Chemistry</b>                  |                                                                                                                | <b>5-10</b>  |
| Select one of the following two options:  |                                                                                                                |              |
| <i>Option 1:</i>                          |                                                                                                                |              |
| CHEM 1113<br>& CHEM 1114                  | General Chemistry 1<br>and Laboratory in General Chemistry 1                                                   |              |
| CHEM 1133<br>& CHEM 1134                  | General Chemistry 2<br>and Laboratory in General Chemistry 2                                                   |              |
| <i>Option 2:</i>                          |                                                                                                                |              |
| CHEM 1400<br>& CHEM 1401                  | Foundations of Chemistry<br>and Foundations of Chemistry Lab                                                   |              |
| <b>Organic Chemistry</b>                  |                                                                                                                | <b>10-11</b> |
| CHEM 3311<br>or CHEM 3451                 | Organic Chemistry 1<br>Organic Chemistry 1 for Chemistry and<br>Biochemistry Majors                            |              |
| CHEM 3321                                 | Laboratory in Organic Chemistry 1                                                                              |              |
| CHEM 3331<br>or CHEM 3471<br>or BCHM 3491 | Organic Chemistry 2<br>Organic Chemistry 2 for Chemistry Majors<br>Organic Chemistry 2 for Biochemistry Majors |              |
| CHEM 3341<br>or CHEM 3381                 | Laboratory in Organic Chemistry 2<br>Laboratory in Advanced Organic Chemistry                                  |              |
| <b>Biochemistry</b> <sup>1</sup>          |                                                                                                                | <b>6-8</b>   |
| Select one of the following:              |                                                                                                                |              |
| BCHM 2700<br>or BCHM 4611                 | Foundations of Biochemistry<br>Principles of Biochemistry                                                      |              |
| Select one of the following:              |                                                                                                                |              |
| BCHM 3400                                 | Mechanisms of Cancer                                                                                           |              |
| BCHM 3450                                 | Principles of Pharmacology and<br>Toxicology                                                                   |              |
| BCHM 4400                                 | Core Concepts in Physical Chemistry for<br>Biochemists                                                         |              |
| BCHM 4631                                 | Computational Genomics Lab                                                                                     |              |
| BCHM 4720                                 | Metabolic Pathways and Human Disease                                                                           |              |
| BCHM 4740                                 | Biochemistry of Gene Transmission,<br>Expression and Regulation                                                |              |

BCHM 4850 Therapeutic and Diagnostic Nucleic Acids

**Total Credit Hours** **21-29**

<sup>1</sup> Must be completed at CU Boulder.

## Learning Outcomes

Upon completing the program, students will be able to:

- Master the foundational concepts of general and organic chemistry, including equilibrium, kinetics, bonding (covalent and non-covalent) and reactivity and apply these concepts to biological systems.
- Explain how biomolecules (DNA, RNA, proteins, lipids, carbohydrates and metabolites) are synthesized and control biological processes.
- Identify the factors that determine the three-dimensional structures of biological macromolecules (DNA, RNA, proteins), and membranes (including organelles) and explain how structure relates to function.
- Describe how cells sense their environment and use this information to regulate cellular functions such as DNA replication, gene expression, signal transduction, cell division and cell death.
- Develop a conceptual, mechanistic and mathematical understanding of biomolecular interactions, including binding and catalysis.
- Explain how energy is stored, transformed and harnessed in biological systems.
- Analyze data, interpret graphs, solve quantitative problems to interpret results of scientific studies. Evaluate the rigor and reproducibility of scientific results.
- Learn and apply the rigorous scientific methods on which (bio)chemical knowledge is built: making observations, formulating hypotheses, executing experiments, evaluating rigor and reproducibility.
- Effectively communicate scientific information in oral, written and visual formats to specialized and general audiences.