ESSENTIAL CONCEPTS & COMPETENCIES:
Disciplinary Frameworks for Teaching, Learning, & Assessment

About Essential Concepts and Competencies:
Over the past two years, each of the Measuring College Learning panels has defined a set of essential concepts and competencies for undergraduate-level learning in its discipline. Essential concepts and competencies are deep understandings and complex skills that faculty believe are fundamental to the discipline, valuable to students, and worth emphasizing given limited time and resources. Essential concepts and competencies should not be seen as fixed, universal, or comprehensive. Rather, they are meant to be reasonable and productive frameworks that can orient discussions about teaching, learning, and assessment.
Students of biology should understand...

**Evolution:** The diversity of life evolved over time by processes of mutation, selection, and genetic change.

**Information Flow:** The growth and behavior of organisms are activated through the expression of genetic information in context.

**Structure and Function:** Basic units of structure define the function of all living things.

**Pathways and transformations of matter and energy:** Biological systems grow and change by processes based upon chemical reactions and are governed by the laws of thermodynamics.

**Systems:** Living systems are interconnected and interacting.

Students of biology should be able to...

**Model:** Construct, use, re-express, and revise models and representations of natural and designed objects, systems, phenomena, and scientific ideas in the appropriate context and in formulating their explanation.

**Apply quantitative reasoning:** Reason about relationships between variables (e.g., data, representations, uncertainty, samples) through the lens of ratios, rates, percentages, probability or proportional relationships when approaching or solving problems or when interpreting results or situations.

**Engage in argument from evidence:** Evaluate the claims, evidence and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

**Engage in scientific inquiry and experimental design:** Design experiments with appropriate strategies, controls, and alternative approaches.

**Analyze and evaluate data:** Extract information from data and analyze it to discover patterns, critically evaluate conclusions, and generate predictions for subsequent experiments.

**Appreciate and apply the interdisciplinary nature of science:** Apply concepts from within biology subdisciplines and outside of biology to interpret biological phenomena.