

MAJOR IN BIOCHEMISTRY, DATA SCIENCE CONCENTRATION

The Data Science concentration in Biochemistry builds on the general biochemistry core set of courses (24 credits of primarily upper division courses) and includes 21 data science specific course credits. This option gives the student 3 “free elective” credits, which they can use to complete either data science elective, bioscience elective, or second semester physics courses. This concentration is designed to provide a solid background in biochemistry, molecular genetics and cell biology, augmented with computer science, mathematics and statistics. The data science concentration is recommended for students interested in a career in life science data analysis. Students who graduate with this concentration obtain the skills necessary for organizing, analyzing and communicating the meaning of massive data sets.

Learning Objectives

Upon successful completion, students will be able to:

1. Explain how DNA is packaged, replicated, repaired, transcribed, and translated in both eukaryotes and prokaryotes.
2. Compare and contrast the regulatory mechanisms of transcription and translation in eukaryotes and prokaryotes.
3. Describe and discuss the molecular architecture of nucleic acids and proteins along with the non-covalent interactions responsible for stabilizing the structure of these macromolecules.
4. Outline the salient features of the central pathways of glycolysis, gluconeogenesis, citric acid cycle, pentose phosphate pathway, fatty acid metabolism, ketogenesis, urea cycle, amino acid and nucleotide metabolism and explain the principles of electron transport, ATP synthesis, and their regulation.
5. Develop critical thinking skills for concepts related to cellular functions and their regulation mechanism.
6. Perform a wide-array of biochemical techniques and discuss how these tools are currently being used in biochemical research.
7. Communicate biochemical concepts to other scientists in written and oral form.
8. Apply modern tools and methods for handling, cleaning, organizing, and mining biochemically relevant data sets.
9. Apply data science techniques to such data sets to address biochemical questions.
10. Use omics resources and computational tools to address biochemical questions.
11. Apply data visualization techniques to summarize biochemical data and present the results of analyses.