

Curriculum Goals, Student Learning Outcomes (SLO) & Components

Biology Undergraduate Major

Approved 4/12/12

Goal 1: Develop knowledge and understanding of core content in biology

SLO 1: Illustrate and examine phylogenetic relationships among organisms, and characterize and differentiate the evolutionary processes that yield such relationships.

Component 1: Apply concepts of natural selection and evolution in understanding any aspect of biology, ranging from genes to speciation.

Component 2: Map key events in biological evolution onto the broad phylogenetic tree of life.

Component 3: Summarize biological information in the context of phylogenetic trees.

Component 4: Construct a basic phylogenetic tree from biological data.

SLO 2: Explain and illustrate the basic structure and function of cells.

Component 1: Explain how internal membranes and organelles contribute to cell functions.

Component 2: Describe the molecular properties of cell membranes, and relate these properties to the selective permeability of membranes.

Component 3: Explain how cell size and shape affect the overall rate of nutrient intake and the rate of waste elimination.

Component 4: Explain how cellular molecules and organelles generate and utilize energy in cells to maintain homeostasis.

Component 5: Explain the differences between prokaryotic and eukaryotic cells with regard to macromolecules, membranes, and organelles, and evaluate the significance of these differences.

Component 6: Explain mitotic and meiotic division, and regulation of cell growth.

Component 7: Explain and illustrate how cells respond to their internal and external environments.

SLO 3: Explain and illustrate how the normal physiology of organisms functions in different taxa to maintain homeostasis in various environments.

Component 1: Explain how functional units at different levels of biological organization permit diverse organisms to maintain relatively constant internal environments.

Component 2: Explain how organisms sense and respond to their external environment.

Component 3: Compare and contrast the differences in physiology among organisms, both within and between taxa, that allow them to cope with differences in their abiotic and biotic environments.

SLO 4: Explain and illustrate how the growth and behavior of organisms are activated and regulated through the expression of genetic information in context.

Component 1: Explain and illustrate the relationship between phenotype and genotype.

Component 2: Explain and illustrate the various modes of genetic action, including Mendelian genetics, quantitative genetics, and epigenetics.

Component 3: Explain and illustrate the applications of genomics in science and society.

Component 4: Explain and illustrate how genetic information is stored and expressed.

SLO 5: Explain and illustrate the pathways and transformations of energy and matter in biological systems.

Component 1: Describe the structure and function of biological molecules, including carbohydrates, proteins, and lipids, that are involved in anabolic and catabolic processes in living organisms.

Component 2: Describe the regulation of pathways involved in photosynthesis.

Component 3: Describe the regulation of pathways involved in cellular respiration and explain how these pathways utilize energy from carbohydrates, proteins, and lipids.

Component 4: Explain how biological systems use free energy and nutrient availability to grow and reproduce.

Component 5: Predict how changes in free energy and nutrient availability affect organisms, populations, and ecosystems.

SLO 6: Explain and illustrate how living organisms are interconnected and interacting at multiple functional scales.

Component 1: Interpret coevolutionary and symbiotic relationships and illustrate mutualism, antagonism and commensalism.

Component 2: Examine and describe ecological interactions within and between populations and species, including competitive and exploitative relationships.

Component 3: Describe and explain the generation and maintenance of biological diversity, and its role in ecosystem function.

Goal 2: Develop core competencies in scientific inquiry

SLO 7: Apply the process of science to understand biological phenomena.

Component 1: Review, summarize, and critique scientific literature relevant to a specific biological question.

Component 2: Formulate a testable hypothesis, and design and perform a study to test it.

Component 3: Analyze data to address a question or test the hypothesis of a study.

Component 4: Reach defensible conclusions based on results of data analyses.

Component 5: Synthesize and integrate information to conceptualize and formulate ideas about biology.

SLO 8: Use quantitative skills and reasoning to solve biological problems.

Component 1: Use multiple biological databases as information sources for creating or expanding data sets for analysis.

Component 2: Calculate appropriate indices needed to solve biological problems.

Component 3: Select, compute, and interpret appropriate statistical analyses for analyzing biological data.

SLO 9: Use modeling and simulations to understand biological processes.

Component 1: Describe the critical assumptions and range of application of specific models used to investigate biological processes.

Component 2: Investigate the results of changing parameter values, or initial or boundary conditions, or simplifying assumptions in models and simulations, and interpret the biological relevance of those results.

Component 3: Explain the value of combining models and simulations with empirical studies to gain a more comprehensive understanding of biological processes.

SLO 10: Use appropriate equipment to solve biological problems.

Component 1: Choose the appropriate equipment to use in a biological investigation.

Component 2: Use the proper equipment correctly to gather valid data for a biological investigation.

SLO 11: Recognize the interdisciplinary nature of science and demonstrate the ability to connect biology with other disciplines.

Component 1: Apply basic concepts of cognate courses in chemistry, physics, and mathematics to biological phenomena.

Component 2: Integrate key biological concepts across levels of biological organization.

Component 3: Use tools and techniques emerging from interdisciplinary work involving the combination of biology, computer science, and informatics.

SLO 12: Communicate and collaborate effectively with other biologists and with scientists in other disciplines.

Component 1: Use both verbal and oral communication in a professional manner.

Component 2: Evaluate and critique scientific writing and presentations.

Component 3: Work effectively with peer groups to accomplish a collaborative task, such as a lab report, group presentation, or analysis of data.

SLO 13: Recognize and explain the role of the biologist in the world and society.

Component 1: Explain how biological knowledge relates to technology, political issues, and society.

Component 2: Explain the challenges that societal concerns present to science.

SLO14: Students recognize and act on ethical challenges that arise in their discipline.

Component 1: Describe and demonstrate the biological ethics of working with research subjects.

Component 2: Explain the ethical implications of biological issue for society.

Goal 3: Develop an understanding of career opportunities in biology

SLO 15: Develop a career plan.

Component 1: Set a career goal with the help of biology faculty advisors and the Career Center.

Component 2: Create a timeline of events, courses, and activities designed to prepare for a chosen career goal.

Component 3: Explain the connection between specific areas of biology and specific careers.

SLO 16: Use the resources at the Career Center to improve career skills.

Component 1: Discuss career plans and planning with a career counselor.

Component 2: Participate in Career Center activities that prepare students for their likely careers.

Component 3: Develop a resume.

Component 4: Demonstrate the skills to network effectively.