

FIREARM INJURIES

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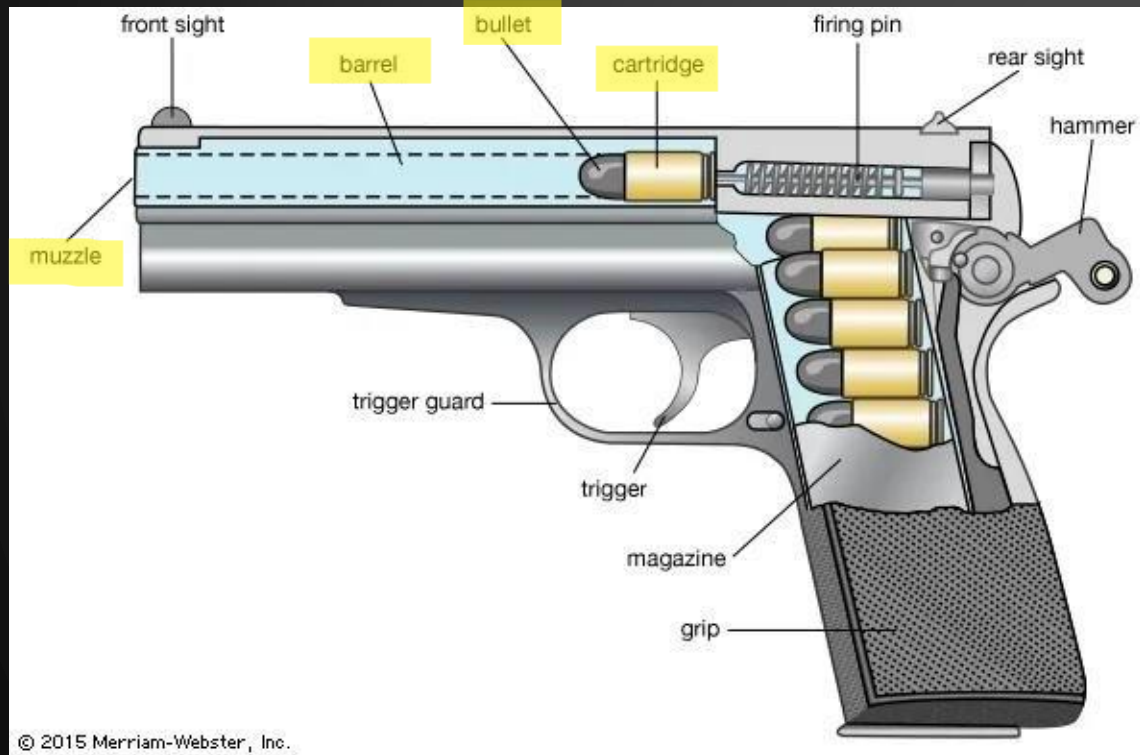


WHAT IS A FIREARM?

A firearm is any weapon that propels a projectile using the expansive force of gases generated by the combustion of an explosive substance.

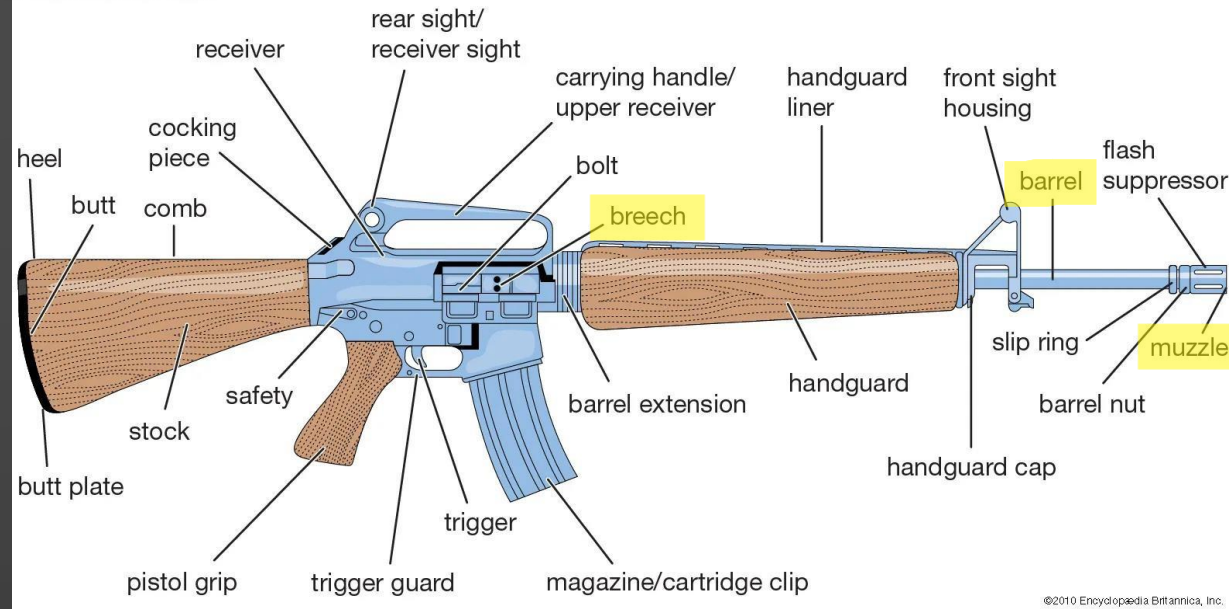
It is an instrument which discharges a missile.

ANATOMY OF THE FIREARM



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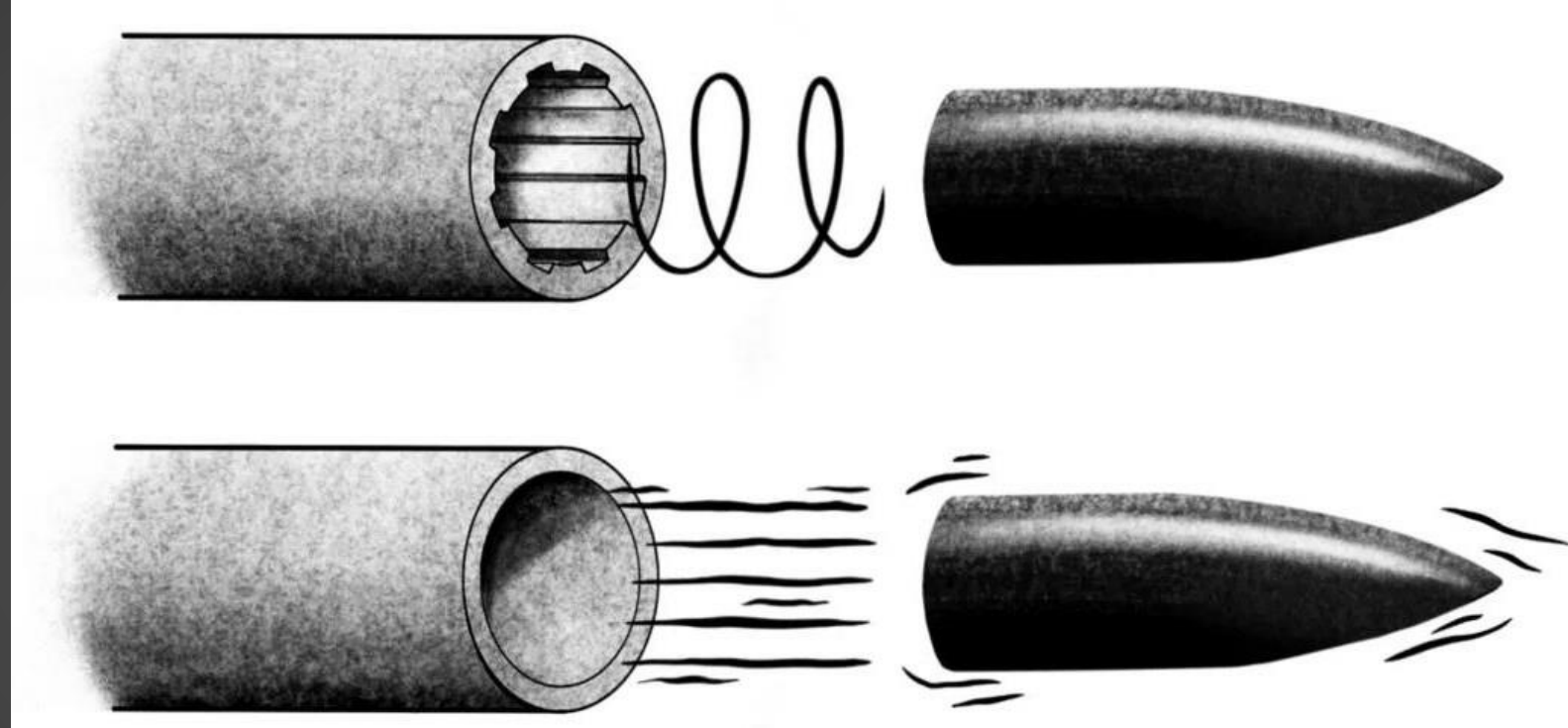
Automatic rifle



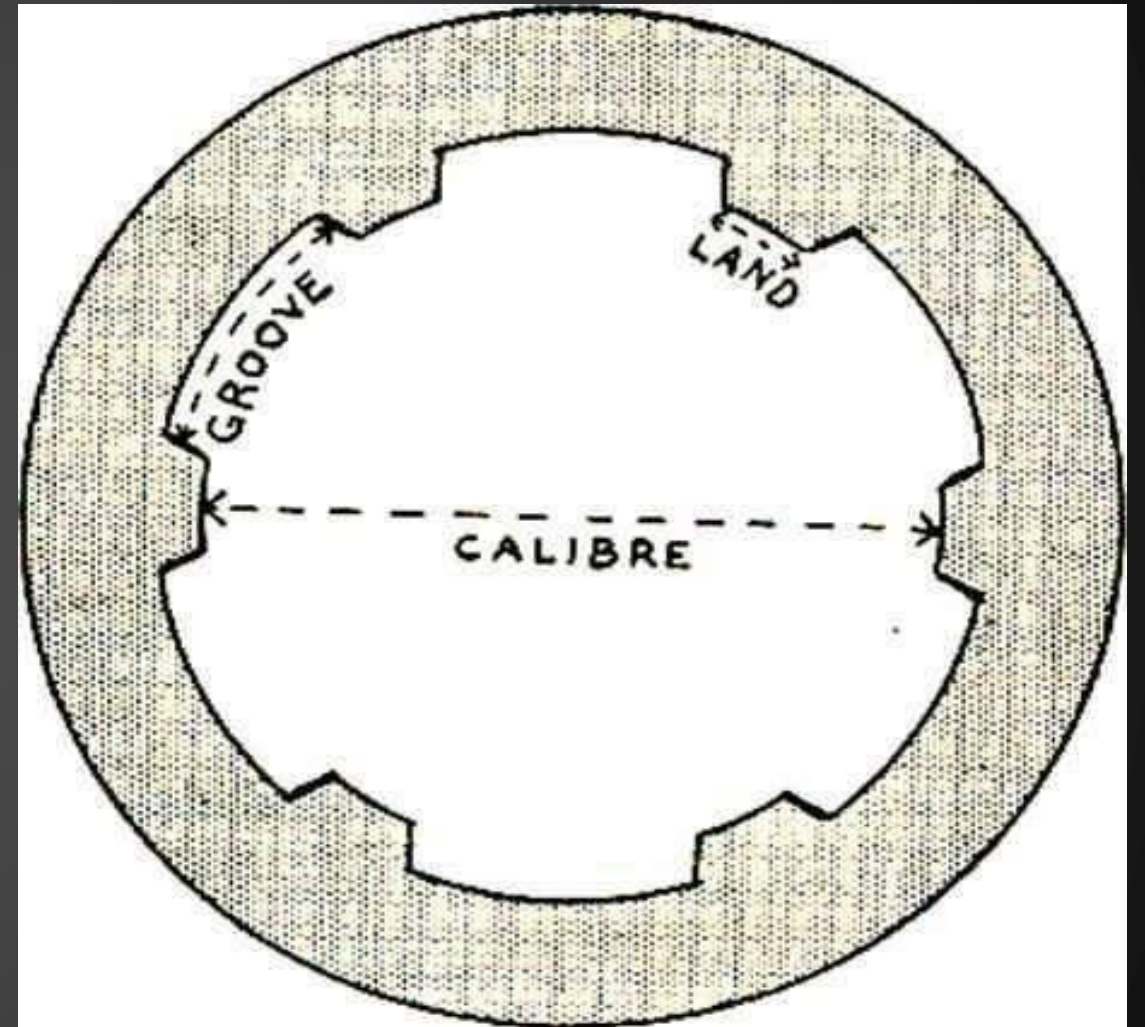
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FIREARMS CLASSIFICATIONS

Firearms are broadly classified into two categories depending on the type of barrel



Rifling refers to the grooves cut into the inner surface of a weapon's bore, extending from the breech to the muzzle. These grooves, typically numbering between 2 and 22 (commonly 4 to 7), are parallel but twisted in a spiral pattern. The grooves are known as "rifling," while the raised ridges between them are called "lands."





What does Rifling do to the bullet?

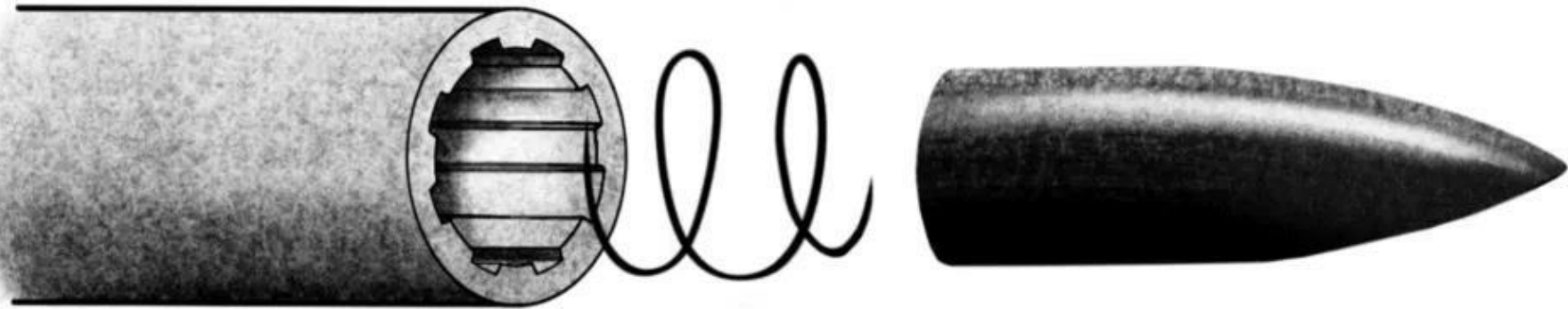
GIVES THE BULLET A SPINNING OR SPIRALING MOTION.



A greater power of penetration.

A straight course and prevents it from unsteady movement as it travels in the air.

Rifled Barrel Spinning Bullet for Stabilized Flight

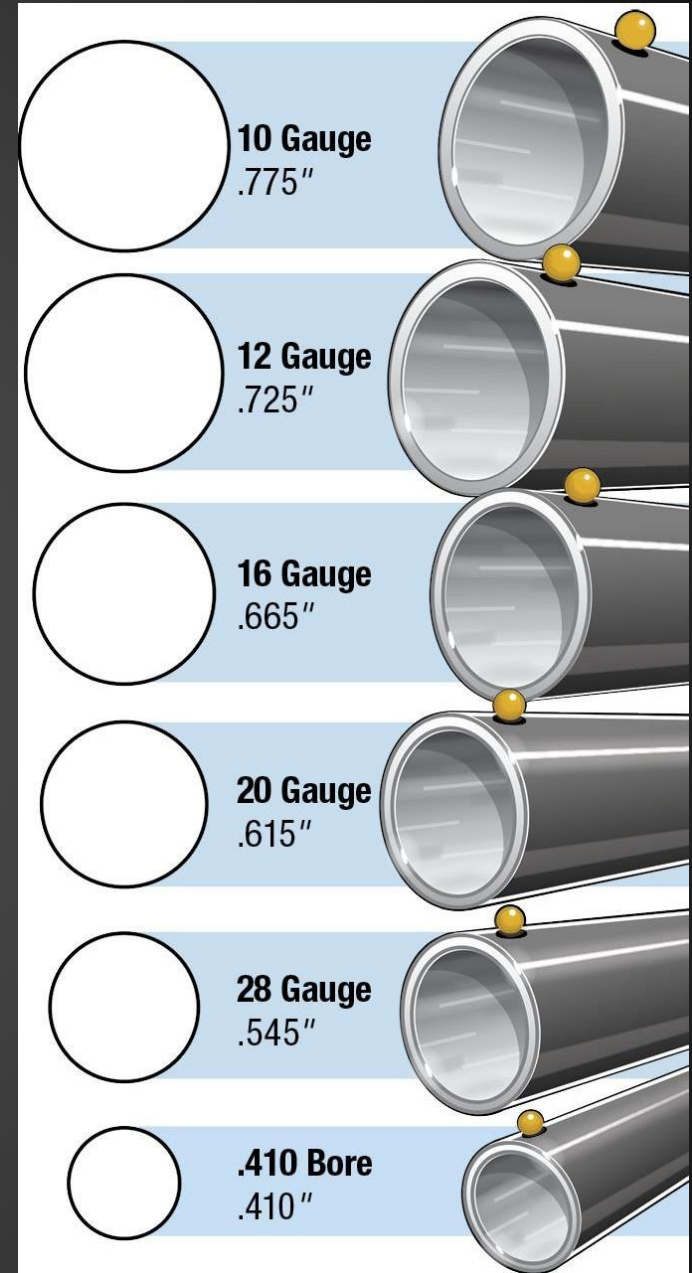
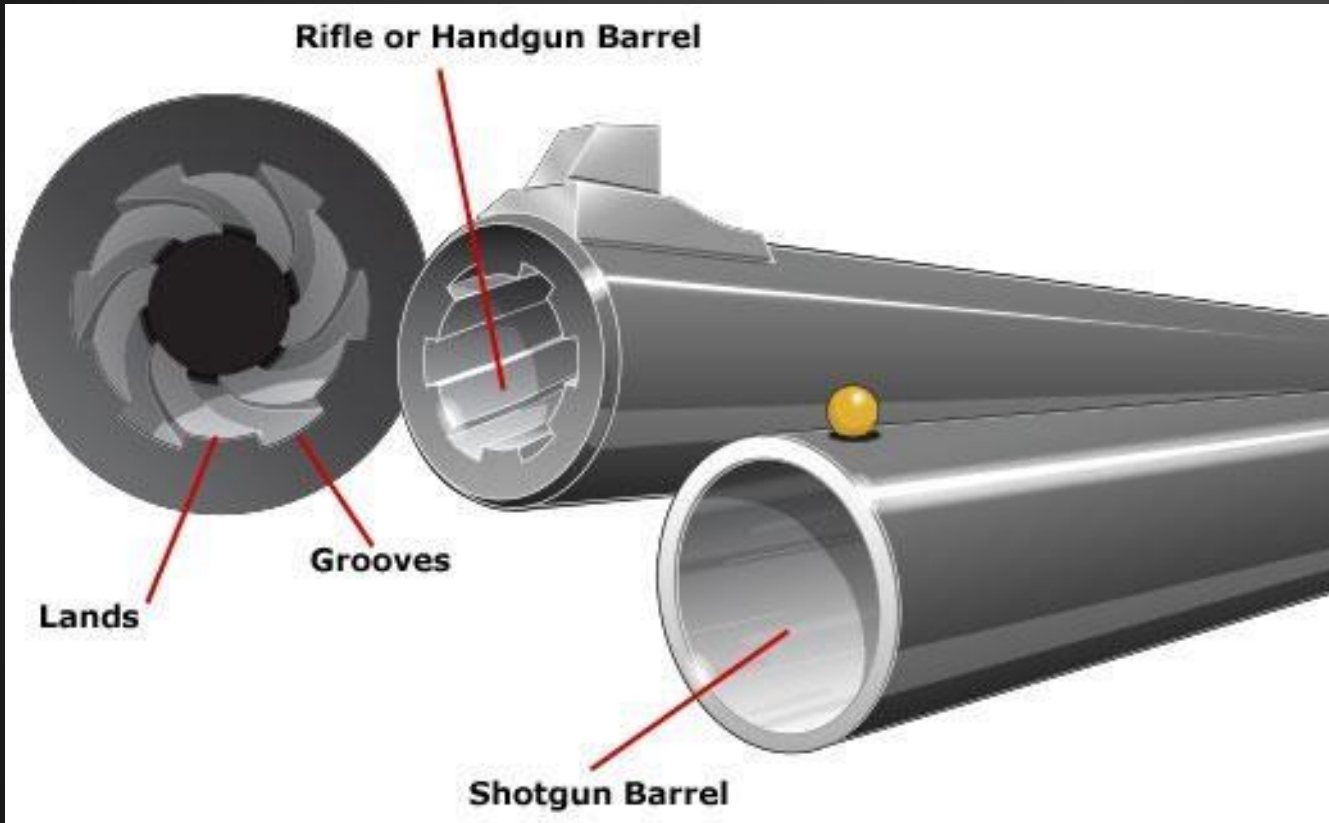


Smoothbore Barrel causing Unstable Flight

SMOOTHBORE FIREARMS

- In smooth bore firearms, the bore or the inner surface of the barrel is uniformly smooth. It is intended to be fired from the shoulder and is designated to fire multiple pellets from the barrel.









BULLET

A bullet (from the French boulette, meaning "little ball") is the projectile fired from a rifled firearm, exiting through the muzzle upon discharge.



CARTRIDGE

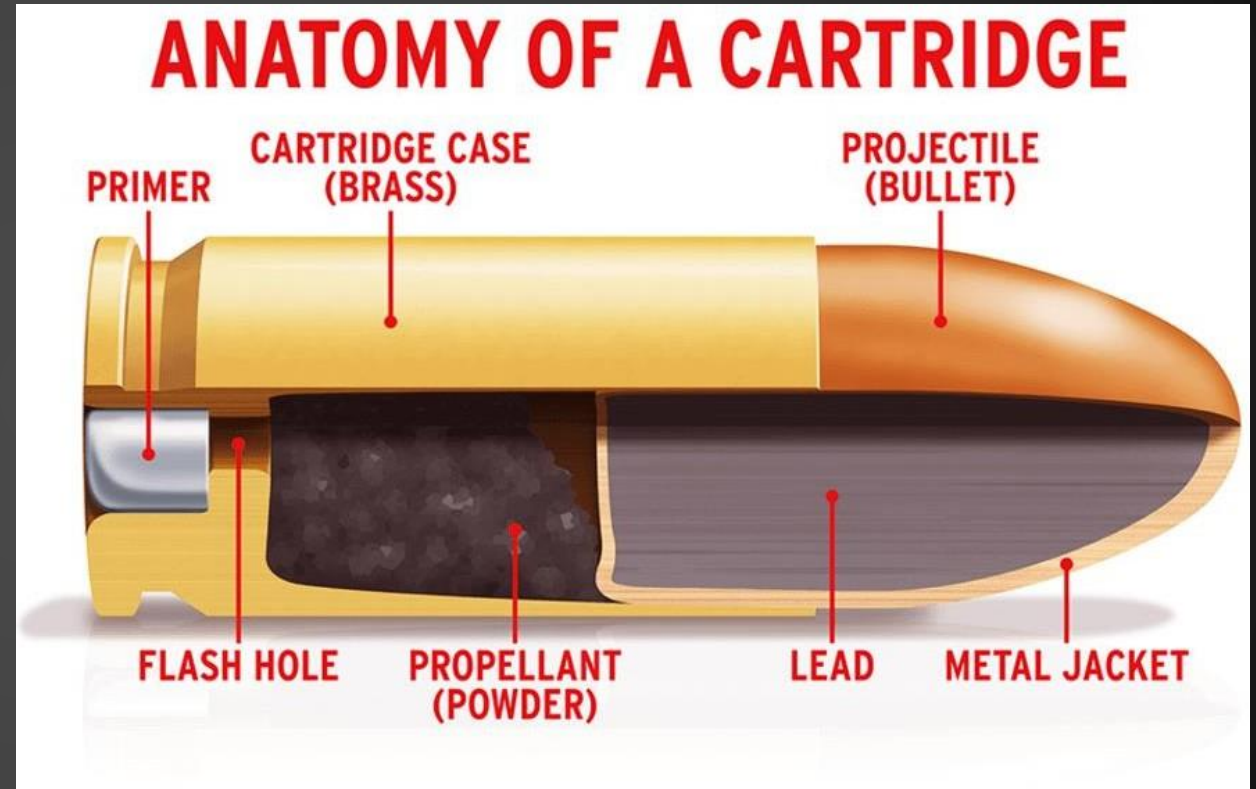
A cartridge is a single unit of ammunition that includes the following components:

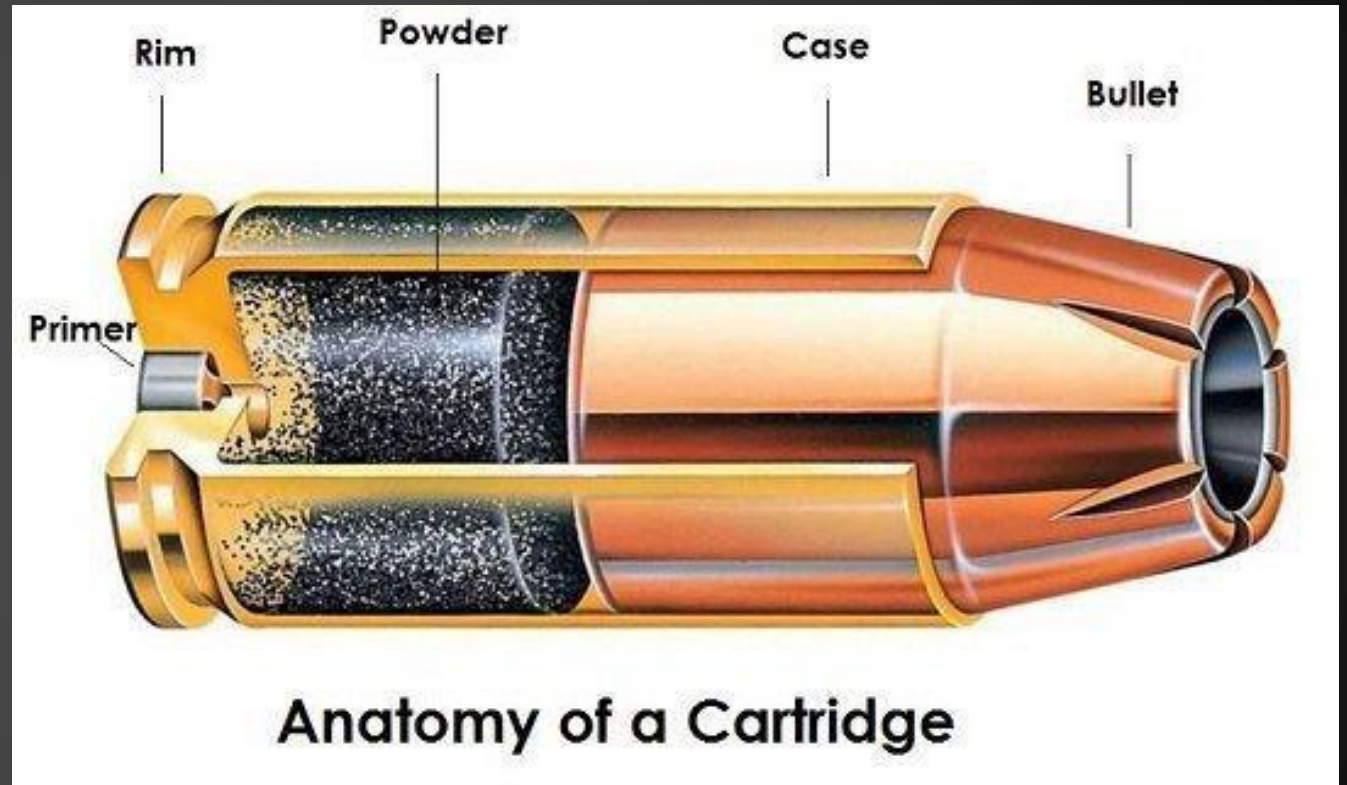
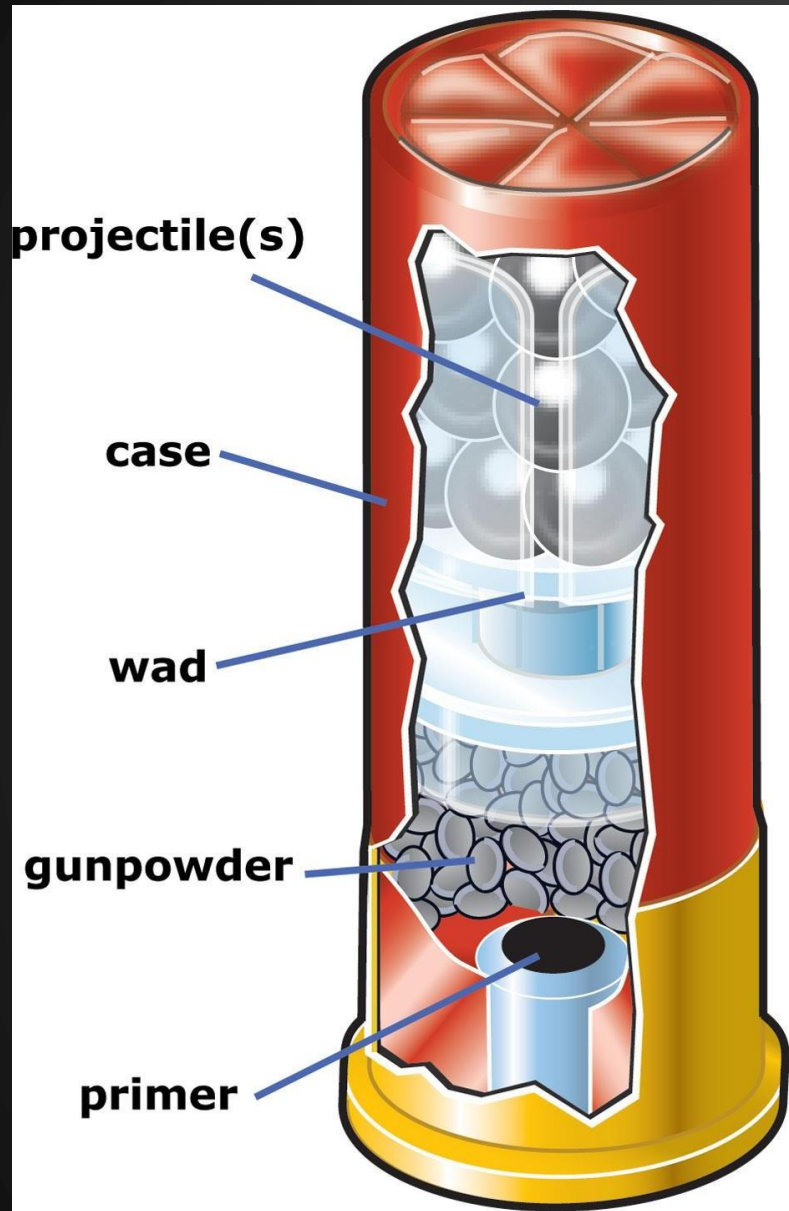
Cartridge case with a percussion cap containing the primer

Propellant charge (gunpowder)

Projectile (bullets or pellets)

Wads (used only in smoothbore weapons)





GUNPOWDER

(Propellant Charge)

- **Black powder:** It produces flame, smoke and heat, and consists of granular ingredients, like sulfur, charcoal and saltpeter (potassium nitrate)
- **Smokeless powder:** It is more effective than black powder as it burns more efficiently and produces much less smoke, resulting in less blackening and tattooing around the entry wound.



WHEN THE BULLET EXITS THE BARREL, IT IS ACCOMPANIED BY:

- Unburned propellant particles
- Partially burned propellant particles
- Soot from the combustion of the propellant
- Nitrates and nitrites resulting from propellant combustion
- Primer residue particles (including oxides of lead, antimony, and barium)
- Vaporized metal and metallic particles stripped from the bullet and cartridge case



FACTORS DETERMINING THE INJURIOUS EFFECTS OF A MISSILE

- Speed of the bullet
- Size and shape of the bullet
- The nature of the missile's movement during flight





Firearm Wounds



Mechanism of injury

- Tissue is lacerated and crushed along the path of the bullet.
- Tissue is displaced forward and radially, resulting in cavitation and pressure injury of nearby structures.
- The level of injury is related to the kinetic energy of the bullet; energy varies based on factors such as bullet weight and velocity.
- Dense organs (e.g., liver, bone) absorb more kinetic energy than less dense organs, resulting in greater injury.

1



Factors Affecting Firearm Wound Characteristics

Firearm Type

The type of firearm, whether a shotgun or a rifle, significantly influences wound characteristics. Shotgun wounds tend to be larger and more irregular due to the dispersion of pellets, while rifle wounds are typically more focused and circular.

Missiles

The shape and composition of the projectiles, such as bullets or pellets, contribute to the wound's appearance. The size, weight, and material of the missile impact how it interacts with the tissue.

Range

The distance between the firearm and the target (range) plays a crucial role in the severity of the wound and the presence of associated markers, such as soot, gunpowder residue, and abrasion collar.

Body Area

The part of the body struck, whether the head or the trunk, influences the extent of the wound and the potential for associated injuries, like skull fractures or internal organ damage.



Key Markers: Tattooing and Blackening

1 Tattooing

Tattooing is a telltale sign of a close-range gunshot wound, characterized by small, reddish-brown punctate abrasions surrounding the wound of entrance. This pattern arises from unburnt or partially burnt gunpowder particles embedded in the skin.

2 Blackening

Blackening, or soot smudging, occurs due to the deposition of powder soot (carbon) produced by the combustion of gunpowder. The extent of blackening provides insights into the proximity of the firearm to the target.

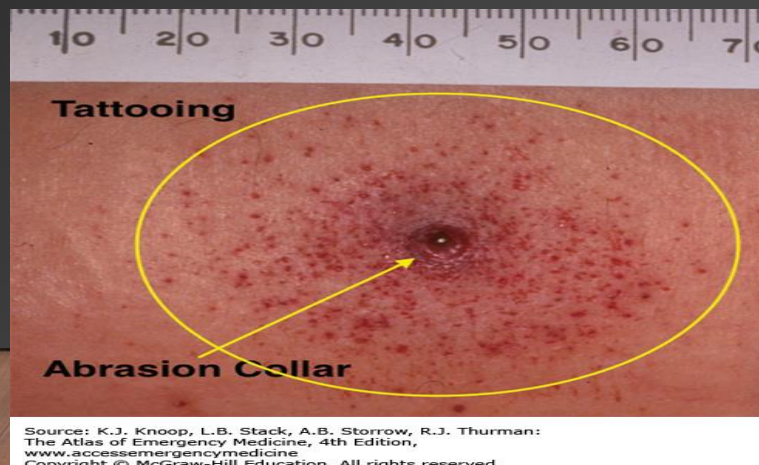
Additional Markers: Abrasion Collar and Bullet Wipe

Abrasion Collar

As the bullet strikes the skin, it first indents and then stretches the skin the skin surface so that perforation takes place through a tense area tense area which produces a rim of flattened reddish -brown zone of zone of abraded epidermis, surrounding the entrance wound.

Grease/Dirt Collar (Bullet Wipe)

A black-colored narrow ring of skin lining the defect, sharply outlined, indicates the removal of substances from the bullet as it passes through the skin. This marker provides information about the bullet's trajectory and potential for secondary evidence transfer.



Contact Shots: Muzzle Imprint and Blowback Phenomenon

Muzzle/Recoil Imprint Mark

A muzzle imprint mark is a distinct sign of a contact shot. Its shape depends on the firearm, ammunition, and anatomical conditions. This imprint can be a valuable clue in identifying the firearm used and its position during discharge.



Blowback Phenomenon

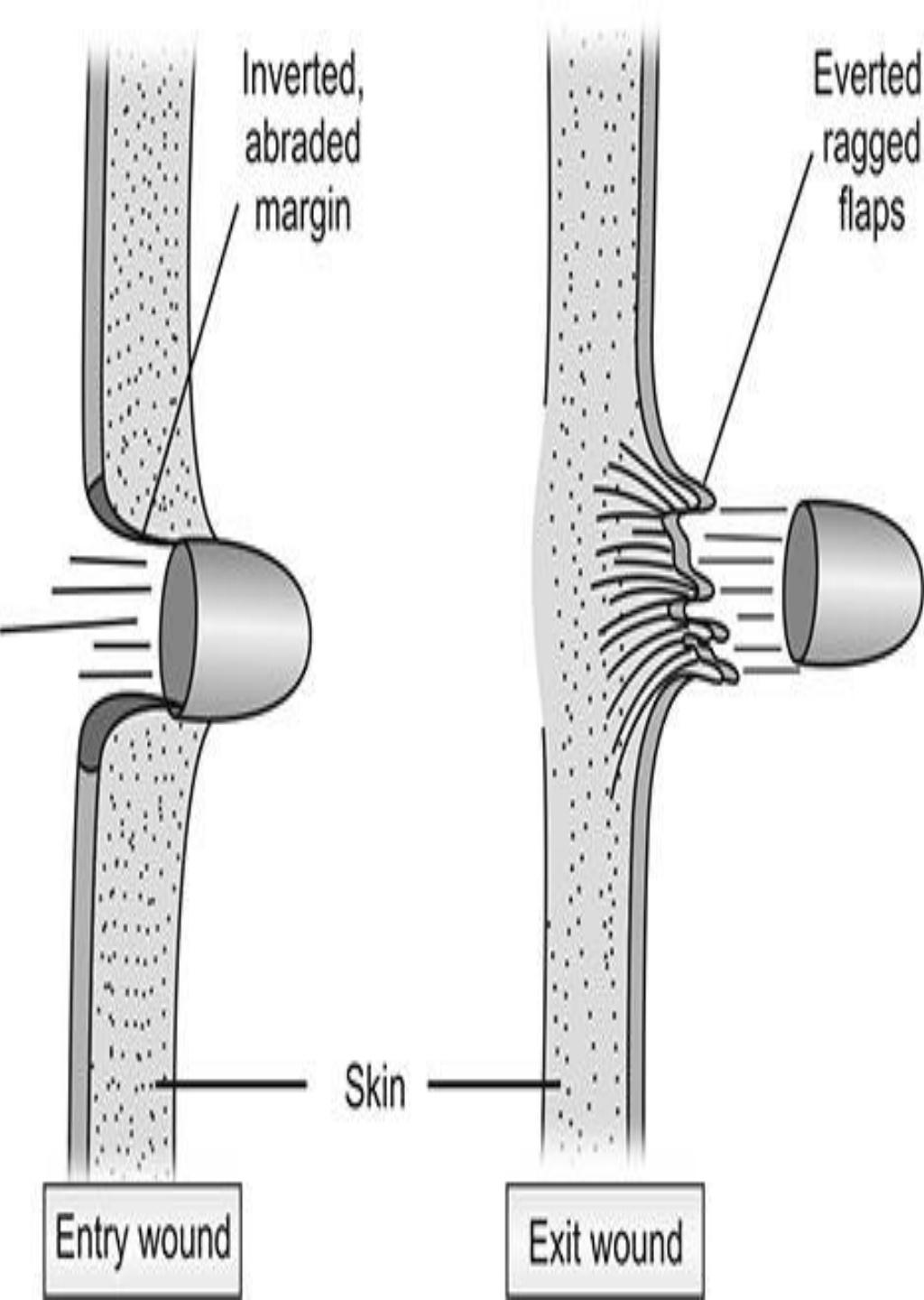
Blowback phenomenon refers to the forceful expulsion of gases and debris back towards the shooter in a contact shot. This can result in a cruciate, stellate, or ragged laceration, especially over especially over thick bone, like the skull.



Classifying Gunshot Wounds

Wounds

Penetrating vs. Perforating



Penetrating Wounds

In penetrating wounds, the bullet enters an object but does not exit. The bullet remains embedded within the object, and the wound is characterized by an entry point but no exit hole.

Perforating Wounds

Perforating wounds involve the bullet passing completely through an object. These wounds have both an entry and an exit point, providing valuable information about the bullet's trajectory and potential for secondary evidence.

Entry and Exit Wound Characteristics: Contact Shot

Contact Shot:

whole of the discharge containing flame, gases, powder smoke and metallic particles will be blown under pressure into the track taken by the bullet through the body



Rifled wound:

Point blank shot, Cruciate/stellate/star shaped when over a dense area like cranial vault (explosive effects of gases), Circular when over thin bone/abdomen with abrasion or contusion collar, Burning, Burning, blackening and tattooing are slight or slight or absent, Surrounding hair are singed, singed, Imprint of muzzle end may be found stamped on skin, Tissues saturated saturated with CO and show cherry red color. color.

Shotgun wound:

Large irregular hole (Explosive blast effect), Scorching, tattooing and blackening blackening may be present, Imprint abrasion abrasion may be present, Shot enters as a solid mass, Cherry red colored injured tissue, In cranium, large and irregular wound wound with fissured fractures radiating outwards from the margin.

Entry and Exit Wound Characteristics: Close shot

Close shot (Flame Range):

Body lies within the range of flame, smoke and powder blast, i.e. within 2–3 inches (5–8 cm).



Rifled wound:

Circular hole surrounded by scorching, singeing and smudging, Abrasion collar, grease collar and tattooing are present.

Shotgun wound:

Circular defect with irregular inverted borders, Edges show scorching and blackening, Fairly wide zone of tattooing, Cherry red appearance of tissues, Pellets enter enmasse, Wads and cartridge parts may contribute to the wound.

Entry and Exit Wound Characteristics: Near Shot

Near Shot (Intermediate Range):

here victim is within the range of powder deposition but outside the range of range of flame (within 60cm).

Rifled wound:

Circular or oval, Singeing of hair and scorching are absent, Smudging not seen beyond 30cm, Grease collar and abrasion collar are present.

Shotgun wound:

Circular or oval, Blackening may be evident around the wound up to a maximum distance of 30cm, Sometimes the wad produces mild abrasions if fired within a range of 30 cm, Tattooing is present over a wide area, The entry wound is approximately 2.5cm in diameter.

Entry and Exit Wound Characteristics: Distant shot shot

Distant shot

the firearm outside the range of flame and powder blast.



Rifled wound:

Circular with inverted margins, Scorching, tattooing and smudging are all absent, Grease collar and abrasion collar are present

Shotgun wound:

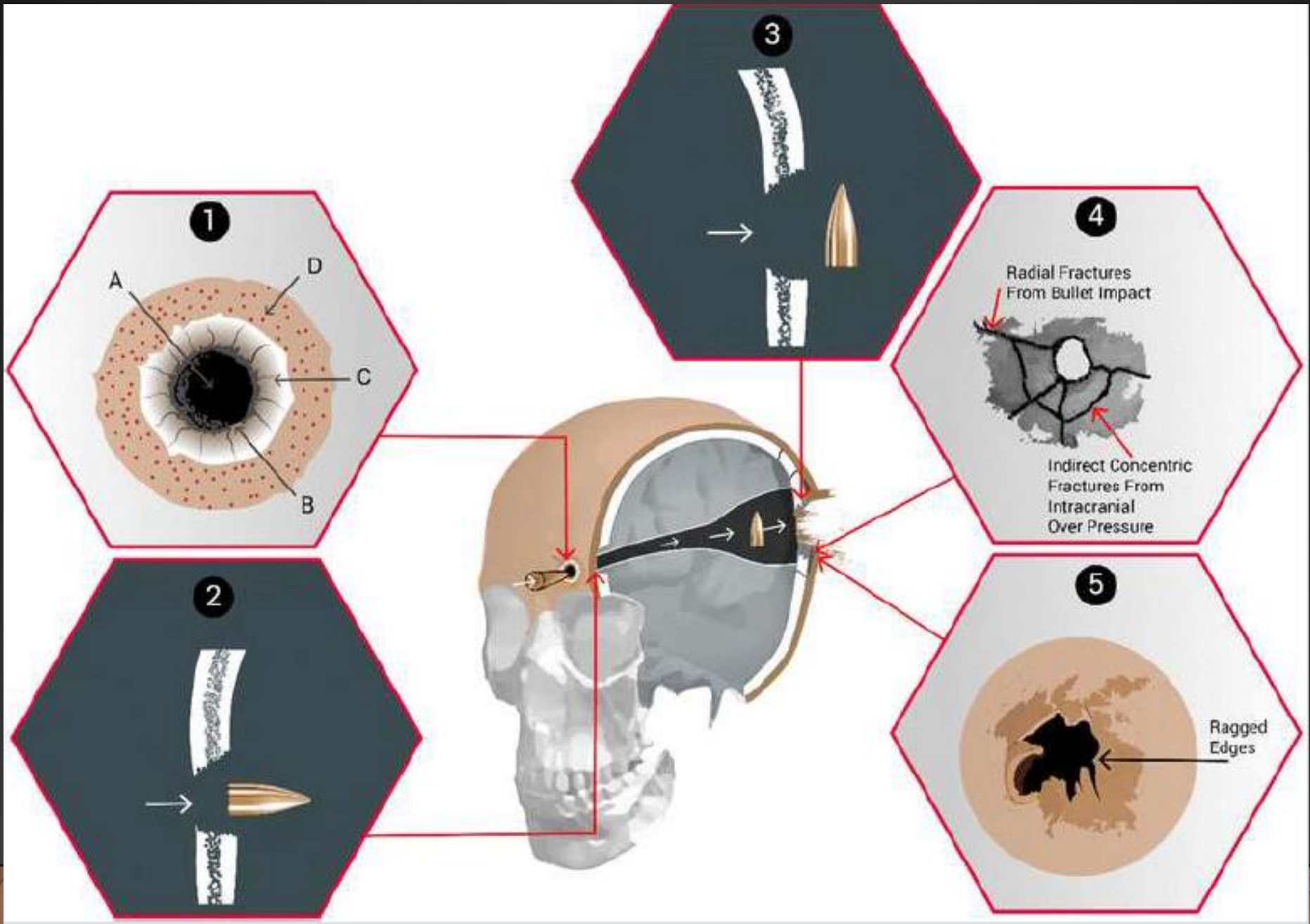
Beyond 2m, no burning or blackening, Tattooing is rare, Wads may contribute up to 5m, Significant dispersion of pellets beyond 2m and increases progressively, Beyond 6m central defect diminishes to nothing and lethality is very less.

EXIT WOUNDS

- In contact wounds and very close range, exit wound is smaller than entry wound due to elastic nature of the skin. However, as range increases, the size of exit wound also increases.



Difference between Entry and Exit wound

Trait	Entrance wound	Exit wound
Size	Smaller	Bigger
Edges	Inverted	Everted
Burning, blackening, tattooing.	Present	Absent
Abrasion collar	Present	Absent
Bleeding	Less	More
Fat	No protrusion	May protrude
Cherry red – tissue	Present	Absent
Fibers of cloths	Turned in	Turned out
Lead ring	Seen in X ray	Absent
Spectrography	More	Less metal




POSTMORTEM AND ANTI-MORTEM FIREARM WOUND

Antemortem

- Bleed profusely 
- The entrance wound is smaller than the diameter of the projectile due to elasticity of skin 

Postmortem

- Postmortem injuries bleed a less 
- Wound will be of the same as the diameter of the projectile as skin loses its elasticity after death.

MEDICO LEGAL IMPORTANCE

Homicidal



Suicidal



Accidental



MEDICO LEGAL IMPORTANCE

Powder
Residue test

On skin
(Dermal
Nitrate Test)

On Clothes
(Walker's test)

Paraffin test

Lung's test

Gonzales' Test

C-Acid Test

H-Acid Test

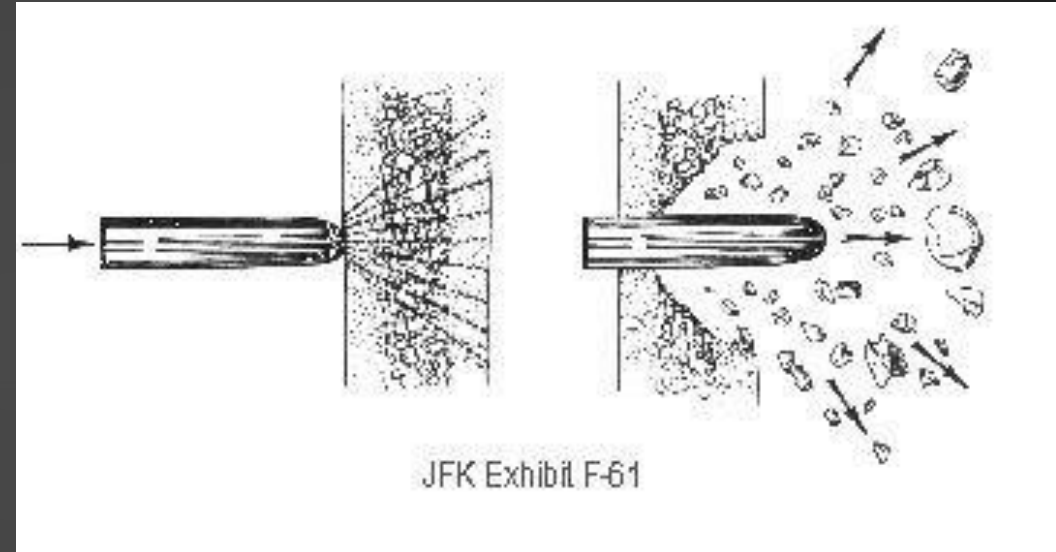
Feature	Accidental	Suicidal	Homicidal
Site of entry wound	Any part	Head/Chest	Any part
Range	Close	Contact/Close	Any range
Direction	Any direction	Upward/backward	Usually upward
No. of wounds	One	Usually one	One or multiple
Firearm residue on hand	Present	Present	Absent
Weapon at scene	Present	Present	Usually absent
Location	Anywhere	Usually home	Anywhere
Sex	Usually males	Usually males	Either sex
Motive	Absent	Depression, mental illness	Robbery, revenge



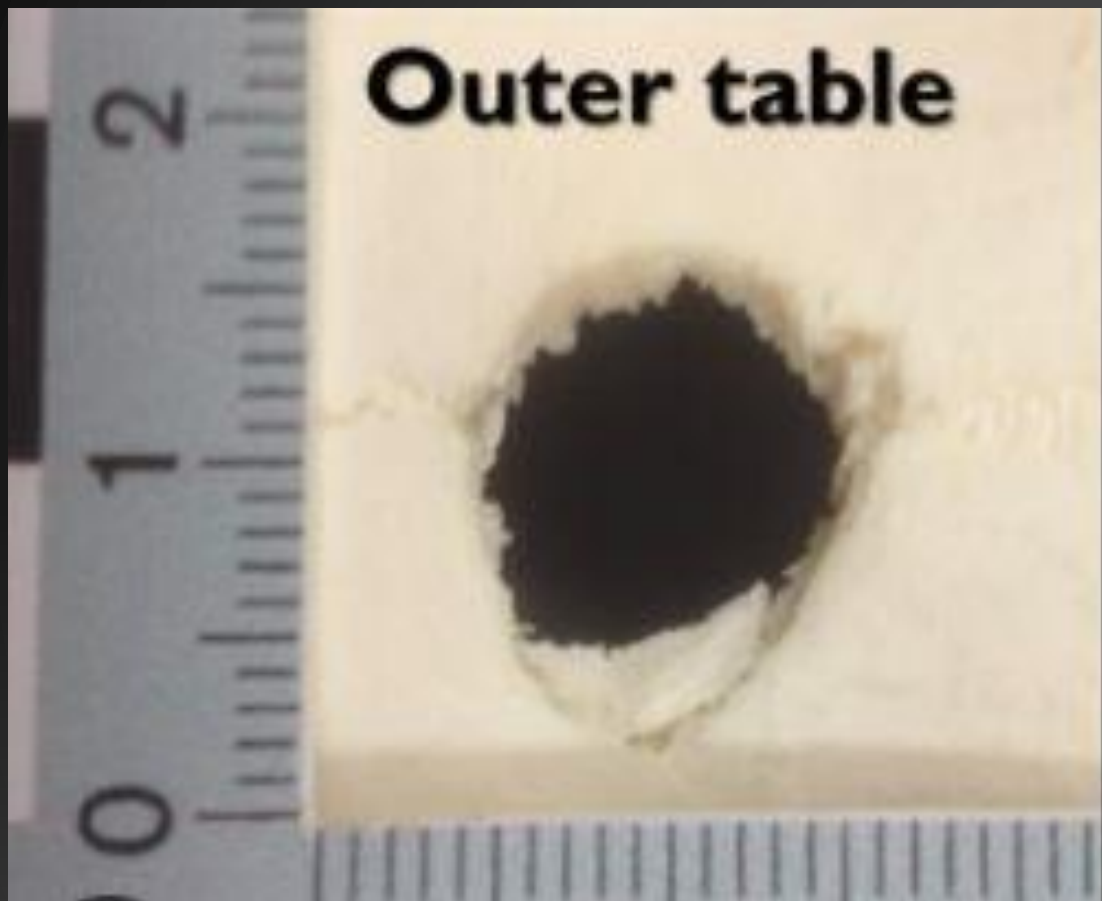
SKULL WOUNDS BY FIREARMS

BEVELING

- In perforating gunshot wounds to the head, entrance and exit wounds show a typical feature called beveling, distinguishing between entrance and exit.
- Beveling is a pattern of bone damage created as the bullet enters or exits the skull.

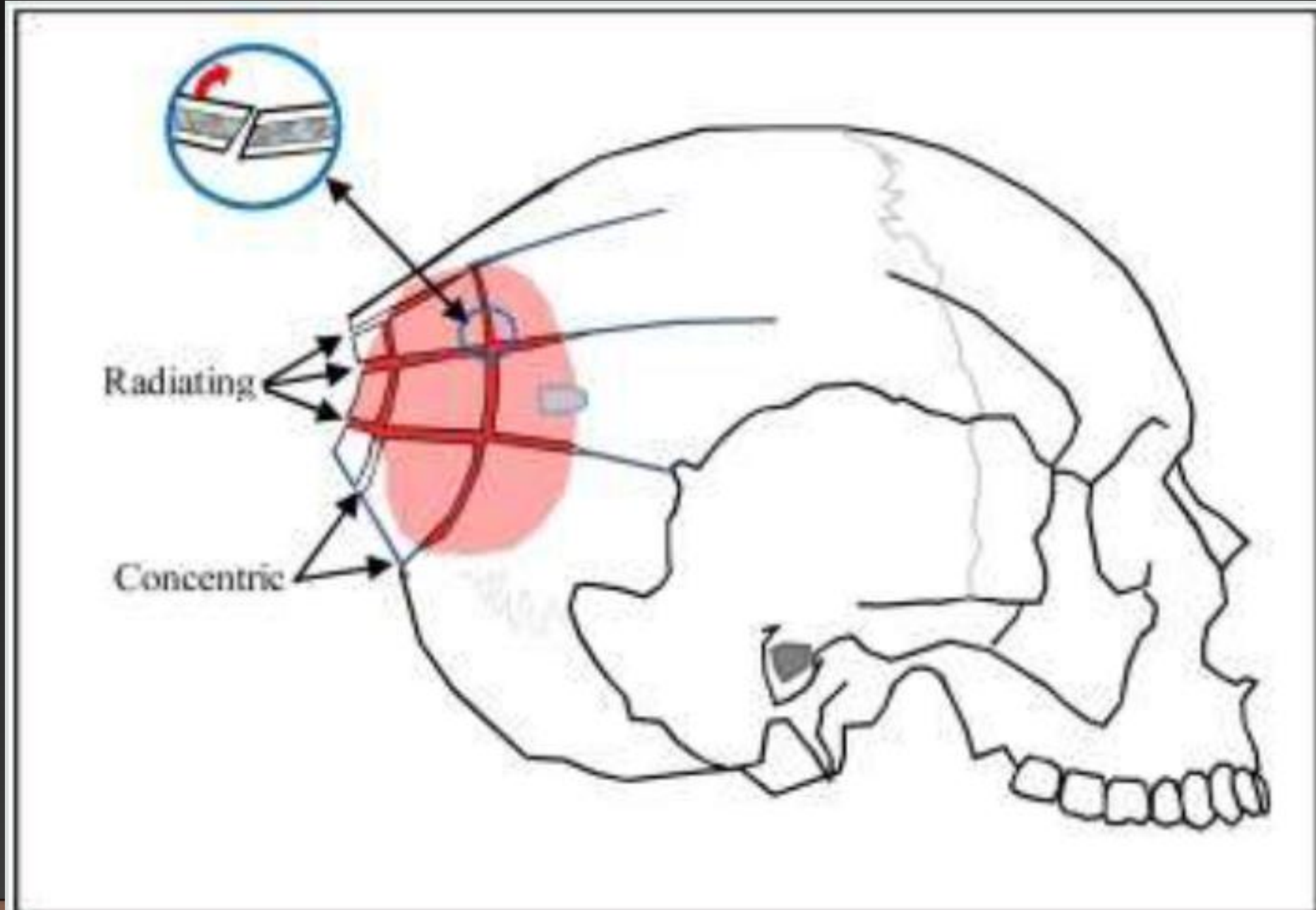


Outer table



Inner table





Even if the bullet does not penetrate the cranial cavity, its energy is still transferred to the bone and central nervous system, resulting in fractures and severe damage

THANK YOU