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FINAL PROJECT

UNIT OVERVIEW

Subject: Introduction to Biology

Grade: 9th

Unit Title: Cell Structure and Function

Rationale: An understanding of the cell, both of its components and of the whole, is foundational for understanding all living organisms. The cell is the basic unit that composes every structure in our body. To truly understand life, which is the primary goal of biology, one must first understand the cell.

Goals:

Goal 1: Students will understand that cells are composed of a variety of specialized structures that carry out specific functions.

Goal 2: Understand that cell functions involve specific chemical reactions.

Goal 3: Students will come to know that cells function and replicate as a result of information stored in DNA and RNA.

Goal 4: The students will also understand that plant cells differ from animal cells and be able to discuss these differences.

Objectives:

Goal 1

Objective 1a: Students will be able to label and define all the organelles of both eukaryotic and prokaryotic cells.

Objective 2a: Students will be able to discuss the significance of these organelles and describe how the cell utilizes these organelles to function properly.

Objective 3a: Students will be able to compare and contrast the differences between plant and animal cells and between prokaryotic and eukaryotic cells.

Goal 2

Objective 1b: Students will understand how food molecules taken in by the cell provides the necessary chemicals to synthesize other molecules

Objective 2b: Students will be able to explain glycolysis

Objective 3b: Students will be able to explain the Citric Acid cycle

Objective 4b: Students will be able to explain the Electron Transport System.

Objective 5b: Students will understand how the energy acquired from glycolysis, the Citric Acid cycle, and the Electron Transport System, is used for cellular growth, repair, and reproduction.

Goal 3

Objective 1c: Students will be able to describe the process of creating new DNA

Objective 2c: Students will understand how DNA is transcribed into RNA which is then translated into proteins.

Objective 3c: Students will be able to discuss how these newly synthesized proteins are used in cellular regulation.

Goal 4

Objective 1d: Students will be able to discuss why plant cells contain organelles and structures that animal cells do not.

Objective 2d: Using a microscope, students will be able to identify and differentiate between a plant and animal cell.

Unit Assessments of Student Learning

Pre: Open with a class discussion over how much they know about cells. Do you know there is a difference between plant and animal cells? Why do you suppose that is? Do you know why you have different types of cells throughout your body? Do you know where those cells come from? Use this discussion to gauge how much the students already know. Also, ask about issues that concern them – Do you know what stem cell research is? How does having a better understanding of our cells lead to a better understanding of the diseases that effect us?

Formative: There will be a short quiz or project the students will complete at the end of each goal, along with several worksheets and group projects that are to be completed during each goal.

Goal 1: There will be a short quiz or project after each goal is completed. After goal 1, students will be given a quiz where they will need to identify and define all parts of a plant and animal cell.

Goal 2: After goal 2, students will write a short story about the journey of a molecule of sugar from its start in our mouths, through its breakdown, and into its final usage in building proteins.

Goal 3: Once goal 3 is complete, students will build a model of DNA using candy and write a short essay on how DNA is transformed into proteins to put on display with the model.

Goal 4: Following goal 4, students will have a brief quiz where they will need to identify, under a microscope, the differences between plant and animal cells.

Summative: Students will have a 100-point exam. This exam will contain information from all four goals and will be broken down into four sections each worth 25 points. Each section will contain 5 multiple choice questions, 5 true/false questions, 5 fill in the blank questions, and one essay question.

LESSON PLAN – Day 1 / Goal 1 / Objective 1a

Entry Point: This will be the first day of the unit so students will be expected to know very little. We will not have covered anything on the cell at this point in the class. Students will be familiar with the microscope and how to use it properly.

Topic: We will be discussing the various organelles of the cell and how cells differ between plants and animals and between prokaryotic and eukaryotic.

Objectives:

Objective A: By the end of the day, students will be familiar with the different organelles of the cell.

Objective B: Students will also understand the differences between types of cells (plant/animal and eukaryotic/prokaryotic).

Objective C: Finally, students will be able to identify these structures under the microscope.

Materials:

- Microscope
- Plant, animal, and bacterial slides for microscope
- Labeled diagrams of all the different types of cells (PowerPoint)
- Blank worksheet of cells for students to label and define (*See WS 1.1*)
- PowerPoint presentation showing sample microscope slides

Procedure:

15 minutes – Having students fill out WS 1.1. Go through PowerPoint presentation with them. Define all parts of the cells. Ask students questions to gauge understanding – why do cells need this organelle?

10 minutes – Discuss differences between cell types. Why do plant cells need cell walls? Why do plant cells need chloroplasts? Why don't prokaryotic cells need nuclei? Do you think there are inherent advantages to any particular cell type? Disadvantages?

25 minutes – Look at cell slides under the microscope. Teacher will go around to each student and ask them to identify specific structures and discuss the role of that structure within the cell - students can use their WS 1.1 if they need it to help define organelles. Make sure all students are familiar with visualizing the different organelles and can compare plant to animal cells and prokaryotic to eukaryotic cells.

Assessment: Students will be assessed on the fact that they have filled out WS 1.1 correctly. Students will also be assessed on their understanding of the various organelles.

Evaluation: There will be no formal evaluation for today's lesson. The teacher will make sure every student has correctly filled out WS 1.1 as he assists students during the lab portion of the class. Also, the teacher will make sure the students understand the various organelles and that there are no questions about cellular functions.

Reflection: To be completed after the lesson

Day 2 / Goal 1 / Objective 2a

Entry Point: Students will come into this lesson understanding the different organelles in the cell as well as the differences between cell types. Students should be able to begin discussing the importance of each organelle.

Topic: We will be discussing the overall importance of each organelle. We will also discuss how a cell would function if specific organelles were not working properly.

Objectives:

Objective A: Students will be able to describe what would be wrong with a cell if a specific organelle were not functioning properly.

Objective B: Students will be able to describe how each organelle functions in respect to all the other organelles. Students need to understand that the cell functions as a whole.

Materials:

- WS 1.1 From Day 1
- PowerPoint presentation from Day 1 of cell diagrams
- Pictures of organisms who have organelles knocked out
- Flashcards with organelles

Procedure:

10 minutes – Go over WS 1.1 from Day 1 with PowerPoint presentation. Make sure all the students still remember what each organelle is and what its function is. Call on random students to ask them about specific organelles.

10 minutes – Begin discussion on how cell functions as a whole. Show students how the organelles need each other to function. Cell needs membrane to surround and protect it. Endoplasmic reticulum produces ribosomes which produce proteins which are transported by the golgi apparatus back to the membrane and the mitochondria provides the energy for it all to happen. Make sure students understand how everything is interwoven

10 minutes – Show pictures of organisms that have specific organelles that don't function properly. Describe the effect of these knockouts on the organism as a whole. Ask the students about specific knockouts – would an organism be able to live if it had no mitochondria? What if it had no lysosomes? Is the nucleus completely necessary? Why do Eukaryotes have a nucleus and prokaryotes don't?

20 minutes – Play “around the world” with organelle flashcards to make sure every student has the organelles down thoroughly. First student to say what the organelle is wins the round, the student will then be asked to describe the function of that organelle. If the student is unsure he can ask his classmates for help.

Assessment: Assessment will be based on each student’s performance during game time. “Around the world” will clearly show what students are comfortable with the functions of organelles and what students need more work.

Evaluation: There will be no formal evaluation today. The teacher will make sure everyone understands the topic during class discussion time. Also, the teacher will be able to get a good idea of how well each student understands the organelles based on their performance in the “around the world” game.

Reflection: To be completed after the lesson

Day 3 / Goal 1 / Objective 3a

Entry Point: Students will be familiar with all organelles of the cell. Students should also be familiar with the differences between plant and animal cells and between prokaryotic and eukaryotic cells. Finally, students should be familiar with the role each organelle plays in the cell and how the cell would function without that organelle.

Topic: Today we will make sure the students understand the key differences between all types of cells, why those differences exist, and what advantages/disadvantages each cell has. There will be a quiz at the end of the day's lesson covering all of Goal 1.

Objective:

Objective A: Students will be able to describe, in detail the differences between prokaryotic and eukaryotic cells and between plant and animal cells.

Objective B: Students will be able to describe why these differences exist between the cells.

Objective C: Students will be able to pass a quiz based on all of the objectives from Goal 1.

Materials:

- PowerPoint presentation from Day 1
- Quiz 1 (*See Quiz 1*)
- Microscopes
- Microscope slides of animal, plant, and bacteria cells

Procedures:

15 minutes – Review material from all previous days. Make sure the students don't have any questions over any of the material. Question students about various organelles and their roles in the cell. Cover the basic differences between cell types. Go through diagrams in PowerPoint presentation so information is fresh in the students' minds.

35 minutes – Quiz 1

Assessment: Will be based on the student's performance on Quiz 1

Evaluation: Quiz 1 will be out of 30 points, each question being worth 2 points.

Reflections: To be completed after lesson.

Day 4 / Goal 2 / Objective 1b

Entry Point: Students will understand how the cell is built but will not yet understand how the cell gets the energy it needs to build. Students will know that cells need energy, but not yet know how that energy is used.

Topic: We will begin discussing how food is taken in by the cell. There will also be an overview of glycolysis, the Citric Acid (TCA) cycle and the Electron transport system (ETS).

Objectives:

Objective A: Students will understand that once food reaches the cell it needs to be in a specific form for the cell to take it in.

Objective B: Students will have a basic understanding of how food is broken down within the cell.

Objective C: Students will be able to draw a diagram showing the path of food from consumption to use.

Materials:

- Worksheet (See WS 2.1)
- PowerPoint presentation discussing cellular metabolism
- Discussion Questions (See procedure)

Procedure: **10 minutes** – Discussing what students already know about cells and energy. Where do humans get energy from? Where do animals get energy from? Do you know what type of molecule your food has to be broken down into to be used as energy? (sugar) How do you think cells get the sugar molecules inside? What do you think happens to the sugar molecule once it is inside the cell?

20 minutes – Lecture using PowerPoint presentation. Discuss how cells engulf food – phagocytosis vs. pinocytosis. Discuss how complex proteins, carbohydrates, and fatty acids are all broken down into pyruvate (a type of sugar). Discuss that once that pyruvate is in the cell, it goes through several processes to be converted into energy that our body can use. Go over brief overviews of glycolysis, TCA cycle, and ETS.

20 minutes – Hand out WS 2.1 and go through it with students. Make sure every student has it completed by the time they leave class. Make sure students don't have any questions regarding metabolic cycles.

Assessment: Students will be assessed based on classroom participation and on the completion of WS 2.1.

Evaluation: There will be no formal evaluation, just make sure every student has WS 2.1 completed by the end of class.

Reflection: To be completed after the lesson.

Day 5 / Goal 2 / Objective 2b

Entry Point: Students will have a basic understanding of the process of glycolysis. They will understand why it occurs – to begin the breakdown of sugar, and what the cell gets out of it – a usable form of energy. Students will not yet understand the process of glycolysis in depth.

Topic: Today we will be covering the process of glycolysis. Hopefully every student will understand all the products and reactants by the end of the lesson.

Objectives:

Objective A: Each student will complete their copy of WS 2.2

Objective B: Each student will gain a better understanding of the process of glycolysis, why it occurs, under what conditions it occurs, and what happens if it does not occur.

Objective C: Each student will be able to begin writing their short story about the journey of a sugar molecule

Materials:

- Movie about cell metabolism
 - The Dissected World of Biology, Program 2 - The Cell
- Overhead of blank glycolysis worksheet to fill in with class
- Worksheet (*See WS 2.2*)
- Sample stories from last year
- PowerPoint presentation discussing reasons behind glycolysis

Procedure: **10 minutes** – Watch movie “Standard Deviants - The Dissected World of Biology, Program 2 - The Cell.” Specifically segment on glycolysis in the cell.

10 minutes – Discuss movie using PowerPoint presentation. So why does glycolysis occur? Under what conditions doesn't occur? What if we go too long under those conditions? Is glycolysis the end of the line of just the starting point for cell metabolism? What if it was the end of the line?

10 minutes – Go over WS 2.2 with class. Explain each step of the pathway. Why specific molecules are used. Why energy is added at certain steps and taken away at other steps. What the end products mean in the long run. Make sure every student has a complete WS 2.2 filled out. Make sure the students don't have any questions regarding glycolysis

10 minutes – Since the final project for this goal is to write a short story about the journey of a sugar molecule through the metabolic process, the teacher will spend 10 minutes ready several of the exemplary papers from last year. Make sure the students know that they should be creative on these papers – humor is greatly encouraged.

10 minutes – Have kids get in groups of 3-4 and start brainstorming ideas for paper. What sorts of things will they need to include. How will you write from the perspective of a sugar molecule?

Assessment: Students will be assessed based on classroom participation and on the completion of WS 2.2.

Evaluation: There will be no formal evaluation today, just make sure that each student has completed WS 2.2 with all the correct answers. Also make sure that students are focused on brainstorming during their group time.

Reflection: To be completed after the lesson.

Day 6 / Goal 2 / Objective 3b

Entry Point: Students will come in knowing the basics of cell metabolism and about glycolysis in depth. They will understand a little about the TCA cycle and what it is for, but that is all. Students will also have started on their short story and will know the basics for what it is supposed to be about as well.

Topic: Today we will be discussing the TCA cycle (Also known as the Krebs Cycle and Citric Acid Cycle). We will go in depth about the purpose of the TCA cycle, how it functions in relation to glycolysis, and what the end products are. We will also continue working on the students' short stories.

Objectives:

Objective A: Students will have an in depth understanding of what the TCA cycle is and how it functions, especially in conjunction with glycolysis.

Objective B: Students will have an idea of how they want to write their paper and what they want to include in it.

Materials:

- Movie about cell metabolism
 - The Dissected World of Biology, Program 2 - The Cell
- Overhead of blank TCA cycle worksheet to fill in with class
- Worksheet (*See WS 2.3*)
- Sample stories from last year
- PowerPoint presentation discussing reasons behind TCA cycle

Procedure:

10 minutes – Watch movie “Standard Deviants - The Dissected World of Biology, Program 2 - The Cell.” Specifically segment on TCA cycle in the cell.

10 minutes – Discuss movie using PowerPoint presentation. So why does the TCA cycle occur? Why does it have to occur after glycolysis? How does it differ from glycolysis? Does it occur under the same conditions as glycolysis? What if the TCA cycle wasn't functioning, would our bodies still have energy? What are the end results of the TCA cycle?

10 minutes – Go over WS 2.3 with class. Explain each step of the pathway. Why specific molecules are used. Why energy is added at certain steps and taken away at other steps. What the end products mean in the long run. Make sure every student has a complete WS 2.3 filled out. Make sure the students don't have any questions regarding the TCA cycle

5 minutes – Read 2 or 3 more examples of good stories from previous years so students have a better understanding of what is to be expected, especially now that we have covered the TCA cycle as well.

15 minutes – Begin working on papers. Have students start an outline on what sorts of things they will need to have for the first 2 parts of cellular metabolism (respiration) – glycolysis and the TCA cycle. What are the important steps that you'll need to include in your story? Can you incorporate humor in any way? Can you think of any way to tell this story on another level, maybe the sugar molecule is an analogy for something else?

Assessment: Students will be assessed based on classroom participation and on the completion of WS 2.3.

Evaluation: There will be no formal evaluation today, just make sure that each student has completed WS 2.3 with all the correct answers. Also make sure that students are focused on beginning their paper during the time given to them at the end of the class.

Reflection: To be completed after the lesson.

Day 7 / Goal 2 / Objective 4b

Entry Point: Students will understand how glycolysis and the TCA cycle function and will have a basic understanding of the Electron Transport System (ETS or ETC). They will not yet understand how the ETS converts protons into usable energy.

Topic: Today we will be discussing the ETS in depth. Students will learn how protons are brought into the ETS. How those protons are converted into a usable gradient. And how the power of that gradient is used to create ATP – a usable energy form for the cell.

Objectives:

Objective A: Students will understand how the ETS functions in conjunction with glycolysis and the TCA cycle.

Objective B: Students will understand the inner workings of the ETS and how protons move from complex to complex

Objective C: Students will help create a rubric as to what their short stories should be graded on.

Materials:

- Movie about cell metabolism
 - The Dissected World of Biology, Program 2 - The Cell
- Overhead of blank ETS worksheet to fill in with class
- Worksheet (*See WS 2.4*)
- Sample stories from last year
- PowerPoint presentation discussing reasons behind ETS

Procedure: **10 minutes** – Watch movie “Standard Deviants - The Dissected World of Biology, Program 2 - The Cell.” Specifically segment on ETS in the cell.

10 minutes – Discuss movie using PowerPoint presentation. What is the ETS cycle? Is it different for NADH and FADH molecules? How does it generate a proton gradient? How is that proton gradient used to create ATP? What is the name of the enzyme that creates ATP’s using the proton gradient? Why does the ETS have to be the last step in metabolism, why couldn’t it be first?

10 minutes – Go over WS 2.4 with class. Explain each step of the pathway. Why specific molecules are used. Make note that no energy is added. What the end products mean in the long run. Make sure every student has a complete WS 2.4 filled out. Make sure the students don’t have any questions regarding the ETS.

5 minutes – Read 1 more story from last year, now that the students have gone through the entire metabolic cycle and understand exactly what happens.

15 minutes – Create rubric with students for what the paper is graded on. What steps will you all have to include? How many pages will it have to be? What will be the things you don't necessarily have to include? How much will grammar and spelling count for? How should the paper be organized? Does it have to be typed? **ASK STUDENTS TO BRING ROUGH DRAFT OF THE PAPER FOR DAY 8**

Assessment: Students will be assessed based on classroom participation and on the completion of WS 2.4.

Evaluation: There will be no formal evaluation today, just make sure that each student has completed WS 2.4 with all the correct answers. Also make sure that all students help contribute to the construction of the rubric for the grading of their short stories.

Reflection: To be completed after the lesson.

Day 8 / Goal 2 / Objective 5b

Entry Point: Students will come into this lesson with an in-depth understanding of cellular metabolism. They will understand the inner workings of glycolysis, the TCA cycle, and the ETS. They will also know what is to be expected of them on their short stories.

Topic: The topic for today will be how the energy created in cellular metabolism is used throughout the cell. This will be a brief discussion and most of the time will be spent working on their short stories.

Objectives:

Objective A: Students will gain an understanding of how the energy produced during metabolism is used elsewhere in the cell.

Objective B: Students will peer-edit each other's short stories and discuss with their peer-reviewer things that need to be worked on.

Materials:

- Students should all have rough drafts of their papers
- Blank rubrics for students to use when peer-editing
- Short PowerPoint presentation on cellular metabolism
- Discussion questions

Procedure:

5 minutes – PowerPoint presentation showing what happens with the ATP created during respiration. ATP is used by proteins and enzymes to synthesize new proteins, to replicate DNA, to repair the cell, to fight off viruses, and to help with cellular reproduction.

10 minutes – Discussion questions to test overall understanding. So where does energy come from? Why do our bodies need some form of energy? How does it get from its starting point to the finish line? Why must food go through such a complicated process? Why can't we just use food directly for energy?

35 minutes – Have students put rough drafts of short stories on table in the center of the room, then have each student pick a random paper to read through. Have students read through paper while looking at the rubric for grading and mark down what the students have and what they lack. Then have the students return the papers to their owners and discuss what they think needs to be accomplished before the final is handed in. Make sure each student puts their name on the rubric they used, they will get a grade for peer-reviewing. MAKE SURE STUDENTS HAVE FINAL COPY FOR DAY 9

Assessment: Will be based on peer-reviewing. All students will need to participate and read another student's paper while filling out a sample rubric for that student. The students grade will be based on how actively they review their peer's paper.

Evaluation: Students will get a 5 point grade for peer-reviewing. If they did the peer review and put some serious thought into their comments, they will get the full 5 points. If they only made a few remarks about what could be improved, they will get 3 points. If they did absolutely nothing, they will fail the assignment and get 0 points.

Reflection: To be completed after the lesson.

Day 9 / Goal 3 / Objective 1c

Entry Point: Students will understand that DNA is located in the nucleus of the cell. They will also understand that DNA carries their genetic information. They will not yet understand how DNA works or how it is replicated.

Topic: Today we will be discussing the process of replicating DNA. What enzymes are used, what it is replicated in a semi-conservative fashion, what happens if mistakes are made, and how those mistakes are repaired.

Objectives:

Objective A: Students will understand the basics of DNA – how it is structured, the direction of replication, and why replication occurs.

Objective B: Students will gain an understanding on all the enzymes used in DNA replication and what their functions are.

Objective C: Students will be able to describe, in detail, how these enzymes function together in order to replicate a strand of DNA

Materials:

- DNA models from last year
- Sample paragraphs from last year
- PowerPoint lecture on DNA replication
- Blank DNA worksheet to over with students on overhead
- Worksheet (*See WS 3.1*)
- Rubber tubing for DNA demonstration

Procedures:

10 minutes – Explain to the class that the final project for this goal will be creating a DNA model out of their favorite candy which can be put on display for a class period and then eaten. Accompanying this model will be a short (approximately 1 page) essay about how DNA is replicated. Show the class several models and essays from last year so they can get an idea of what they'll be doing.

20 minutes – PowerPoint presentation on DNA replication. Make sure to explain how DNA is built with the sugar-phosphate backbone and the bases on the inside. Make sure to explain A pairs with T and C pairs with G. Let students know DNA is always replicated 5' to 3'. DNA is wound up very tightly and wrapped around histones so that it can all fit inside your nucleus, because if you unraveled it, it would be several meters long. Also, explain all the enzymes. Topoisomerase unwinds DNA. Helicase breaks the two strands apart. Primase creates a primer to start transcription. DNA Polymerase creates the new strands of DNA. And Ligase seals the nicks between primase and polymerase.

5 minutes – Example of DNA structure using 2 rubber tubes. Show how DNA is coiled, how it breaks apart using topoisomerase and helicase. Show how replication proceeds from the replication bubble at 2 replication forks.

15 minutes – Go over WS 3.1 with class. Make sure they understand where each enzyme is at and what the role of that enzyme is. Also make sure students comprehend how these enzymes function together in the reproductive process. Emphasize that DNA replication could not occur if any one of these enzymes was missing, much like many other processes we've learned about.

Assessment: There will be no formal assessment today. Just to make sure that each student has a completed WS 3.1 and understands what the final project for this goal will be.

Evaluation: There will also be no formal evaluation today. Everyone's WS 3.1 should be 100% correct since I will be going over it with the class. Class participation will be judged based on who is actively involved throughout the lesson.

Reflection: To be completed after the lesson.

Day 10 / Goal 3 / Objective 2c

Entry Point: Students will not yet understand anything about RNA except that it is produced from DNA. They will need to learn the basics about RNA transcription and translation.

Topic: Today we will be discussing the formation of RNA. How that RNA is then used in the ribosomes to create chains of amino acids. And then how those amino acids are then formed into proteins.

Objectives:

Objective A: Students will understand that RNA is created as a direct copy of certain segments or “genes” of DNA. Students will also understand how that RNA copy is made.

Objective B: Students will learn that once that RNA is created, it travels to the ribosomes where, in conjunction with tRNA a chain of amino acids is created.

Objective C: Students will see how that chain of amino acids can be used to create a functional protein.

Materials:

- 3 giant boxes
- A long rope
- Large balls that can be connected via short pipes
- PowerPoint presentation regarding RNA

Procedure:

25 minutes – Lecture on PowerPoint presentation. Describe the processes of transcription and translation. mRNA is copied from a DNA segment using RNA polymerase. That mRNA is then modified slightly and sent out of the nucleus to the ribosomes. Once at the ribosomes, the mRNA slides between the two subunits of the ribosomes and translation begins. Explain to the students that once the lecture is over, we will have a demonstration of how translation works. Explain to the students how the incoming tRNA lines up with the mRNA and begins to create a chain of amino acids. Describe to the students how the tRNA moves from A to P to E site on the ribosome and how a different event happens at each of these sites. Finally, explain how that chain of amino acids is released and formed into a functional protein.

20 minutes – Interactive model of how translation works. Stretch out rope across the ground and explain to students how the rope represents mRNA. Then put the 3 giant boxes on top of the rope and explain how these are the three (E,P, and A) sites on the ribosome). Finally, tell each student that they are to function as a tRNA and give them each a ball and a

pipe. Start with the first student (tRNA) and explain how the first one is always Methionine. Have the student climb into the first box. Then have the next student come, climb into the first box and move the first student over to the second box. When the first student moves over, he attaches his ball to the next student's ball to represent the growing amino acid chain. This process continues until all the students have gone.

5 minutes – Give the students some time to begin brainstorming ideas for their DNA model project. What sorts of candy will they use? What facts will they need to include in their essay? How big will their model be?
ASK STUDENTS TO BRING SUPPLIES FOR DAY 11

Assessment: Assessment will be based on each student's willingness to participate in the demonstration of translation. If the students actively participate, they will get full participation points for the day.

Evaluation: There will be no formal evaluation today. The teacher will make sure all students are actively engaged during the lecture by asking questions to gauge understanding. The teacher will also make sure each student participates in, and understands, the translation demonstration.

Reflection: To be completed after the lesson.

Day 11 / Goal 3 / Objective 3c

Entry Point: Students will understand how proteins are created from mRNA and ribosomes but they will not yet know how those proteins are used throughout the cell and body.

Topic: Today we will be discussing proteins. What their functions are, what types of structures they form, and why they are a necessary part of our bodies. We will also be working on our DNA models and essays.

Objectives:

Objective A: Students will understand how proteins are formed from the single stranded amino acid structure

Objective B: Students will understand how these proteins are used throughout the body

Objective C: Students will have time in class to get started and hopefully complete their DNA models and paragraphs, so they can be displayed / eaten on Day 12.

Materials:

- Portable computer lab for writing short essays
- Desk space for each student to work on models
- Toothpicks and extra candy for students to use on models
- Digital camera to take pictures of student's finished projects
- PowerPoint lecture for protein introduction

Procedure:

10 minutes – Brief lecture over proteins. Discuss how the amino acids (primary structure) fold into secondary, tertiary, and eventually quaternary structure which is the completed protein. Discuss how these proteins can act as enzymes in the cell and throughout the body. Finally, emphasize the importance proteins play in the regulation of all bodily systems.

40 minutes – Give students plenty of time to build their 3-D DNA models with candy and type their essays on the portable computer lab. Make sure each student has the supplies they need to create the model they want to create. Put on some enjoyable background music as well, take student requests. Give the students the rest of the class period to build and write.

Assessment: Assessment will come tomorrow when they display their finished project. The DNA must be constructed correctly for all possible points – sugar-phosphate backbone on the outside with the bases on the inside, and it must be double stranded and a helix. The essay will also be graded tomorrow when the projects are presented.

Evaluation: Nothing will be evaluated today, the student's final projects will be due tomorrow and they will be presented to the class. At that point, they will be formally evaluated.

Reflection: To be completed after the lesson.

Day 12 / Goal 4 / Objective 1d

Entry Point: Students will know they basic differences between plant and animal cells from goal 1, but they won't know why those differences exist and how extensive they are.

Topic: Today we will be presenting 3-D DNA models that the students have built while they share their essay about how DNA is transcribed and translated into protein. Following that, we will have a brief lecture over the specific differences between plant and animal cells.

Objectives:

Objective A: Each student will get to present his or her model and essay to the class and share what they know about DNA replication.

Objective B: Each student will write down a grade they think the presenter should get and why, i.e. each student will be evaluated by his or her peers while he presents.

Objective C: Each student will get introduced to the specific differences between plant and animal cells and why those differences exist.

Materials:

- Students need their models and essays
- Students need sheet to record grades and reasoning
- PowerPoint lecture of animal and plant cell differences

Procedure:

40 minutes – Students present their models and essays. While each student presents they will be evaluated by the other students on several issues. Is there model built correctly? Does their essay contain everything it needs to? Are all the enzymes listed? Are steps listed in the correct order? Does the presenter have a clear understanding of what he/she is talking about? How are his/her presentation skills? Are they just reading, or making some eye contact as well? Take all these things into consideration while reviewing.

10 minutes – Break down candy models so the kids having something to much on during the lecture portion of the class. PowerPoint lecture on plant and animal cells. Discuss why plant cells have cell walls, chloroplast, and vacuoles while animal cells do not. How do animal cells get their energy then? Why is that different than plant cells? Which way seems easier? Why don't we have chloroplast then?

Assessment: Assessment of presentations will be based on 2 things. First, what the other students in the class think the presenter deserves. Second, what the teacher feels they deserve. If the model is built correctly, the student will get full points for that. If the essay includes all the enzymes, the correct steps in the correct order, and an overall understanding of the topic, the presenter will get an A. If only some of the qualifications are met, the grade will go down from there.

Evaluation: As stated in the *Assessment* portion, the presenters will be evaluated based on student and teacher response. It will be a combination of these 2 things that determines the student's overall grade on their 3-D model.

Reflection: To be completed after the lesson

Day 13 / Goal 4 / Objective 2d

Entry Point: At this point students will understand the differences between plant and animal cells but they will not yet be able to identify those differences in real life examples.

Topic: Today we will be using the microscopes to recognize the various and significant differences between plant and animal cells. We will also be taking a short quiz over the differences between plant and animal cells.

Objectives:

Objective A: Each student will be able to prepare their own microscope slide after dissecting a plant and part of a deceased animal.

Objective B: Using their prepared slides students will be able to pick out and describe the specific differences between plant and animal cells

Objective C: Each student will take a quiz covering the main differences between plant and animal cells.

Materials:

- Quiz (See Quiz 2)
- Microscope slides
- Plants to dissect
- Deceased lab animals to dissect
- Microscopes

Procedure: **15 minutes** – Have students dissect their plant and animal selection and show them how to prepare a microscope slide. Make sure they cut their segments very thin, so they're only dealing with a few layers of cells which will make looking at the cells under the microscope much easier.

10 minutes – Have students identify differences between the plant and animal cell. Look specifically for the chloroplast, the cell wall, the vacuole, and the mitochondria.

25 minutes – Take Quiz 2. Students may ask questions, or look at their prepared slides under the microscope if they would like to. **TELL STUDENTS TO BRING REVIEW QUESTIONS FOR TOMORROW.**

Assessment: Quiz 2 will be 10 questions, each worth 3 points

Evaluation: Standard evaluation scale will be applied to Quiz 2

Reflection: To be completed after the lesson.

Day 14 / Review

Entry Point: Students should be familiar with all topics and ideas that we have covered this unit

Topic: Today we will be reviewing everything we covered in Goals 1-4. Students will have the chance to ask questions about the test tomorrow. The teacher will make sure all students are prepared as possible.

Objectives:

Objective A: Students will come to class with review questions over material they do not fully understand.

Objective B: Students will have their questions answered during the review period.

Materials:

- All previous lectures and quizzes
- All overhead worksheets
- Some sample questions from the exam

Procedures:

30 minutes: Answer student's questions about the exam. Cover ideas/concepts they are having difficulty with. Make sure all questions have been covered.

20 minutes: Read a few sample questions from tomorrow's exam. Walk the students through each question and how they should answer it. Make sure there are no overall concepts that students are having difficulty with. If there are, explain them in greater depth with as much time as you are able.

Assessment: There will be no assessment today.

Evaluation: Make sure students are actively engaged in the review. Make sure to answer all students' questions.

Reflection: To be completed after the lesson.

Day 15 / Unit Exam

Entry Point: Each student should come into the exam with a full grasp on all the topics we have covered this unit.

Topic: Today will be the unit exam. It will cover topics from all 4 of the goals we have discussed.

Objectives:

Objective A: Each student will take and pass the Unit Exam

Materials: -Exam (*See Exam 1*)
-Microscopes already set up with slides in them

Procedure: **50 minutes** – Students will take Exam 1. If students have questions they are allowed to ask for help from the teacher.

Assessment: Each question will be worth 1 point. The 4 essays will each be worth 10 points. Make sure students know to only write a paragraph or two for each essay, they do not need to be long responses.

Evaluation: Standard evaluation will apply to Exam 1 (90-100 = A, 80-89 = B, etc).

Reflection: To be completed after the lesson.