Investigations for Chapter 6
Cell Structures and Their Functions

Investigation 6A ◆ Cell Structure

In this investigation, you will examine some cells from unicellular and multicellular organisms. By comparing selected cell preparations, you will be able to identify different cell structures and propose explanations for their functions.

Materials (per team of 2)
2 pairs of safety goggles
2 lab aprons
coverslip

at one edge of the coverslip. The paper will act as a wick, pulling the salt solution across the slide and into contact with the cells. Continue observing the cells until the cytosol appears to pull away from the cell walls. The boundary of the cytosol is the plasma membrane.

7. Obtain a prepared slide of Gram-stained bacteria. The slide has three sections, each of which contains a different species of bacteria. Examine each section with the low-power objective and then the high-power. Sketch in your logbook a few bacteria of each species under high power. Note the color and shape of each species. Estimate and record the cell sizes.
8. Obtain a prepared slide containing human and frog blood. Examine each blood sample under low power, then high. Find a field where the cells are separate and distinct, and sketch a few cells of each type under high power. Estimate and record the cell sizes.
9. Obtain a prepared slide containing plant and animal cells. Examine the plant and animal cells under low power, then high. Find a field where the cells are separate and distinct, and sketch a few cells of each type under high power. Estimate and record the cell sizes.
10. Obtain a prepared slide of paramecia. Examine the cells under low power, then high. Find a field where the cells are separate and distinct, and sketch a few under high power. Estimate and record cell sizes. Paramecia are mobile organisms. Try to identify cell structures that play a role in locomotion.
11. Wash your hands before leaving the laboratory.

Analysis

1. Are the plasma membranes of plant cells difficult to see? Explain your answer.
2. Did the Lugol's iodine solution aid in your observation of cells? Why do biologists use stains to study cells?
3. What is the significance of the observation that some bacteria stain purple with Gram's stain and others stain red?
4. What differences did you observe between the human and frog blood samples? Do these observations suggest that humans and frogs have different ways of maintaining their blood cells?
5. Construct a summary table comparing the common organelles of plant and animal cells. What parts of the plant cell were not present in the animal cell? What are the functions of these plant-specific cell structures?
6. What cell structures are used by the paramecia for locomotion? Are there similar structures in any human cells, and if so, what might be their functions?

Investigation 6B ◆ From One Cell to Many

Single-celled organisms come in many different shapes and sizes. Despite their varied appearance, these organisms all must carry out certain essential life processes. To that end, they have evolved specific cell structures to meet each of those needs. Among multicellular organisms, some protists are colonial, where each member of the colony is nearly identical to the next. A true multicellular organism, such as a plant or an animal, requires that cells exhibit a division of labor.

In this investigation, with the aim of identifying the life processes that all cells share, you first will observe microorganisms found in pond water. Next, you will examine prepared slides of various mammalian tissue types. Your task is to observe them carefully and, based on their appearance, form a hypothesis as to which life process that cell type contributes.

Materials (per team of 2)
2 pairs of safety goggles
2 lab aprons
coverslip
dropping pipet
microscope slide
compound microscope
key to pond-water organisms
pond-water culture
Detain™ in dropping bottle (slowing agent)
prepared slide A
prepared slide B
prepared slide C
prepared slide D
prepared slide E

SAFETY Put on your safety goggles and lab apron. Tie back long hair.

Procedure

1. Place 1 or 2 drops of the pond-water culture on a microscope slide, add a coverslip, and examine under low power with your microscope.
2. Try making observations through the high-power lens, keeping in mind that most of the organisms are transparent or almost transparent. Decrease the amount of light by adjusting the diaphragm. Many of the organisms move rapidly and are hard to find under high power. The coverslip will slow some of them, but you can also add a drop of Detain™, a slowing agent.
3. Use the key to pond-water organisms to identify some of the organisms. Roundworms, daphnia, cyclops, rotifers, and immature forms (larvae) of insects are among the multicellular creatures that could be in your pond water. In your logbook, list as many life processes shared by the microorganisms as you can. For each process in your list, describe a tissue or cell type in a human that is involved in performing that function.
4. The five prepared slides are all from mammals and are associated with the functions of reproduction, movement, protection, food storage, and sensory communication. Obtain prepared slide A, and observe first under low power, then high. Sketch a few cells under high power.
5. Obtain prepared slides B through E in turn, and observe each under low power, then high. For each slide, sketch a few distinct cells under high power.
6. Use your observations to match each of the five prepared slides with one of the five functions: reproduction, movement, protection, food storage, and sensory communication.

Analysis

1. How many different organisms did you observe in the pond water? Describe some of the differences among them.
2. What limits the size of single-celled organisms?
3. At the genetic level, how does a lung cell differ from a brain cell?
4. Which prepared slides correspond to which functions? Explain your answers.
5. List other functions carried out by single-celled organisms and the cell types that correspond to them in multicellular organisms.

Investigations for Chapter 7

Transport Systems

Investigation 7A ◆ Water Movement in Plants

The normal pathway of moving water in a living plant is first into the roots, then through the stem, and finally into the leaves. Environmental influences, the chemical properties of water, and structures in the plant are involved in the movement. This laboratory investigation deals with the following questions:

1. What plant structures—roots, stems, or leaves—are most important in the movement of water?
2. What are the types of cells that transport water in a plant? What are their characteristics?
3. Is all the water that is delivered to the leaves used, or is some lost?
4. How would you describe the source and direction of the force that moves water upward in a plant, against the force of gravity?

Hypothesis: Before beginning the investigation, read the procedure for Part A. Write a prediction that describes what you think will happen to each test tube.

Materials (per team of 3)
3 pairs of safety goggles
6 18-mm × 150-mm test tubes
test-tube rack
glass-marking pencil
heavy-duty aluminum foil
scalpel
petroleum jelly
cotton swab
compound microscope
prepared slide of woody-stem cross section
prepared slide of leaf cross section