

# Plant Cell Crime Scene

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**Subject:** The Living Environment

**Grade Level:** 7-12

**Standards:** Next Generation Science Standards ([www.nextgenscience.org](http://www.nextgenscience.org))

**MS-LS1-1.** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

**MS-LS1-2.** Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.

**Schedule:** 45 minutes

**CCMR Lending Library Connected Activities:**  
Forensics: Case of the Missing Diamond Maker



<p><b><u>Objectives:</u></b></p> <p>Given TEM (Transmission Electron Microscope) images, students will decide if the image is an animal or plant cell. They will use this information to determine if a suspect could be the murderer.</p>	<p><b><u>Vocabulary:</u></b></p> <p>Transmission Electron Microscope              Light Microscope              Cell              Organelle              Forensic Botany</p>
<p><b><u>Students Will:</u></b></p> <p>Decide what evidence needs to be collected at a murder scene.</p> <p>Write down observations of trees, leaves, plant cell textbook images, plant cell light microscope images, plant cell TEM images. Observations will become more detailed and specific.</p> <p>Use given measurements to identify plant cell organelles.</p> <p>Describe how forensic botany could be useful in a murder mystery.</p> <p>Determine if the suspect could be the killer.</p>	<p><b><u>Materials:</u></b></p> <p>Student worksheet with images and measurements.</p>
<p style="text-align: center;"><b>Safety</b></p>	<p>There are no safety concerns.</p>



## **Science Content for the Teacher:**

Forensic botany is study of plants and use of plant remains to help solve crimes or other legal problems. Many popular television crime shows (CSI, Law and Order, Bones, etc.) show an increase in using forensic botany. A famous case involving forensic botany was the 1935 kidnapping of the young son of aviation hero Charles Lindbergh. The kidnapper was caught based on a testimony using the structure of the wood of the ladder used by the kidnapper.

In this activity, students will combine knowledge of microscopy and plant cell structure to apply it to a fictitious murder case involving forensic botany.

Prior to this activity, students should have studied cells and their subunits (organelles), light microscopy and received an introduction to the transmission electron microscope. Transmission electron microscopy (TEM) is a microscopy technique in which a beam of electrons passes through a very thin specimen. Electrons interact with each other as they are transmitted through the specimen. This interaction forms an image on a fluorescent screen. Students should understand that TEMs can image specimen at a much higher resolution than light microscopes (teacher can choose to explain the small de Broglie wavelength of electrons). This allows the user to see the specimen on a scale thousands of times smaller than what can be seen in a light microscope. Students should understand that the TEM allows for better research and analysis in scientific fields. Today, TEM images will be used in the classroom for solving a forensic botany “murder mystery”.

## **Classroom Procedure:**

### **Before class:**

Teacher will make copies of student worksheet with images and measurements.

### **Do now (5 minutes):**

A murder victim was found in a poplar tree garden. What evidence do you look for to find out who the killer is?

### **Introduction (5 minutes)**

A poplar is a type of tree found in North America. Today you will observe evidence like a scientist and try to figure out if the suspect could be the killer.

Students share their do nows out loud as a class. Students might volunteer evidence like: fingerprints, DNA, clothing, hair samples, etc. Teacher will tell students that since the murder happened by a lake, all fingerprints were washed away and no other biological samples were found. A suspect’s muddy shoe was found in his home. What kind of material would the suspect have on his shoe if he were the murderer? Poplar tree samples!



**Activity (25 minutes):** Making observations with at least 3 reasons.

Image #	Immediate observations	What is it?	How do you know? (give at least 3 reasons!)
Image #1		Tree (Poplar)	
Image #2		Leaf (Poplar)	
Image #3		Plant cell - textbook image	
Image #4		Plant cell - light microscope	
Image #5 Found on suspect		Plant cell TEM image with cell organelle measurements (ER, mitochondrion, lysosome)	
Image #6 Found on suspect		Plant cell TEM image with cell organelle measurements	
Image #7 Found on suspect		Plant cell TEM image with cell organelle measurements (chloroplast)(large vacuole, lysosome, ER)	

**Conclusion:**

Could the suspect be the killer? How do you know?

**Next steps:**

If poplar plant material was found on the suspect’s shoe, what should detectives and scientists look for next? If no plant material was found, where should detectives and scientists look for clues next?

**Discussion (10 minutes)**

Students will discuss as a class what their findings were. Could the suspect be the killer?



Why or why not? What evidence do you have?

**Assessment:**

Category	3	2	1	0
Image #1	Image is identified with at least 3 justifications.	Image is identified with only 2 justifications.	Image is identified with no justifications.	Image is not identified.
Image #2	Image is identified with at least 3 justifications.	Image is identified with only 2 justifications.	Image is identified with no justifications.	Image is not identified.
Image #3	Image is identified with at least 3 justifications.	Image is identified with only 2 justifications.	Image is identified with no justifications.	Image is not identified.
Image #4	Image is identified with at least 3 justifications.	Image is identified with only 2 justifications.	Image is identified with no justifications.	Image is not identified.
Image #5	Image is identified with at least 3 justifications.	Image is identified with only 2 justifications.	Image is identified with no justifications.	Image is not identified.
Image #6	Image is identified with at least 3 justifications.	Image is identified with only 2 justifications.	Image is identified with no justifications.	Image is not identified.
Image #7	Image is identified with at least 3 justifications.	Image is identified with only 2 justifications.	Image is identified with no justifications.	Image is not identified.
Conclusion	Conclusion is supported with at least 3 reasons.	Conclusion is supported with only 2 reasons.	Conclusion is given with no support.	No conclusion is given.
Next steps	-----	-----	Next step is identified for detectives and scientists.	No next step is given.

Total points: \_\_\_\_\_ / 25



## **Resources:**

HAMPSHIRE, NEW. "Crime Scene Botanicals - Forensic Botany - Botanical Society of America." 2013.  
<<http://botany.org/PlantTalkingPoints/Crime.php>>

"How does a Transmission Electron Microscope work - IvyRose Holistic." 2014. 11 Aug. 2016  
<<http://www.ivyroses.com/Biology/Techniques/How-does-a-Transmission-Electron-Microscope-work.php>>

"Cells Cells - Parts of the Cell Rap - YouTube." 2011. 16 Aug. 2016  
<<https://www.youtube.com/watch?v=-zafJKbMPA8>>

## **Extra Activities:**

### **Struggling Students and ELL Students;**

- Provide note cards with definitions of vocabulary words and corresponding images.
- Pair up a weaker ELL with a stronger ELL to do the activity in English and in their native language.
- For struggling students, choose 4 images to identify instead of 7

### **Advanced students:**

- Drawing a scale model of a cell. Knowing the sizes of cells and their organelles, students can create their own scale and realistic model of a cell.
- Create your own "mystery" activity using TEM images and have other students guess what it is.

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