



Trace Evidence: Fiber

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Fibers

- Used in forensic science to create a link between a crime and a suspect.
- Considered to be **CLASS EVIDENCE** because they are *mass produced*.
- Sensitive evidence – 95% of all fibers may be lost within 24 hours.
- Only the fibers you would not expect to find are investigated.
 - Example: pink fibers found all over the victim's body found on a pink carpet vs. pink fibers found on a suspect's pants



Sources

- Fibers can originate from many sources:
 - Carpet
 - Clothing
 - Linen
 - Furniture
 - Insulation
 - Rope/ligature
 - Tape

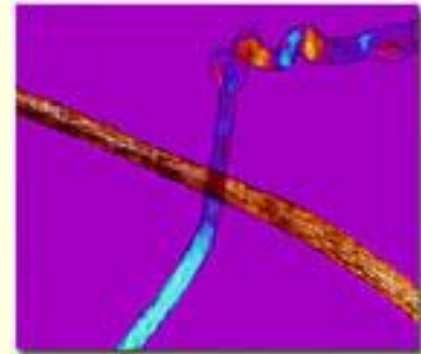
Two Types of Fibers

- Natural
 - derived from plants or animal hair

- Synthetic
 - manmade

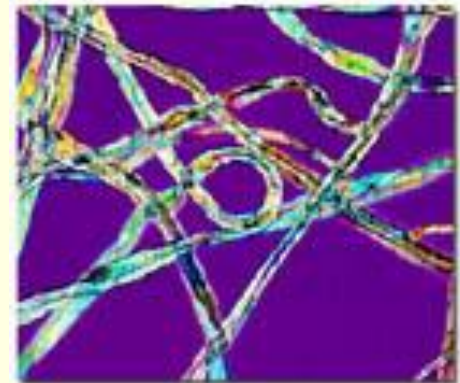
Natural Fibers: Animal Fibers

- Sheep (wool)
 - most common; the end use is often determined by coarseness
 - fine wool fibers are used for clothing, while coarse wool fibers are used in carpeting
- Goat (mohair, cashmere)
- Camel (wool)
- Llama
- Alpaca (wool)
- Fur fibers from mink, rabbit, beaver, etc.
- Silk (fiber from the cocoon of the silkworm)



Natural Fibers: Plant Fibers

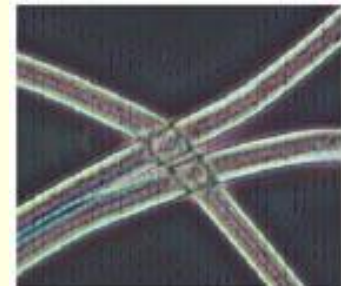
- Cotton (ribbon-like shape with irregular twists; most common)
- Flax (Linen)
- Ramie
- Sisal (often used in linen rugs)
- Jute (used in ropes)
- Hemp (the common name for cannabis for industrial or non-drug use; typically used for rope or sack)
- Kapok (fiber from kapok tree seed pods; used in pillows and mattress stuffing)
- Coir (coconut husks; used in carpet, rugs)



Synthetic Fibers

More than half of all fibers used in the production of textile materials are manmade.

- **Polyester** (most common; wrinkle resistant; often spun with cotton)
- **Nylon** (very common; elastic and strong; lustrous and silk-like when stretched)
- **Acrylics** (wool-like, soft and warm; quick drying and resistant to moths)
- **Rayon** (cellulose-derived, regenerated, thin fiber)
- **Acetates** (cellulose-based, wrinkle-resistant fiber)



Special Fibers

- **Aramid fiber** is a light, but strong, synthetic fiber.
 - **Heat-resistant** aramid fiber is typically used for bullet-proof vests, military applications, and racing tires
 - **Fire-resistant** aramid fiber is used for firemen or disaster response teams.

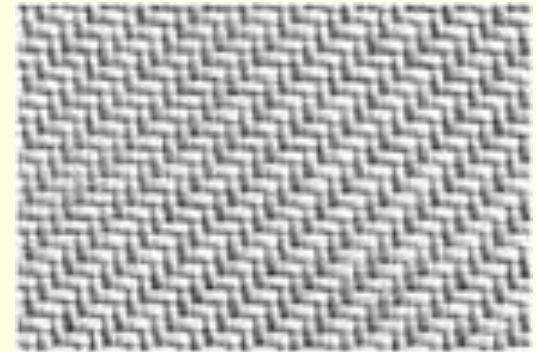


Types of Fibers

- **Fiber** – a fine, slender piece of thread or filament
- **Yarn** – a twisted aggregate of fibers
- **Textiles** – woven fibers; fabrics

Weaving

Lengthwise threads (the **warp**) are woven by crosswise threads (the **weft**) in a pattern.



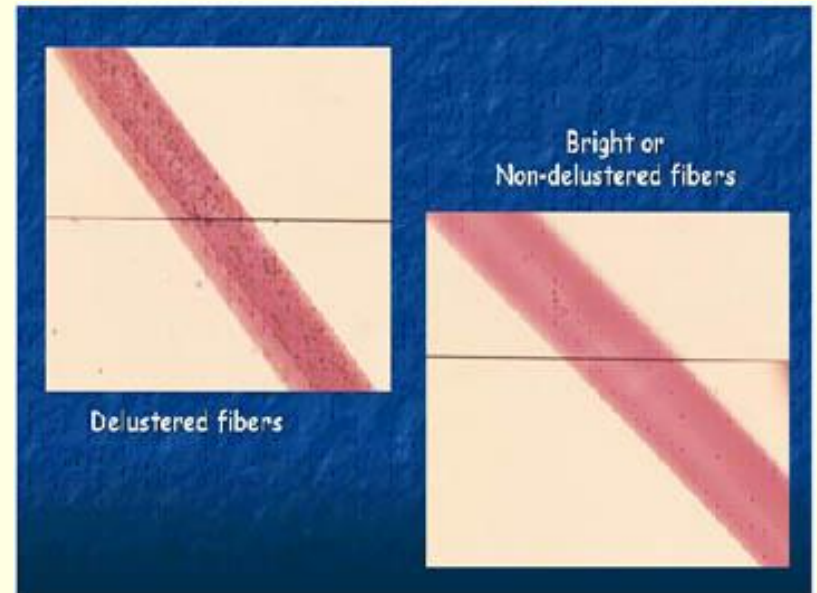
Common Weave Patterns

- Plain (firm, tends to wrinkle)
- Basket (not very durable, shrinks when washed)
- Satin (not durable, shiny surface)
- Twill (very strong, dense and compact, soft)
- Leno (open weave, easily distorted)

Fiber Comparisons

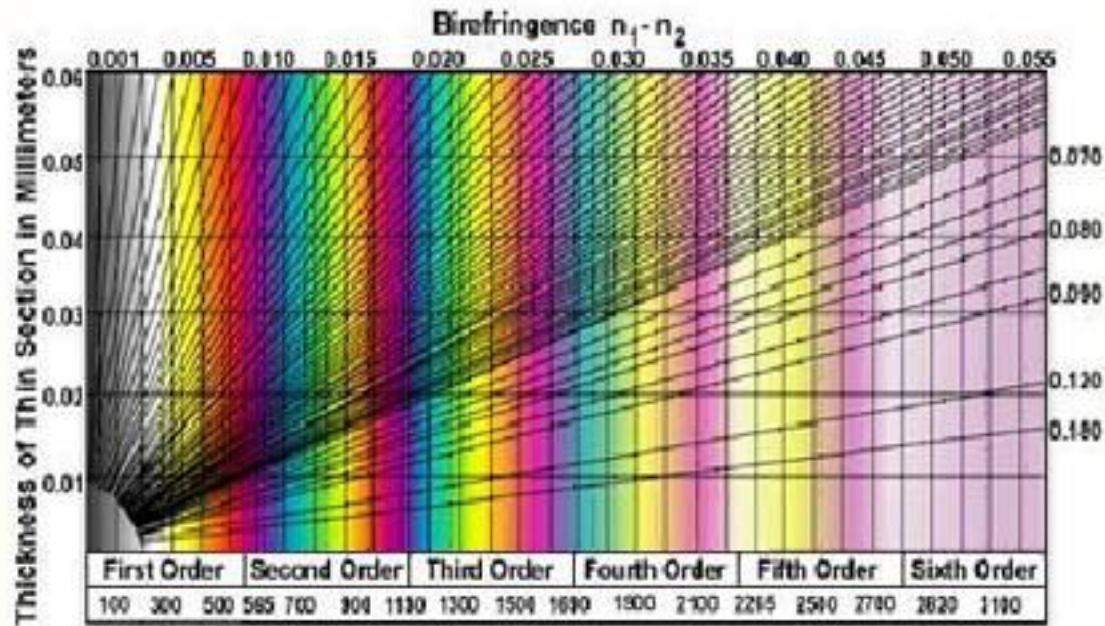
- **Microscopic Comparisons**

- Color
- Diameter
- Surface markings
- Delustering agents
- Cross-sectional shape



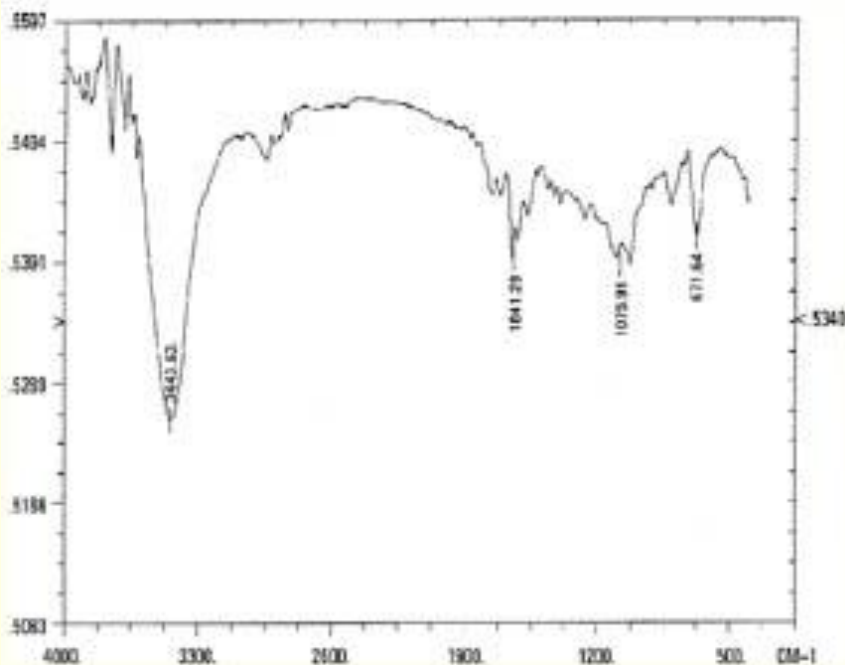
Fiber Comparisons (continued)

- **Polarized Light Microscopy** – determines birefringence (difference between two refractive indices) using polarized light



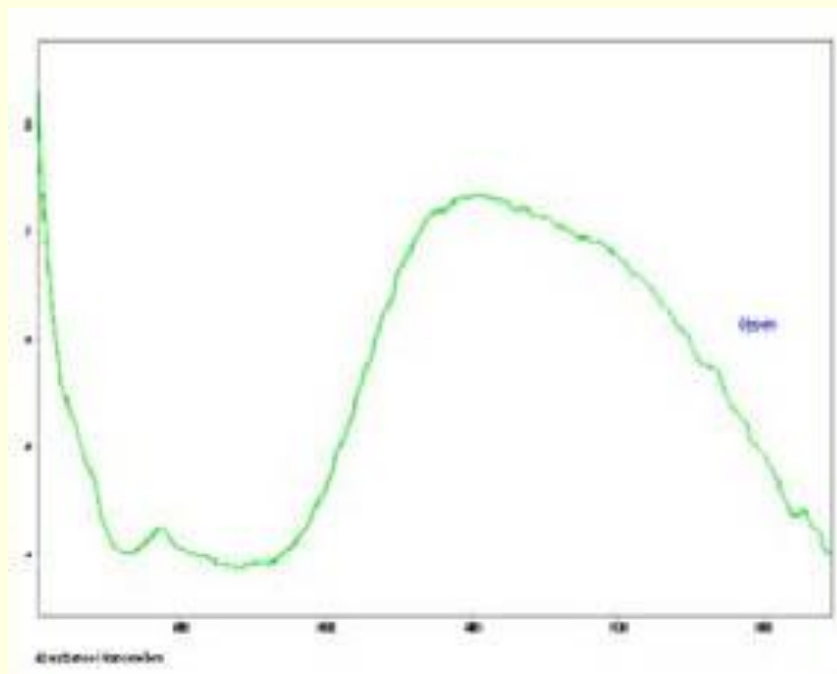
Fiber Comparisons (continued)

- **Fourier Transform Infrared Spectroscopy (FTIR)** – analysis of a fiber's chemical composition based on its ability to absorb light at different wavelengths



Fiber Comparisons (continued)

- **UV-Visible Microspectrophotometry** – distinguishes slight/subtle color differences based on absorption of light at different wavelengths



Significance of Fiber Evidence

Two Possible Conclusions in Fiber Comparisons

- The Questioned fiber *could have* originated from the Known sample.
- The Questioned fiber *did not* originate from the Known source.
- The number of fibers is directly proportional to the likelihood of actual contact (i.e., the greater the number of fibers, the more likely that contact actually occurred.)

Significance of Fiber Evidence (continued)



Greater number of fiber types



More unique the material



Greater significance

Resources

- Saferstein, Richard. *Forensic Science: An Introduction*. New Jersey: Pearson Prentice Hall, 2008.
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- Saferstein, Richard. *Forensic Science Handbook*. Englewood Cliffs, NJ: Prentice-Hall, 1982.
- Bertino, Anthony J. *Forensic Science: Fundamentals and Investigations*. Mason, OH: South-Western Cengage Learning, 2009.