Eyewitness Test

http://www.psychology.iastate.edu/faculty/gwells/theeyewitnesstest.html

http://www.psychology.iastate.edu/faculty/gwells/stillidentificationtest.html

http://www.psychology.iastate.edu/faculty/gwells/homepage.htm

Chapter 6: Fibers

"Wherever he steps, whatever he touches, whatever he leaves even unconsciously, will serve as silent witness against him. Not only his fingerprints or his footprints, but his hair, the fibers from his clothes, the glass he breaks, the tool marks he leaves, the paint he scratches, the blood or semen he deposits or collects—all of these and more bear mute witness against him. This is evidence that does not forget."

—Paul L. Kirk (1902 – 1970)
Forensic scientist

Fibers

Students will learn:

- How fibers can be used as circumstantial evidence to link the victim, suspect, and crime scene.
- Why fibers are class evidence.
- Why statistics are important in determining the value of evidence.

Fibers

Students will be able to:

- Distinguish and identify different types of fibers.
- Understand polymerization.
- Carry out an experiment in thin-layer chromatography.
- Judge the probative value of fiber evidence.
- Design and carry out scientific investigations.
- Use technology and mathematics to improve investigations and communications.

Fibers

- **Are considered class evidence**
- **Have probative value**
- **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 filaments
- Types of fibers and fabric
  - **Natural**—animal, vegetable or inorganic
  - **Artificial**—synthesized or created from altered natural sources

Types of Fibers

Synthetic

- Rayon
- Nylon
- Acetate
- Acrylic
- Spandex
- Polyester

Natural

- Silk
- Cotton
- Wool
- Mohair
- Cashmere

Classification

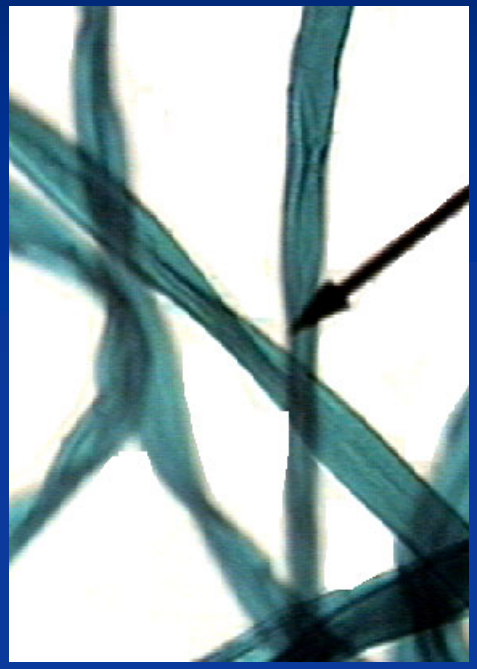
Natural fibers are classified according to their origin:

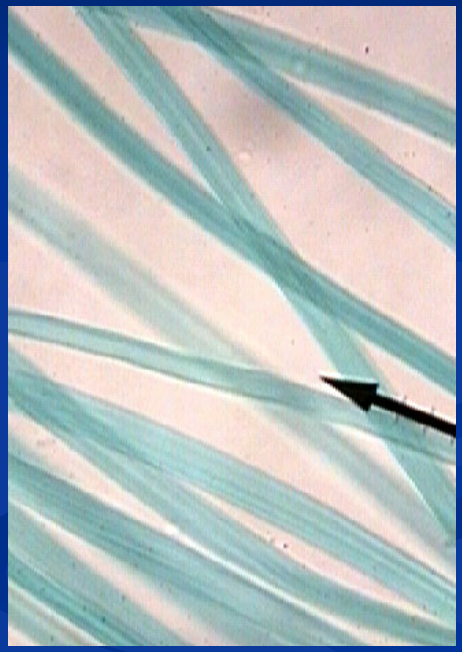
- Vegetable or cellulose
- Animal or protein
- Mineral

Cellulose Fibers

- **Cotton**—vegetable fiber; strong, tough, flexible, moisture absorbent, not shape retentive
- **Rayon**—chemically-altered cellulose; soft, lustrous, versatile
- **Cellulose acetate**—cellulose chemically-altered to create an entirely new compound not found in nature.

Fiber Comparison

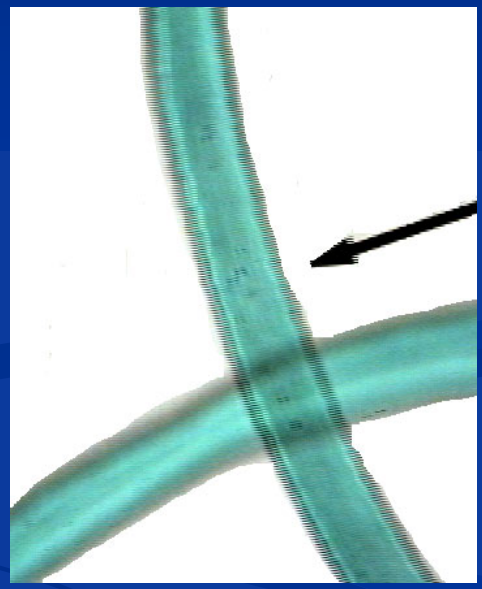




Can you tell the difference(s) between the cotton on the left and the rayon on the right?

Protein Fibers

- **Wool**—animal fiber coming most often from sheep, but may be goat (mohair), rabbit (angora), camel, alpaca, llama, vicuna
- **Silk—**insect fiber that is spun by a silk worm to make its cocoon; fiber reflects light and has insulating properties



Mineral Fibers

- **Asbestos**—a natural fiber that has been used in fire-resistant substances
- **Rock wool**—a manufactured mineral fiber
- **Fiberglass**—a manufactured inorganic fiber

Synthetic Fibers

(Made from derivatives of petroleum, coal and natural gas)

- **Nylon**—most durable of man-made fibers; extremely light weight
- **Polyester**—most widely used man-made fiber
- **Acrylic**—provides warmth from a lightweight, soft and resilient fiber
- **Spandex**—extreme elastic properties

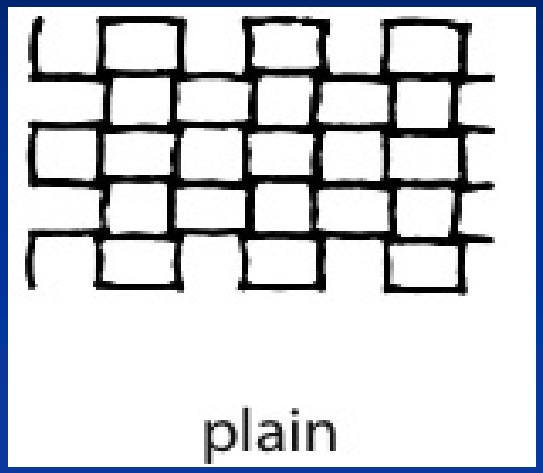
Fabric Production

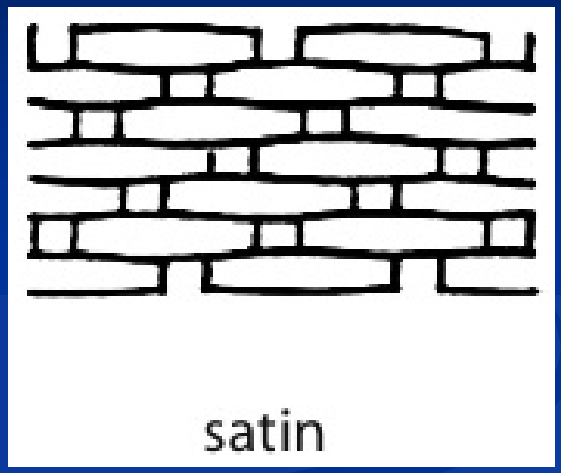
Fabrics are composed of individual threads or yarns, made of fibers, that are knitted, woven, bonded, crocheted, felted, knotted or laminated. Most are either woven or knitted. The degree of stretch, absorbency, water repellence, softness and durability are all individual qualities of the different fabrics.

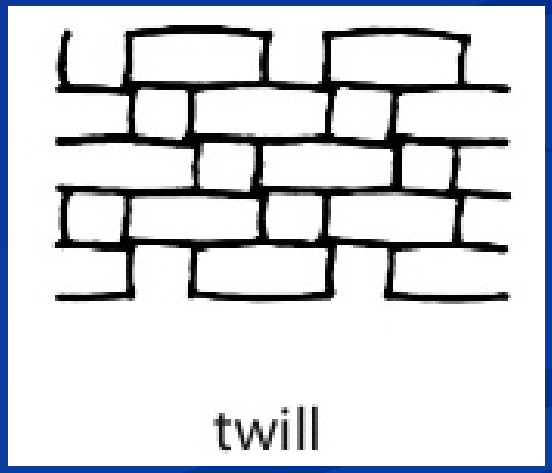
Weave Terminology

- **Yarn**—a continuous strand of fibers or filaments, either twisted or not
- **Warp**—lengthwise yarn
- **Weft**—crosswise yarn
- **Blend**—a fabric made up of two or more different types of fiber.

Weave Patterns







Plain Weave

- The simplest and most common weave pattern
- The warp and weft yarns pass under each other alternately
- Design resembles a checkerboard

Twill Weave

- The warp yarn is passed over one to three weft yarns before going under one
- Makes a diagonal weave pattern
- Design resembles stair steps
- Denim is one of the most common examples

Satin Weave

- The yarn interlacing is not uniform
- Creates long floats
- Interlacing weave passes over four or more yarns
- Satin is the most obvious example

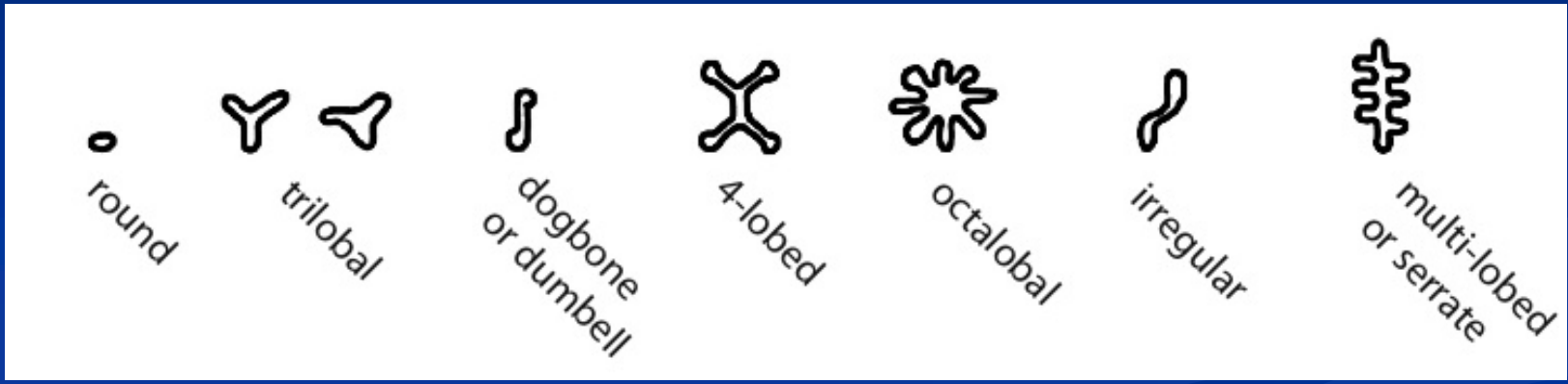
Knitted Fabric

Knitted fabrics are made by interlocking loops into a specific arrangement. It may be one continuous thread or a combination. Either way, the yarn is formed into successive rows of loops and then drawn through another series of loops to make the fabric.

Polymers

- Synthetic fibers are made of polymers which are long chains of repeating chemical units.
- The word polymer means many (*poly*), units (*mer*).
- The repeating units of a polymer are called monomers.
- By varying the chemical structure of the monomers or by varying the way they are joined together, polymers are created that have different properties.
- As a result of these differences, forensically they can be distinguished from one another.

Filament Cross-Sections



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.

Testing for Identification

- **Microscopic observation**
- **Burning**—observation of how a fiber burns, the odor, color of flame, smoke and the appearance of the residue
- **Thermal decomposition**—gently heating to break down the fiber to the basic monomers
- **Chemical tests**—solubility and decomposition

Testing for Identification

- **Density**—mass of object divided by the volume of the object
- **Refractive Index**—measuring the bending of light as it passes from air into a solid or liquid
- **Fluorescence**—used for comparing fibers as well as spotting fibers for collection

Dyes

- Components that make up dyes can be separated and matched to an unknown.
- There are more than 7000 different dye formulations.
- Chromatography is used to separate dyes for comparative analysis.
- The way a fabric accepts a particular dye may also be used to identify and compare samples.

Identification and Comparison of Fibers

- **Fourier Transform Infrared analysis (FTIR)**—based on selective absorption of wavelengths of light
- **Optical microscopy**—uses polarizing light and comparison microscopes
- **Pyrolysis gas chromatography-mass spectrometry (PGC-MS)**—burns a sample under controlled conditions, separates and analyzes each combustion product

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.

Fiber Evidence

Fiber evidence in court cases can be used to connect the suspect to the victim or to the crime scene. In the case of Wayne Williams, fibers weighed heavily on the outcome of the case. Williams was convicted in 1982 based on carpet fibers that were found in his home, car and on several murder victims.

More about Fibers

For additional information about fibers and other trace evidence, check out Court TV's Crime Library at:

www.crimelibrary.com/criminal_mind/forensics/trace/1.html