

UNIT OVERVIEW

FROM CELLS TO ORGANISMS

Unit Issue: Public health, preventing the spread and the treatment of infectious diseases.

Anchoring Phenomenon: Organisms as different as humans, plants, and many of the microorganisms that make people sick are all made of cells.

Listed below is a summary of the activities in this unit. Note that the total teaching time is listed as 21–30 periods of approximately 45–50 minutes (approximately 5–6 weeks). If there is insufficient time to complete this unit, consider skipping Activity 10.

| Activity Description | Topics | Advance Preparation | Assessment | Teaching Periods |
|---|--|--|-------------------------------|------------------|
| <p>1. Investigation: Disease Outbreak Students model the spread of an infectious disease by simulating participation in various activities that could expose them to infectious agents. They use a model disease indicator to find out if they were infected. Based on the results, the class discusses how infectious diseases are spread, laying a foundation for further analysis of the cause and transmission of the disease.</p> | evidence, trade-offs, infectious | Determine time-line for the different parts of the activity; prepare Student Sheets; set up different Places and Action dropper bottles. Submit certificate to order <i>Elodea</i> required later in the unit. | AID A1 E&T QUICK CHECK A2b | 2–3 |
| <p>2. View and Reflect: An Invisible Organism Students watch a segment of the video, <i>A Science Odyssey: "Matters of Life and Death,"</i> which focuses on the bubonic plague epidemic in San Francisco in the early 1900s. This story introduces the role of microbes in spreading infectious diseases and the cellular nature of living organisms.</p> | evidence, trade-offs, vector LITERACY | Obtain and preview video. | E&T A3 | 1 |
| <p>3. Laboratory: Evidence of Microscopic Organisms Students learn how to use a microscope and how to draw their observations. They use their observations to gather evidence that there are living organisms that cannot be seen with just the human eye. Their observations of these single-celled organisms will be used to develop the idea that all living things are made of cells.</p> | microbe | Prepare Student Sheets; gather microscopes; set up microscope video camera (optional); prepare/obtain any additional slides (optional); develop a microscope performance assessment (optional). | PCI Proc. QUICK CHECK | 2–3 |
| <p>4. Reading: The History of Cell Theory Students read about the history of the scientific discoveries leading to cell theory. Students learn that individual cells are the building blocks that make up multicellular bodies. They identify the contributions of scientists to both science and technology.</p> | cell, cell theory, germ theory of disease, microbe, multicellular, unicellular LITERACY | Prepare Student Sheet. | EXP A1 | 1–2 |

FROM CELLS TO ORGANISMS (continued)

| Activity Description | Topics | Advance Preparation | Assessment | Teaching Periods |
|--|---|--|---|------------------|
| <p>5. Laboratory: Cells Alive! Students explore the idea that cells are alive and perform life functions (e.g., respiration). Students use yeast, a single-celled organism, to investigate the ability of cells to respire.</p> | cell, cellular respiration, energy, indicator, matter, microbe, multicellular, unicellular | Obtain packets of fresh active dry yeast; prepare yeast solution; prepare clay suspension; test tap water with BTB. | ODA Proc. AID A5 | 2 |
| <p>6. Reading: Parts of a Cell A reading elaborates on the basic structures common to all cells. The roles of the cell membrane, cytoplasm, and nucleus are emphasized. Students read about how the cell structures of the various microbes examined in the “Evidence of Microscopic Organisms” activity are used to classify these organisms.</p> | bacteria, cell, cellular respiration, function, organelles (cell membrane, cell wall, chloroplast, cytoplasm, mitochondria, nuclear membrane, nucleus), protist, structure, virus LITERACY | Prepare Student Sheets. | MOD A3 | 1–2 |
| <p>7. Investigation: Investigating the Cell Membrane Students investigate the function of the cell membrane by evaluating the ability of particles to pass through the plastic membrane of a sandwich bag. They will use the reaction between starch and Lugol’s solution as evidence of the movement of some particles across the cell membrane. The class discusses how cell permeability relates to cell function.</p> | cell, cell membrane, cytoplasm, function, model, structure | Set up control and demonstration cups; de-shell eggs (optional). | ODA Proc. AID A3 | 1–2 |
| <p>8. Modeling: Modeling Cell Structure and Function Students use an interactive computer animation to review what they have learned about the structure and function of cells and to compare animal and plant cells. Students then construct, present, and are assessed on a physical model of a plant or animal cell.</p> | cell, model, organelles (cell membrane, cell wall, chloroplast, cytoplasm, genetic material, mitochondria, nuclear membrane, nucleus) | Make sure students have access to computers with internet; obtain materials to make cell models. | MOD Proc. 5 (Summative Assessment) | 2 |
| <p>9. Laboratory: Observing Multicellular Organisms Students view prepared slides of multicellular organisms and prepare a slide of onion tissue. They compare the cells of multicellular organisms to the unicellular organisms they observed in the “Evidence of Microscopic Organisms” activity. They will use their observations as the basis of understanding cells, tissues, and other levels of multicellular organization in the next activity.</p> | cell, cell membrane, chloroplast, cytoplasm, multicellular, nucleus, unicellular | Prepare Student Sheet; gather microscopes; obtain and prepare onion for slide making; set up microscope video camera (optional). | PCI Proc. QUICK CHECK EXP A3 (Summative Assessment) | 2 |

FROM CELLS TO ORGANISMS (continued)

| Activity Description | Topics | Advance Preparation | Assessment | Teaching Periods |
|---|---|--|---|------------------|
| <p>10. Reading: Cells, Tissues, and Organs Students further investigate levels of biological organization. A short reading provides additional information on levels of organization in multicellular organisms.</p> | <p>cell, levels of organization, organ, organ system, tissue</p> <p>LITERACY</p> | | EXP A4 | 1 |
| <p>11. Modeling: Energy and Matter in Cells Students use physical models to explore the breakdown of food during digestion and the use of the resulting subunits as building blocks for human proteins or for generating usable energy. They then create drawn models to represent the use of food as a source for matter and energy.</p> | <p>carbohydrates, cell, cellular respiration, digestion, energy, fats, matter, multicellular, proteins</p> <p>LITERACY</p> | Prepare Student Sheets. | <p>MOD A4 (Summative Assessment)</p> <p>EXP A5</p> | 1–2 |
| <p>12. Laboratory: The Cells of Plants Students investigate plant-specific cellular structures through microscopy. By comparing photosynthetic and nonphotosynthetic cells, they will identify structures required for photosynthesis. Students will also explore the structure–function relationship between plant-specific structures and photosynthesis.</p> | <p>cell, cell wall, chloroplast, energy</p> | Prepare Student Sheet; obtain additional living plant materials (such as spinach and onion) to make slides; set up microscope video camera (optional). | EXP A4 | 1–2 |
| <p>13. Laboratory: A Plant’s Source of Energy Students collect evidence for photosynthesis by examining the aquatic plant <i>Elodea</i>. They first perform an investigation to observe the uptake of carbon dioxide by the plant as one indicator that photosynthesis is taking place. Students then design an experiment to investigate the role of light in photosynthesis.</p> | <p>cell, cellular respiration, chloroplasts, energy, photosynthesis</p> | Order and prepare <i>Elodea</i> ; prepare Student Sheet; determine light source(s). | <p>PCI Proc.</p> <p>EXP A7 (Summative Assessment)</p> | 2–3 |
| <p>14. View and Reflect: Fighting Disease The discovery of the first antibiotic and the problems encountered in testing and producing this “miracle drug” are investigated. Students view a video segment containing historic footage and photographs that help explain how infectious diseases first came to be treated.</p> | <p>antibiotic, bacteria, cell, evidence, microbe, scientific method</p> | Prepare Student Sheet; obtain and preview video. | | 1 |
| <p>15. Investigation: Disease Detectives Students assume the role of epidemiologists as they read information about patients. They investigate microbes that might be the infectious agents and hypothesize which microbe is causing the disease. As new evidence comes to light, they evaluate their hypotheses.</p> | <p>bacteria, cell, epidemiologist, evidence, hypothesis, infectious agent, microbe, protist, trade-offs</p> <p>LITERACY</p> | Prepare Student Sheet. | E&T A3 | 1–2 |