

SCIENCE 1003

Microbiology

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IV. OTHER MICROORGANISMS

You have learned how God has provided great diversity in the protozoa and algae. In addition to these plants and animals, several more groups of microorganisms are worthy of study. The *fungi* comprise a group of diverse plants which range from mushrooms to tiny yeasts and molds. Colonies of molds and yeasts can be seen with the unaided eye, but their detailed structures require some magnifications. A number of plant pathogens belong to this group of fungi, but a few plants (such as some fir trees and orchids) require a particular fungi around their roots in order to grow properly. While the fungi absorb certain minerals from the soil and pass them on to the tree, the

tree is providing food for the fungi.

The smallest organisms are the *rickettsias* and *viruses*. The rickettsias can be seen with the very best light microscopes, but detailed studies require electron microscopy. The largest viruses, such as the smallpox virus, are the only ones scarcely within the range of the best optical microscopes. All other viruses require electron microscopy.

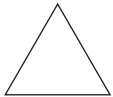
In this section you will study some of the general features of the fungi, bacteria, viruses, and rickettsias. You will learn how these play an important role in man's life.

SECTION OBJECTIVES

Read these objectives. When you have completed this section, you should be able:

12. To learn and to write some Scripture concerning the Lord as Creator.
13. To collect, to describe, and to identify some common fungi.
14. To discuss the economic importance of fungi to man.
15. To survey the major characteristics of bacteria, rickettsias, and viruses.

VOCABULARY



Study these words to enhance your learning success in this section.

aerobic organisms	hypha	sporangiophore
anaerobic organisms	motile	sporangium
conidiophore	mycelium	vector
conidium	nonmotile	virion
fungus (plural, fungi)	saprophyte	

THE FUNGI

Fungi are plants that lack chlorophyll. They are either **saprophytes** or parasites. *Saprophytes* obtain their food from nonliving organic material. *Parasites* obtain their food from living hosts. Some parasites are harmful to humans, animals, and plants. The fungi include many larger species such as the mushrooms and truffles. In this section you will study molds, yeasts, and mildews. Besides those fungi mentioned here, thousands of other fungi are plant pathogens. Fungi lack characteristic plant parts such as stems, roots, and leaves.

Structurally, molds consist of a threadlike

filament called a **hypha**. Hyphae occur in masses called **mycelium**.

Molds reproduce by spores. A fertile hypha that bears spores is a **conidiophore**. The spores are conidia (singular, **conidium**). If the spores are borne in a saclike structure, the sac structure is a **sporangium**. In this case the fertile hypha would be a **sporangiophore**.

Unless you live in an area where molds are troublesome, you may have completely overlooked them. In the following exercise, you will collect and grow some fungi and examine them under the microscope.

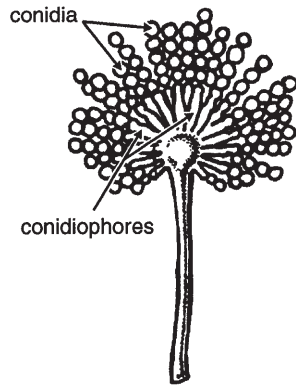


Figure 8: *Aspergillus*

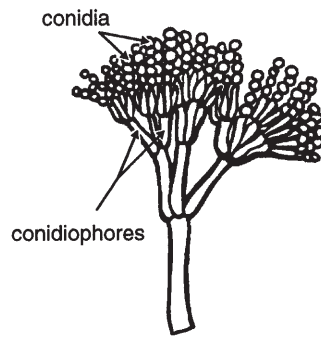


Figure 9: *Penicillium*

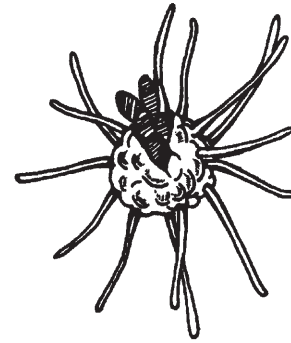


Figure 10: Mildews

Examine some fungi by collecting some molds, mildews, and yeasts.

These materials are needed:

- magnifier, tripod 10X
- microscope
- two slides
- two coverslips
- dropper
- forceps
- Roquefort cheese
- Camembert cheese
- plastic cup (disposable)
- tablespoon
- needle
- bakers' yeast
- sugar
- water
- methylene blue (stain)

(Keep cheeses refrigerated until 4-6 hours before use. This will allow the cheese to soften and ripen a little more.)

- molds on jellies, fruits, and breads. (**Do not collect mold on seeds,** for they contain the molds of *Aspergillus* and are often poisonous.)
- mildews from the leaves of roses, lilacs, willow trees, and the leaves of various cereal grains. (**Do not collect the actual grain.**)



Follow these directions. Check the boxes as you complete each step.



1. Mix a packet of yeast with two cups of warm water and a tablespoon of sugar. Let the mixture stand about five minutes until it gets foamy.



2. Place a drop of the yeast solution on a slide. Add a drop of stain.



3. Focus the slide on low power, then switch to high power. You can observe the yeasts budding. *Budding* is a type of asexual reproduction in which the cell wall of a yeast cell pushes outward. As the bud constricts, it is pinched off by the force. The bud may remain attached for a while.



4. Look carefully for evidence of bubbles of carbon dioxide as the yeasts consume sugar and give off carbon dioxide. The bubbles of carbon dioxide appear as extremely tiny bubbles. Occasionally the little bubbles will combine into a large bubble. (The CO₂ makes bread rise.)



5. Sketch some cells and label the bubbles of CO₂ and the buds.



6. Observe the mold on Camembert cheese. It generally looks like white masses as the cheese ripens (ages). The white mass is *mycelium*. With a needle, scratch a fragment of the mold loose from the cheese. This fragment may be observed with a strong magnifying glass. *Penicillium camemberti* (Figure 9) gives this cheese its distinctive flavor. Sketch and label the white mycelium.



7. Observe the Roquefort cheese. Take a needle and carefully scratch a blue area from the cheese. Place it on a slide and add a drop of water. You may see just the spores of the mold, which will appear as tiny blue-green circles. Blue cheese is flavored by the presence of *Penicillium roqueforti* (Figure 9). Roquefort cheese gets its unusual flavor primarily from this mold. Sketch your observations, and label your drawing.

- 8. Observe mildew (Figure 10) on leaves with a magnifying glass or binocular microscope. Try to scratch off a fragment of the mildew and place it in a drop of water. Use a clean slide and coverslip. The mildews are very difficult to observe under the microscope. Some skill is required to get the material off the leaf. Sketch your observations, and label your drawing.

- 9. Observe mold from fruit or jelly. The green molds of *Aspergillus* and *Penicillium* are usually found on jellies and jams and bruised fruit. Use the tweezers to pick up a section of the mold and place a tiny amount on the slide. Observe with low power. Sometimes these cultures can best be seen with a magnifying glass or binocular microscope. Sketch your observations, and label your drawings.

- 10. In each of the drawings you have made, write a label as to the source of the culture. For example, *Source: jelly*.

Molds are important in the flavoring and aging of cheese. The flavor of Roquefort and Camembert cheese owe their distinctive flavor to molds belonging to the genus *Penicillium*. Certain strains of *Penicillium chrysogenum* and *Penicillium notatum* produce the antibiotic *penicillin*. Note the spellings of the genus *Penicillium* and of the antibiotic *penicillin*.

The molds of *Penicillium* and *Aspergillus* are soil organisms. These genera are important in the production of antibiotics and of

organic acids. Large quantities of citric acid are produced from *Aspergillus niger*. Several enzymes are produced by *Penicillium* and *Aspergillus*. These enzymes are purified and used in various industrial compounds and in medicine.

Because some molds contain toxins, care should be taken to store food where it is cool enough to stop mold growth. Also, moldy food should be destroyed or the moldy portion removed before eating.