



## CORAL REEF ECOLOGY

### Concepts

Scientific method  
Difference between plants and animals cells

### HCPS III Benchmarks

SC 4.1.2  
SC 4.4.1

### Duration

2 hours

### Source Material

PRISM

### Vocabulary

Cell  
Cell Membrane  
Cytosol  
Endoplasmic reticulum  
Golgi apparatus  
Lysosomes  
Mitochondria  
Zooxanthellae

## Plant and Animal Cells

### Summary

Students will begin the unit by finding out what the differences are between plant and animal cells. They will learn that coral is an animal.

### Objectives

- Students will learn that coral is an animal.
- Students will learn the differences between plant and animal cells.

### Materials

#### Part 1:

Coral fragments or pictures of a reef  
Microscopes  
Magnifying glasses  
Plant slide (onion skin)  
Animal slide (cheek scraping or if access a polyp)  
Overhead projector  
“Animal and Plant Cells Worksheets” (1 per student)  
“Cell Parts” worksheet ( 1 per student)  
Transparency of Plant, Animal, and Coral Cell examples  
Transparency of “Coral Cell with Zooxanthellae”

#### Part 2:

Index cards for each organelle (card will include name, script and instructions for the play)  
Large nametags with organelle name for around the student’s neck  
Cardboard boxes  
Large index cards with “Energy”, “Sugar” and “Protein”  
6” x 9” piece of white paper (1 per student)

### Making Connections

By learning the differences between plant and animal cells students will begin to explore and understand the ways in which plant and animals are different. They will recall these differences at various times throughout the remainder of the unit.

### Teacher Prep for Activity

**Part 1:** Photocopy, both “Animal and Plant Cell” Worksheets, “Cell Parts” and make a transparencies of each cell sample picture and the “Coral Cell with Zooxanthellae” (Cover the instructions on this page). Gather your coral fragments and familiarize yourself with your coral. Have magnifying glasses or a digital microscope nearby



so you can look closely at the calyx (the calyx is where the actual polyp lives). If you have pre-made slides of plant and animal cells, have them ready near your microscopes. If you need to make your own slides, place a very thin slice of an onion on a clean microscope slide and put a drop of iodine on it (iodine can be purchased at most drug stores), and slide the cell cover over the iodine and onion slice. To make an animal cell, scrape the lining of your inner cheek with a toothpick and smear the cells on a microscope slide. Place a drop of water on your cheek cells and slip the slide cover on the water and cheek cells.

A sample picture of each a plant, animal and coral cell slide has been provided at the bottom of this lesson plan.

**Part 2:** Print the scripts for animal and plant cells. Cut out each cell part and paste it on a small note card. Write each cell part name on large note cards and punch two holes on either corner. Tie off yarn or string to create a necklace for nametags. Create an open space in your classroom for where the play will take place.

## Background

Only living things have **cells**. Plant cells can be distinguished from animal cells by three characteristics. First, plant cells are bounded by a cell membrane and a rigid cell wall, whereas animal cells have only a cell membrane to protect their insides from the outside environment. Second, plant cells have mitochondria and chloroplasts (an organelle that uses photosynthesis) to produce energy, while animal cells only have mitochondria. Finally, plant cells contain vacuoles-storage units-which are absent in many animal cells.

The similarities between plant and animal cells are that they are both eukaryotic cells (cells that contain a nucleus). They share many kinds of cell parts (or **organelles**) such as the **nucleus, mitochondria, endoplasmic reticulum, golgi apparatus, lysosomes, cytosol and cell membrane**.

Coral polyps are living animals. Some corals have a symbiotic relationship with plant cells (zooxanthellae). These types of corals are typically found in areas close to the surface of water so that the zooxanthellae can use photosynthesis to create energy. Because zooxanthellae uses less than 5% of the energy it produces while the rest goes to the corals, corals containing zooxanthellae are usually the reef-building types of corals. You can read more information on coral cells here: <http://www.this-magic-sea.com/COMCORAL.HTM>

## Procedure

### Part 1:

1. Show the students a variety of coral skeletons and pictures. Ask the class what they think it is: a plant, animal, rock, etc. Ask inquiry types of questions:
  1. What observations can they make?
  2. If the organism is an animal, why?
  3. What is the difference between plants and animals?

Make a list of all of the differences suggested by students. What purposes do these differences serve? How are plants and animals similar? Which one do you think is more



complex? Have students use microscopes to observe the shapes of plant and animal cells. *Optional: Have students draw a diagram of what they see under the microscope. Ask students: “Why do you think the plant cell looks rectangular in shape?” “What other differences do you see between the two cells?”*

2. Hand out the “Animal and Plant Cells Worksheets” and the “Cell Parts” worksheet. Explain that only living organisms have cells.
3. Go over the different parts of the two cells using the supplied “Teacher’s Answer Guide” diagrams. As you discuss each part, have a student or yourself read out loud to the class the description and function of each part from the “Cell Parts” worksheet. Have the students complete the worksheets by filling in part as discussed. Explain to the class that the plant cell is rectangular in shape because the plant cell has a cell wall, and the cell wall is what they are looking at. The cell wall helps strengthen the plant cell and helps it withstand the elements of weather, such as wind, rain, and snow. The plant cell also contains chlorophyll (green in color) and the animal cell does not. The chlorophyll observed in the plant cell allows the plant to get energy from the sun and produce food in a process called photosynthesis. ([http://www.girlstart.org/detectives/view\\_lesson.asp?ID=595](http://www.girlstart.org/detectives/view_lesson.asp?ID=595))
4. After they have filled out their worksheets, show the students the picture of the coral cell with the zooxanthellae and explain that it is a coral cell. Ask them, using the information they just learned about the differences between plant and animal cells, if coral is a plant or an animal, or even if it is a mineral (only living things have cells). Do animals or plants have cell walls?

## Part 2:

5. Pass out note cards with the organelle name and script on each card. Ask the students to split up in two groups depending on their cell part: “plant cell” and “animal cell”. Each group should be able create a complete cell. They may use their worksheets from Part 1 to help.
6. Remind the class that each cell part has an important function. Ask the students if they can remember a cell part and what function it does in the cell. Then, ask them if that function reminds them of anything else that they know. For example, mitochondria makes energy for the cell, and therefore reminds the student of a battery, or the nucleus directs the processes of the cell so it reminds them of a computer. Do this for each cell part.
7. Explain that they will now create a puppet that represents the cell part indicated on their notecard. First, they will create the mouth of the puppet. Instruct the students to fold the 6”x9” sheet “hot-dog style” into 3 equal sections. Second, fold the sheet into a “W” indicated in **Fig. 1** on page 12. Explain that their fingers can be inserted into the folded gaps at either end of the “W” to make the mouth move up and down.
8. Once the mouthpiece is done, the students can start designing their representative cell part using construction paper, glue and their scissors. Their puppet should be designed based on an analogy of the cell part. Some examples have been covered in Step 6, but students may be to come up with their own. Use the “Cell Parts” worksheet to help the students come up with an analogy based on the description and function for each cell part. See **Fig. 2** on page 12.



9. Once the students have finished their puppets, have each student read their script from the note card in front of class, using the puppet to speak for them. Each student should be able to recognize if their cell part is found in a plant cell, animal cell, or in both cells. See **Fig. 2** on page 12 as an example.

## Assessments

Assessment checklist (page 5)

## Resources

Oxford Illustrated Science Dictionary

<http://www.this-magic-sea.com/COMCORAL.HTM>

## Extension Activity/Art Connection

Challenge your students to create a model of the animal and plant cell using playdoh or things found around their house. Encourage them to use recycled materials or items that are used/no longer of use.

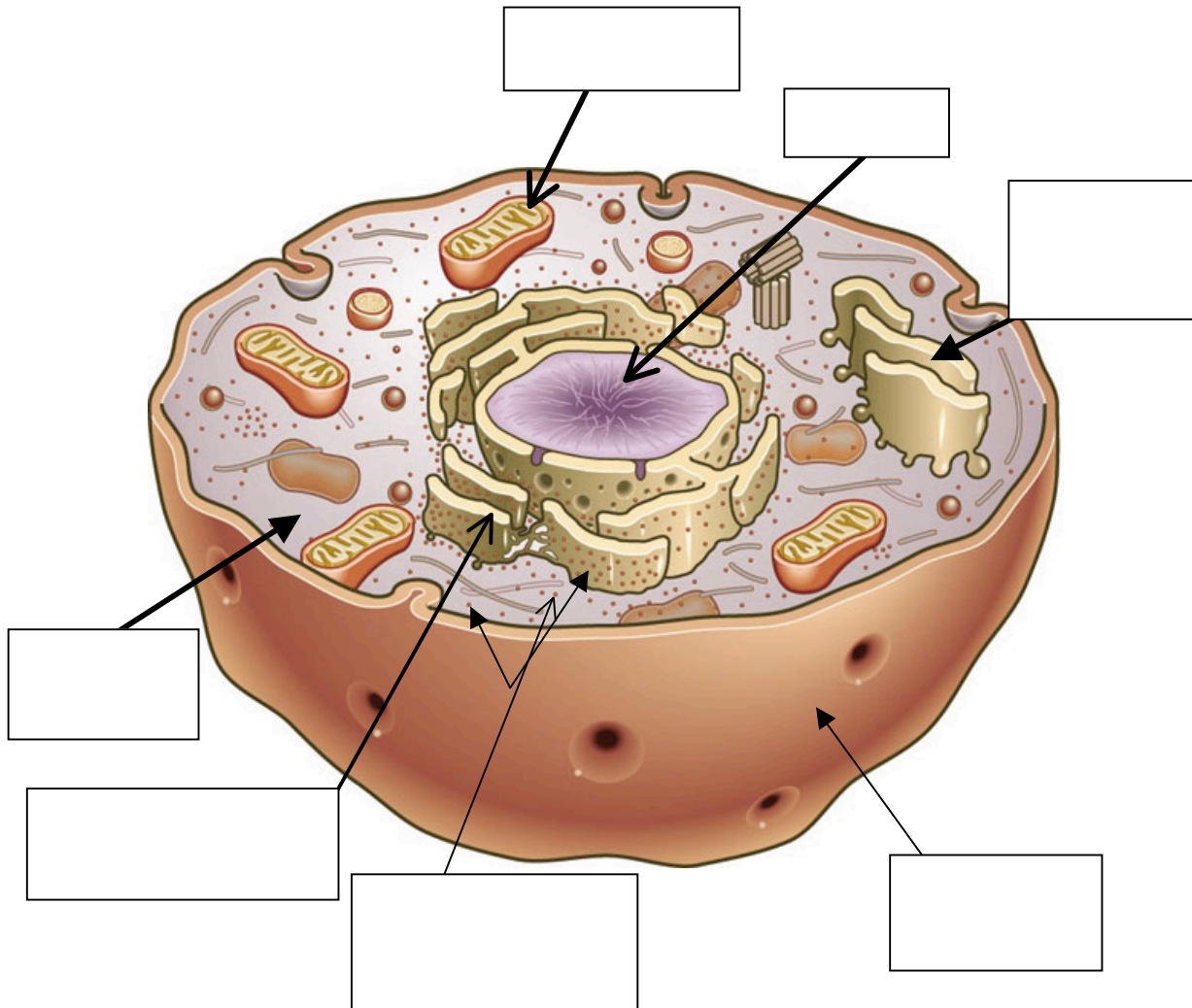
This can be done as a homework assignment or an in-class art activity. If you plan to do it in-class, then give the students advanced notice to collect supplies to build their coral polyp and bring them in to class.

To review the parts of a cell and vocabulary, have the students label each part on their cell.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Animal and Plant Cells Worksheet



Questions:

1. Which type of cell is this?

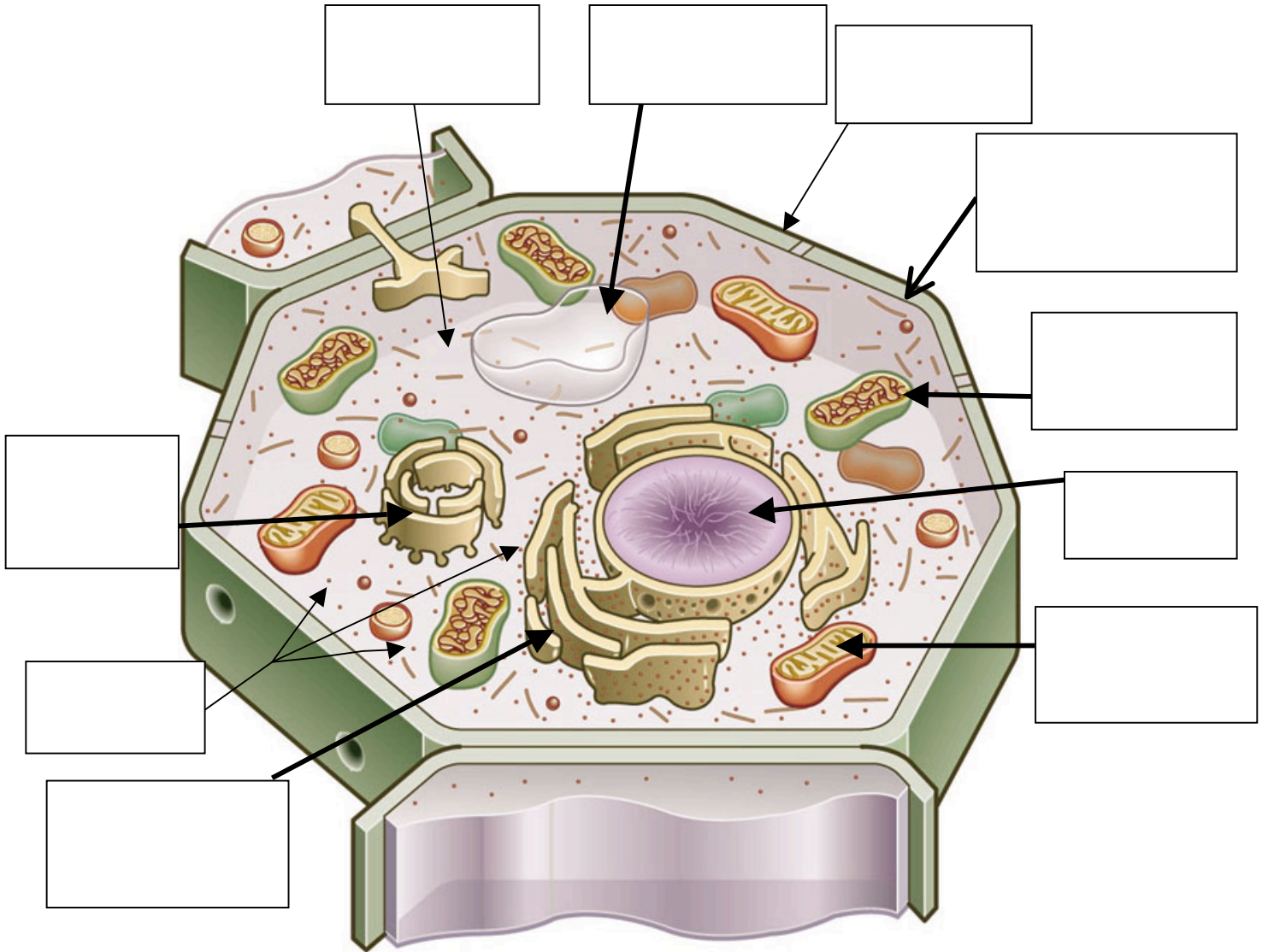
2. How do you know which type of cell it is?

Source: Oxford Illustrated Science Encyclopedia:  
<http://www.oup.co.uk/oxed/children/oise/pictures/nature/>

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Animal and Plant Cells Worksheet



Questions:

1. Which type of cell is this?
2. How do you know which type of cell it is?

Source: Oxford Illustrated Science Encyclopedia:  
<http://www.oup.co.uk/oxed/children/oise/pictures/nature/>



Name: \_\_\_\_\_

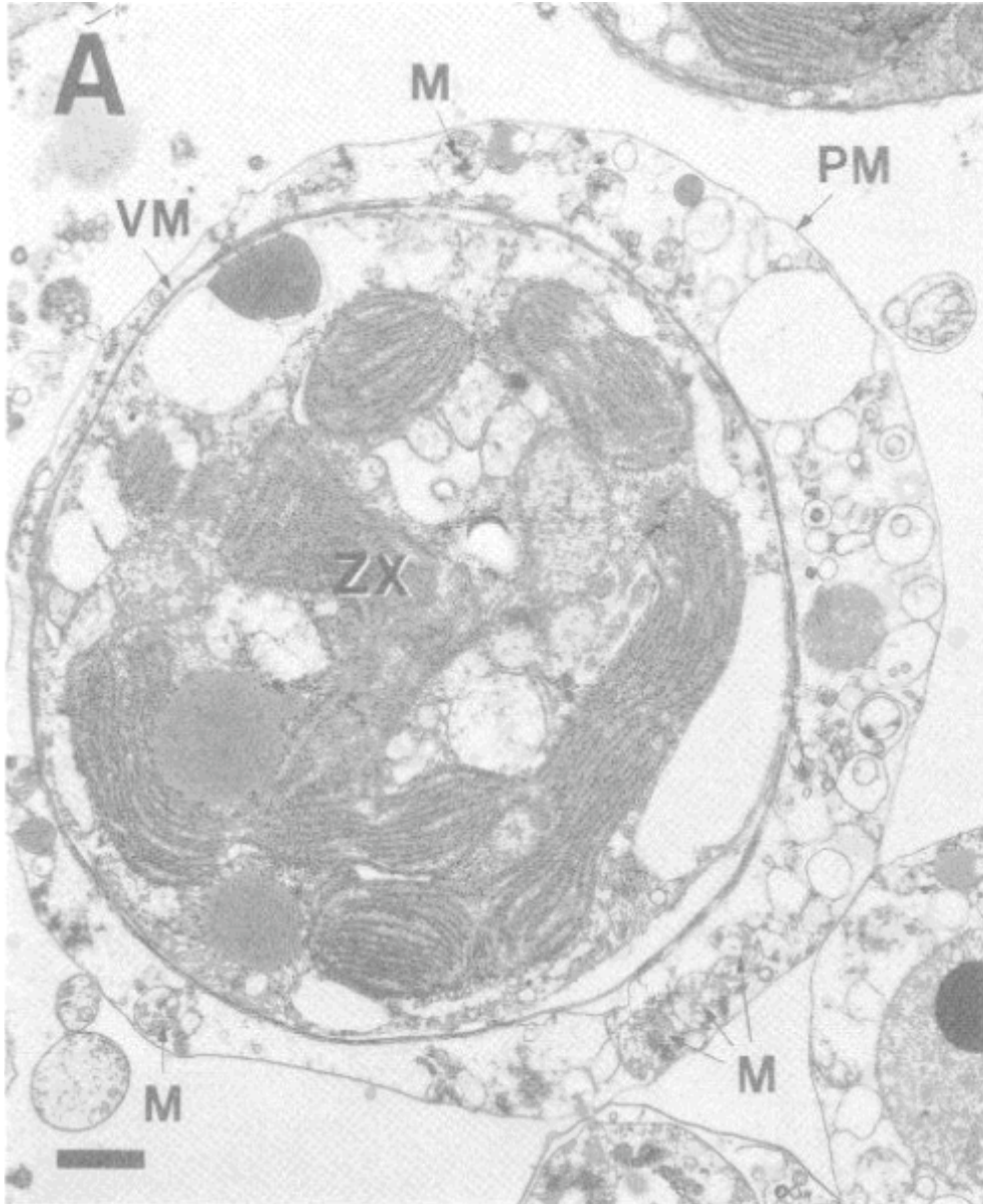
Date: \_\_\_\_\_

## Cell Parts

Cell Part	Description	Function
Cell (Plasma) Membrane	Semi-permeable membrane surrounding the cell.	"Traffic-cop". It selects what enters the cell.
Nucleus	Spherical, often in the center of the cell, bounded by a membrane (skin).	Cell brain or the "computer" of the cell. Contains information to make the cell work.
Cytoplasm	Semi-fluid between the cell membrane and the nucleus.	Jelly-like substance within the cell that holds up the other cell parts in the cells.
Vacuole	Membrane bound sack in the plant cell.	It's the "warehouse" in a cell that stores food and waste products.
Cell Wall	Surrounds a plant cell.	It supports and creates the shape of a cell.
Mitochondria	Shaped like a football or a peanut in the cell.	Called the "powerhouse of the cell" because it creates energy for the cell.
Chloroplasts	Green, similar in shape to a mitochondria.	It is the spot of photosynthesis where energy is made for plant cells.
Endoplasmic Reticulum	White, maze-like cell part surrounding the nucleus	It is used to transport food or other materials from one part of the cell to another.
Ribosomes	Tiny, round organelles that float around in the cytoplasm or attaches to the Endoplasmic Reticulum.	It creates protein.
Golgi Apparatus (Body)	Stacks of saucer-like membranes	Works with the Endoplasmic Reticulum to transport materials across the cell.

## Coral Cell with Zooxanthella

The picture below shows a coral cell that contains a symbiotic single celled alga called zooxanthella. Point out the parts of the coral cell to the class that they just learned.



Gates et al. Biol. Bull. 182: 324-332. (June. 1992)

PM= coral cell plasma Membrane

ZX= Zooxanthellae

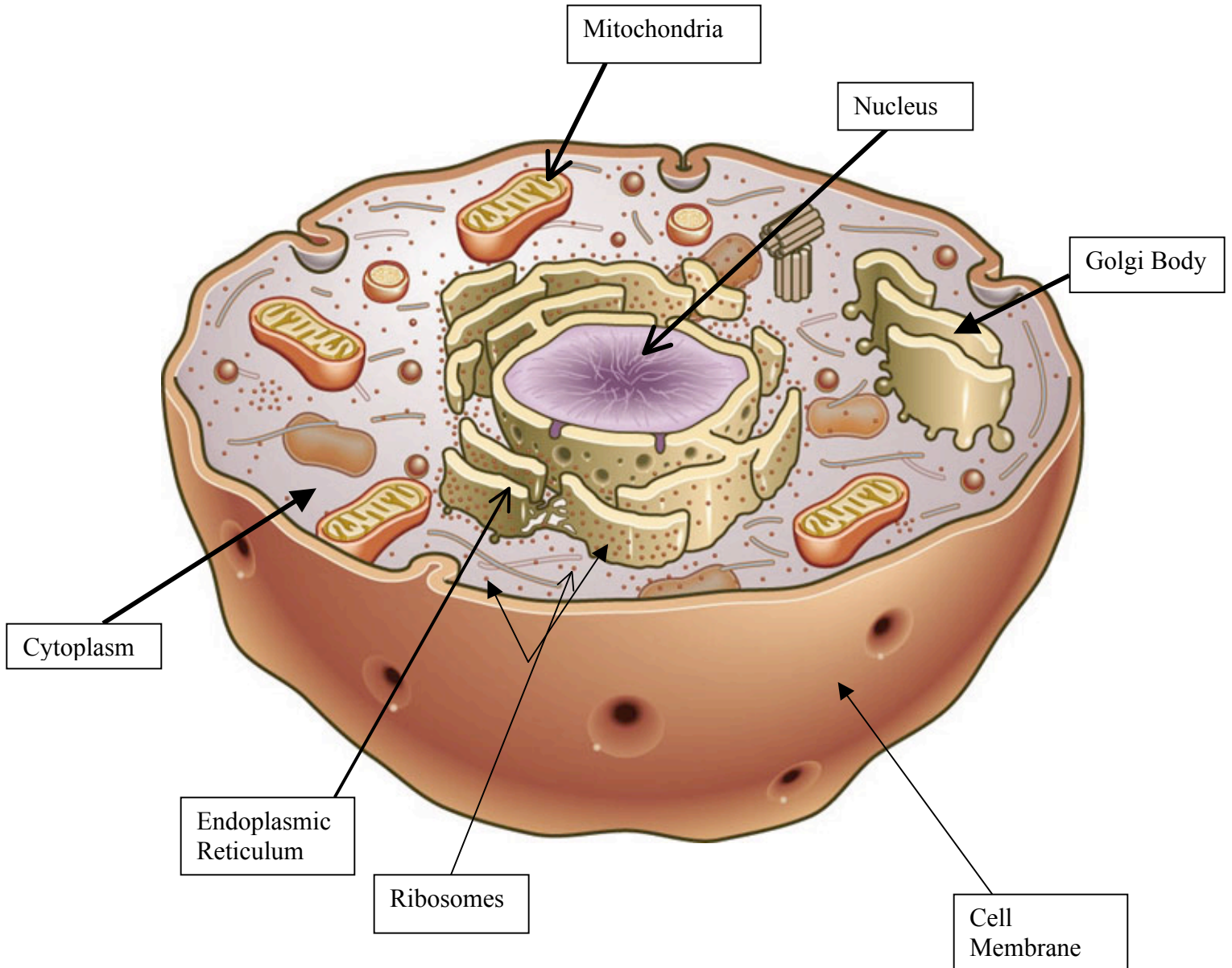
M= Mitochondria

VM= plant cell vacuolar membrane



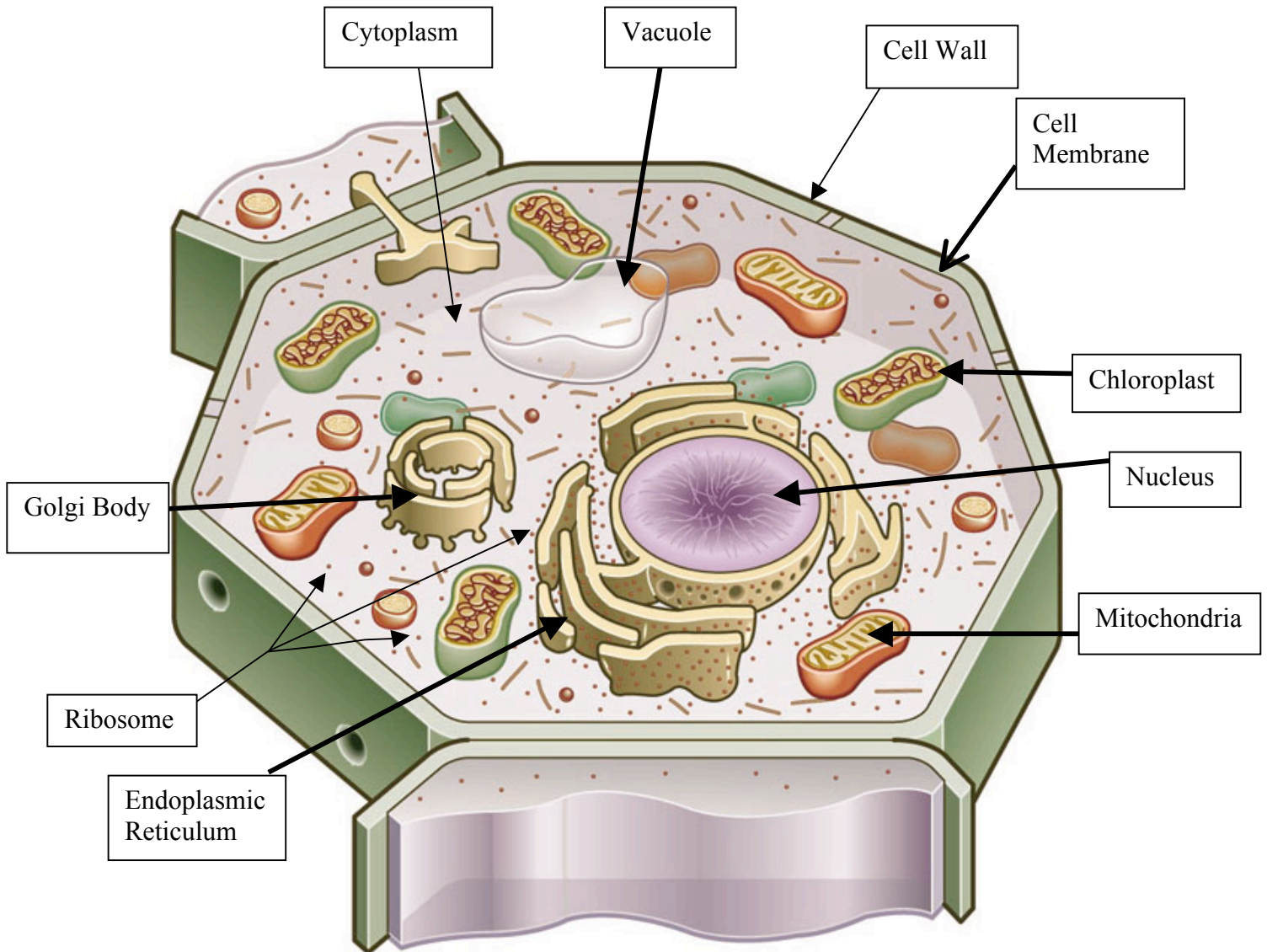
## Teacher's Cell Parts Answer Guide

Animal cell:



Source: Oxford Illustrated Science Encyclopedia:  
<http://www.oup.co.uk/oxed/children/oise/pictures/nature/>

### Plant cell:



Source: Oxford Illustrated Science Encyclopedia:  
<http://www.oup.co.uk/oxed/children/oise/pictures/nature/>

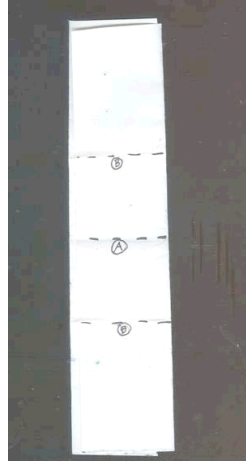
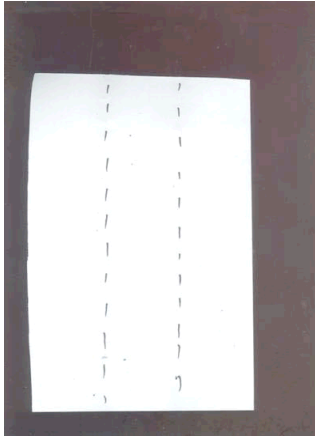


Fig. 1. The students will first fold their 6"x9" paper into three parts. Second, they will fold their papers A) with a "valley fold" in half, then B) two mountain folds. The student should end up with a paper that's folded in a "W".

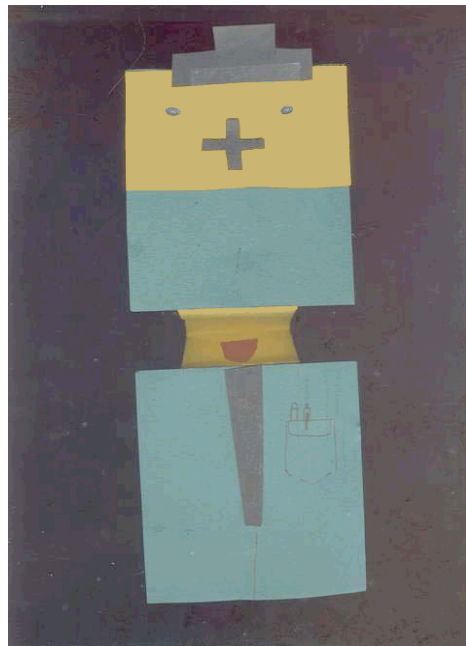


Fig. 2. The students will create a puppet to represent their cell part. This is Morty the Mitochondria. He is a battery that represents the mitochondria of the cell.



Directions: Cut up the script and paste each organelle part onto notecards. Each student will receive one notecard with one part from either the animal cell script or the plant cell script.

### **Animal Cell Script:**

#### **CELL MEMBRANE**

Script: "Hi, I'm a cell membrane. My job is to protect the insides of the cell from the outside environment."

**Directions:** Move on the far side of the play area with arms out in a semi-circle.

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#### **CYTOPLASM**

Script: "I'm the cytoplasm. I am the gel-like substance between the cell membrane and the nucleus where the organelles are found."

**Directions:** Wave arms in front of yourself as you "float" around the cell between the other organelles.

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#### **NUCLEUS**

Script: "I'm the mighty nucleus. I direct the cell activity to make sure that all of the other organelles in the cell do their jobs."

**Directions:** Stand in the middle of the play area and motivate the organelles to work.

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## ENDOPLASMIC RETICULUM

Script: "I'm the endoplasmic reticulum. I'm a network of passageways that carries materials from one part of the cell to another."

**Directions:** Pick up a card from the ground or desk that is marked "sugar" and give it to the golgi body.

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## GOLGI BODY

Script: "I'm the golgi body. I receive materials from the Endoplasmic reticulum and then package and distribute these materials to other parts of the cell."

**Directions:** Recieve card from the ER and put it in the box and give it to the mitochondria.

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## RIBOSOMES

Script: "We're ribosomes. We are grainlike bodies that float around the cytoplasm. When we attach to Endoplasmic reticulum, we produce proteins."

**Directions:** Ribosomes will float around for a while and then land on the ER. Once attached to ER, ribosome will bring out cards marked "protein" from their pockets and say, "I made protein!"

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## MITOCHONDRIA

Script: "I'm the mitochondria. I use sugars like glucose to create energy so that the cell can function."

**Directions:** Stand in the play area and receive boxes from the Golgi body. Once received, the mitochondria will pull out cards marked "energy" from their pockets and say, "I made energy!"

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## PLANT CELLS SCRIPT

### CELL MEMBRANE

Script: "Hi, I'm a cell membrane. My job is to protect the insides of the cell from the outside environment."

**Directions:** Move on the far side of the play area with arms out in a semi-circle.

---

### CYTOPLASM

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Script: "I'm the mighty nucleus. I direct the cell activity to make sure that all of the other organelles in the cell do their jobs."

**Directions:** Stand in the middle of the play area and motivate the organelles to work.

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## ENDOPLASMIC RETICULUM

Script: "I'm the endoplasmic reticulum. I'm a network of passageways that carries materials from one part of the cell to another."

**Directions:** : Pick up the sugar card from the ground (or table) and give it to the golgi bodies. You will also pick up "waste" card from the ground and give it to the Golgi Body.

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## GOLGI BODY

Script: "I'm the golgi body. I receive materials from the Endoplasmic reticulum and then package and distribute these materials to other parts of the cell."

**Directions:** Recieve objects from the ER and put them in boxes. Give the boxes to the mitochondria and the vacuole.

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## RIBOSOMES

Script: "We're ribosomes. We are grainlike bodies that float around the cytoplasm. When we attach to Endoplasmic reticulum, we produce proteins."

**Directions:** Ribosomes will float around for a while and then land on the ER. Once attached to ER, ribosome will bring out cards marked "protein" from their pockets and say, "I made protein!"

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## MITOCHONDRIA

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**Directions:** Stand in the play area and receive boxes from the Golgi body. Once received, the mitochondria will pull out cards marked "energy" from their pockets and say, "I made energy!"

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## CHLOROPLAST

Script: "I'm the chloroplast. I am only found in plant cells. I make energy from the sunlight and then use this energy to make food for the cell."

**Directions:** Wave their arms in the direction of the sun and say, "I love the sun" and pull out cards marked, "sugar", from their pockets.

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## **VACUOLE**

Script: "I'm the vacuole. I store food, water and waste from the cell."

**Directions:** Stand near the cell membrane and receive boxes from the golgi body.

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## **CELL WALL**

Script: "I'm the cell wall. I'm only found in plant cells. I am made of cellulose and is the rigid layer surrounding the cell membrane."

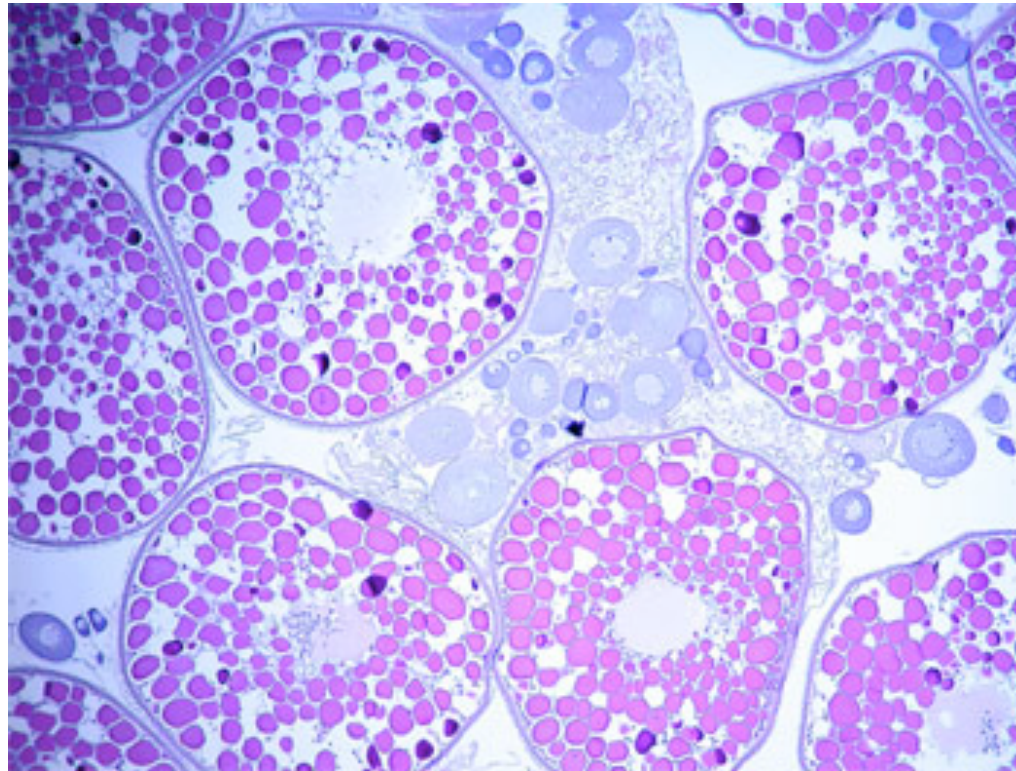
**Directions:** Stand behind the cell membrane with arms in a semicircle.

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### **Notes:**

The sun can also be a student.

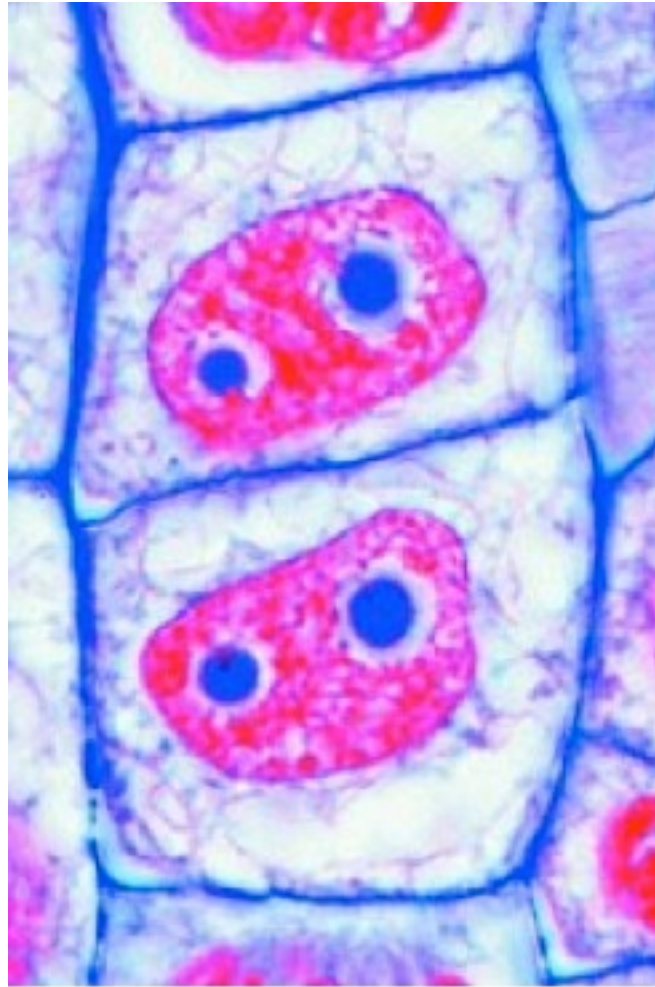
If there are more students than organelles, students can double up on cell membranes, cell walls, and ribosomes.



**Photo of maturing fish eggs. Available at:**

[http://images.google.com/imgres?imgurl=http://www.afsc.noaa.gov/ABL/MESA/images/grenadiereggs.jpg&imgrefurl=http://www.afsc.noaa.gov/ABL/MESA/ mesa\\_sa\\_gren\\_m.htm&usq=\\_\\_6OG1iVnEhwGodr\\_FGTANR4uYVuM=&h=263&w=350&sz=62&hl=en&start=23&um=1&tbnid=AnI1\\_-36IyHoVM:&tbnh=90&tbnw=120&prev=/images%3Fq%3Dcoral%2Bhistology%26start%3D21%26ndsp%3D21%26um%3D1%26hl%3Den%26rls%3Dcom.microsoft.en-us:IE-SearchBox%26rlz%3D1I7TSHA%26sa%3DN](http://images.google.com/imgres?imgurl=http://www.afsc.noaa.gov/ABL/MESA/images/grenadiereggs.jpg&imgrefurl=http://www.afsc.noaa.gov/ABL/MESA/ mesa_sa_gren_m.htm&usq=__6OG1iVnEhwGodr_FGTANR4uYVuM=&h=263&w=350&sz=62&hl=en&start=23&um=1&tbnid=AnI1_-36IyHoVM:&tbnh=90&tbnw=120&prev=/images%3Fq%3Dcoral%2Bhistology%26start%3D21%26ndsp%3D21%26um%3D1%26hl%3Den%26rls%3Dcom.microsoft.en-us:IE-SearchBox%26rlz%3D1I7TSHA%26sa%3DN)

**Histology** = The branch of biology dealing with the study of living tissues, also refers to the study of microscopic anatomy.



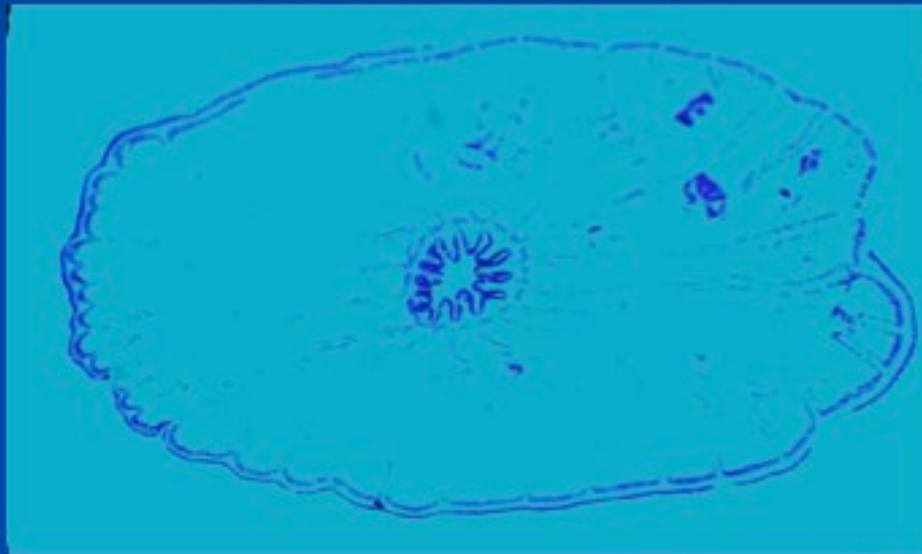
**Photo of plant cell slide. Available at:**

[http://www.msmedia.com.au/mpacks/IMAGES/Plant\\_Cells\\_S.jpg](http://www.msmedia.com.au/mpacks/IMAGES/Plant_Cells_S.jpg)



# Hematoxylin & Eosin staining

*Actinodiscus fungiformis*



**Slide of coral cell. Available at:**

[http://www.nhm.ku.edu/inverts/presentations2004/harim\\_museumlunch\\_april2004.ppt#289,26,Slide 26](http://www.nhm.ku.edu/inverts/presentations2004/harim_museumlunch_april2004.ppt#289,26,Slide 26)