



## **Learning Outcomes for a Year-Long Introductory Biology for Life Science Majors Sequence**

### **Molecular/ Cellular level:**

1. Describe and relate anabolic (photosynthesis) and catabolic (respiration and fermentation) pathways emphasizing the transformation of energy and matter.
2. Predict how a molecule's movement is affected by its thermal energy, size, electrochemical gradient, and biochemical properties.
3. Illustrate how conservation of the genetic code and the varying effects of mutations facilitate evolution.
4. Model the processes by which evolution allows for the emergence of cell complexity and diversity.
5. Describe the building blocks and synthesis of the major classes of biomolecules and the contribution of their three-dimensional structure to their functions.
6. Articulate how cells store, use, and transmit genomic information.
7. Explain mechanisms by which cells receive and respond to internal and external signals that vary through space and time.
8. Model cell components, emphasizing them as a system of interacting parts

### **Physiology Level**

1. Explain how structure relates to physiology and transfer these concepts to a new situation.
2. Describe how biological systems detect and respond to different internal/external environmental conditions through feedback.
3. Compare and contrast solutions to shared homeostatic challenges across various forms of life.

### **Ecology and Evolution Level**

1. Develop a model to explain the flow of energy, and compare and contrast the cycling of matter in various ecosystems in the biosphere at human and geologic time scales.
2. Provide morphological, molecular and developmental evidence of the common ancestry of life.
3. Use phylogenies to explore the evolutionary relationships among taxonomic groups.

4. Describe how biotic and abiotic components of the environment shape organismal traits through the process of natural selection
5. Outline how evolutionary processes impact biodiversity.
6. Explain how mutation and genetic recombination contribute to phenotypic variation in a population and predict how abiotic and biotic selective pressures can alter those populations over space and time.
7. Describe how interactions between structure and function influence ecosystems at multiple scales.
8. Explain how biotic and abiotic interactions influence and are influenced by morphological, physiological and behavioral traits.
9. Explain how evolutionary, developmental, and environmental processes influence the evolution of structures, functions, and behaviors that impact fitness.
10. Use multiple representations to model the relationships between species/population abundance and distribution in relation to biotic and abiotic factors.

### **Competencies**

1. Generate questions and construct testable hypotheses about biological mechanisms based on observations of the natural world.
2. Design an experiment using appropriate methodology (experimental techniques, controls, data collection and analysis), reach conclusions and identify future lines of inquiry.
3. Integrate interdisciplinary concepts from within and outside biology to address complex problems.
4. Identify ways that interdisciplinary concepts are used to explain biological phenomena.
5. Defend a viewpoint on a socio-scientific issue based on biological research
6. Evaluate multiple representations (e.g., diagrams, physical models, mathematical relationships) by comparing the applications, strengths, and limitations of different models and their relationship to real biological systems.
7. Create models (e.g., cartoon, schematic, flow chart, interpretive dance, etc.) to demonstrate biological concepts or systems.
8. Apply quantitative skills to biological problems.
9. Explain and use mathematical relationships relevant to biology.
10. Work productively in teams with diverse perspectives.
11. Share ideas with peers clearly and accurately using scientific conventions.
12. Effectively communicate experimental outcomes using professional scientific formats (e.g. report, poster, presentation).

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Final Consent: 10/14/2018 without paramount objections**

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