

02_Metabolism and Cellular Transport

Content Area: **Science**
Course(s):
Time Period: **Full Year**
Length: **3-4 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

Biology focuses on the diversity, complexity, and interdependence of life on Earth. Students will develop an understanding of how organisms evolve, reproduce, and adapt to their environments. This will include an exploration of how to relate the structure and function of molecules to their role in cell biology and metabolism. Further understanding of evolution and reproduction will be explored through the science of genetics. Knowledge of biodiversity and adaptation will be illustrated through the science of ecology.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

- Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- Systems of specialized cells within organisms help them perform the essential functions of life.
- Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.
- Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
- Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.
- As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products.
- Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings.

CONTENT AREA STANDARDS

SCI.HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
SCI.HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

MA.K-12.4	Model with mathematics.
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
LA.RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.) and make relevant connections, to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
LA.W.9-10.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
LA.W.9-10.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach, or consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience.
LA.W.9-10.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.W.9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals).
LA.W.9-10.9	Draw evidence from literary or nonfiction informational texts to support analysis, reflection, and research.
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.1H.IPRET.8).

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.
- Relevant parts (e.g., organ system, organs, and their component tissues) and processes (e.g., transport of fluids, motion) of body systems in multicellular organisms interact to maintain homeostasis.
- Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.
- Feedback (negative or positive) can stabilize or destabilize a system.

- Feedback mechanisms maintain homeostasis.

Procedural Knowledge

Students will be able to:

- Develop a model in which they identify and describe* the relevant parts (e.g., organ system, organs, and their component tissues).
- In the model, students describe the relationships between components, including:
 - The functions of at least two major body systems in terms of contributions to overall function of an organism.
 - Ways the functions of two different systems affect one another.
 - A system's function and how that relates both to the system's parts and to the overall function of the organism.
- Use the model to illustrate how the interaction between systems provides specific functions in multicellular organisms.
- Develop an investigation plan and describe the data that will be collected and the evidence to be derived from the data, including:
 - Changes within a chosen range in the external environment of a living system.
 - Responses of a living system that would stabilize and maintain the system's internal conditions (homeostasis), even though external conditions change, thus establishing the positive or negative feedback mechanism.
 - Describe why the data will provide information relevant to the purpose of the investigation.
- In the investigation plan, students describe:
 - How the change in the external environment is to be measured or identified.
 - How the response of the living system will be measured or identified.
 - How the stabilization or destabilization of the system's internal conditions will be measured or determined.
 - The experimental procedure, the minimum number of different systems (and the factors that affect them) that would allow generalization of results, the evidence derived from the data, and identification of limitations on the precision of data to include types and amounts.
- Collect and record changes in the external environment and organism responses as a function of time.
- Students evaluate their investigation, including:
 - Assessment of the accuracy and precision of the data, as well as limitations (e.g., cost, risk, time) of the investigation, and make suggestions for refinement.
 - Assessment of the ability of the data to provide the evidence required.
 - If necessary, students refine the investigation plan to produce more generalizable data

EVIDENCE OF LEARNING

Formative Assessments

- Checks for understanding during lesson.
- Use of student-friendly proficiency scales to track progress.
- Do Now activities.
- Student-centered questioning and discussion that is facilitated by instructor.
- Exit Tickets.

Summative Assessments

- Benchmarks – departmental benchmark given at the end of MP1, MP2, and MP3
- Alternative Assessments
 - Lab inquiries and investigations
 - Lab Practicals
 - Exploratory activities based on phenomenon
 - Gallery walks of student work
 - Creative Extension Projects
 - Build a model of a proposed solution
 - Let students design their own flashcards to test each other
 - Keynote presentations made by students on a topic
 - Portfolio

RESOURCES (Instructional, Supplemental, Intervention Materials)

[Miller & Levine Biology Textbook](#)

- Unit 3 - Cells
 - Chapter 8 - Life is Cellular
 - Case Study: *What's happening to me?*
 - Interactivity: *Build a Cell*
 - Quick Lab: *How Can You Make a Model of a Cell?*
 - Exploration Lab: *Detecting Diffusion.*
 - Interactivity: *Osmosis.*
 - Animation: *Active Transport.*
 - Interactivity: *Cell Differentiation and Specialization.*
 - Analyzing Data: *Mitochondria in a Mouse.*
 - Interactivity: *Levels of Organization.*

- Video: *Cystic Fibrosis*.

POGIL Biology

- Membrane Structure and Function
- Transport in Cells

Gizmos

- Diffusion (STEM Case)
- Osmosis (STEM Case)
- Human Homeostasis
- Paramecium Homeostasis.

[Brainpop](#)

[NSTA](#)

[Data Nuggets](#)

[Online Resources](#)

INTERDISCIPLINARY CONNECTIONS

ELA/Literacy

Mathematics

Technology

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.