

## Unit 2: Cell Structure and Function

### Biology

16 Class Meetings

*Rev. June 2019*

#### Essential Questions

- Why are there different types of cells?
- How do cell structures relate to the survival of the cell and to the survival of living things?

#### Enduring Understandings with Unit Goals

**EU 1:** Fundamental life processes depend on the physical structure of the cell, the basic unit of life.

- Relate organelle structures to the functions of cells of different organisms.

**EU 2:** In a multicellular organism, cells become specialized to perform various tasks related to the overall survival of the organism, and therefore must communicate with one another through chemical messaging.

- Describe the ways the specialized cell structures contribute to the overall function of the cell within an organism.
- Evaluate the role of hormones and other chemicals in intercellular and intracellular communication.

**EU 3:** Cellular boundaries are imperative to maintaining cellular homeostasis

- Compare and contrast the functional differences between cell walls, cell membranes and their functions.

#### Standards

##### Next Generation Science Standards

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

##### Common Core State Standards

- **CCSS.ELA-Literacy.RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

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- **CCSS.ELA-Literacy.RST.9-10.3** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- **CCSS.ELA-Literacy.RST.9-10.4** 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 9-10 texts and topics*.
- **CCSS.ELA-Literacy.RST.9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- **CCSS.ELA-Literacy.RST.9-10.9** Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
- **CCSS.Math.Content.HSN.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- **CCSS.Math.Content.HSA.CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
- **CCSS.Math.Content.HSS.IC.B.6** Evaluate reports based on data.

### MSMHS 21<sup>st</sup> Century Learning Expectations

**Competency 1.** Read and write effectively for a variety of purposes

**Competency 2.** Speak effectively with a variety of audiences in an accountable manner

**Competency 3.** Make decisions and solve problems independently and collaboratively

**Competency 4.** Apply scientific knowledge and concepts to a variety of investigative tasks

**Competency 5.** Contribute to a positive learning environment with respect and responsibility

### Unit Content Overview

- Unit Phenomena (such as overdrinking water)
- Prokaryotic cell structures
- Eukaryotic cellular organelles (structure and function)
- Cell specialization
- Hormones and cell to cell communication
- Structure and function of the cell wall
- Structure and function of the cell membrane
- Fluid mosaic model of the cell membrane
- Hydrophobic versus hydrophilic regions of the phospholipid membrane

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- Active and passive transport of materials across a cell membrane
- Protein channels
- Surface area to volume ratios in regard to cell size and maintaining homeostasis
- Osmosis, diffusion, and dialysis
- Hypotonic, hypertonic, and isotonic solutions in regard to cellular conditions
- Endocytosis versus exocytosis

#### **Interdisciplinary Connections**

- Mathematics-Surface area ratios, comparing concentrations
- Marine Studies- The cellular conditions of salt and freshwater fish to suit their relative environments

#### **Daily Learning Objectives with *TWPS* Activities**

##### **The student will be able to...**

- Design a model that explains the unit phenomena.
  - *Can you die from drinking too much water? Why?*
- Describe components of the Cell Theory including researchers, discoveries and major constructs.
  - *A friend tells you he read somewhere that rotting garbage can turn maggots, which are fly larvae, and the maggots then can grow into adult flies. What part of the cell theory could you use to refute his claim?*
- Compare and contrast eukaryotic and prokaryotic cells.
  - *Compare and contrast eukaryotic and prokaryotic cells.*
- Illustrate cell specialization within multicellular organisms.
  - *Explain the process how a stem cell become specialized?*
- Investigate how cells use electrical and chemical signals to communicate.
  - *How does one cell “talk” to the other?*
- Relate organelle structures to the functions of cells of different organisms.
  - *Think about the most important organelle in the cell. Provide an explanation on why it is the most important.*
- Compare and contrast plant and animal cells.
  - *There has been a mutation in a plant, where the plant cells have started getting replaced with animal cells. Explain if the plant would be able to stand up right.*
- Justify how surface area and volume impact cell size.
  - *Why might unicellular organisms have larger cells multicellular organisms?*
- Demonstrate how cell membranes are selectively permeable.
  - *What will happen to the cornstarch solution during the demonstration? Explain why this will happen.*

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- Examine the effects of concentration gradients on homeostasis in cells.
  - *What exactly is the process that allows cells to regulate and maintain their water content?*
- Predict the effect that tonicity of a solution will have on a cell.
  - *Pickles are made by immersing cucumbers in a concentrated saltwater solution. Describe whether the solution is hypertonic, hypotonic or isotonic. Explain what happens to allow for the solution and pickles to have the same concentration.*
- Identify how active and passive transport allows materials to pass through the cell membrane.
  - *Explain how sodium will move pass a cell membrane through active transport.*
- Construct a model to represent how cell walls and cell membranes maintain cellular homeostasis.
  - *Create a drawing of what the egg in corn syrup looked like. Why did the egg look that way?*

### Instructional Strategies/Differentiated Instruction

- **HLP:** Academically Productive Talk
- **HLP:** Writing to Learn
- **HLP:** Effective Feedback
- Entrance slips/activities
- Lecture with notes
- Close reading with annotations
- Accountable Talk discussions
- Graphic organizers
- Foldable
- Self-assessments
- Homework
- Student reflection
- Think-write-pair-share
- Individual response board
- Card Sort
- Exit slips
- Laboratory exercises
- Guided notes
- Providing students with completed notes and outlines
- Rephrasing information for students
- Student choice
- Strategic grouping

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- Flash cards for vocabulary
- Shortened/modified reading assignments
- Engineering Design Process

### Assessments

#### **FORMATIVE ASSESSMENTS:**

- Osmosis/Diffusion Lab
  - MSMHS Rubric 4: Scientific Research
- Cell Model
  - MSMHS Rubric 3: Problem Solving
- Written homework assignments
- Accountable Talk Discussion
- Daily Think-Write-Pair-Share (TWPS)
- Entrance and exit slips
- Surface Area to volume ratio investigation and problems

#### **SUMMATIVE ASSESSMENTS:**

- Quiz on EU 1
- Osmosis/Diffusion Lab
- Quiz on EU 2
- Cell Model
- Unit Test

### Unit Task

**Unit Task Name:** Osmosis/Diffusion – Egg Lab

**Description:** Students will evaluate the processes of osmosis and diffusion of a cellular membrane by witnessing and recording results of the transformation of an egg (EU 1, EU 2). Students will conduct an experiment using a raw egg to simulate the processes of diffusion and osmosis by exposing the egg to hypertonic, hypotonic and isotonic solutions. Each day students will record results on the gain/loss of the egg's mass. Students will write a lab report based on the school-wide rubric.

**Evaluation:** MSMHS Rubric 4: Scientific Research

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#### **Unit Resources**

- Lab materials
- Internet databases
- POGIL: Prokaryotes and Eukaryotes
- POGIL: Organelles in Eukaryotes
- POGIL: Cell Size
- POGIL: Membrane Structure and Function
- POGIL: Transport in Cells
- Science Takeout: Stem Cells
- Science Takeout: Cell Communication
- Laptops