

2020 Unit 02: Cell Structure and Function

Content Area: **Science**
Course(s): **Advanced Placement Biology**
Time Period: **October**
Length: **6 weeks**
Status: **Published**

Alternative Assessments

Performance tasks
Project-based assignments
Problem-based assignments
Presentations
Reflective pieces
Concept maps
Case-based scenarios
Portfolios

Benchmark Assessments

Skills-based assessment
Reading response
Writing prompt
Lab practical

Unit Overview

The cell is the basic unit of life. Cells contribute to the organization of life and provide the environment in which organelles function. Organelles in turn provide compartmentalization and organize cellular products for dispersal and waste for disposal. Cells have membranes that allow them to establish and maintain an internal environment. These membranes also control the exchange of material with the cell's external environment—an important, foundational concept. The maintenance of the internal and external conditions of a cell is called homeostasis. Student understanding of these concepts will be necessary in later units when the focus of instruction shifts to cellular products and by-products and when students learn why cellular exchange of energy and materials matters.

Enduring Understandings

- All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.

- Cells have membranes that allow them to establish and maintain internal environments that are different from their external environments.
- How are living systems affected by the presence or absence of subcellular components?
- Living systems, from the organismal to the cellular level, demonstrate the complementary nature of structure and function.
- Living things need to sense changes in their environments and respond to keep internal parameters within a certain range.
- Measurement and observation tools are used to categorize, represent and interpret the natural world.
- Specialization is seen within the eukaryotic cell as well as at the organism level in multicellular organisms.

Essential Questions

- How are living systems affected by the presence or absence of subcellular components?
- How do living things divide responsibilities and function as a coordinated entity?
- How do organisms maintain homeostasis?
- How do the mechanisms for transport across membranes support energy conservation?
- How do we build and refine models that describe and explain the natural and designed world?
- How does structure relate to function in living systems from the organismal to the cellular level?
- What are the advantages and disadvantages of cellular compartmentalization?

Standards / Indicators / Student Learning Objectives (SLOs)

- Construct models that explain the movement of molecules across membranes with membrane structure and function. [Clarification Statement: Emphasis is on the structure of cell membranes, which results in selective permeability; the movement of molecules across them via osmosis, diffusion and active transport maintains dynamic homeostasis.] (LS1.A)
- Describe the Fluid Mosaic Model of cell membranes.
- Describe the mechanisms that organisms use to maintain solute and water balance.
- Describe the role of the cell wall in maintaining cell structure and function.
- Describe the roles of each of the components of the cell membrane in maintaining the internal environment of the cell.
- Describe the structure and/ or function of subcellular components and organelles.
- Explain how concentration gradients affect the movement of molecules across membranes.
- Explain how subcellular components and organelles contribute to the function of the cell.
- Explain how the structure of biological membranes influences selective permeability.
- Explain the effect of surface area-to-volume ratios on the exchange of materials between cells or organisms and the environment.
- Provide examples and explain how organisms use feedback systems to maintain their internal environments. (LS1.A)

SCI.HS-LS1-6

Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

SCI.HS-LS1-7	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
9-12.HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Science & Engineering Practices

9-12.HS-ETS1-1.1.1	Analyze complex real-world problems by specifying criteria and constraints for successful solutions.
9-12.HS-ETS1-3.6.1	Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
9-12.HS-ETS1-2.6.1	Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Disciplinary Core Ideas

9-12.HS-LS1-1.LS1.A.1	Systems of specialized cells within organisms help them perform the essential functions of life.
9-12.HS-LS1-3.LS1.A.1	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.
9-12.HS-LS1-4.LS1.B.1	In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

Cross Cutting Concepts

9-12.HS-LS1-2.4.1	Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales.
9-12.HS-LS1-4.4.1	Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales.
9-12.HS-LS1-7.5.1	Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems.
9-12.HS-LS1-5.5.1	Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.
9-12.HS-LS1-1.6.1	students investigate systems by examining the properties of different materials, the structures of different components, and their interconnections to reveal the system's function and/or solve a problem. They infer the functions and properties of natural and

designed objects and systems from their overall structure, the way their components are shaped and used, and the molecular substructures of their various materials.

9-12.HS-LS1-3.7.1

Feedback (negative or positive) can stabilize or destabilize a system.

Lesson Titles

- Cell Size
- Cell Structure and Function
- Cell Structure: Subcellular Components
- Mechanisms of Transport
- Membrane Transport
- Plasma Membranes

21st Century Skills and Career Ready Practices

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Interdisciplinary Connections:

LA.RH.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, qualitatively, as well as in words) in order to address a question or solve a problem.
LA.RH.11-12.9	Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.
LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.RST.11-12.2	Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on

explanations in the text.

LA.RST.11-12.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
LA.RST.11-12.5	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
LA.RST.11-12.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
LA.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
LA.RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
LA.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
LA.RST.11-12.10	By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
LA.WHST.11-12.1.A	Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
LA.WHST.11-12.1.B	Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.
LA.WHST.11-12.1.C	Use transitions (e.g., words, phrases, clauses) to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
LA.WHST.11-12.1.E	Provide a concluding paragraph or section that supports the argument presented.
LA.WHST.11-12.7	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.WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.12.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.12.C.CS4	Contribute to project teams to produce original works or solve problems.
TECH.8.1.12.D.CS2	Demonstrate personal responsibility for lifelong learning.

TECH.8.1.12.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.1.12.F.CS2	Plan and manage activities to develop a solution or complete a project.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.

ELA/Literacy & Math Standards

- • Conduct short as well as more sustained research to determine how feedback mechanisms maintain homeostasis. Synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
- • Gather applicable information from multiple reliable sources to support claims that feedback mechanisms maintain homeostasis. Use advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
- • Graph functions expressed symbolically showing the role of cellular division and differentiation in producing and maintaining complex organisms and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
- • Make strategic use of digital media in presentations to enhance understanding of the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
- • Use a mathematical model to illustrate the role of cellular division and differentiation in producing and maintaining complex organisms. Identify important quantities in the role of cellular division and differentiation in producing and maintaining complex organisms and map their relationships using tools. Analyze those relationships mathematically to draw conclusions, reflecting on the results and improving the model if it has not served its purpose.
- English Language Arts/Literacy
- Mathematics

Instructional Strategies, Learning Activities, Levels of Blooms / DOK

- additional help during tutoring/Delsea One
- cancer project
- class discussion
- class notes
- dialysis bag demonstration
- dialysis diffusion and osmosis lab
- onion root tip mitosis microscope lab
- slide presentation
- TED talk
- transpiration virtual lab
- video clips
- webquest

Modifications

ELL Modifications

- Focus on domain specific vocabulary and keywords
- Group students
- K-W-L charts (what I know - what I want to know - what I've learned).
- Provide ELL students with multiple literacy strategies
- Repeat, reword, clarify
- Tap prior knowledge
- Use graphic organizer
- Use real objects when possible

IEP & 504 Modifications

- Focus on domain specific vocabulary and keywords
- modeling and showing lots of examples
- non-verbal redirection of behaviors
- providing study guides that don't lead the student to study too much extraneous information (less unnecessary details)/scaffolded study guides
- rewording questions so that there are not higher level vocabulary within the question (you are testing for understanding of the content not the ability to understand the question)

Gifted and Talented Modifications

- Ask students' higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning.
- Determine where students' interests lie and capitalize on their inquisitiveness. (Is there a specific career they are interested in? How would this apply to their interest?)
- Encourage students to explore concepts in depth and encourage independent studies or investigations
- Evaluation of thesis statements
- Generating and testing hypotheses
- Graph analysis / interpretation
- Journal article analysis

At Risk Modifications

- additional help during tutoring/Delsea One/Academic Enrichment
- hands-on Instruction
- modeling and showing lots of examples
- review, restate, reword directions
- testing modifications
- visuals

Formative Assessment

- exit ticket
- google survey
- Kahoot
- KWL form
- lesson summary
- previous class review
- question of the day
- Think-pair-share

Summative Assessment

- alternative assessment
- benchmark assessment / marking period assessment
- cell election project
- cell membrane quiz
- cell structure quiz
- cell structure test
- membrane transport test

Resources and Materials

- AP Classroom
- Google Classroom
- Membrane Channels Simulation: Students begin by asking questions that arise from demonstrations with aromatic sprays and they will articulate the movement of particles from areas of high concentrations to lower concentrations. The students will then ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information. Students will develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationship between systems or between components of a system using a computer simulation. Students will then communicate scientific and/or technical information or ideas in multiple formats (including orally, graphically, and textually). <https://phet.colorado.edu/en/simulation/membrane-channels>
- Membrane Diffusion: Collaboratively, students will analyze data using tools, technologies, and/or models in order to make valid and reliable scientific claims or determine an optimal design solution.

Students can then work either collaboratively or independently to use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. <https://phet.colorado.edu/en/contributions/view/3593>

- textbook

Technology

- chromebooks
- <https://www.cellsalive.com/>
- internet
- microscopes

TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.12.C	Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.12.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
TECH.8.1.12.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.