Ballistics

Learning Objectives

- I can explain the discovery of gun powder
- I can explain how bullets are test fired and matched
- I can determine the position of a shooter based on bullet trajectory

What is Forensic Ballistics?

The scientific analysis or interpretation of all ballistic related evidence with the purpose of interpreting and establishing the facts in a shooting related crime

History of Gunpowder

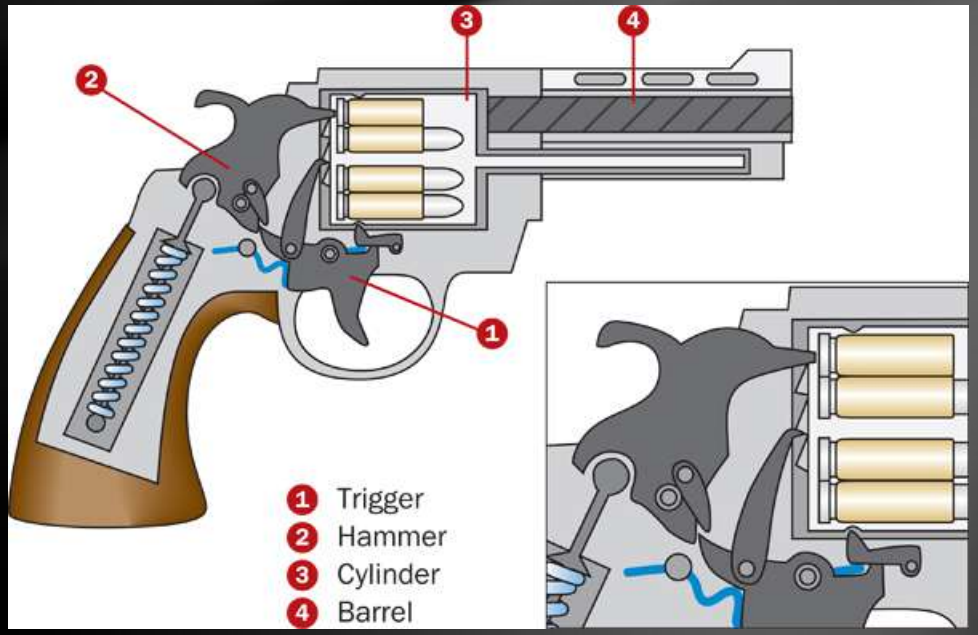
How Firearms Work

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

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



Anatomy of a Cartridge

The bullet.

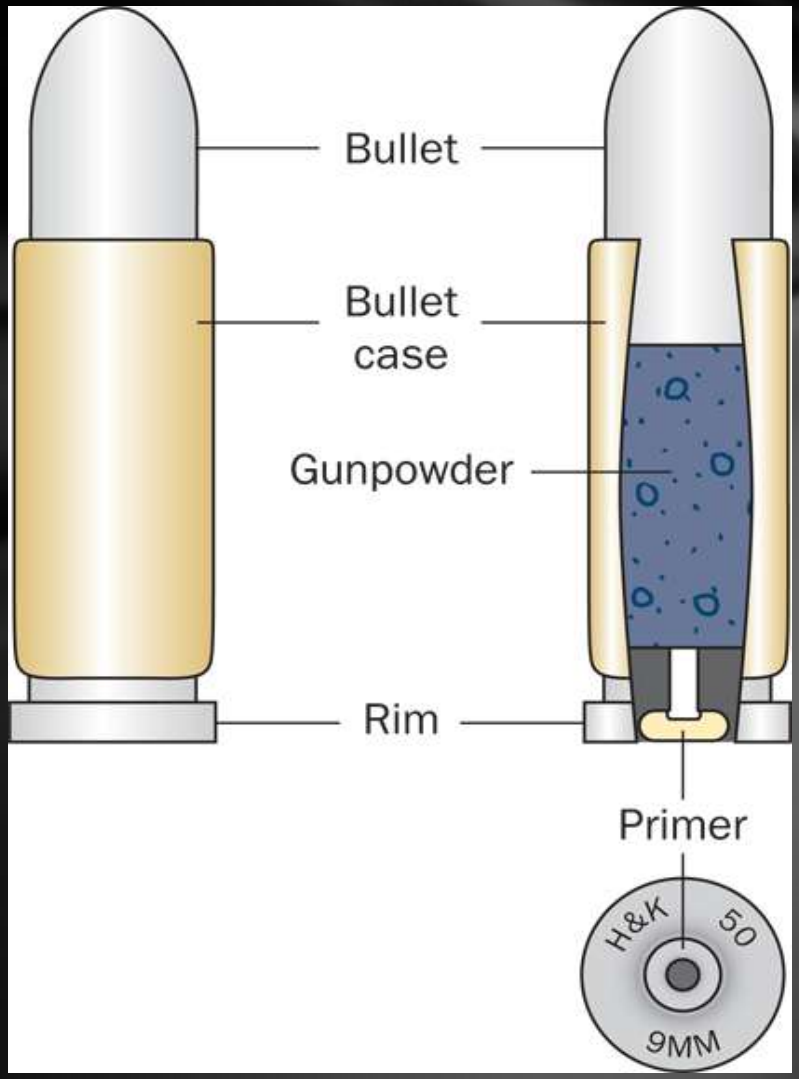
- The metal projectile firing from the gun.

The casing or shell.

- The outer portion or the cartridge.

The powder

- Combustion reaction produces gas, rapidly expanding to fire the bullet out of the gun.



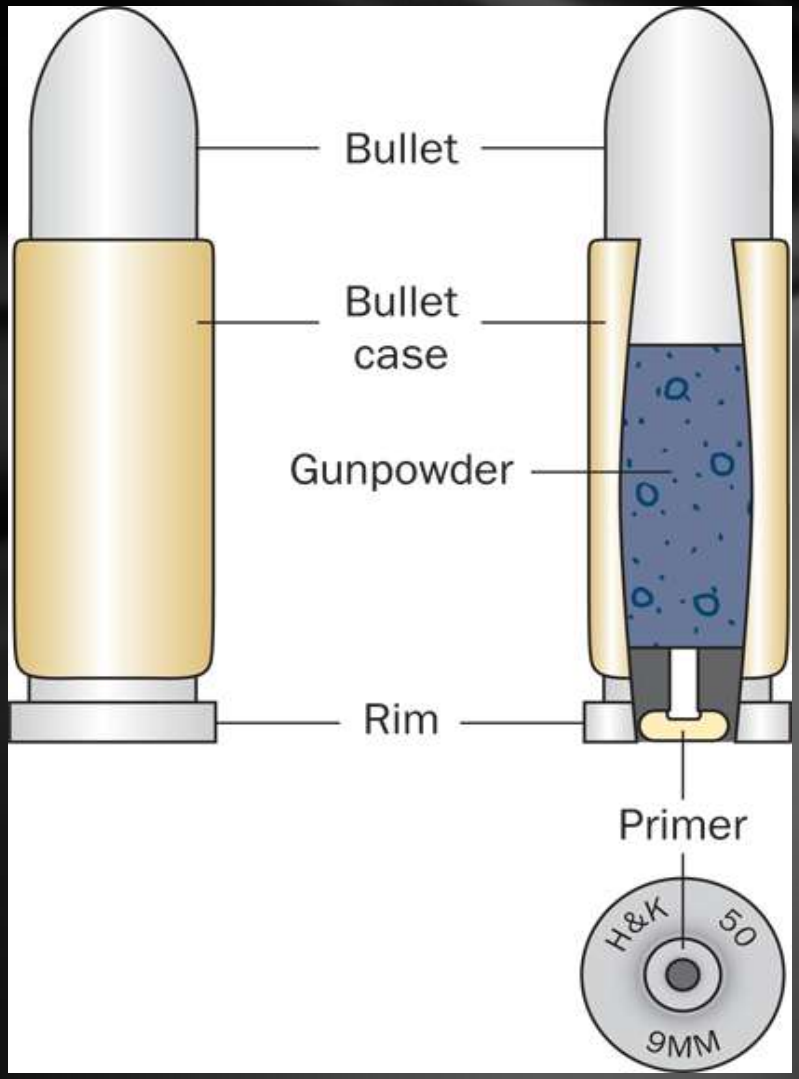
Anatomy of a Cartridge

The rim.

- Grabbed by the ejector removing a spent cartridge from the gun

The primer

- Hit by the pin to begin combustion of the powder.

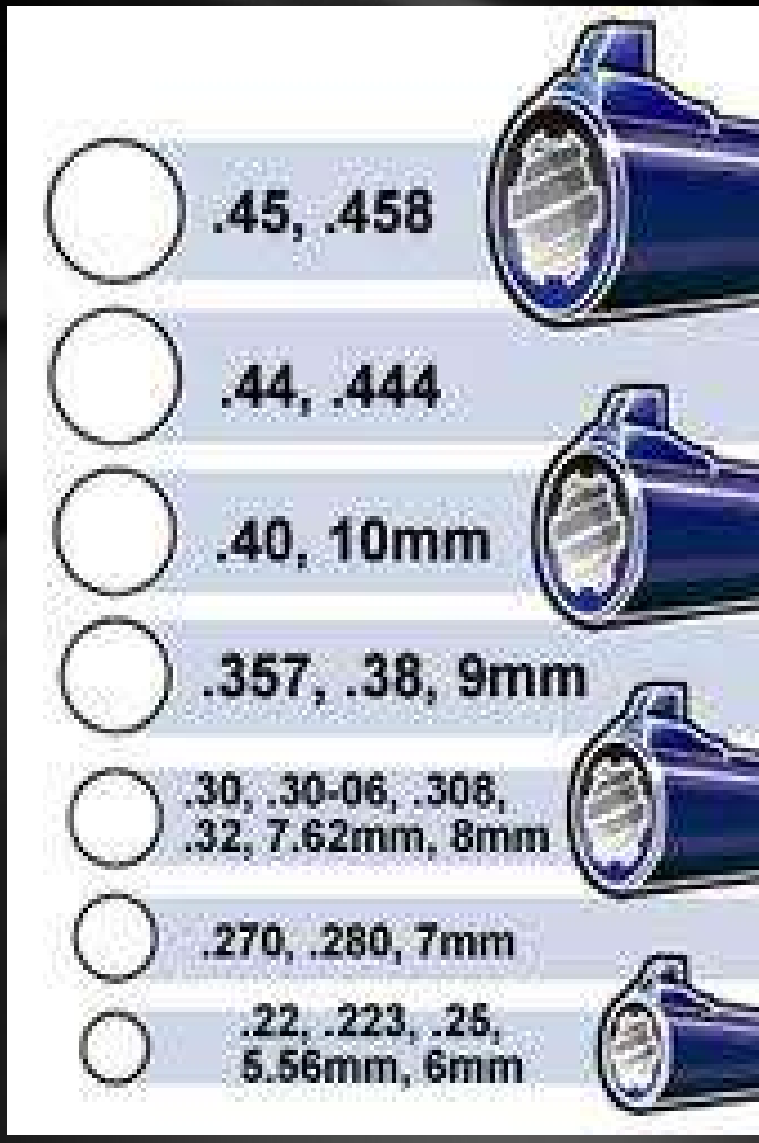


Anatomy of a Cartridge

Caliber is a measure of the diameter of the cartridge

Measured in hundredths of an inch

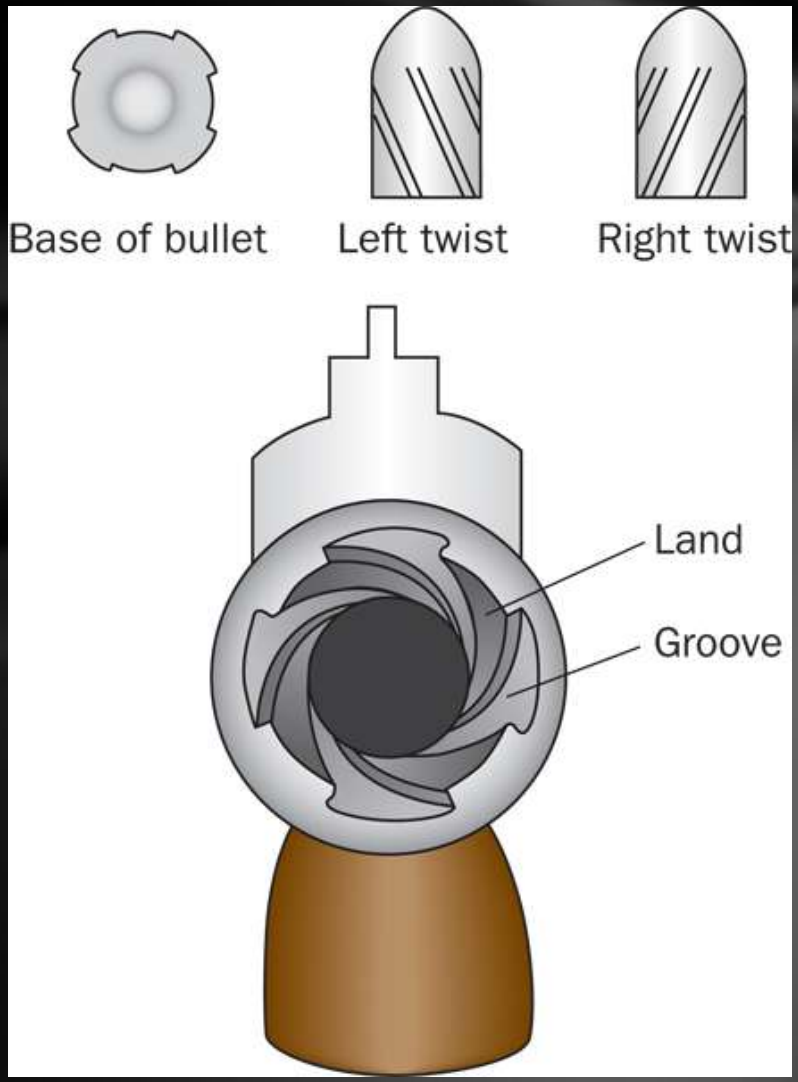
Common calibers include .22, .25, .357, .38, .44, and .45



Rifling and Striations

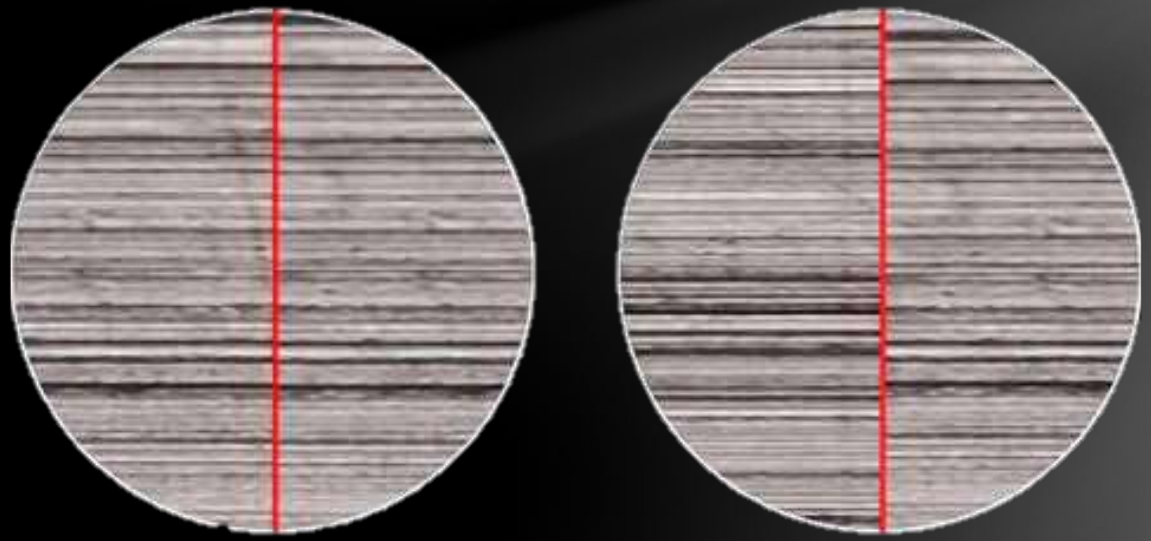
Grooves and ridges in the barrel causes the bullet to spin, making aim more accurate.

This creates striations that can match a bullet to a particular gun



Rifling and Striations

A suspect was named in a homicide case. Two guns were collected from the suspects home to compare bullets fired from the suspects guns to those found in the victim. Identify particular striations used in determining whether the suspects gun was used in the shooting. Which, if either is the a match?



Gunshot Residue

Particles of unburned powder and traces of smoke are left on the hand, arm, face, hair, or clothing of the shooter and/or victim

Chemical testing can detect residue even if removal is attempted

Distance from victim to shooter can be determined by examining the residue pattern on the victim

Trajectory

Two reference points are needed to define the trajectory. Reference points can be

- Bullet holes in objects or victims
- Entry and exit points on a victim
- Gunshot residue or spent casings

The path of a bullet can be traced with lasers or calculated mathematically

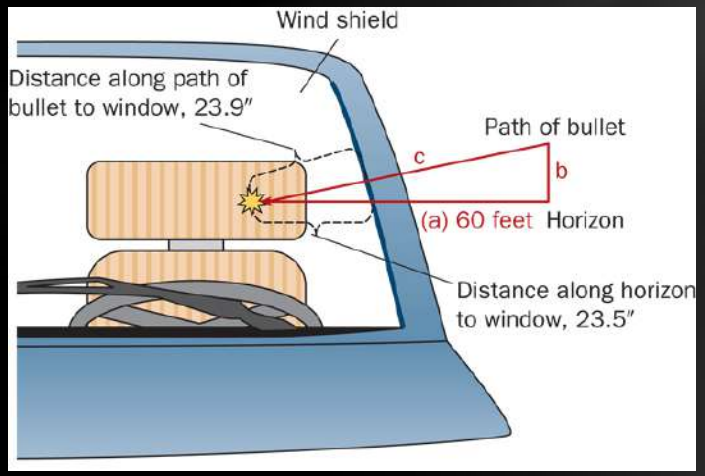
Pythagorean Theorem and Soh Cah Toa

Trajectory

A rifle was shot from a nearby building through the windshield of a car and hit the drivers side seat.

a. If the bullet struck at an angle of 23.9º from a building 60 feet away, what floor of the building was the bullet shot from? Assume each floor is 10 ft tall.

b. If the bullet travels at 2,500 ft/s, how long does it take for the bullet to hit the victim? Hint: v=d/t




Death

Learning Objectives

- I can describe steps of a death investigation
- I can estimate time of death

Investigating Death

When the cause of death is unclear or suspicious an investigation is completed by a medical examiner or coroner. This includes:

- Violent crime, suicide, or accident
- Within 24 hours of entering a hospital or having surgery
- A natural death when a patient is not in the care of a doctor or medical facility
- Death in police custody or correctional facilities
- Death from a communicable disease that may pose a threat to public health.

At the Death Scene

Draw sketches of the body at the scene

Take photographs of

- the scene
- the victim's face
- the underside of the body

Document signs of trauma

Estimate time of death

Collect Evidence and establish chain of custody

Interview Family

Medical Examination

Update chain of custody

Investigate clothing and body

Search for biological and nonbiological evidence

Order X-rays and perform an autopsy to confirm time of death

Determine manner of death (natural, accidental, homicide, suicide, or unknown)

Identify cause of death (specific injury or disease resulting in death)

Evidence Collected During the Autopsy

Blood

- In order to identify the victim blood is collected from an artery and placed on a blood card for DNA profiling
- Dried blood is scraped into a test tube using a scalpel or swabbed with a Q-tip

Semen

- Semen is swabbed with a Q-tip and DNA profiled

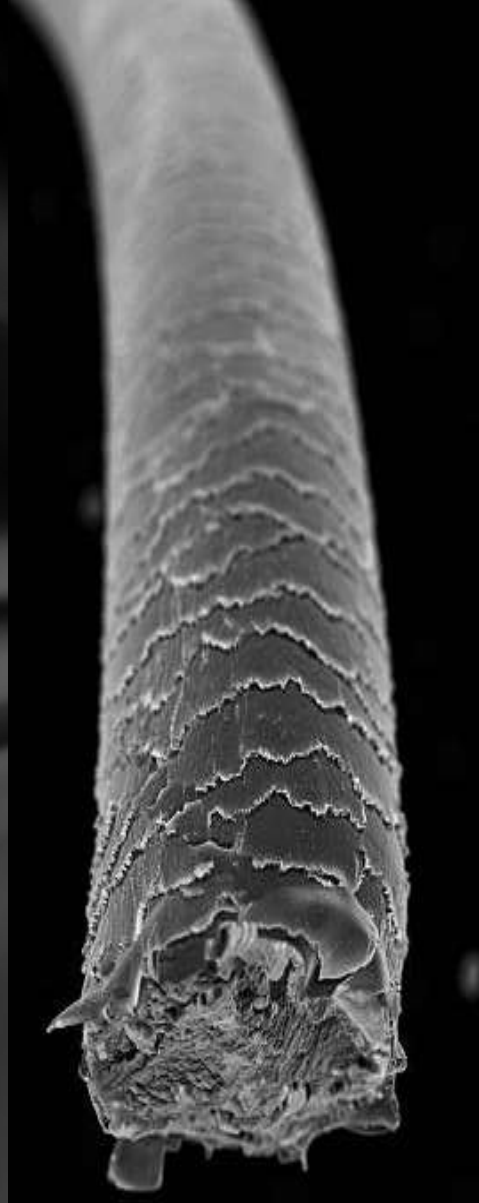
Evidence Collected During the Autopsy

Hair

- Loose hairs are collected, noting where it came from, and compared to the victims own hairs, follicular tags provide DNA evidence

Tissue

- Tissue samples are collected in individual sterile containers and stored in a cool area such as a refrigerator
- May be used to detect cancer and disease



Evidence Collected During the Autopsy

Fingernails

- Each fingernail is trimmed and placed in its own labeled sterile envelop

Bite Marks

- A forensic odontologist may be brought in to take dental records and study bite marks.
- Bite marks will also be swabbed for DNA with a moist Q-tip which is then dried and placed in a test tube

Laboratory Analysis

Toxicology—the science related to the detection of drugs, alcohol, and poisons

Histology—the study of tissues

Neuropathology—the study of disease and trauma associated with the nervous system

Serology—the study of blood, semen, and other body fluids (for legal matters)

Estimating Time of Death

Livor Mortis - Color of Death

- Blood settles into the lower parts of the body
- Lividity begins about two hours after death, discoloration becomes permanent after eight hours
- Can help determine the position of the body during the first eight hours after death

Estimating Time of Death

Rigor Mortis - Rigidity of Death

- Calcium accumulates in the muscles after two hours causing the body to become stiff
- By 15 hours muscle tissue deteriorates causing the stiffness to disappear

Estimating Time of Death

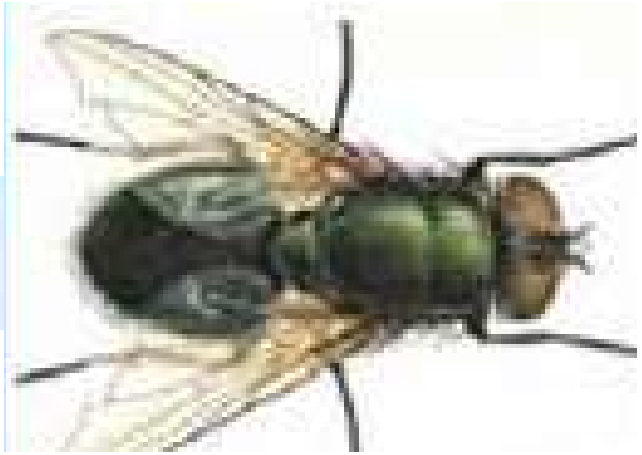
Algor Mortis - Chill of Death

- Body heat falls 1.5 degrees per hour slowing to less than 1.0 degree after about 12 hours depending on environment
- Corpse temperature is measured by a thermometer inserted into the liver
- Time of death is expressed as a range of time

Estimating Time of Death

Blow Fly Life Cycle

- Immediately – eggs are found in moist areas of the body
- 1.8 days – stage 1 larva, thin body, black mouth

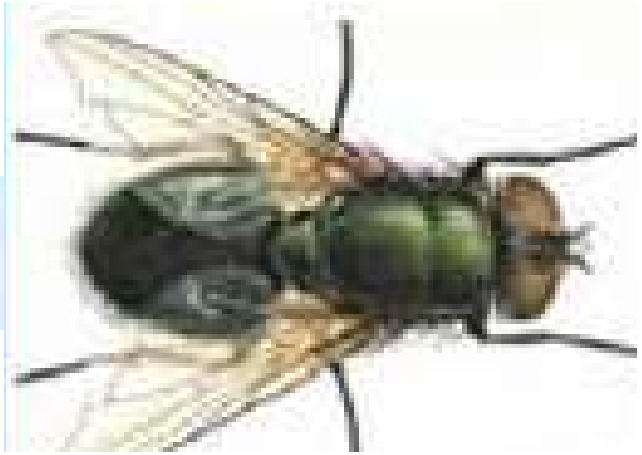


Estimating Time of Death

Blow Fly Life Cycle

- 2.5 days – stage 2 larva, dark crop becomes visible, actively feeding
- 4-5 days – stage 3 larva, dark crop disappears, fat body



Estimating Time of Death

Blow Fly Life Cycle

- 8-12 days – Pre-pupa, larva migrates away to dry areas
- 18-24 days – Pupa, immobile, does not feed, dark brown “balloon”
- 21-24 days – adult blow fly, incapable of flight for first few hours