

UNIVERSITY OF CALIFORNIA, RIVERSIDE

Student Learning Outcomes for the B.A./B.S. in Biochemistry

Students completing the B.A./B.S. major will be able to:

1. General laboratory safety: Students will learn the proper use of safety goggles, lab coats, gloves and other standard measures of personal protection, the proper handling of toxic/corrosive/reactive compounds and radioisotopes, and the safe operation of electrophoresis apparatus, (ultra)centrifuges and other standard equipment.
2. General laboratory skills: Students will be taught how to prepare reagent solutions of correct concentration and pH, proper techniques for pipetting, serial dilution, and other routine laboratory manipulations, the use of spectrophotometers, electrophoretic methods, and chromatography equipment.
3. Given knowledge of common mechanisms of regulation for biomacromolecules, students should be able to predict the sites and nature of regulation in pathways that transform energy.
4. Given a knowledge of the basic structure of fatty acids, triglycerides, nucleotides, and carbohydrates; students should be able to compare and contrast the synthesis, storage, and transformation of macromolecules from which living organism harvest derive energy.
5. Given a macromolecular structure, students should be able to explain the contribution of entropy, enthalpy and temperature of a macromolecule and water (associated and in bulk solvent) in a folded versus unfolded state.
6. Given a biological example, students should be able to explain how thermodynamically unfavorable processes can occur.
7. Given an enzyme reaction, students should be able to differentiate the effect of an enzyme on the change in free energy of a reaction versus the change in transition state free energy.
8. Given entropy, enthalpy and temperature, students should be able to justify why evolutionary selection is constrained by the laws of thermodynamics.
9. Given knowledge of biomacromolecules, students should be able to identify, draw (sketch) and know properties (functions) of biomacromolecules.
10. Given a list of macromolecules, students should be able to devise an experiment on how they interact or interpret results of experiments on their interactions.
11. Given structural changes of a macromolecule, students should be able to predict the impact of structural substitution would have on macromolecule structure and function.
12. Given experimental data, students should be able to assess how enzymes facilitate biochemical reactions.
13. Given that evolutionary forces such as gene duplications and genomic mutations can provide changes in protein structure(s) and function(s) students should be able to **explain** how protein structures might change while retaining an evolutionarily conserved function.
14. Given an understanding of replication, transcription and translation, students should be able to determine how changes in DNA sequence affect the amino acid sequence of the protein it encodes.
15. Given an understanding of common mechanisms of gene regulation, students will be able to explain or predict changes in transcription in response to biologic variables.
16. Given an understanding of genetic information transfer, students should be able to explain the role of RNA in the flow of genetic information.
17. Given an understanding of evolution and natural selection, students should be able to make predictions on how environmental factors will affect information flow over generations.

18. Given an understanding of commonly encountered signal transduction mechanisms, students will be able to predict or design models for information transfer cascades.
19. Given an appropriate question and a working knowledge of Biochemistry, students should be able to formulate hypotheses, design experiments, and assess the quality of experimental design.
20. Given a fundamental understanding of Biochemical concepts, students should be able to formulate experiments and assess the quality of experiments addressing molecular structure, assays of biological function, and isolation/ separation of biomolecules.
21. Given a data set, students should be able to assess the reliability of the data and draw appropriate conclusions.
22. Given a set of data, students should be able to appropriately present and interpret the data.
23. Scientific Professionalism and Ethics: Students will be taught the principles of ethical conduct of research and scholarship, including plagiarism and appropriate citation, qualifications for authorship, appropriate application of image and data manipulation techniques, confidentiality, etc.
24. Written Communication Skills: Students will receive training in written and electronic communication practices.
25. Oral Communication Skills: Students will be afforded an opportunity to develop oral communications skills by presenting posters, oral reports, and team projects, where practical.
26. Career Opportunities: Students will learn about career opportunities in academia, industry, and government service through presentations by practicing scientists and the opportunity to perform internships.

Program Website: <http://biochemistry.ucr.edu/>