

Hair and Fiber Lab

Target Audience 9-12.



Background: Often, forensic scientists need to determine the characteristics of items found at a crime scene and compare these items to ones found on a suspect or at the suspect's home, car, boat or anything connected to the suspect. Physical Properties of trace substances can be used to describe and compare these items of criminal interest. The Locard Principle states that if one surface touches another, there will be an exchange of some physical material, which can be identified. Hair and Fibers are examples of these types of material. Hair and fiber evidence is often used to identify victims and/or suspects from a crime. These crimes can include murder, sexual assault, hit and run accidents and burglary. Not only can be used to identify people, it can show the entrance or exit route of the perpetrator. Hair and fibers can be used to identify clothes or shoes, or any other item belonging to the suspect. Common characteristics of hair include color, continuous or fragmented medulla, with of hair, artificial coloring and recognizable textures. Hair can be identified from humans or different animals. If human, further DNA testing can be performed if the root containing DNA is attached to the hair.

Hair structure: The hair grows from follicles in the skin and covers the surface of mammals. A small muscle that helps the hair stands up surrounds each follicle. A nerve connects the hair follicle to the brain with a sebaceous gland next to the follicle producing sebum, an essential oil. The hair is embedded in the skin follicle at the root and extends the length of the hair shaft. A cross section of a hair includes the cuticle on the outside next to the cortex and finally the inner core is called the medulla. Most of the hair is cortex, which contains the color pigments.

Forensics scientists first determine if the hair is human or animal, then compare to suspect's hair or known pets. A comparison microscope works best for this analysis.

The lab on Hair and Fibers is based on the Carolina Biological Supply Company Kit #ER-69-9871 "His Hair, Her Hair, Whose Hair." Additional hair and fiber slides were purchased from R.P. Cargille Labs.

Knowledge and skills:

- Student should know how to use a microscope
- Students should know how to make up a clean slide with a cover slip

Fundamental Understanding:

- Hair structures from different animals and ethnic groups of people
- Characteristic fibers e.g. wool, cotton, nylon

Essential Question:

What are the different distinction characteristics of hair and fibers?



Purpose: To identify hair from different animals and people in order to match hair from a crime scene to an individual person or animal. In addition, different types of fibers are identified.

Safety Precaution: allergies to latex, xylene (in Kleermount)

Equipment:

- Microscopes
- Microscope slides, cleaned with soapy water and an alcohol rinse, dry with lens paper or Kim Wipes and/or lens paper
- Cover slips
- Forceps
- Hair samples from the kit and other collected specimens include horse, rabbit, deer, dog, and cats
- Bat hair slide (very interesting) from Cargille Labs
- Fibers (wool, cotton, nylon) from Cargille Labs

Reagents:

- dropper bottle of water
- dropper bottle of glycerin
- 1 dropper bottle of latex
- Kleermount with xylene
- Alcohol, 70% isopropyl alcohol

Procedure:

1. Clean slides with warm soapy water, rinse with alcohol and dry with Kim wipes or lens paper. Label each slide prior to adding the sample of hair or fiber, include the name of the type of slide you are making.
2. Three types of slides can be made: a. wet mount, b. a scale cast and c. a whole mount slide. The scale cast and whole mount slides need to be prepared 24 hours in advance.
3. Wet mount slides: Obtain a sample of hair or fiber and place on clean slide with forceps, add a drop or

two of glycerin or water, cover with cover slip and view in microscope.

4. Scale cast: Place a drop of latex near the end of clean slide and with a second slide pull the latex along the slide into a thin film, immediately add several strands of a specific hair or fiber to the film of latex. Let dry overnight. Once latex is hard, use forceps to remove the hair and examine the scale cast left from the hair or fiber under the low power objective. Do not use high power objectives.
5. Whole-mount slides: Place a drop of Kleermount in the center, add several strands of hair or fiber to the Kleermount, and cover with cover slip. Leave for a day to dry, before viewing.
6. Sketch each type of hair or fiber and label each slide: note color and patterns in data table.

Hair Data Table:

	Color	Shape	Medulla pattern (continuous or broken)	Bleached or Dyed	Probable source
1.					
2.					
3.					
4.					

Fibers:

	Color	Patterns	Shape
1. Wool			
2. Cotton			
3. Nylon			
4. Unknown			

Questions:

1. Compare and contrast the different types of hair characteristics from different ethnic groups of people.
2. Compare and contrast the different types of hair characteristics from different animals.
3. Compare and contrast characteristics of the different fibers.

Conclusion:

Discuss the results of the suspects' hair to the known hair sample. Whose hair was it?



Teacher Notes:

R.P. Cargille Laboratories has many more interesting hairs and fiber slides.

References and Resources:

Notes are from "Crime Scene Investigations - Real Life Science Labs for Grades 6-12" by Pam Walker and Elaine Wood and "Criminalistics" Lab Manual, seventh edition by Clifton E. Meloan, Richard E. James and Richard Saperstein, Prentice Hall 2001.

Carolina Biological supply Company kit# 69-9871 "His Hair, Her Hair, Whose Hair"

R.P. Cargille Laboratories, 55 Commerce Road, Cedar Grove, New Jersey 57009-1289, 973-239-6633, fax-973-239-6096 (bat hair, wool, cotton and nylon fibers)

Hair

<http://www.natural-hair.com/structure.html> (nice figure of hair structure)

<http://www.salonweb.com/gold/tri.htm> (discusses hydrogen bonds and beta structure of the hair)