Program-level Concept Goals

The study of biology is increasingly complex and multi-disciplinary, yet, there are central concepts which are fundamental to all biological systems. These concepts constitute the biology program's Concept Goals, which are instilled in each student in preparation for a variety of careers in biology:

- Within biological systems, structure and function are interdependent.
- Energy transformations underlie all biological processes.
- Expression of a unique subset of genes from an organism's inherited DNA genome determines a cell's particular characteristics.
- Biological diversity is the result of a continuous process of evolution in an ecological context.

Program-level Learning Goals

Development of key skills ranging from experimental design to analytical thinking to communication and more are essential for the training of a biologist. The Biology Department prepares students by integrating key competencies throughout the curriculum so students are prepared to address and solve problems in biology in a variety of careers. Specifically, we prepare students by developing their abilities in the following areas and by providing opportunities to conduct novel research in biology:

- Scientific Thinking and Applying the Process of Science
- Quantitative Literacy
- Data Analysis and Visualization
- Modeling
- Science Communication and Collaboration
- Placing Biology in the Broader Context of Science as a Way of Knowing

Program-level Learning Goals with Competencies for the Department of Biology

Scientific Thinking and Applying the Process of Science

- Locate, interpret, and evaluate scientific information
- Recognize gaps in our current understanding of a biological system or process and identify what specific information is missing
- Develop research questions based on your own or others' observations
- Formulate testable hypotheses and state their predictions
- Plan, evaluate, and implement scientific investigations
- Interpret, evaluate, and draw conclusions from data in order to make evidence-based arguments

Quantitative Literacy

- Describe how quantitative reasoning helps biologists understand the natural world
- Use probability and understanding of biological variability to reason about biological processes and statistical analyses
- Interpret and manipulate mathematical relationships to make quantitative comparisons using appropriate equations to solve problems
- Interpret the biological meaning of quantitative results

Data Analysis and Visualization

- Select, carry out, and interpret statistical analyses
- Create and interpret informative graphs and other data visualizations
- Produce professional quality data representations
- Describe how biologists answer research questions using databases, large data sets, and data science tools

Modeling

- Recognize the important roles that scientific models, of many different types (conceptual, mathematical, physical, etc.) play in predicting and communicating biological phenomena
- Given two models of the same biological process or system, compare their strengths, limitations, and assumptions
- Build, evaluate, and revise conceptual and quantitative models to make inferences and solve problems about biological systems
- Summarize relationships and trends that can be inferred from a given model or simulation
- Use models and simulations to make predictions and refine hypotheses

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Science Communication and Collaboration

- Communicate clearly, accurately, and with respect for diversity, using appropriate language and style, to a variety of audiences, in a variety of modes (oral, written, digital, visual)
- Collaborate productively and collegially in teams, be respectful of a diversity of perspectives, and provide and respond to constructive feedback

Placing Biology in the Broader Context of Science as a Way of Knowing

- Integrate concepts across other STEM disciplines and multiple fields of biology
- Consider science as one way of understanding the world and appreciate that real-world problems often require interdisciplinary solutions (beyond STEM)
- Critically analyze ethical issues in the conduct of science
- Apply scientific reasoning in daily life and recognize the impacts of science on a local and global scale
- Consider the potential impacts of outside influences (historical, cultural, political, technological) on how science is practiced