

Lesson Title: The Cell as a System

Subject: Freshmen / Sophomore Biology (Fifth Bell)

Teacher: Ms. Diana M. VonEye

Date: 2 February 2005

Monday Tuesday Wednesday Thursday Friday

Grade: 9th and 10th

Class Background: 14-17 years of age; 17 females, 11 males; 20 Caucasians, 8 African Americans; 3 IEPs.

Time: 3 fifty minute class periods

Rationale:

The animal cell can be seen as a comparison to many systems that exist in our world today. Through the process of scientific literacy and scientific inquiry, students will design the animal as a city system, and support their reasoning. Scientific inquiry assist the student to know that scientists' explanations about what happens in the world come partly from what they observe, partly from what they think. It is also designed to encourage student skills in using technology. It is important that students see that all parts of the animal cell are interlinked to one another, and depend on the functions of each piece- just like cities are interdependent and linked.

Standards Met:

NSES Standard C: All students should develop understanding of the cell.

ODE Grade 9: Doing Scientific Inquiry: 3. Construct, interpret and apply physical and conceptual models that represent or explain systems, objects, events or concepts.

ODE Grade 9: Scientific Inquiry: A. Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations.

ODE Grade 9: Doing Scientific Inquiry: 5. Develop oral and written presentations using clear language, accurate data, appropriate graphs, tables, maps and available technology.

ODE Grade 10: Characteristics and Structure of Life: 1. Explain that living cells

- A. are composed of a small number of key chemical elements (carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur)
- B. are the basic unit of structure and function of all living things
- C. come from pre-existing cells after life originated, and
- D. are different from a viruses.

ODE Grade 10: Characteristics and Structure of Life: 2. Compare the structure, function and interrelatedness of cell organelles in eukaryotic cells (e.g., nucleus, chromosome, mitochondria, cell membrane, cell wall, chloroplast, cilia, flagella) and prokaryotic cells.

ODE Grade 10: Doing Scientific Inquiry: 2. Present scientific findings using clear language, accurate data, appropriate graphs, tables, maps and available technology.

ODE Grade 10: Doing Scientific Inquiry: 4. Draw conclusions from inquiries based on scientific knowledge and principles, the use of logic and evidence (data) from investigations.

ODE Grade 11: Doing Scientific Inquiry: 3. Design and carry out scientific inquiry (investigation), communicate and critique results through peer review.

ODE Grade 11: Doing Scientific Inquiry: 5. Summarize data and construct a reasonable argument based on those data and other known information.

ODE Grade 11: Scientific Theories: 7. Explain how theories are judged by how well they fit with other theories, the range of included observations, how well they explain observations and how effective they are in predicting new findings.

Objectives:

1. The students will be able to identify the structures found (nucleus, plasma membrane, cytoskeleton, and nucleolus, etc.) within a cell.
2. Students will be able to identify the functions of the organelles (mitochondria, centrioles, endoplasmic reticulum, Golgi apparatus, vacuole, ribosomes, lysosomes, etc.) within the cell and its structure.
3. Students will see and understand how these organelles work as a system.
4. Students will create a working written and visual understanding of the structure and functions of the organelles in an animal cell.
5. Students will be able to communicate and share findings of student investigation by first making conclusions based on what they see using their previous knowledge and acquired knowledge.
6. The students will be able to develop more concrete conclusions and reevaluate why they stated their previous conclusion.
7. By utilizing technological resources and language skills the students will know about the animal cell's structure and its internal functions.

Activities:

1. Read the chapter 5 about cell structure and function in the BSCS textbook.

2. Students will be given data sheets to be filled out on computer in groups of 3.
Visit the Resource Center computers downstairs to use www.virtualcell.com to complete worksheet. Take tour of cell to fill out worksheets as a group.
3. Identify the function(s) of the structures and organelles of the cell.
4. The students will be engaged into a discussion on the topic of seeing a cell as a system. Allow students to name systems in a city and make a comparison to the cell during open class discussion.

Questions to ask students:

1. What do you need to make a city function?
 2. Who takes out the trash?
 3. Where does energy come from for streetlights?
5. List analogies of cell organelles to scenario of a city system on the board for students to refer to.
 6. Write an individual short essay comparing and contrasting the animal cell to the given system using proper grammar, format, style, and presentation. Included in this is a defense on the system choice, and defending all choices about selection of structure and function for each “piece” of the system in its relation to the animal cell.
 7. In small cooperative groups of three, construct a model of an animal cell with various materials.
 8. Completed projects and models will be presented to the class on the third and final day.

Materials:

- ❖ Virtual cell worksheets, Computers, Color pencils, Markers, Construction paper, Macaroni, Candy, Paint, Spaghetti, Packing peanuts, Pipe cleaners, Toothpicks...
- ❖ Anything else that is destructible students can use safely to make their cells.

Handouts:

1. Virtual Cell Worksheets located in the appendix.
2. Various rubrics for students to know how they will be graded.
3. For students with special needs (IEPs) or learning disabilities provide a word guide may be provided for the fill-in-the-blank assignment.

Homework:

1. Complete virtual cell worksheets, if not completed in class.
2. A description of the structures and functions for specified animal structure and organelles in individual short answer format.
3. Presentation and completed diagram of animal cell.
4. A completed defensive essay on the choices made for each individual cell part and why the part of the city system is appropriately chosen.

Technology Equipment:

1. Computers
2. The Internet

Management:

1. This lesson can be completed over the course of 3 fifty minute class sessions.
2. Worksheets are passed out on first day to allow for students to work on computers in Resource Room at school, (most questions are able to be answered with the textbook too) if they don't have a computer at home.
3. Work is done individually and in cooperative groups.
4. Materials for animal cell model are created and gathered before class for groups containing 3 students each.
5. Grading standards and rubrics are given to students to understand expectations.
6. Completed worksheets and animal cell diagrams are turned in at the end of each class session.

Resources:

www.virtualcell.com

Assessment:

- | | | |
|---|---|--|
| <input type="checkbox"/> Class discussion(s) | <input type="checkbox"/> Test(s) | <input type="checkbox"/> Written journal |
| <input type="checkbox"/> Presentation(s) | <input type="checkbox"/> Quiz | <input type="checkbox"/> Project |
| <input type="checkbox"/> Graded homework | <input type="checkbox"/> Oral evaluation | <input type="checkbox"/> Group project |
| <input type="checkbox"/> Additional experiment(s) | <input type="checkbox"/> Group discussion | <input type="checkbox"/> Design own experiment |
| <input type="checkbox"/> Lab Report | <input type="checkbox"/> Other: _____ | |

APPENDIX:

HANDOUTS AND EVALUATION TOOLS*

* Retyped from the files of worksheets, quizzes and tests of Mrs. Shell.

NAME: _____ DATE: _____ BELL: _____

LIST ANALOGIES OF CELL ORGANELLS TO SYSTEMS IN A CITY

Directions:

Using the information that was collected during your brainstorming session “What is Needed to Make a City Function”, make a comparison to the functions of the organelles that you have discovered are part of the animal cell. You should have a list of systems needed to make a city function in your class notes. The following list of organelles should be included. You may also include others.

ORGANELLE	CITY SYSTEM
Nucleus	
Plasma Membrane	
Cytoskeleton	
Nucleolus	
Mitochondria	
Centrioles	

Endoplasmic Reticulum	
Golgi Apparatus	
Vacuole	
Ribosome	
Lysosome	

NAME _____ DATE _____ BELL _____

GROUP WORK: VIRTUAL CELL TOUR: CELL BIOLOGY

1. To get to the site, go to www.virtualcell.com. Click on the Virtual Textbook. Under Biology, click on Chapter 3: Cell Biology. Click on Next Page to begin the tour.

Complete all sections needed to fill out this worksheet.

2. The cell (plasma) membrane is found in both _____ and _____ cells.

Plant cells have both a _____ and a _____

_____. The cell membrane lets things in and out of the cell and is made up of

two things:

- a. 1) _____ and 2) _____

3. In the sample representation of a Phospholipid, the yellow structures represents the _____ or water loving section while the blue represents the _____ or water fearing end of the Phospholipid. The water loving portion is composed of _____ and _____. The water fearing portion is composed of _____ and _____. The hydrophilic head is polarized while the tails are non-polar. The polar (this means it has opposite ends, like a magnet) "head" attracts _____, while the non-polar "tail" repels _____. This attraction / repulsion is what forms the two layers of the cell membrane. The Phospholipid _____ are on the outside, where the water is, and the two non-polar tails are pointed towards each other, where the water isn't. This creates a fluid double layered membrane.

4. There are _____ in the cell that allow some materials to pass through. These are generally globular _____. They fall into three function categories 1) _____ regulate transport and diffusion; 2) _____ identify the cell to other cells; and 3) _____ allow the cell to receive instructions.
5. **Steroids** are sometimes a _____ of cell membranes in the form of _____. When it is present it reduces the fluidity of the membrane.
6. **Transport proteins** come in two forms: _____ and _____. _____ proteins are peripheral proteins which do not extend all the way through the membrane. They move specific molecules through the membrane one at a time. _____ proteins extend through the bilipid layer. They form a pore through the membrane that can move molecules in several ways. Draw and label an illustration of these two proteins in the cell membrane.

Here:

7. **Carrier proteins** do not extend through the membrane. They _____ and _____ molecules through the bilipid layer and release them on the opposite _____.
8. **Channel proteins** simply act as a _____ pore. Molecules will randomly move through the opening via a process called diffusion. This process requires no energy, molecules move from an area of high concentration to an area of _____ concentration.

9. _____ also use the process of diffusion. Molecules that are moving naturally into the cell through diffusion are used to drag another molecule into the cell.
10. The **Sodium/Potassium pump** uses energy from _____ to drag molecules from an area of _____ concentration to an area of _____ concentration. This is an example of _____ transport.
11. _____ extend across the cell membrane and serve to identify the cell. The _____ system uses these proteins to tell friendly cells from foreign invaders. They are as unique as _____.
12. _____ proteins are used in intercellular communication.
13. The process by which the membrane itself wraps around the particle and pinches off a _____ inside the cell is called _____.
14. The process by which large molecules that are manufactured in the cell are released through the cell membrane is called _____;
15. The **nucleus** contains _____ and the _____.
16. The **Nucleolus** manufactures _____. _____ is composed of DNA. There are three processes that enable the cell to manufacture protein. _____ lets the nucleus make exact copies of its DNA. _____ lets the cell make RNA working copies of its DNA. In translation the Messenger RNA is used to line up amino acids in a protein molecule.
17. The **organelles** involved in protein production are 1) _____, 2) _____, 3) _____, 4) _____.

18. The **rough E.R.** has _____ attached to it. These give it its texture. The _____ manufacture _____ for the cell.
19. **Centrioles** are only found in _____ cells. They function in cell _____. They have _____ groups of _____ arrangement of the protein fibers. Draw a picture of a centriole in the box.
20. **Lysosomes** are called _____ sacks. They are produced by the _____ body. They consist of a single membrane surrounding powerful _____ enzymes. Those lumpy brown structures are digestive _____. They help protect you by _____ the bacteria that your white blood cells engulf. _____ act as a clean up crew for the cell. Zoom in and draw what you see.
21. **Chloroplasts** are the site of _____. They consist of a _____ membrane. The stacks of disk like structures are called the _____. The membranes connecting them are the _____ membranes. Zoom in and draw a picture.
22. **Mitochondrion** is the _____ of the cell. It is the site of _____. It has a _____ membrane. The inner membrane is where most _____ respiration occurs. The inner membranes are _____ with a very large surface area. These ruffles are called _____. Mitochondria have their own _____ and manufacture some of their own _____. Draw a picture of the mitochondrion with its membrane cut.

23. **Endoplasmic Reticulum (ER)** is a series of double membranes that _____ back and forth between the cell membrane and the _____. These membranes fill the _____ but you cannot see them because they are very _____. The rough E.R. has _____ attached to it. This gives it its texture. These ribosomes manufacture _____ for the cell. The ribosomes are the _____ which manufacture proteins. Draw the rough ER with a ribosome.

24. **Smooth E.R.** _____ ribosomes. It acts as a _____ throughout the cytoplasm. It runs from the cell membrane to the nuclear _____ and throughout the rest of the cell. It also produces _____ for the cell. Draw a picture of the smooth ER.

25. **Cell Membrane** performs a number of critical functions for the _____. It regulates all that _____ and leaves the cell; in multicellular organisms it allows _____ recognition. Draw and shade the cell membrane.

26. **Nucleus** is called the _____ of the cell. It is a large _____ spot in eukaryotic cells. It _____ all cell activity. The nuclear membrane has many _____. The thick ropy strands are the _____. The large solid spot is the _____. The nucleolus is a spot of _____ chromatin. It manufactures _____. The chromatin is _____ in its active form. It is a _____ of DNA and histone proteins. It stores the

information needed for the manufacture of _____. Draw a picture of the nucleus and its nucleolus.

27. **Golgi body** is responsible for packaging _____ for the cell.

Once the proteins are produced by the _____ E.R., they pass into the _____ like cisternae that are the main part of the Golgi body. These proteins are then squeezed off into the little _____ which drift off into the cytoplasm. Draw a picture of the Golgi body as it is squeezing off the proteins.

28. _____ is the site of photosynthesis. It consists of a double membrane. Inside this organelle are stacks of disk like structures called _____. The membranes connecting them are the _____ membranes.

Name: _____

Date: _____

Project Title: _____

Teacher(s): _____

GROUP PRESENTATION CELL MODEL



Process	Below Avg.	Satisfactory	Excellent
1. Has clear vision of final product	1, 2, 3	4, 5, 6	7, 8, 9
2. Properly organized to complete project	1, 2, 3	4, 5, 6	7, 8, 9
3. Managed time wisely	1, 2, 3	4, 5, 6	7, 8, 9
4. Acquired needed knowledge base	1, 2, 3	4, 5, 6	7, 8, 9
5. Communicated efforts with teacher	1, 2, 3	4, 5, 6	7, 8, 9
Product (Project)	Below Avg.	Satisfactory	Excellent
1. Format	1, 2, 3	4, 5, 6	7, 8, 9
2. Mechanics of speaking	1, 2, 3	4, 5, 6	7, 8, 9
3. Organization and structure	1, 2, 3	4, 5, 6	7, 8, 9
4. Creativity	1, 2, 3	4, 5, 6	7, 8, 9
5. Demonstrates knowledge	1, 2, 3	4, 5, 6	7, 8, 9, 10
6. Other:	1, 2, 3	4, 5, 6	7, 8, 9

Total Score: _____/100

Teacher(s) Comments: