

# FIBERS





# Introduction and How Forensic Scientists Use Fibers

- How are fibers used in Forensic Science?
  - To create a link between **CRIME** and **SUSPECT**
- Fibers are not specific to an individual, but...
  - often fall off and are picked up during activities and go unnoticed
  - may provide police with evidence even if a suspect wears gloves
- Fibers are a form of trace evidence



# Introduction and How Forensic Scientists Use Fibers

- Fiber Transfer

Direct Transfer	Secondary Transfer
Transfer occurs from <b>victim to suspect</b> or suspect to victim	Transfer occurs from a <b>source</b> to the <b>victim</b> then to the <b>suspect</b>



# Introduction and How Forensic Scientists Use Fibers

- In an investigation, collection of fibers within **24 hours** is critical.
- Fiber evaluation can show such things as the
  - **type** of fiber
  - its **color**
  - possibility of **violence**
  - **location** of suspects
  - and point of **origin**.





# Sampling and Testing

- How are fibers found?
  - Black Lights
  - Magnifying Glasses
- Fibers are collected by:
  - Vacuum
  - Sticky Tape
  - Forceps (tweezers)





# Sampling and Testing

- Natural fibers require only an ordinary **microscope** to find characteristic shapes and markings.
- Infrared spectroscopy can reveal the **chemical** structure of fibers that, otherwise, may look very much alike.

# Sampling and Testing

## *Fiber Burn Analysis Key*

When fiber is removed from flame,

- |  |           |
|--|-----------|
| 1a. It ceases to burn .....                                  | Go to 2   |
| 1b. Fiber continues to burn .....                            | Go to 3   |
| 2a. Fibers have the odor of burning hair .....               | Go to 4   |
| 2b. Fibers do not smell like hair .....                      | polyester |
| 3a. Fibers produce a small amount of light ash residue ..... | rayon     |
| 3b. Fibers produce a gray fluffy ash .....                   | cotton    |
| 4a. A hard black bead results from burning .....             | wool      |
| 4b. A brittle, black residue results .....                   | silk      |

- If a large quantity of fibers is found, some can be subjected to **BURN** tests (see analysis key above) or dissolving them in various liquids.
- Crimes can be solved in this way by comparing fibers found on different suspects with those found at the crime scene.



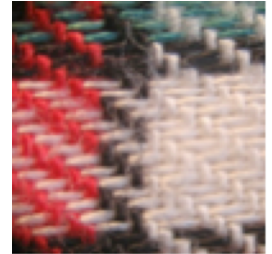
# Fiber and Textile Evidence

- The most common fiber transfer is **SHEDDING** of textiles (clothing, carpets, upholstery)
- Fibers can be classified as:
  - **Natural** Fibers (come from animals, plants, and minerals mined from the ground)
  - **Synthetic** Fibers (are man made and are either regenerated or polymers)





# Fiber Classification – *Natural Fibers*



**Animal fibers** (made of proteins): **woven wool textile**

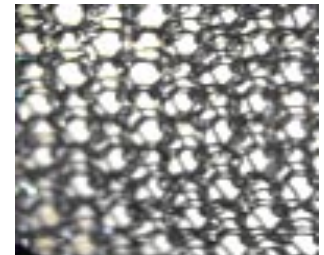
- Wool from **SHEEP**, cashmere and mohair from **GOATS**, angora from **RABBITS**, and hair from **ALPACAS**, **LLAMAS**, and **CAMELS** are commonly used in textiles.
- Shimmering silk from **CATERPILLARS** is longer and not as easily shed.



# Fiber Classification – *Natural Fibers*

## Plant fibers:

- Cotton from **SEEDPODS** is the plant fiber most commonly used
- Coir from **COCONUTS** is durable.
- Hemp, jute, and flax from **STEMS**
- Manila and sisal from **LEAVES**





## Fiber Classification – *Natural Fibers*

**Plant fibers** (made of the polymer cellulose):

- can absorb **water**.
- are **insoluble** in water.
- are very resistant to damage from harsh **chemicals**.
- can only be dissolved by strong **acids**.
- Must be identified quickly at crime scenes because they become **brittle** over time.



# Fiber Classification – *Natural Fibers*

## Mineral Fibers:

- Fiberglass is a fibrous form of **glass**.
- Asbestos is a **naturally** occurring mineral with a crystalline structure.





## Fiber Classification – *Synthetic Fibers* (*artificially produced*)

- Until the nineteenth century only plant and animal fibers were used to make clothes and textiles.
- Half the products produced today are artificially produced.



# *Synthetic Fibers*

- Artificially produced fibers include
  - a) rayon
  - b) acetate
  - c) nylon
  - d) acrylics
  - e) polyesters



# Fiber Classification – *Synthetic Fibers*

## Regenerated Fibers (derived from cellulose):

- Rayon is the most common of this type of fiber. It can imitate natural fibers, but it is **stronger**.
- Celenese<sup>®</sup> is cellulose chemically combined with acetate and is often found in **carpets**.
- Polyamide nylon is cellulose combined with three acetate units, is breathable, lightweight, and used in **performance clothing**.



# Yarns, Fabrics, and Textiles

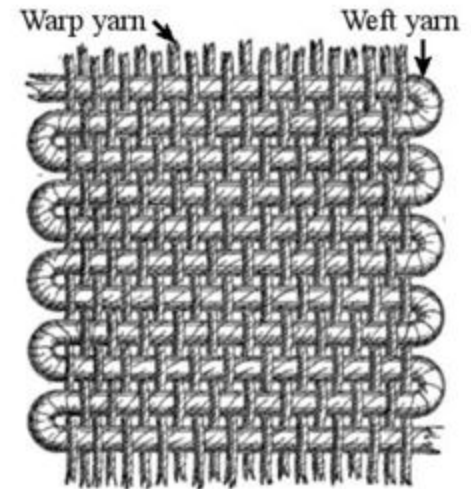
- Fibers can be **twisted** (spun) into yarn of any length, thick or thin, loose, or tight. A blend can be made to meet different needs such as resistance to wrinkling.





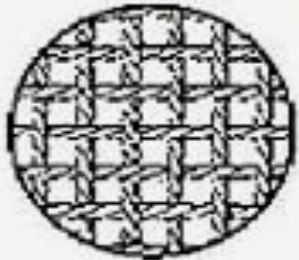
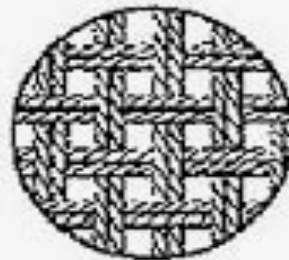
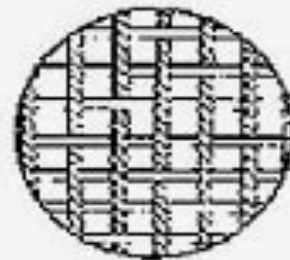

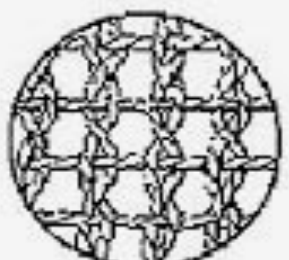
# Yarns, Fabrics, and Textiles

- Fibers can be woven into fabrics or textiles.
- **Warp**: lengthwise threads
- **Weft**: crosswise threads
- Weave Pattern: The pattern in which the weft passes over and under the warp.





# Yarns, Fabrics, and Textiles

Plain / Tabby	Basket	Satin	Twill	Len o
				
<ul style="list-style-type: none"><li>◆ firm and wears well</li><li>◆ snag resistant</li><li>◆ low tear strength</li><li>◆ tends to wrinkle</li></ul>	<ul style="list-style-type: none"><li>◆ open or porous weave</li><li>◆ does not wrinkle</li><li>◆ not very durable</li><li>◆ tends to distort as yarns shift</li><li>◆ shrinks when washed</li></ul>	<ul style="list-style-type: none"><li>◆ not durable</li><li>◆ tends to snag and break during wear</li><li>◆ shiny surface</li><li>◆ high light reflectance</li><li>◆ little friction with other garments</li></ul>	<ul style="list-style-type: none"><li>◆ very strong</li><li>◆ dense and compact</li><li>◆ different faces</li><li>◆ diagonal design on surface</li><li>◆ soft and pliable</li></ul>	<ul style="list-style-type: none"><li>◆ open weave</li><li>◆ easily distorted with wear and washing</li><li>◆ stretches in one direction only</li></ul>