KEY CONCEPTS: cell, microorganism, paramecium, cilia, cell wall, macronucleus, food vacuoles, contractile vacuoles

NEXT GENERATION SCIENCE STANDARDS (NGSS)

MIDDLE SCHOOL:

1. **MS-LS1-1:** Students who demonstrate understanding can conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
2. **MS-LS1-2:** Students who demonstrate understanding can develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
3. **MS-LS1-3:** Students who demonstrate understanding can use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

HIGH SCHOOL: *This activity may be used as a foundational exercise to support the following standards.*

1. **HS-LS1-2:** Students who demonstrate understanding can develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
2. **HS-LS1-4:** Students who demonstrate understanding can use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
3. **HS-LS1-6:** Students who demonstrate understanding can 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.

AP BIOLOGY LEARNING OBJECTIVES

1.2 ELEMENTS OF LIFE

- **ENE-1.A** Describe the composition of macromolecules required by living organisms.

2.1 CELL STRUCTURE: SUBCELLULAR COMPONENTS

- **SYI-1.D** Describe the structure and/or function of subcellular components and organelles.

2.2 CELL STRUCTURE AND FUNCTION

- **SYI-1E** Explain how subcellular components and organelles contribute to the function of the cell.

AP BIOLOGY SCIENCE PRACTICES

Students will use practices 1 (Explain biological concepts, processes, and models presented in written format) and 2 (Analyze visual representations of biological concepts and processes) in their entirety in these activities. Students will also use practice 3.D (Make observations, or collect data from representations of laboratory setups or results) and 6.C (Support a claim with evidence from biological principles, concepts, processes, and/or data) in these activities.