Name_____
Period_____
Date_____

Microscopic Plant Structure & Water Transport Activity

Objective: To develop an understanding of how the hierarchical structure of a plant contributes to the transport of water in the tree. Note: You will be using your communication skills and will be developing proper microscope technique in this activity.

Introduction:
You have learned that water has specific properties that help it to travel in a plant. As you know, the polarity of water leads to cohesion, adhesion, and surface tension in the microscopic tubes of plants. Capillary action allows water to resist gravity and to move from the roots through the stems to the leaves. In this activity, you will work in two groups to advance your knowledge about the microscopic structures of the plant that are used in water transport.

Procedure:

Lab (composition) Notebook

1. In your lab notebook, write the following information:
    a. Name of activity at the top of the page
    b. Date in upper right corner
    c. Introduction heading (underline heading)
        i. In one paragraph, rephrase the information from the introduction above
            1. At the end of the introduction paragraph, cite this handout in APA format by writing (Mellor, 2019) before the period of the last sentence.
    d. Hypothesis
        i. Begin a new paragraph by stating “The hypothesis for this activity is that there are macroscopic structures and (*write your own description of the microscopic structures you think you will see*) that allow the water to move easily through *large/small* diameter (choose one) tubing”. Sketch the macroscopic structures of a plant (roots, stems, leaves) identifying the path that water moves in a typical plant (not the redwood).
    e. Procedure heading (underline heading)
        i. You do not have to write all of the procedure over again, instead please write “Refer to procedure in “Microscopic Plant Structure & Water Transport Activity” written by Mellor, 2019”
            1. If you make any changes to the procedure written below, note those changes in this section.
    f. Observations and Data Collection

i. Complete this section following the instructions written in each part of the lab.

g. Analysis/Conclusion
   i. Complete this section following the instructions written in each part of the lab.
   ii. Answer the questions written in this handout directly in the space provided (do not put in your lab notebook).
   iii. After completing all questions and activities, write a paragraph explaining whether the hypothesis was supported or refuted. Include the evidence from the lab activity that led to this conclusion. Include any sources of error and one future experiment that could be performed as a follow-up to this activity.

h. Reference(s)
   i. Write out the end-of-text APA citations for each of the sources you use in this lab activity.

PART A: Organism and Organ System

1. In your lab notebook, quickly sketch the macroscopic structures of the plant organism at your table. Indicate the organ systems (roots, stem, leaves) and the direction water moves.

PART B: Organ and Tissue and Cell Structures

2. For part B, you will be assigned to become an expert in the histology of a specific organ. You will go to a lab bench with microscopes and with other students. At the lab bench, you will find directions specific to the structures involved in the function of that organ.
3. When you complete the tasks at the lab benches, put away your slides, lower the stage, return your objective lens to the scanning objective (4x), unplug and coil the cord around the arm of the microscope.
4. Cover your microscope and return to your desk.
5. Return to your desk and draw what you learned in your corner of the whiteboard. After all students have returned to your table and drawn in their corners, share what you learned about your specific structures.
6. If all students have not returned to your table, begin answering the questions for parts A and B at the end of this handout.
7. After all students have shared information about their organs and tissues, work as a group to develop an illustration in the center of the white board that compiles part A and all aspects of part B.
8. When your drawing is completed, call Mrs. Mellor over to describe your illustration.
9. After describing your illustration to Mrs. Mellor, take a picture and upload to Google classroom.
10. Before the next class, print out a picture (this does not have to be in color) and tape the picture into your lab notebook under an Analysis/ Conclusion heading.

PART C: Capillary Action in Various Diameters of Tubing

1. After donning goggles, go to your lab bench with your group.
2. Put four drops of food coloring into 25 mls of tap water in a beaker.
3. Use the stirring rod to gently stir the solution.
4. Create a table in your lab notebook to record these results.
5. Place your thumb over the tops of the tubes to prevent air from entering the top.
6. Place the tubes (with your thumb over the top of the tubes) into the solution for thirty seconds but do not let the tubes touch the bottom.
7. At the end of thirty seconds, measure the distance that the solution traveled up each tube.
8. Record your results in the table in your notebook.
9. Place the tubes (without your thumb over the top of the tubes) into the solution for thirty seconds but do not let the tubes touch the bottom.
10. At the end of thirty seconds, measure the distance that the solution traveled up each tube.
11. Record your results in the table in your notebook.
12. Follow your teacher's instructions for cleaning up after this activity.

Analysis Questions: Write the answers to the questions in the space provided here.

PART A

1. There is a hierarchy of life in which the components contribute to the overall function of an organism. Fill in the following table based on your prior knowledge and the knowledge you obtained from today's activity. Include a cell in the tissue making up a specific organ in a plant and animal. Do the best that you can by just using your own brain. (4 pts)

Type of organism	Organ system	Organ	Tissue	Cell
Plant				
Human				

2. There is a higher level of organization to biology beyond the organism. This includes a community, biome, biosphere, ecosystem, population. In the space below, define these terms in your own words but remember to cite your source. After defining the terms, draw a flow chart showing all of the levels of organization from smallest (the cell) to the largest . (5 pts)

PART B

1. Transpiration is the loss of water vapor through pores in the leaf. What abiotic factors (non-living components of the environment) could contribute to the amount of water lost by a plant? (4 pts)

2. Provide two examples of adaptations that would allow a plant to survive in the presence of the abiotic factor you mentioned in question B1. (4 pts)

PART C

1. What role do each of the following play in capillary action (4 pts)?
    a. Cohesion -

    b. Adhesion -

    c. Surface tension -

    d. Polarity -

2. After completing all questions and activities, write a paragraph in your lab notebook explaining whether the hypothesis was supported or refuted. Include the evidence from the lab activity that led to this conclusion. Include any sources of error and one future experiment that could be performed as a follow-up to this activity.

ROOT TIP L.S. FOR ROOT HAIR ORIGIN - 6 experts

Reference pages: Campbell Reece Biology 7th edition text pgs. 713-714, 717-721, and 744-748

1. Use proper microscope technique to focus at 400X total magnification on the longitudinal section of the corn root tip.
2. Use the petri dish to draw a circle in your lab notebook.
3. Write the name of the specimen above the circle.
4. Below the circle, write “400X total magnification”
5. In the circle, draw what you see as you see it. Use a pencil and add color with colored pencils. Make sure that you can clearly identify the following structures:
    - Epidermis
    - Root hair
    - Cortex
    - Vascular cylinder
6. Use a ruler to draw a line from the outside of the circle to each structure. Neatly write the label outside of the circle.
7. As a group, develop an explanation for how each of the structures play a role in the uptake and transport of water. Be able to thoroughly describe the movement of water in this structure and how the properties of water contribute to this movement.

STEM TYPES HERBACEOUS AND WOODY - 6 experts

Reference pages: Campbell Reece Biology 7th edition text pgs. 713-715, 717-721, 724-728, and 748

1. Use proper microscope technique to focus at 400X total magnification on the woody cross-section (a purplish eudicot stem).
2. Use the petri dish to draw a circle in your lab notebook.
3. Write the name of the specimen above the circle.
4. Below the circle, write “400X total magnification”
5. In the circle, draw what you see as you see it. Use a pencil and add color with colored pencils. Make sure that you can clearly identify the following structures:
    - Epidermis
    - Vascular bundle
    - Vascular cambium
    - Xylem
6. Use a ruler to draw a line from the outside of the circle to each structure. Neatly write the label outside of the circle.
7. As a group, develop an explanation for how each of the structures play a role in the uptake and transport of water. Be able to thoroughly describe the movement of water in this structure and how the properties of water contribute to this movement.

LEAF TYPES MONOCOT AND DICOT C.S. - 6 experts

Reference pages: Campbell Reece Biology 7th edition text pgs. 713-719, 724-725, and 748-751

1. Use proper microscope technique to focus at 400X total magnification on the cross section of the dicot leaf (bottom specimen on the slide).
2. Use the petri dish to draw a circle in your lab notebook.
3. Write the name of the specimen above the circle.
4. Below the circle, write “400X total magnification”
5. In the circle, draw what you see as you see it. Use a pencil and add color with colored pencils. Make sure that you can clearly identify the following structures:
    - Upper and lower epidermis
    - Vein
    - Xylem
    - Guard cells
    - Cuticle
6. Use a ruler to draw a line from the outside of the circle to each structure. Neatly write the label outside of the circle.
7. As a group, develop an explanation for how each of the structures play a role in the uptake and transport of water. Be able to thoroughly describe the movement of water in this structure and how the properties of water contribute to this movement.

LEAF EPIDERMIS* MONOCOT AND DICOT W.M. - 6 experts

Reference pages: Campbell Reece Biology 7th edition text pgs. 713-719, 724-725, and 748-751

1. Use proper microscope technique to focus at 400X total magnification on the whole mount of the dicot leaf epidermis (bottom specimen on the slide).
2. Use the petri dish to draw a circle in your lab notebook.
3. Write the name of the specimen above the circle.
4. Below the circle, write “400X total magnification”
5. In the circle, draw what you see as you see it. Use a pencil and add color with colored pencils. Make sure that you can clearly identify the following structures:
    - Epidermal cell
    - Guard cells
    - Cuticle
    - Stomatal pore
6. Use a ruler to draw a line from the outside of the circle to each structure. Neatly write the label outside of the circle.
7. As a group, develop an explanation for how each of the structures plays a role in the uptake and transport of water. Be able to thoroughly describe the movement of water in this structure and how the properties of water contribute to this movement.

*NOTE - Epidermis is spelled incorrectly on some slides. Please use the correct spelling.