Fiber

Come in and get your notebooks out. We have notes today!
What is a FIBER?

• Defined as the smallest unit of a textile visible to the naked eye
• Used as supporting evidence to help place an individual at the crime scene
• 95% of fibers are lost within the first 24 hours, so fiber collection at the beginning of an investigation is critical
FIBER
- Are considered class evidence
- Are common trace evidence at a crime scene
- Can be characterized based on comparison of both physical and chemical properties

FABRIC?
- Fabric is made of fibers. Fibers are made of twisted threads.
Fiber Transfer

- **Direct transfer:** fibers transferred directly from victim to suspect or suspect to victim

- **Secondary transfer:** a victim has fibers that were picked up and then transferred to the suspect
When you analyze an unknown fiber, what do you look for? Ultimately, you want to know what kind of fiber it is!

**New Terms**

**Crimp**: is the fiber straight or crimped (*wavy*)

**Pliability**: is the fiber pliable (*bends*) or non-pliable (*breaks*)

**Resilience**: is the fiber resilient (*reshapes after being crumpled*)

**Texture**

**Color**

**Origin**

**Crimp**

**Resilience**

**Pliability**

**Odor**
Fibers

Naturally occurring materials

Natural Fibers
  *Animal
  *Plant
  *Mineral

Synthetic Fibers
  *Regenerated Fibers
  *Synthetic Polymer Fibers

Man-Made Materials
Common Fiber Types

**Natural**
- Silk
- Cotton
- Wool
- Mohair
- Cashmere

**Synthetic**
- Rayon
- Nylon
- Acetate
- Acrylic
- Spandex
- Polyester

Sometimes microscopic images are not enough to categorized a fiber. Other tests should be preformed.
Natural Fibers—Animals

- **Fur**—used to make coats and gloves
- **Hair**—wool (*sheep*), cashmere and mohair (*goats*), and angora (*rabbits, camels, llamas, alpacas*)
- **Silk**—from the cocoons of the silk caterpillar

All animal fibers are made up of protein.
Natural Fibers—Plant

- **Seeds**—cotton is in the seedpod of cotton plants; easily woven and dyed so common in clothing
- **Fruit**—coir is made from the covering surrounding coconuts; used to make baskets
- **Stem**—flax (linen) and jute (twine)
- **Leaf**—manila and sisal; both used for twine

All plant fibers are made up of cellulose.
Natural Fibers—Mineral

- **Fiberglass**—fiber form of glass that is weak and brittle; used as insulation
- **Asbestos**—very durable fibers used for pipe coverings, brake linings, ceiling tiles, and other uses
Synthetic Fibers—Regenerated Fibers

• Cellulose is combined with chemicals such as acetate
• **Rayon**—imitates natural fibers and generally is smooth and silky in appearance
• **Celanese**—cellulose combined with acetate; used in carpets
• **Capron**—breathable, light weight material used in high performance clothing
Synthetic Fibers—Synthetic Polymer Fibers

- **Polyester**—common synthetic fiber; represents a large group of fibers with a common chemical makeup
- **Nylon**—similar to polyester, but easily broken down by light and concentrated acid
- **Acrylic**—found in artificial wool or imitation fur; has a light, fluffy feel
- **Olefins**—used in high performance clothing such as thermal socks and carpets because they are quick drying and resist wear
Synthetic fibers are forced out of a nozzle when they are hot, and then they are woven. The holes of the nozzle are not necessarily round; therefore, the fiber filament may have a unique shape in cross-section.
Textiles

- Fibers are woven into textiles (fabrics)
- Weaving consists of arranging lengthwise threads (the warp) side by side and close together
- Crosswise threads (the weft) are then woven back and forth in one of several different patterns
Weave Patterns

• **Plain:** alternating warp and weft threads; firm and wears well, snag resistant, tends to wrinkle

• **Basket:** alternating pattern of two weft crossing two warp threads; doesn’t wrinkle, not durable, shrinks when washed

• **Satin:** one weft crosses over three or more warp threads; not durable, snags, shiny surface, high light reflectance
Weave Patterns (cont.)

- **Twill**: weft is woven over three or more warps and then under one; next row, the pattern is shifted over one to the left or right by one warp thread; strong, dense, compact, diagonal design.

- **Leno**: uses two warp threads and a double weft thread; the two adjacent warp threads cross over each other; the weft travels left to right and is woven between the two warp threads; easily distorted with wear and washing, stretches in one direction only.
Collection of Fiber Evidence

- Bag clothing items individually in paper bags. Make sure that different items are not placed on the same surface before being bagged.
- Make tape lifts of exposed skin areas of bodies and any inanimate objects
- Removed fibers should be folded into a small sheet of paper and stored in a paper bag.
Collection and Preservation

- Clothing should be packaged in paper bags
- Each article must be placed in separate bags to prevent contamination
- Must keep clothing from different people from coming into contact
- Carpets, rugs, and bedding should be folded to protect areas suspected of containing fibers
- Knife blades should be covered to protect adhering fiber
- If a body was wrapped in a carpet or blanket, tape lifts must be done on the body
- If individual fibers are found, they must be removed with clean forceps and placed in a small sheet of paper, must be folded and labeled and placed in another container
Forensic Examination of Fibers

• Important evidence in incidents involving personal contact - homicide, assault, sexual

• Cross-transfers may occur between the clothing of a suspect and victim

• Hit-and-run victims can leave fibers, threads, or whole pieces of clothing on a vehicle

• Fibers can also become fixed in screens or glass broken during a breaking-and-entering attempt
Analytical Techniques Used

• Two fibers may seem to be the same color, differences may exist in the dyes applied to them when made

• Most fibers are dyed with a mixture of colors to obtain a desired shade

• Can use a **visible light microspectrophotometer** to compare the colors of fibers

• A fiber as small as 1 mm long or less can be examined
Analytical Techniques Used

• A more detailed analysis of the fiber’s dye composition can be obtained by a chromatographic separation of dye

• Small strands of fibers are compared for dye content by extracting the dye off each fiber with a solvent and then spotting the dye solution onto a thin-layer chromatography plate

• The dye of the questioned and standard fibers are separated on the plate and compared for similarity
Others

• When fibers are compared, they must be shown to have the same chemical composition (belong to the same class)

• For example, the standard and questioned fabric both being nylon instead of one being nylon while the other is cotton

• Many manufactured fibers exhibit double refraction or birefringence which will make it look crystalline

• Polarized white light will split into two rays that are perpendicular to each other and produce interference colors, polarization