

Impression Evidence

Types of Impressions

- **Patent** (visible)—two dimensional impressions that are visible to the unaided eye
 - Prints in dust, blood, paint, etc...
- **Latent**—hidden to the eye but can be made visible using development techniques
- **Plastic**—three dimensional imprints left in a soft substance such as wax, snow, mud, etc...
 - Can be easily lost so they must be made permanent through casting

Collection Methods

Investigators analyze the impression evidence to find unique **characteristics** to link shoes, tires, tools, and other objects found in a suspect's possession to evidence at a crime scene.

Collection of impression and imprint evidence can be accomplished using several methods:

2-D: This type of impression is documented using **photography**. Some impressions may be dusted with fingerprint **powder** to be photographed or lifted with **tape**. They may also be collected using an **electrostatic** dust lifting process. If the object is small enough it can be removed and taken to the lab.

3-D: This type of impression can be documented using **photography** as well as by **casting**, which involves using dental stone or a similar substance to preserve the dimensional characteristics of the print.

Example of Shoe Print in
Bio-Foam Impression Foam



Definitions to remember

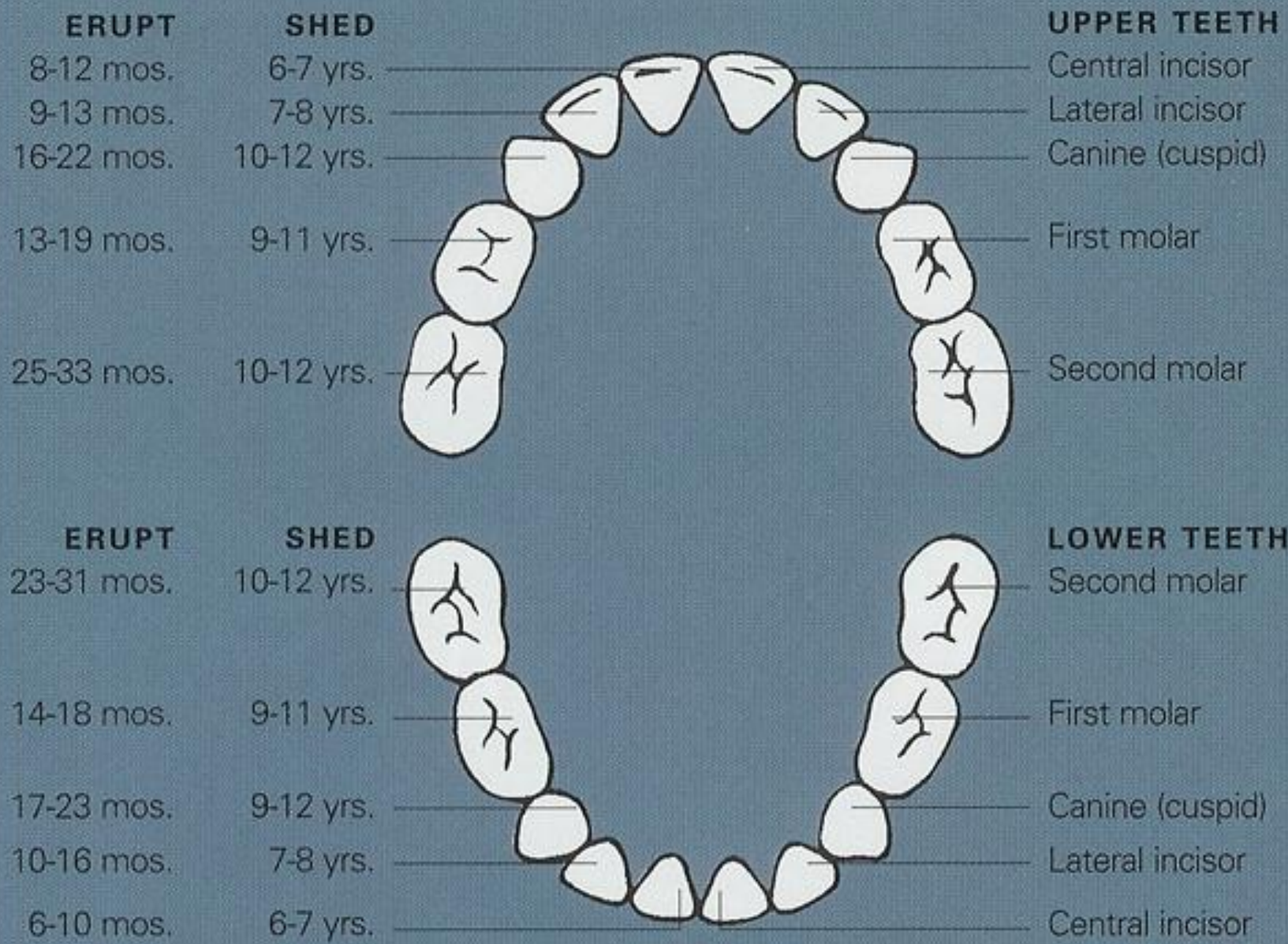
- Class versus individual evidence

Bite Marks

Primary (baby) teeth

- Humans have 20 primary (milk or baby) teeth that erupt in a predictable pattern beginning between 6 and 12 months old.

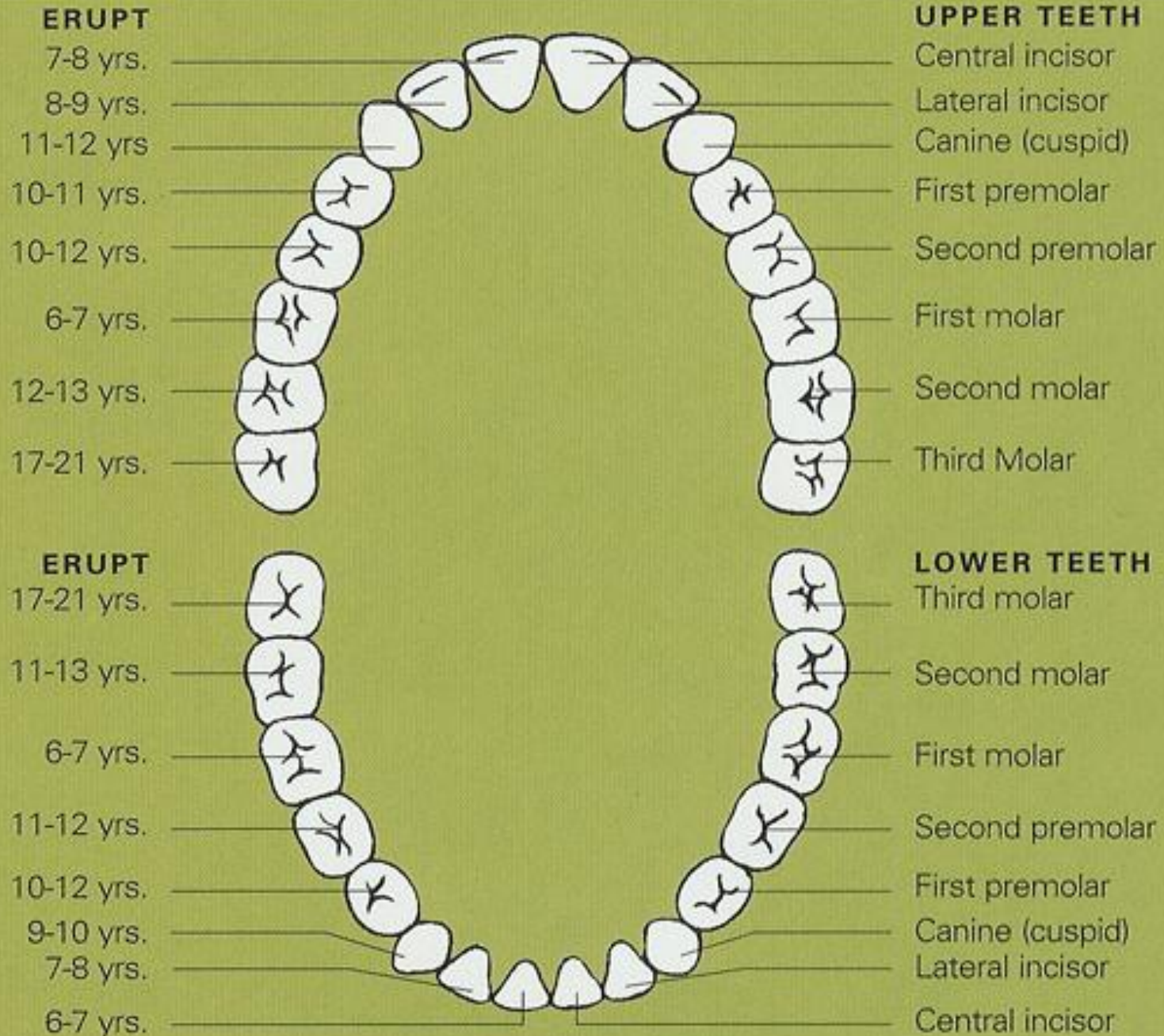
Primary Teeth: Tooth Development and Identification Charts



Permanent Teeth

- Gradually primary teeth are replaced by 32 permanent teeth.
- The last teeth to develop are the wisdom teeth which erupt on average between 17-21
- Teeth are a great indicator of age in children.
- The presence of wisdom teeth is an indicator that the individual is over 17.

Permanent Teeth: Tooth Development and Identification Charts



Bite marks

- Differences in the size of teeth and jaws, position and crowding makes each person's mouth unique.
- Can be used to:
 - Identify remains
 - Identify a suspect

Bite Mark Evidence

Investigators can analyze **bite marks** for characteristics to help them identify victims or suspects as well as to exclude others. Marks can be left on a victim's **skin** or other **objects**, such as Styrofoam cups, gum, or foods. **Saliva** or **blood** may be left behind that can be tested for **DNA**. Dental records including **x-rays** can also provide useful information, especially when attempting to identify a victim.

Features to analyze:

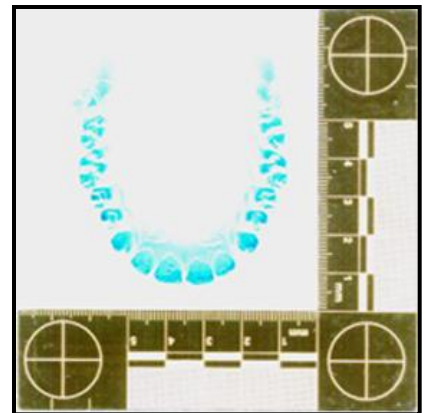
- **Type** of bite mark (human or animal)
- Characteristics of the **teeth** (position, evidence of dental work, wear patterns, etc.)
- **Color** of area to estimate how long ago the bite occurred (old or recent bite)
- Swab for **body fluids** for DNA tests

Did you know?

The most famous incident where bite mark evidence led to a conviction, was in the case of the notorious serial killer, Ted Bundy. He was responsible for an undetermined number of murders between 1973 and 1978 and was finally tied to the murder of Lisa Levy through bites that he had inflicted on her body.



Bite Mark Evidence Video



Tire Track Evidence

Tire Tracks

- The tread and impression are examined for two reasons:
 - Tread pattern and measurements can be used to determine the make and model of car
 - Nature of the impressions can determine how the vehicle was being driven
- Tire tracks can be patent, latent, or plastic

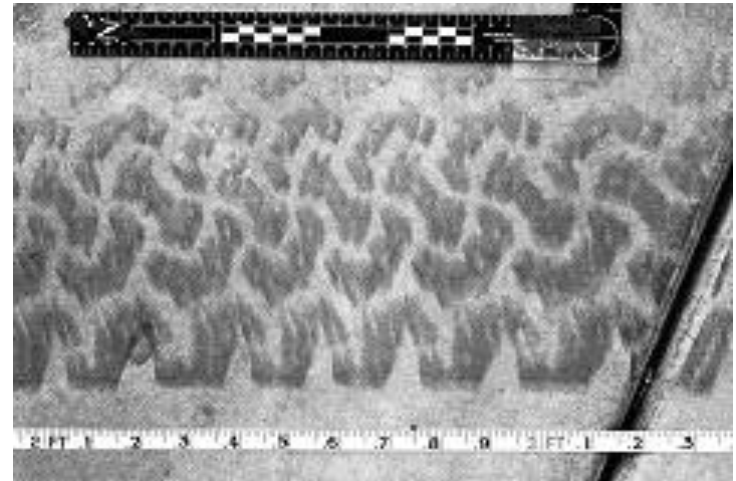
Anatomy of a tire

- The tread surface is made of ridges (elevations) and grooves (indentations) which are designed to channel water away and provide traction.
- Each model of tire has a unique pattern.
- A single tire tread can usually indicate the type of vehicle.



Recording tread patterns

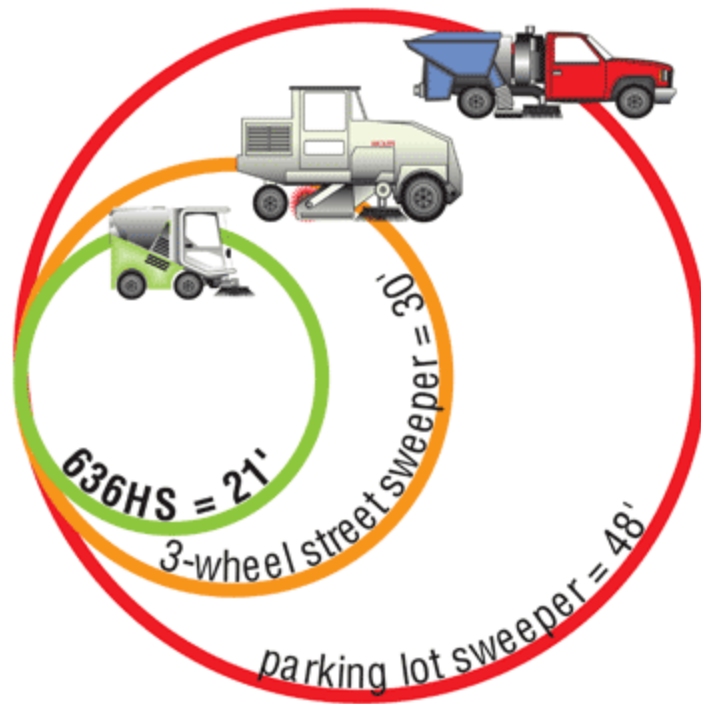
- Ribs and grooves are counted across the entire width shoulder to shoulder.
- Unique characteristics are noted:
 - Wear pattern
 - Defects
 - Items embedded in the grooves
- Suspect tires are inked for a reference sample and driven over smooth concrete covered with paper.

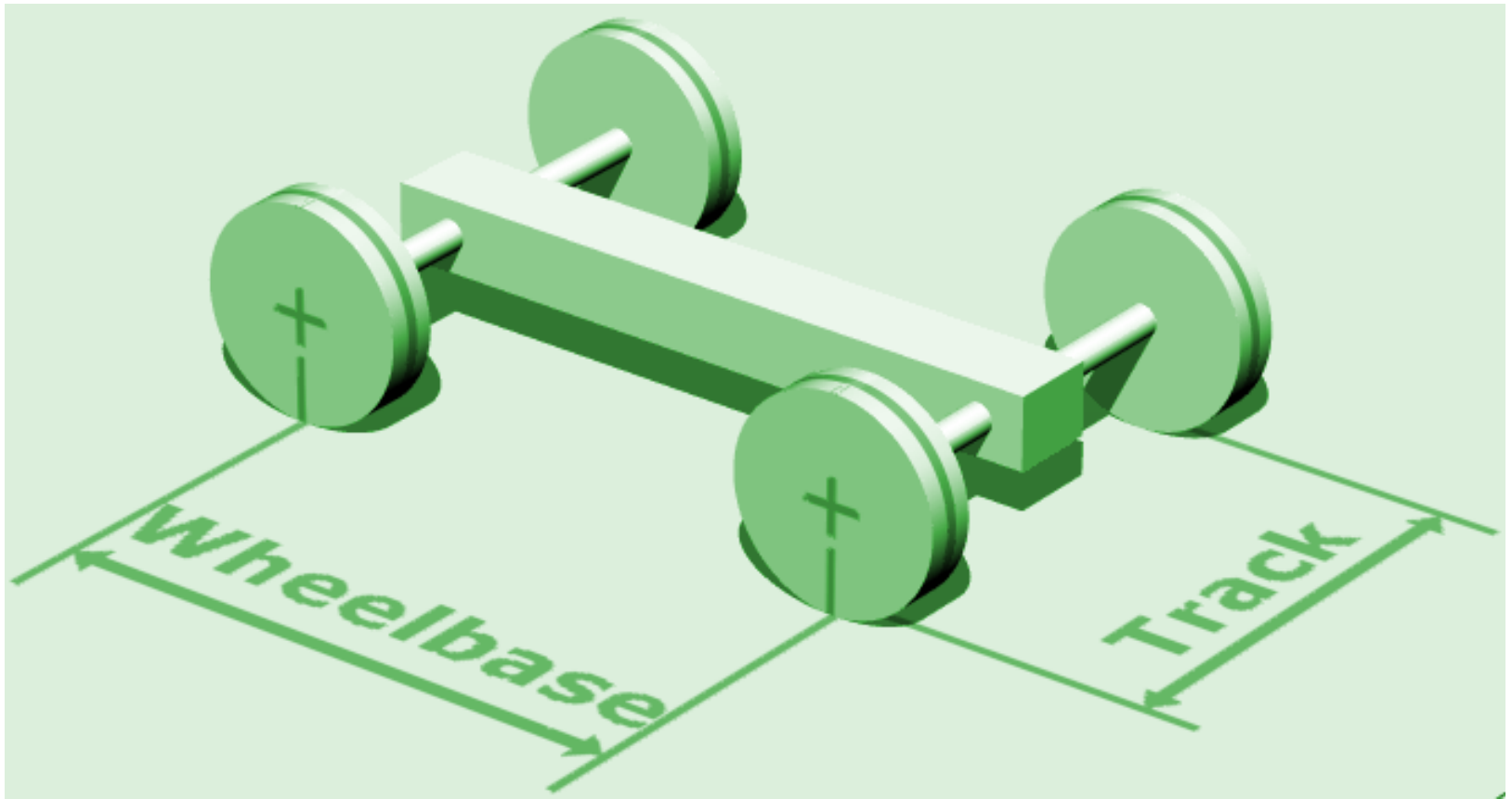


Identifying the Vehicle

- Because the same type of tire can be used on more than one type of vehicle sometimes more information is needed.
- Track width is the distance from the center of the right tire to the center of the left tire.
 - May be different in front and back
- Wheelbase is the distance from the center of the front axle to the center of the rear axle
- Turning diameter is the minimum space required for a car to make a U-turn.

Turning diameter



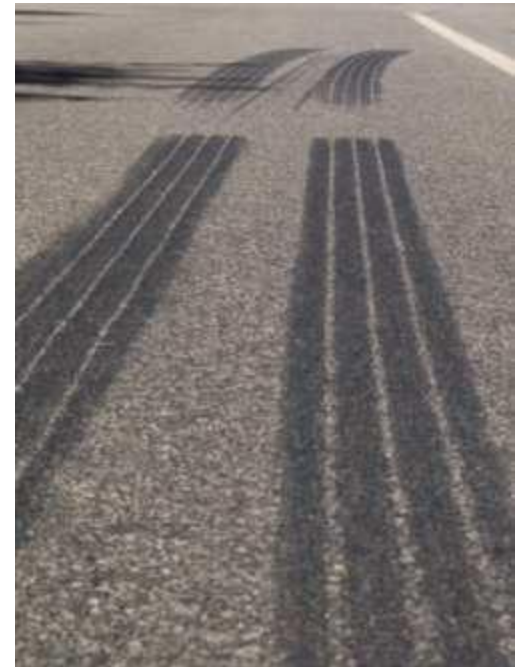


Direction of travel

- Can be determined by:
 - Vegetation that was disturbed
 - Debris that was cast off
 - Splash patterns from mud or water
 - Substance transfer like an oil leak
 - Tire marks

Tire Marks

- Skids
 - Formed when you brake suddenly and lock the wheels.
 - Provides evidence of when breaks wear applied
 - Can calculate velocity using a skid to stop formula



- Yaw marks
 - Formed when a vehicle takes a curve too fast and skids sideways
 - Tires and road surface melt from extreme temperature
 - Squeal and smoke are produced



Tire Scrubs

- Produced by a damaged or overloaded tire or tires immediately after impact.
- Curved, irregular width
- May have striped pattern
- Can determine area of impact

Tire Track Evidence

Features to analyze:

- **Tread** pattern
- **Width & depth** of the tread pattern
- Unique characteristics due to the **wear pattern** or **defects**

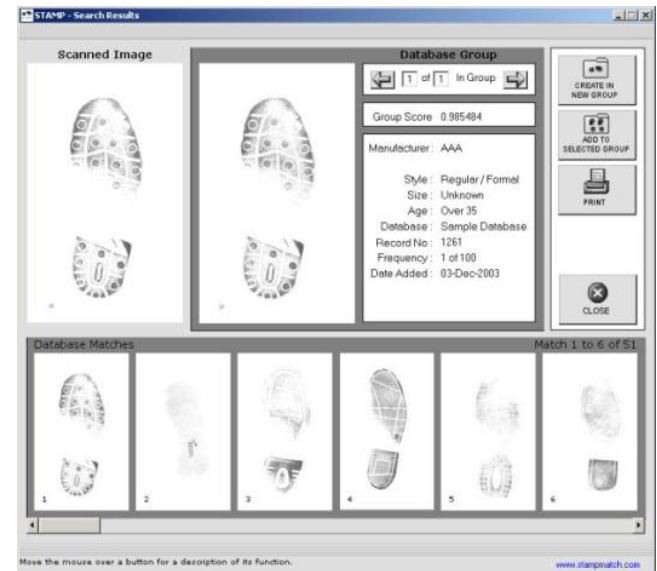
Tire databases are available help investigators determine the brand and model of the tire that left the impression , which can be used to determine the type of **vehicle** that made the tracks.



Shoe Impressions

Databases

- Shoe Impression Databases exist to help investigators determine the type of shoe that left the impression.
- Several manufacturers use the same generic sole pattern which complicates identification
- Can be used as class evidence



Wear Patterns

- Strongly individual characteristic
- Provides info on:
 - Whether someone walks on their toes or heels
 - Weight
 - Whether they walk straight ahead or toes pointed inward or outward
 - Shape of the foot and their activities
 - Surface they usually walk on
 - Unique features of defects such as cuts, holes, or debris.

Gait and Tracks

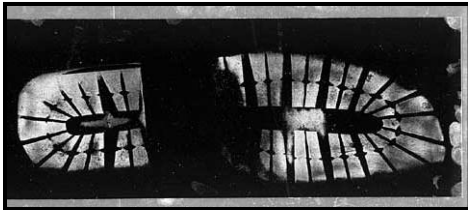
- Gait = walking habits
- Requires numerous prints to determine
- Limps or injuries will cause an asymmetrical gait (one foot will angle differently or cause a deeper impression)
 - This can also be seen if a person is carrying a heavy object
- The length of stride, pressure, and shape can indicate whether someone was walking or running.

Collecting the Evidence

- 1. Photograph First!!! Use multiple angles, techniques to reduce glare, and a ruler for scale.
- 2. Lift latent impressions
 - Works like fingerprinting. You can use luminol, dusting, or electrostatic lifting.
 - Electrostatic dusting may reveal fine dust patterns not visible otherwise. It works by applying an electric charge to a special type of lifting film and then viewing it with a special light source.
 - Works on paper, wood flooring, carpet, tile, and pavement
 - Gel Lifting
 - Works well on uneven surfaces that have oily or moist impressions.

Collecting the Evidence

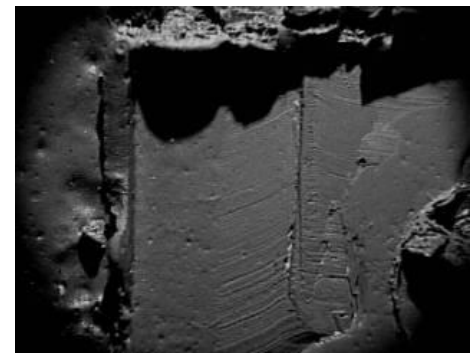
- 3. IF it's a plastic print---CAST IT.
 - Spray it with hairspray to prevent it from collapsing
 - Fill it with plaster or dental stone
 - Snow can be sprayed with snow wax to protect the delicate impression.



Tool Marks

Tool Marks

- Impressions, scratches, or abrasions resulting from contact between a tool and an object.
- Even mass produced tools may have small differences that make them distinguishable.
- Considered circumstantial evidence. WHY????



Types

- Indentation Marks
 - Tool is pressed against a softer substance
 - Often left by screwdrivers and crowbar when attempting to pry something open
- Abrasion Marks
 - Made when surfaces slide across each other
 - Often made by pliers, knives, axes, and gun barrels
 - Leaves scratch marks (striations)
- Cutting Marks
 - Produced along the edge of a surface that is cut.
 - Left by saws, wire cutters, etc...

Cutting Marks on Bones

- The type of saw blade used to dismember a body can be determined by looking at the cut surfaces of the bones.

Saw	Characteristics	Pattern
Stryker	Circular areas of short radius; some overlapping marks	Few teeth marks
Band saw	Very smooth cut	Few teeth marks; straight fine cut; seldom overlapping marks
Hack saw	Overlapping marks	Tiny tic-tac-toe board look with thousands of squares
Chain saw	Blade goes directly through bone; messy cut	Roughened edge
Table saw	Parallel, curved striations	Ridge grooves

Characteristics

- Some are a result of the manufacturing process
- Some result from using the tool
- Oxidation (rusting) and uneven sharpening can also give characteristic patterns
- Documenting the evidence
 - Always photograph!
 - If possible cast the impression

Technology

- In 2000, knife blade analysis was attacked in court and ruled inconclusive because of lack of testing.
- The Ames Laboratory began a database as a result
- The *Profilometer* is a scanning tool that measures and records the depth of tool marks. It then uses a contour map to identify the tool mark.
 - Preliminary tests show it has a 99.9 percent accuracy rate.

Bullet Striations

Notes

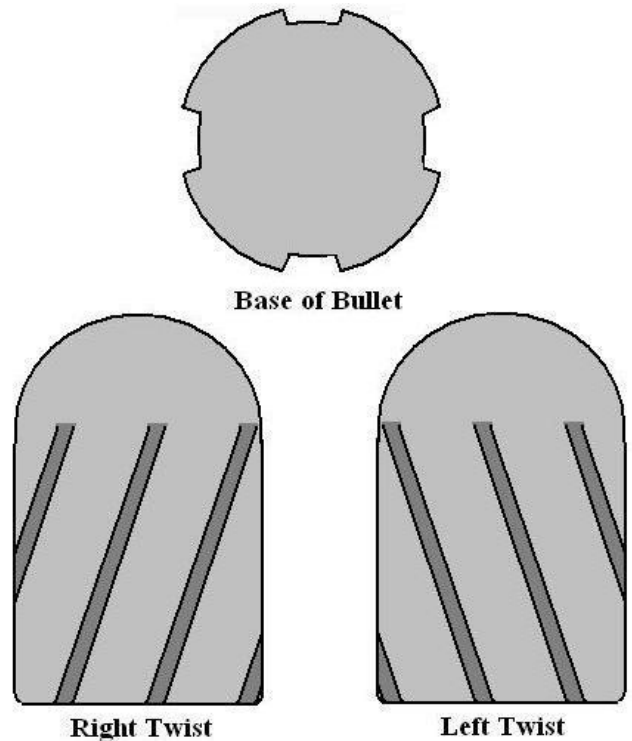
- Look at your notes for the different types of guns (rifle, pistols, and shot guns)
- Study the differences

Semiautomatic vs. Automatic

- Semiautomatic weapons fire one bullet per pull of the trigger.
- Automatic weapons will continue to fire as long as the trigger is depressed.
- In both, the empty cartridges ejects automatically and the next cartridge advances automatically

Rifling

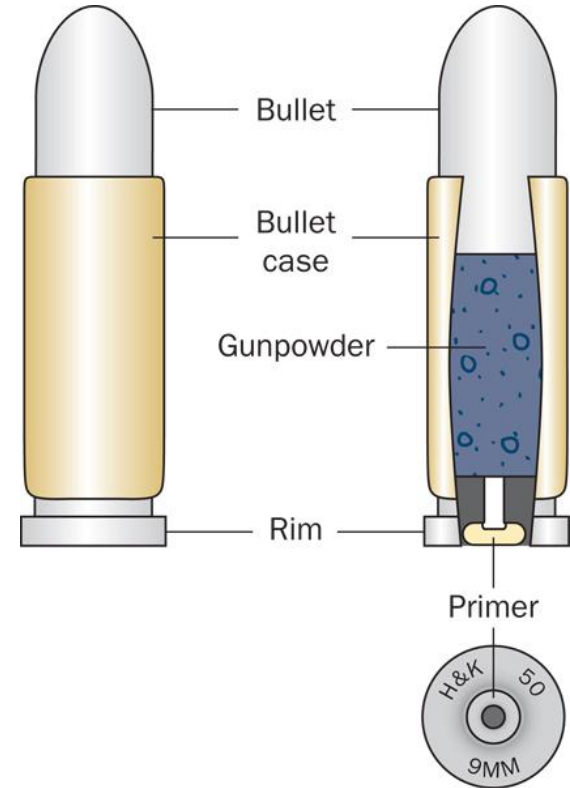
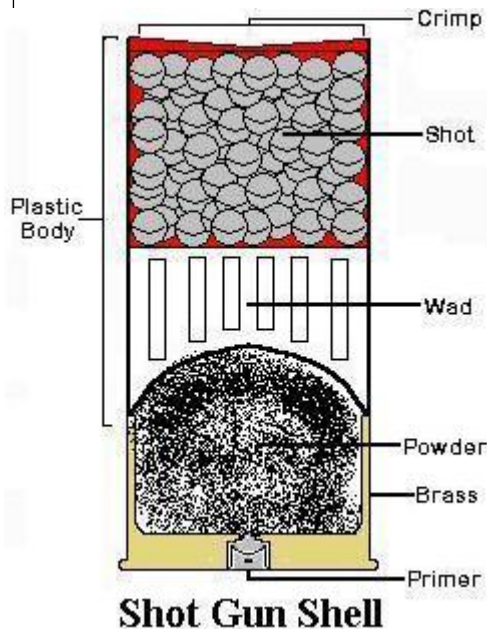
- Purpose is to improve accuracy.
- Grooves---indentations in the rifles barrel
- Lands---raised areas in the barrel that surround the grooves
- No two gun barrels are the same.



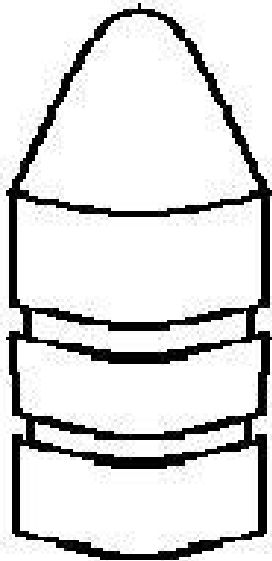
Bullet vs. Cartridge

- Cartridge—a case that holds a bullet, primer powder, and gunpowder
- The bullet, usually of metal, is out front with the cartridge,

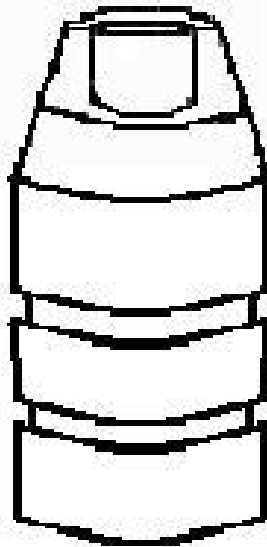
holding the primer and propellant powders, behind.



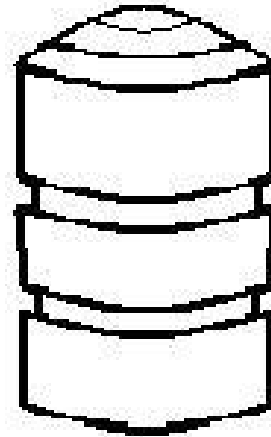
Three Main Shapes



Round Nose



Hollow Point



Wadcutter

Shapes



- Round Nose

- Maximum penetration
- Cheapest shape to manufacture
- Easily loads into chambers

- Hollow Point

- Spreads or mushrooms on impact
- Causes additional damage to target
- Inhibits penetration

- Wad Cutter

- Used exclusively as a practice load
- Minimizes penetration
- Rips a hole in target paper which is visible by the shooter



Three Basic Compositions of Bullets



■ Lead

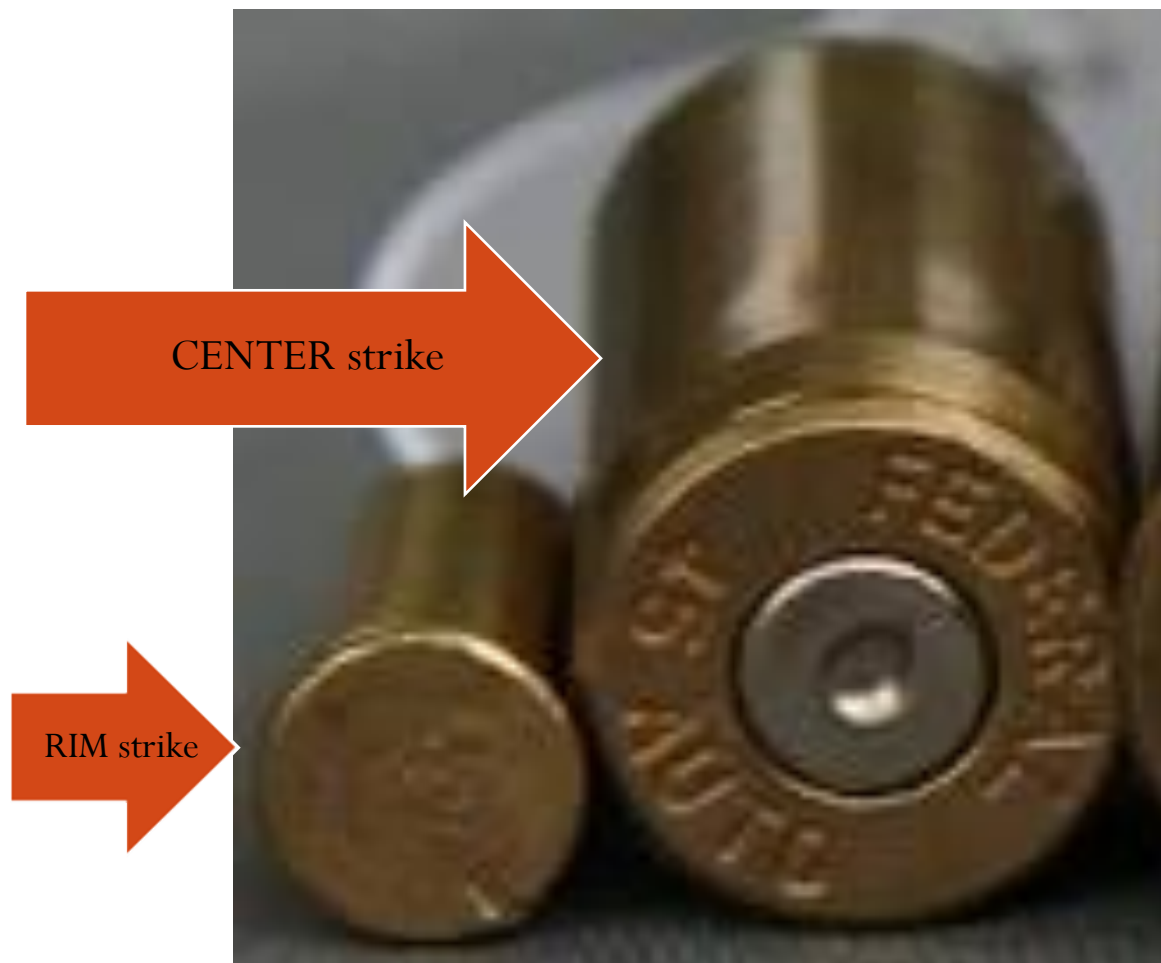
■ 1/2 Jacketed

■ Jacketed (Full metal jacket)

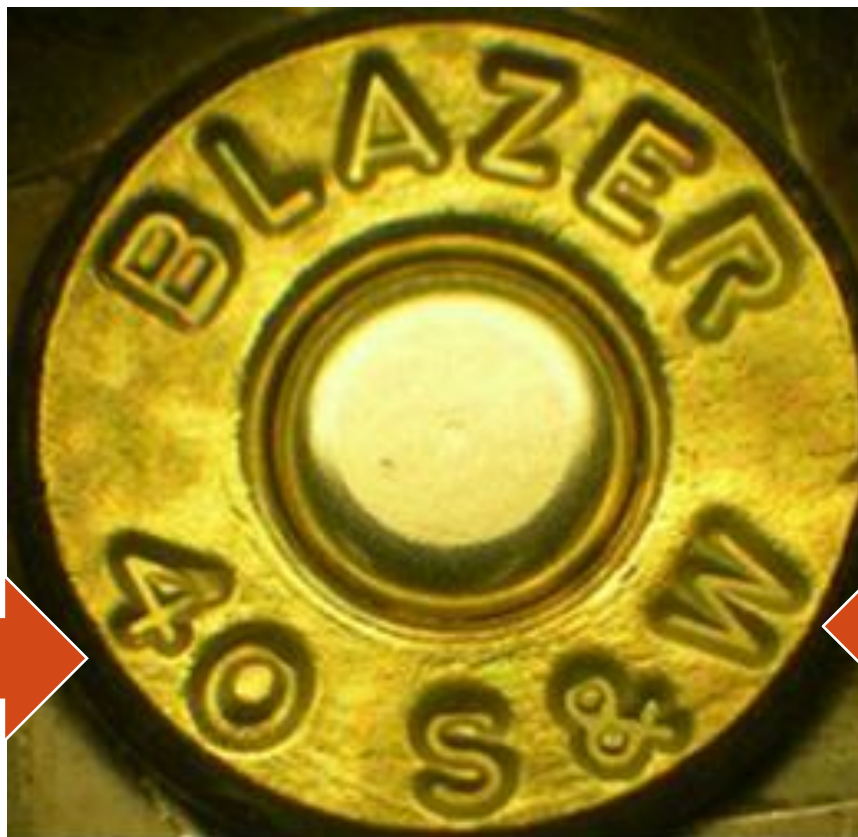
Composition

- **Lead**
 - Cheap
 - Dense
 - Soft
 - Easy to mold
- **½ Jacketed**
 - A lead bullet coated with copper half way up the exposed portion of the bullet
 - Used primarily for hollow points
 - Copper improves exit velocity
 - Lead promotes mushrooming
- **Jacketed**
 - A lead bullet completely coated in copper
 - Copper improves exit velocity
 - Used to hold the shape of the bullet in an effort to maximize penetration

Firing Pin Strikes



Headstamp

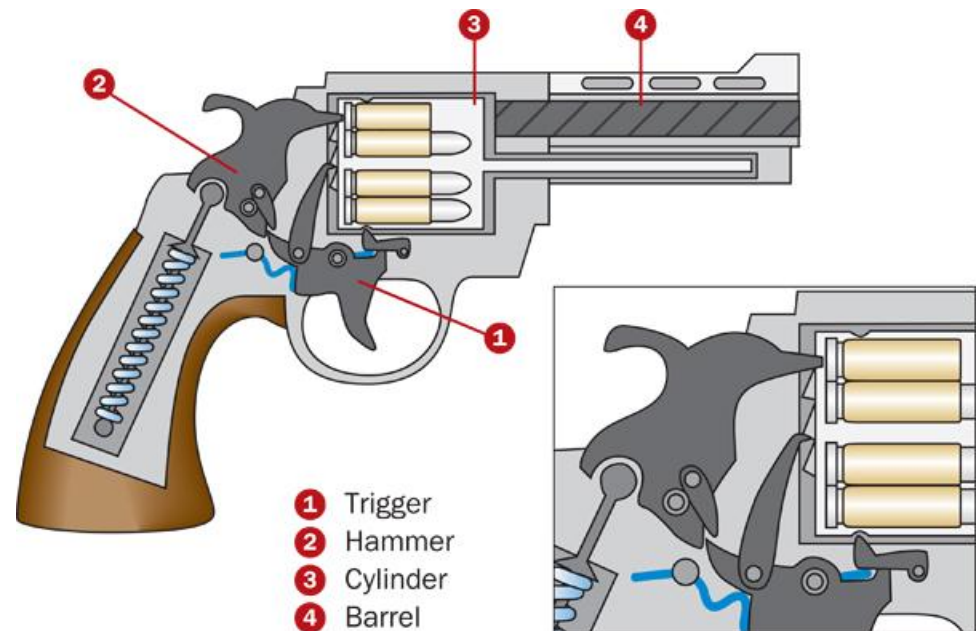


Caliber

Manufacturer

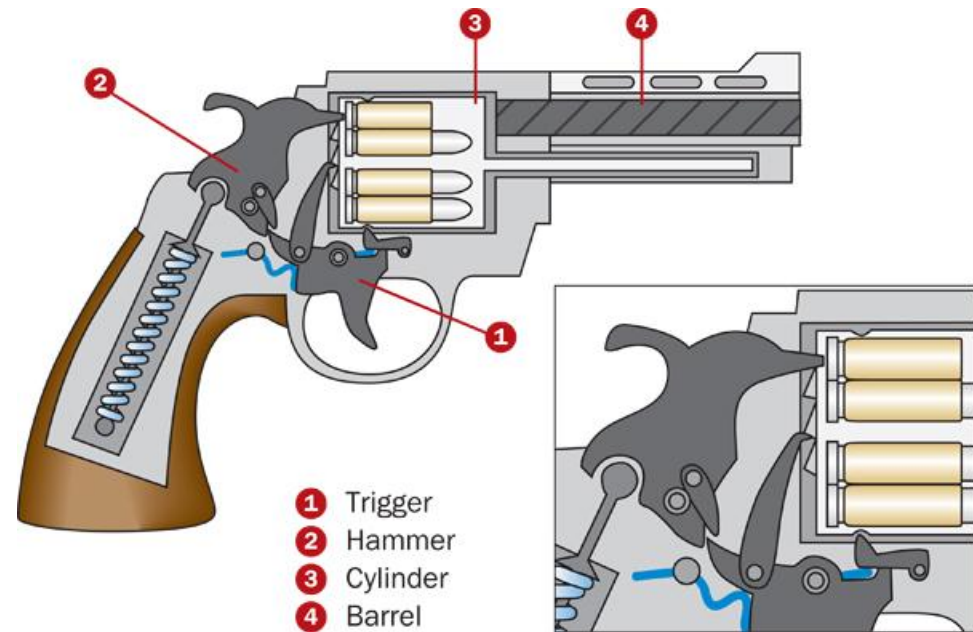
How a firearm works

- The firing pin hits the base of the cartridge, igniting the primer powder
- The primer powder sparks through the flash hole to the main propellant supply



How a firearm works

- The pressure of the explosion pushes the bullet from the casing into the barrel
- The bullet follows the lands and grooves spiraling out of the barrel

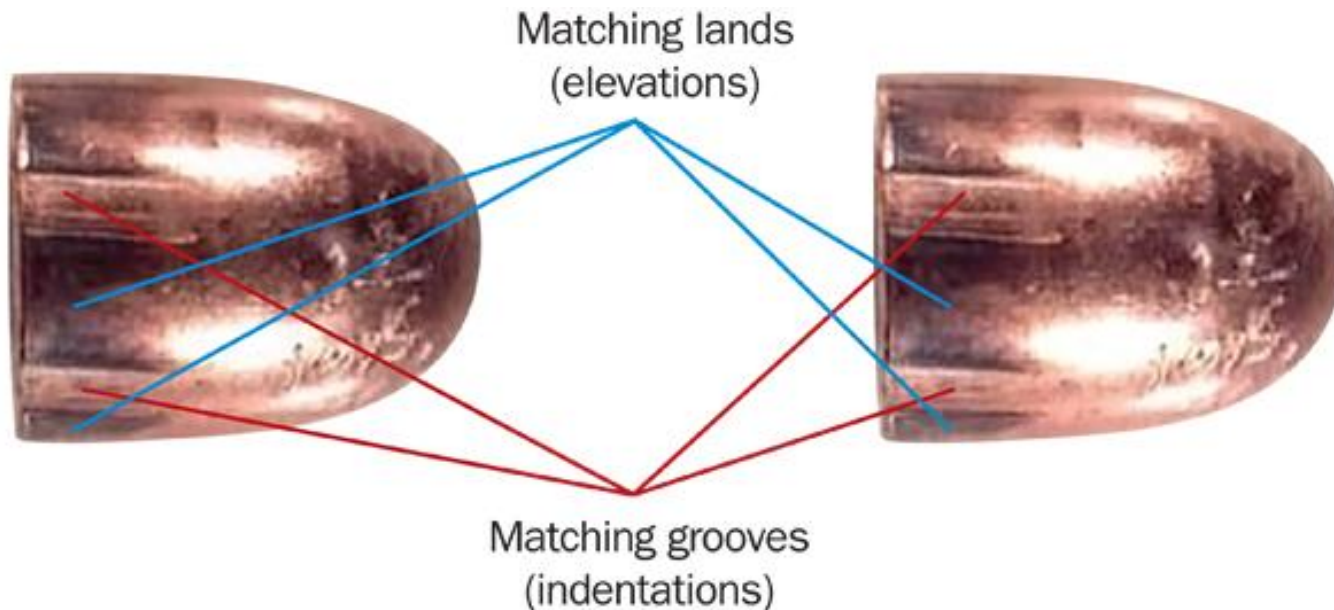


Caliber

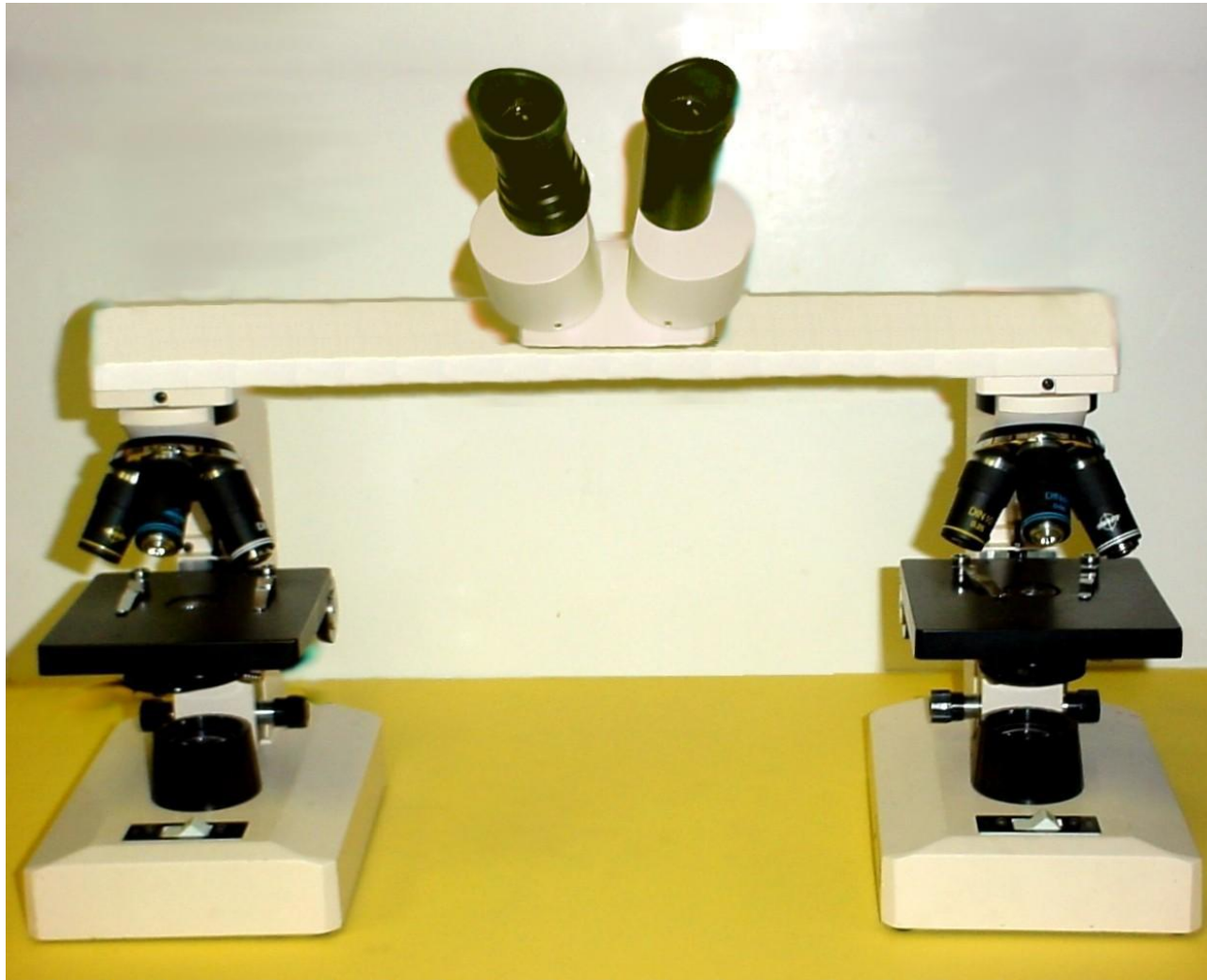
- Caliber—a measure of the diameter of the cartridge
- In hundredths of an inch (metric system in Europe)
- Common calibers include
.22, .25, .357, .38, .44, and .45
- Why should the caliber of ammunition match the firearm that shoots it? If they do not match, what could go wrong?

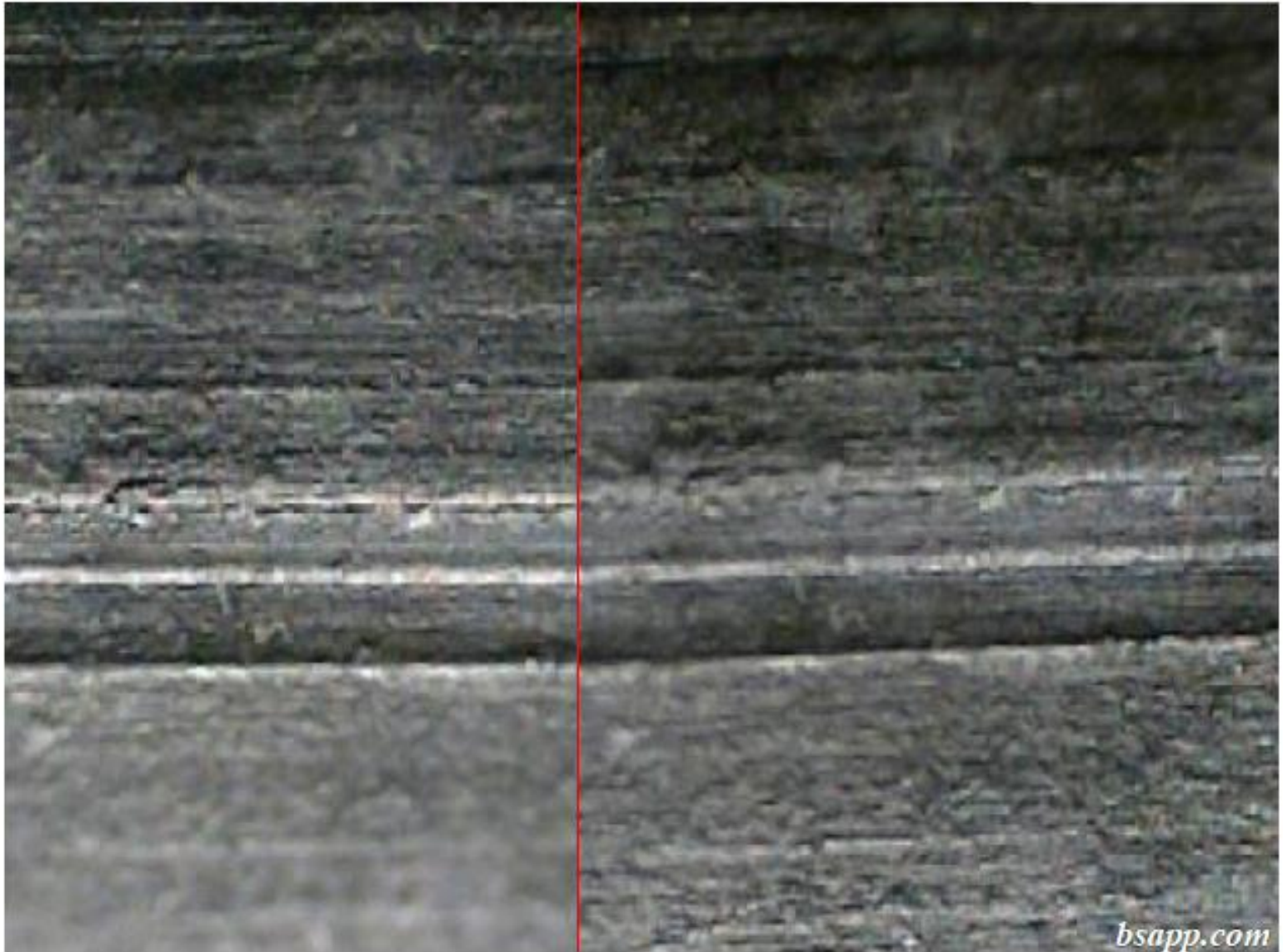
Analysis

- Comparison bullets are shot from the suspected weapon into a water tank or ballistics gel which captures the bullet without damaging it.
- Lands and grooves are then compared.



Comparison Microscope





bsapp.com

