

Biochemistry Supplement

Context

In the belief that all professional chemists need to know some biochemistry, the ACS guidelines require that approved programs offer and certified majors graduate with the equivalent of three semester hours of biochemistry. Molecular aspects of biological structures, equilibria, energetics, and reactions should be covered in the required biochemistry experience for chemistry majors. Sufficient introduction should be presented so that students can obtain the flavor of modern biochemistry and an appreciation of the important applications in biotechnology.

Conceptual Topics

Three general subject areas in biochemistry, along with specific topics in each area, are appropriate for meeting the biochemistry requirement. While all three general subject areas are expected, CPT recognizes that most approved curricula will not be able to cover all of the topics for each of the three general areas.

Biological Structures and Interactions

- Fundamental building blocks (amino acids, carbohydrates, lipids, nucleotides, and prosthetic groups)
- Biopolymers (nucleic acids, peptides/proteins, glycoproteins, and polysaccharides)
- Membranes
- Supramolecular architecture

Biological Reactions

- Kinetics and mechanisms of biological catalysis
- Biosynthetic pathways and strategies/metabolic engineering
- Metabolic cycles, their regulation, and metabolomics
- Organic and inorganic cofactors

Biological Equilibria and Thermodynamics

- Acid-base equilibria
- Thermodynamics of binding and recognition
- Oxidation and reduction processes
- Electron transport and bioenergetics
- Protein conformation/allostery, folding, oligomerization, and intrinsically disordered proteins (IDPs)

Practical Topics

Some of the required topics in biochemistry may be covered in laboratory courses. The experiments that are used for this purpose should emphasize techniques of general importance to biochemistry as described in the general guidelines outlined above. Some examples are: error and statistical analysis of experimental data, spectroscopic methods, molecular biology techniques (including PCR), electrophoretic techniques, kinetics, chromatographic separations, protein purification, bioinformatics and -omics, molecular modeling, protein engineering, and isolation and identification of macromolecules and metabolites.

Illustrative Modes of Coverage

Most commonly approved programs implement the requirement in one of two ways:

- 1) minimally three-semester-credit-hour self-contained foundation course in biochemistry and/or
- 2) the first semester of a traditional two-semester biochemistry sequence. A second-semester in-depth course is expected to build upon foundation courses that cover fundamental biochemistry, chemical bonding and structure, organic chemistry, thermodynamics, and kinetics. A prerequisite of more than one semester of organic chemistry may be needed for either mode of delivery.