

SCOPE, SEQUENCE, and COORDINATION

A National Curriculum Project for High School Science Education

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Student Materials

Learning Sequence Item:

1054

Cellular Organelles

January 1997

Adapted by: Godrej Sethna

Cell Structures That Underlie Cell Functions. Students should examine and compare the organelles of the cell needed for secretion, digestion, synthesis, storage, and cell movement (*Biology, A Framework for High School Science Education, p. 86*).

Contents

Matrix

Suggested Sequence of Events

Lab Activities

1. Pea Soup
2. Beet Slice
3. The Locomotion
4. A Closer Look

Readings

Science as Inquiry

Pea Soup**What's in a cell?****Overview:**

An experienced cook can break an egg and separate the yolk from the egg white without damaging the yolk. In this activity you will “break” plant cells and separate some of the parts so that they remain intact.

Procedure:

Filter the cell extract provided through 3–4 layers of cheesecloth. Centrifuge the resulting liquid for 10 minutes at 400 rpm. Separate and save the solid (Pellet 1). Centrifuge the liquid (supernatant) from the first spinning for 10 minutes at 1500 rpm. Again separate and save the solid (Pellet 2). Finally, centrifuge the liquid from the second spinning for 15 minutes at 10,000 rpm. Separate and save both the solid (Pellet 3) and liquid (final supernatant) portions.

Prepare two slides of each of the four fractions that were obtained. Add one drop of Lugol's iodine to one set of slides and one drop of methylene blue to the other set. Examine each slide under a microscope using 100×–400× magnification. Record your observations using diagrams.

Questions:

1. What were the colors of the three pellets?
2. How can the differences in color be explained?
3. How do slides 1–4 compare with slides 5–8 as examined under a microscope?
4. What type of material would you expect to find if the original cell extract were centrifuged for 20 minutes at 20,000 rpm?
5. What type of material would you expect to find if the final supernatant were centrifuged for 20 minutes at 20,000 rpm?

Science as Inquiry

Beet Slice**What's red in red beets?****Overview:**

Ever wondered what gives a beet its red color? Here's an opportunity to find out.

Procedure:

Carefully cut a thin slice of beet. Place the slice on a microscope slide, add a drop of water, and cover with a coverslip. Examine the slide with a microscope, first with low power and then with high power. Record your observations using diagrams.

Now very carefully cut a piece of beet to measure $3\text{ mm} \times 5\text{ mm} \times 3\text{ mm}$. Place it in a dish and add 3 mL of sucrose solution. Using a sharp blade, chop the beet piece for 15 minutes. Take turns doing the chopping. Examine a drop of the liquid under $400\times$ magnification. Record your observations using diagrams.

Questions:

1. What did you observe in the first slide?
2. What did you observe in the second slide?
3. What differences did you notice between the two?
4. What changes in the above procedure would be necessary if you were given a bleached or albino beet?

Science as Inquiry

The Locomotion**Watch them swim!****Overview:**

A swimmer moves through water using a variety of “strokes” depending on which appendage or combination of appendages are used. In this activity you will look at some microscopic organisms, observing how they move in liquid and which parts of the cell are used in movement.

Procedure:

Place a drop of one of the cultures on a clean slide. Carefully place one edge of a coverslip on the slide and slowly lower the coverslip to enclose the drop. Observe the culture under the microscope, first with low power and then with high power. Record your observations using diagrams.

Repeat the process for each culture, recording your observations.

Questions:

1. What did you observe?
2. What would you see if you were to observe a flagellum of a moving organism in “slow motion”? Use a series of diagrams.
3. How is the leg of a swimmer like a flagellum?
4. How are cilia different from flagella?
5. How are cilia like flagella?

Science and Technology

A Closer Look**Using an electron microscope****Overview:**

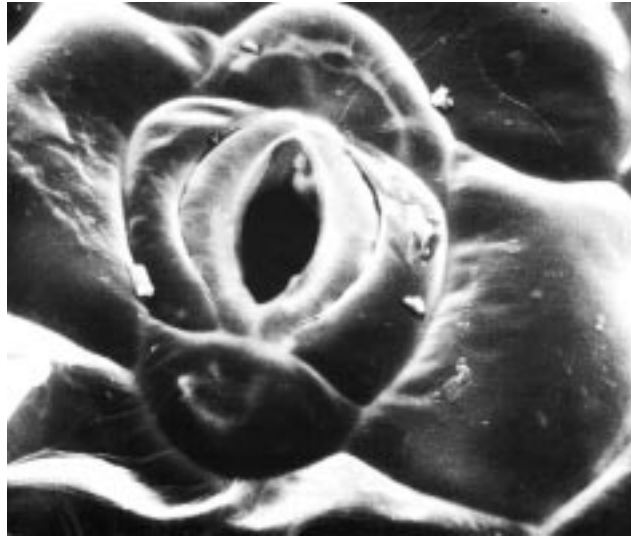
A microscope of the type that you use in your science class is called a *light microscope*. Unlike a light microscope, an *electron microscope* uses a beam of electrons to illuminate the object. In this activity you will examine photographs, called electron micrographs, taken with a scanning electron microscope (SEM).

Procedure:

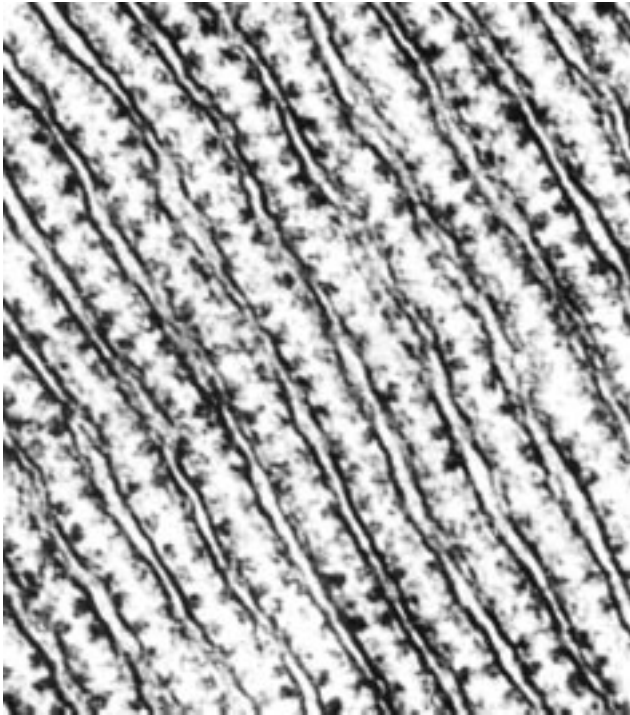
Examine the photographs of cell parts included on the following pages and record your observations.

Questions:

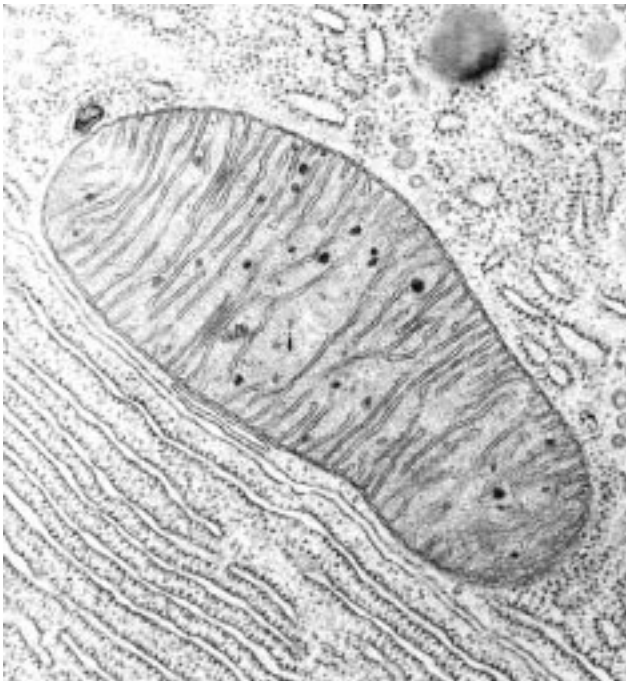
1. What did you observe?
2. How are these photographs different from pictures obtained with a light microscope?



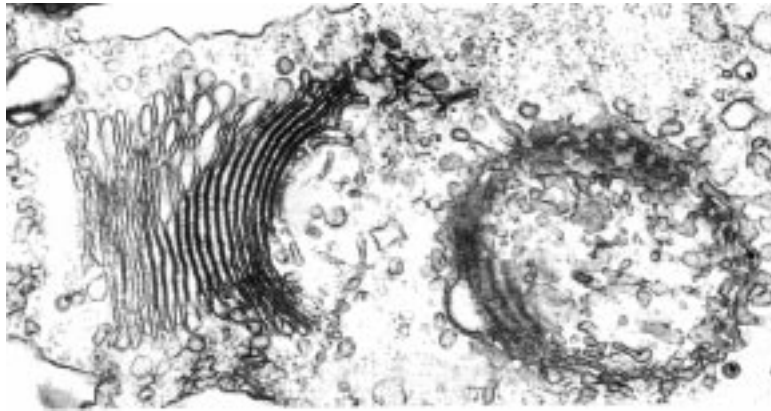
Stoma



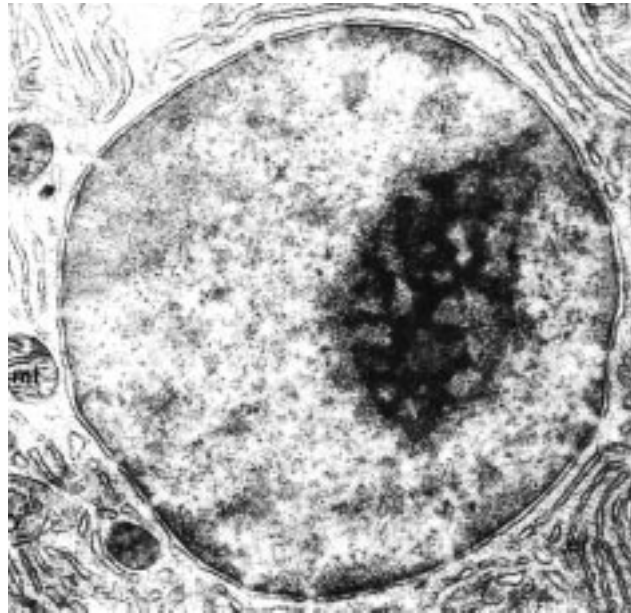
Endoplasmic reticulum



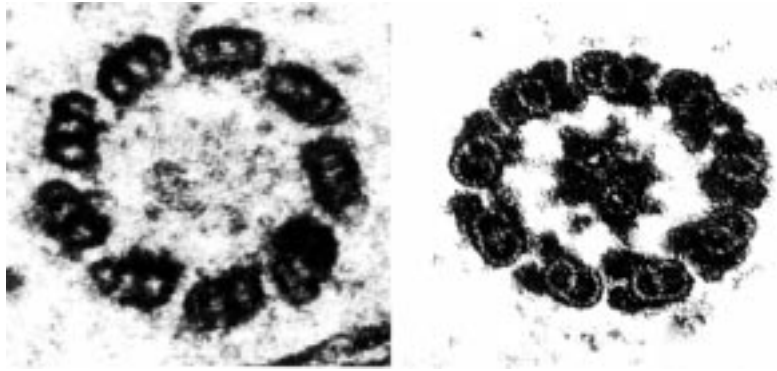
Mitochondrion



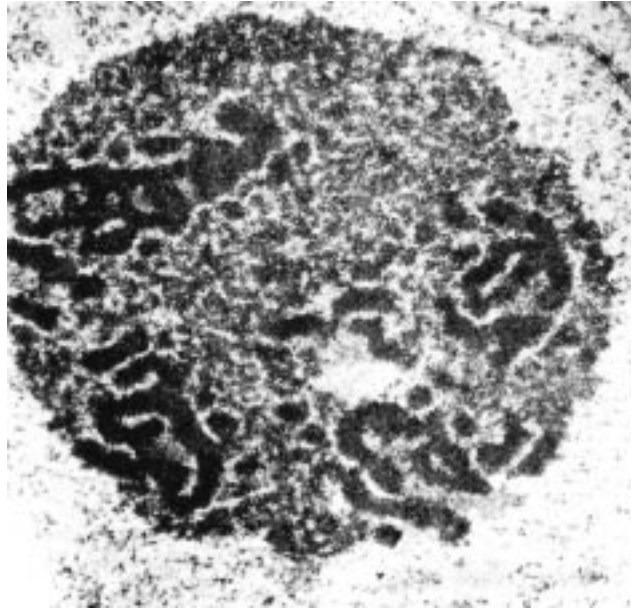
Golgi Apparatus



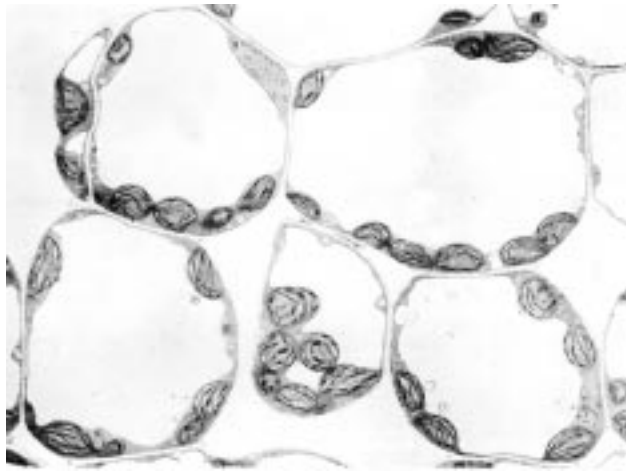
Nucleus



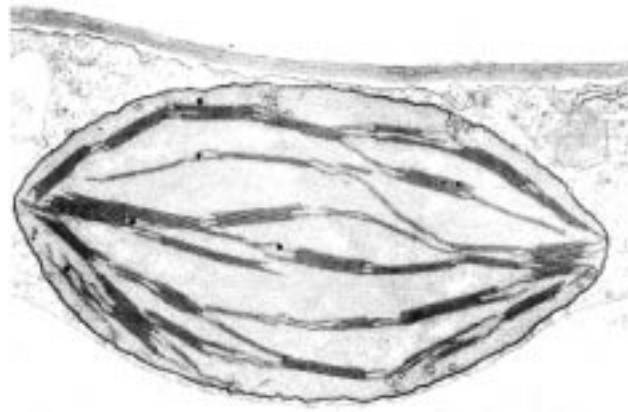
Centrioles



Nucleolus



Mesophyl



Chloroplast