




**Microorganisms**

**STANDARD V:** Students will understand that microorganisms range from simple to complex, are found almost everywhere, and are both helpful and harmful.

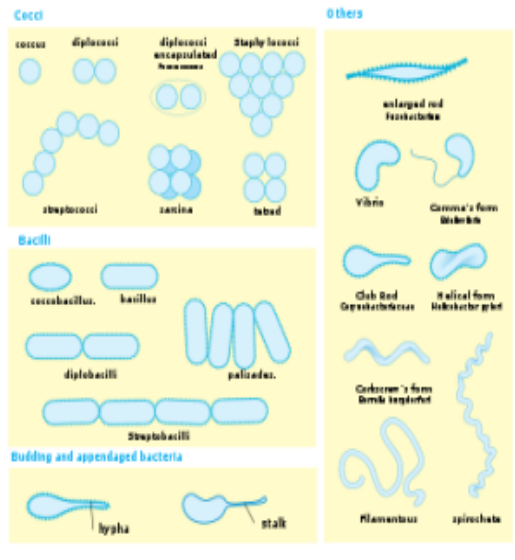
**Objective 1:** Observe and summarize information about microorganisms.

- a. Examine and illustrate size, shape, and structure of organisms found in an environment such as pond water.
- b. Compare characteristics common in observed organisms (e.g., color, movement, appendages, shape) and infer their function (e.g., green color found in organisms that are producers, appendages help movement).
- c. Research and report on a microorganism's requirements (i.e., food, water, air, waste disposal, temperature of environment, reproduction).

# Objective 1.a: Organism, size, shape, structure

Organism	Size	Shapes & Color	Structure
Algae	Size ranges from size of bacteria (0.5 $\mu\text{m}$ ) to over 50 m long (1 $\mu\text{m}$ = 1/25,000th inch; 1 m = 39 inches)	Various	


# Objective 1.a: Organism, size, shape, structure

Organism	Size	Shapes & Color	Structure
Bacteria	Size ranges from 0.2-2 microns in width or diameter, and up to 1-10 microns in length	Various - most common: <ol style="list-style-type: none"> <li>1. Coccus - round</li> <li>2. Rod-shaped</li> <li>3. Spiral-shaped</li> </ol>	

# Objective 1.a: Organism, size, shape, structure

Organism	Size	Shapes & Color	Structure
Fungi	Various from one-celled to large mushrooms	Various	

# Objective 1.a: Organism, size, shape, structure

Organism	Size	Shapes & Color	Structure
Protozoa	Various from one-celled to large mushrooms	Various	 <p>Trypanosoms Eualena Lexitaria Trichomonas Dittulgia Textularia Achlieophrys Coleps Stentor vorticella</p>

## Objective 1.b: Common characteristics

Microorganism	Color	Movement	Appendages	Functions
Algae	Various: Green - photosynthesis (producers)	Floating; Whip-like action; "Swimming"	1. Flagella (whip) 2. Cilia (tiny hairs)	1. Whip-like movement 2. "Swimming" and floating on currents
Bacteria	Various: Green - photosynthesis (producers)	Same as algae	Same as algae	Same as algae
Fungi	Various: Mostly consumers (Saprophytes)	Mostly immobile (Yeast, mold, mushrooms)	Stalks	Help with reproduction
Protozoa	Various: Green - photosynthesis (producers)	Floating; Whip-like action; "Swimming"	1. Flagella (whip) 2. Cilia (tiny hairs) 3. Pseudopods (false feet)	1. Whip-like movement 2. "Swimming" and floating on currents 3. Inching along

## Objective 1.c: Microorganism's requirement

Microorganism	Food, Water, Air	Waste Disposal	Environment & Temperature	Reproduction
Algae	Food-producers and consumers Water-fresh and salt water Air-required; oxygen filtered from water	Secrete waste across cell membranes	Found in all temperature extremes 1. Salt water 2. Fresh water 3. Damp places on land	Sexual & Asexual: 1. using little spores 2. growing copies of themselves from buds 3. broken-off fragments
Bacteria	Food-producers and consumers Water-fresh and salt water Air-required; oxygen filtered from water	Secrete waste across cell membranes	Found in all temperature extremes and every place on earth	Sexual & Asexual: 1. using little spores 2. Conjugation (with other bacteria) 3. growing copies of themselves from buds



## Objective 1.c: Microorganism's requirement

Microorganism	Food, Water, Air	Waste Disposal	Environment Temperature	Reproduction
Fungi	Consumers: Mostly saprophytes and decomposers	Do not ingest material. They absorb only what they need; no waste is produced.	Fungi can be found in moist warm places. They will grow almost anywhere from your feet (athletes foot) to forest (mushrooms).	Sexual & Asexual: 1. using little spores 2. growing copies of themselves from buds 3. broken-off fragments
Protozoa	Food-producers and consumers Water-fresh and salt water Air-required; oxygen filtered from water	Must be in liquid to be active Can survive dry conditions by sealing themselves up	Found in all moist places and temperature extremes	Sexual & Asexual: 1. binary fission (splitting in half-asexual) 2. multiple fission (splitting in many pieces-asexual) 3. Conjugation (sexual)



## STD V, Obj. 1 Suggested Applications

### COMPLETE A CONTENT FRAME.

- Have students do a web quest using World Book or similar sites, AND/OR
- Use video such as YouTube "Pond water", AND/OR  
<http://www.youtube.com/watch?v=I3Q57vmIvyM&feature=related>
- Set up microscopes with pond water

### REVISION ACTIVITY

- Microorganisms cards BINGO using key words from standard

**RESOURCES:** Content Frame sheet; Word cards

### ASSOCIATED ILOs

1. Use Science Process and Thinking Skills  
a, b, d,
2. Manifest Scientific Attitudes and Interests  
a,
3. Understand Science Concepts and Principles  
a, b, c
4. Communicate Effectively Using Science Language and Reasoning  
a, b, c, d
6. Understand the Nature of Science  
a, b, c

**STANDARD V: Students will understand that microorganisms range from simple to complex, are found almost everywhere, and are both helpful and harmful.**

**Objective 2:** Demonstrate the skills needed to plan and conduct an experiment to determine a microorganism's requirements in a specific environment.

- a. Formulate a question about microorganisms that can be answered with a student experiment.
- b. Develop a hypothesis for a question about microorganisms based on observations and prior knowledge.
- c. Plan and carry out an investigation on microorganisms. {Note: Teacher must examine plans and procedures to assure the safety of students; for additional information, you may wish to read microbe safety information on Utah Science Home Page.}
- d. Display results in an appropriate format (e.g., graphs, tables, diagrams).
- e. Prepare a written summary or conclusion to describe the results in terms of the hypothesis for the investigation on microorganisms.



## STD V, Obj. 2 Suggested Applications

### CONDUCT A "Moldy Bread" EXPERIMENT or design your own

- Formulate a question about how bread gets moldy
- Develop a hypothesis about moldy bread based on observations and prior knowledge.
- Plan and carry out an investigation by changing variables like different kinds of bread in different locations, temperature, amounts of water, etc. {Note: Safety first!}
- Display results in an appropriate format (e.g., graphs, tables, diagrams).
- Prepare a written summary or conclusion to describe the results in terms of the hypothesis for the investigation on moldy bread.

### RESOURCE: Lab Sheet

### ASSOCIATED ILOs:

1. Use Science Process and Thinking Skills  
a, b, c, d, f, g, h, i
2. Manifest Scientific Attitudes and Interests  
a, c, d, e, f
3. Understand Science Concepts and Principles  
a, b, c
4. Communicate Effectively Using Science Language and Reasoning  
a, b, c, d, e
6. Understand the Nature of Science  
a, b, c

**STANDARD V: Students will understand that microorganisms range from simple to complex, are found almost everywhere, and are both helpful and harmful.**

**Objective 3:** Identify positive and negative effects of microorganisms and how science has developed positive uses for some microorganisms and overcome the negative effects of others.

1. Describe in writing how microorganisms serve as decomposers in the environment.
2. Identify how microorganisms are used as food or in the production of food (e.g., yeast helps bread rise, fungi flavor cheese, algae are used in ice cream, bacteria are used to make cheese and yogurt).
3. Identify helpful uses of microorganisms (e.g., clean up oil spills, purify water, digest food in digestive tract, antibiotics) and the role of science in the development of understanding that led to positive uses (i.e., Pasteur established the existence, growth, and control of bacteria; Fleming isolated and developed penicillin).
4. Relate several diseases caused by microorganisms to the organism causing the disease (e.g., athlete's foot -fungi, streptococcus throat -bacteria, giardia - protozoa).
5. Observe and report on microorganisms' harmful effects on food (e.g., causes fruits and vegetables to rot, destroys food bearing plants, makes milk sour).



## STD V, Obj. 3 Suggested Applications

- a. *Main Idea/Detail Note Frame*
- b. *One Sentence Summary Frame*
- c. *Problem Solution Frame*
- d. *Concept Mapping Frame*
- e. *Spool Writing Template*

**RESOURCE:** *Main Idea/Detail Note Frame; One Sentence Summary Frame; Problem Solution Frame; Concept Mapping Frame; Spool Writing Template*

### **ASSOCIATED ILOs:**

- 1. Use Science Process and Thinking Skills  
b, d, i
- 2. Manifest Scientific Attitudes and Interests  
a, b, c, d, e, f
- 3. Understand Science Concepts and Principles  
a, b, c
- 4. Communicate Effectively Using Science Language and Reasoning  
a, b, c, d, e
- 5. Demonstrate Awareness of Social and Historical Aspects of Science  
a, b
- 6. Understand the Nature of Science  
a, b, c