Death Investigation

Autopsy and the Role of the Medical Examiner

GAVS 5 Autospy

SFS2. Students will use various scientific techniques to analyze physical and trace evidence.

c. Evaluate how post mortem changes are used to determine probable time of death:

- Rigor mortis
- Livor mortis
- Algor mortis
- Gastric contents

SFS5 Students will evaluate the role of Forensics as it pertains to Medico legal Death Investigation.

- a. Identify various causes of death (blunt force trauma, heart attack, bleeding, etc.).
- b. Analyze evidence that pertains to the manner of death (natural, homicide, suicide, accidental, or undetermined).

Learning Targets: I can

1. Describe what is autopsy and why is it used in death investigations
2. Describe the five manners of death?
3. Describe how the cause of death can be determined
4. Complete an autopsy report

Scene Investigation

A critical phase of the death investigation will be a preliminary reconstruction of events that preceded the onset of death, so all significant details of the scene must be recorded.

- Blood spatter and blood flow patterns must be documented.
- Any tire marks or shoe prints must be documented.
- Fingerprints must be processed and collected.
- Evidence discarded, dropped, or cast off by a perpetrator must be collected.
- Weapons, fired bullets, and casings are collected and documented.
- Photographs must always be taken before the scene is altered in any way.

Cause of Death

- A primary objective of the autopsy is to determine the cause of death.
- Some of the more common causes of death are blunt force injury, sharp force injury, asphyxia, gunshot wound, and substance abuse.
- Blunt force injuries are caused a non-sharpened object such as a bat or pipe.
- A blunt force injury can abrade tissue or can cause a contusion arising from bleeding from tiny ruptured blood vessels within and beneath the skin, known as a *contusion*.

Bruising (contusions) on the skin

Cause of Death

- Sharp force injuries occur from weapons with sharp edges, such as knives or blades.
- *Asphyxia* encompasses a variety of conditions that involve interference with the intake of oxygen. For example, death at a fire scene is caused primarily by the extremely toxic gas, carbon monoxide.
- Hanging is another example of death by asphyxia.
- Gunshot wounds originate from projectiles fired by a firearm.
- The distance a weapon was fired from a target is one of the most important factors in characterizing a gunshot wound.

Cause of Death

- Substance abuse is so common that a forensic pathologist will routinely order toxicological tests for the presence of drugs in nearly all autopsies.

Causes of Death

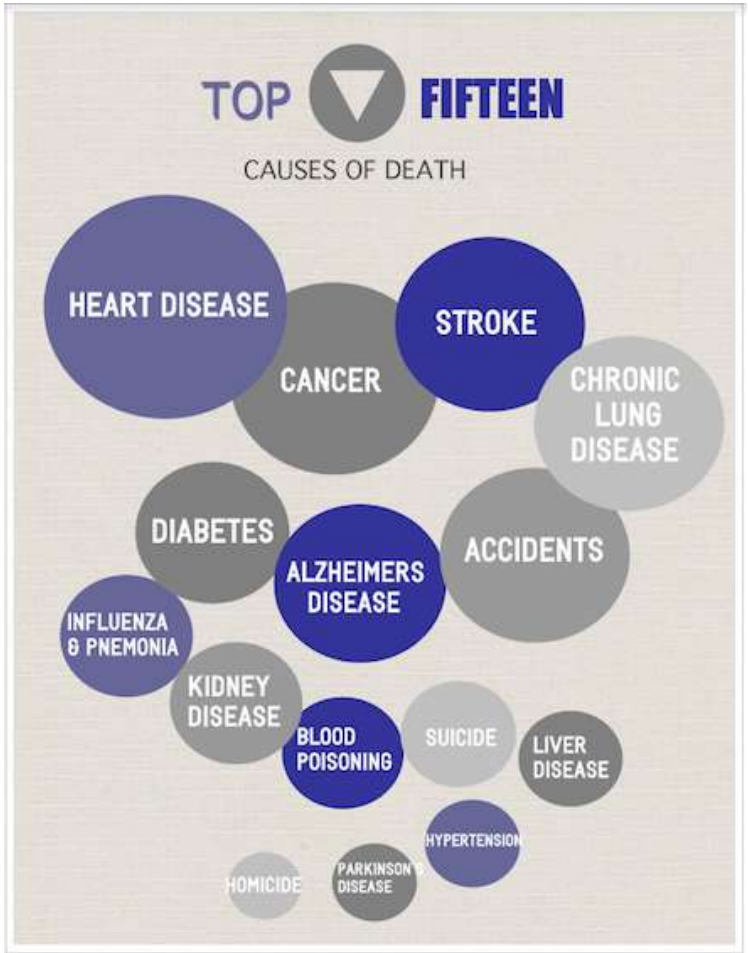
Life expectancy in US in 2011 =79yrs

Life expectancy in Somalia in 2011 = 50yrs

Top 3 causes of death were
1)Diarrhea from disease
2) Influenza and Pneumonia
3) War traumas.

Death Certificate – legal document issued by a medical practitioner certifying death and stating the cause of death.

World population pyramids: http://www.worldlifeexpectancy.com/world-health-review/united-states-vs-albania



Defensive Wounds and Visible Marks

- Defensive Wounds are injuries received by the victim of an attack while trying to defend themselves.
  - Usually on arms and hands (assailant's skin or blood under victim's fingernails)
  - Sometimes on feet and legs if kicking the assailant.
  - May include bites, scratches or claw marks
  - From defensive wounds, investigators can determine perpetrator's position, type of weapon, amount of force, perpetrator's height
- Visible Marks are wounds resulting from attack that can be observed with the naked eye such as bruises, abrasions, incised wounds, lacerations.

Defensive Wounds and Visible Marks (cont)

- Bruises – or contusions – hemorrhages into tissue produced by blood escaping from vessels.
  - Can be found on skin, internal organs, and muscles.
  - Usually caused by blunt force impact
  - Can be caused by pinching or squeezing
  - Can occur as result of , or exaggerated by, disease such as Scurvy or Leukemia.
  - The shape of the bruise can
  - indicate the shape of a weapon.

Defensive Wounds and Visible Marks (cont)

- Abrasions – friction injuries which remove skin or tissue
  - an impact from the side causes a “slide” or moving abrasion in the direction of impact can be determined
  - A direct impact creates an imprint pattern f the object
  - Post-mortem abrasions
  - appear leathery and brown

Defensive Wounds and Visible Marks (cont)

- Incised Wounds – wounds that breach the full thickness of the skin due to contact with a sharp edge including stabs, cuts, and slashes
  - Stabs, or puncture wounds, are wounds that go through all layers of skin and deeper into the body. They are usually deep, but not wide and often bleed profusely.
  - Slash wounds are wide cuts
  - across an area of the body wit
  - a sharp instrument, but are no
  - deep wounds.

Defensive Wounds and Visible Marks (cont)

- Lacerations – splitting of the skin by direct crushing due to blunt trauma. Typically occurs over bone such as the scalp, eyebrow, or cheekbone.
  - Different from incised wounds because they are accompanied by a bruise or abrasion and have ragged edges
  - Usually have tissue bridges –
  - strips of tissue that remain
  - across the open wound.

Defensive Wounds and Visible Marks (cont)

- Bite Marks – often a combination of bruises and abrasions and are caused by a human or animal biting and leaving the pattern of dentition behind in the skin.
  - Can be swabbed for saliva and analyzed for DNA
  - Photographed to compare to bite impressions of possible suspects.

Autopsy

- An *autopsy*, in its broadest definition, is simply the examination of a body after death (i.e., a postmortem examination).
- The goal of a *forensic/medicolegal autopsy* is to determine the cause of death and confirm the manner of death, often to be used in criminal proceedings.
  - Performed by a medical examiner or pathologist
  - Ordered when the death is unexplained, unexpected, or suspicious.
    - Only about 10% of deaths are referred for autopsy.

GBI: http://gbi.georgia.gov/medical-examiners-office

Evidence From the Autopsy

- Here, the medical examiner or coroner will carefully examine the victim to establish a cause and manner of death.
- Tissues and organs will be retained for pathological and toxicological examination.
- At the same time, arrangements must be made between the examiner and investigator to secure a variety of items that may be obtainable from the body for laboratory examination.

Evidence from the Autopsy

- The following are to be collected and sent to the forensic laboratory:
  1. Victim's clothing
  2. Fingernail scrapings
  3. Combings from head and pubic hairs
  4. Buccal swab (for DNA typing purposes)
  5. Vaginal, anal, and oral swabs (in sex-related crimes)
  7. Recovered bullets from the body
     Hand swabs from shooting victims (for gunshot residue analysis)
  8. Swabs of body areas suspected of being in contact with DNA arising from touching or saliva
  9. Hand stubs or swabs for gunshot residue analysis

Smithsonian History of Autopsy Video

- http://www.smithsonianchannel.com/videos/catching-killers-cyber-forensics/49138
- 46:03 mins

Andre Vesalius

- https://www.youtube.com/watch?v=4akYJ4ZVZgc
- 3:25 mins

Autopsy Procedure

- Bodies arrive in a body bag to ensure evidence is not lost or contaminated
- The body will be refrigerated for preservation
- Photographs of the body are taken
- Notes are made of the state and position of clothing.
- Evidence is collected from the surface of the body such as hair samples, fingernail clippings, gunshot residue, fibers, glass fragments, paint chips, and other foreign objects.
- A UV light illuminates other evidence such as body secretions
- The body is cleaned, weighed and measured.
- Notes are made concerning race, sex, hair color/length, eye color, estimation of age, identifying marks such as tattoos, birthmarks or scars, evidence of medical treatment, and x-rays are made of the body.
- A blood and Vitreous Humor sample is taken to submit for toxicology testing.
  - Vitreous Humor is the liquid part of the eye. Drugs remain in this fluid loner than in the bloodstream.

External Examination

- The forensic autopsy consists of an external examination and an internal examination.
- The first steps taken for the external examination include a broad overview of the condition of the body and the clothing.
- The external examination also consists of classifying the injuries. This includes distinguishing between different types of wounds, such as a stab wound versus a gunshot wound.

Petechial hemorrhages in a victim's eye

Courtesy Elizabeth A. Laposata, MD, FCAP, FASCP, Forensic Pathology & Legal Medicine, Inc., Providence, RI

Internal Examination

- The dissection of the human body generally entails the removal of all internal organs through a Y-shaped incision beginning at the top of each shoulder and extending down to the pubic bone.
- Performing the internal examination entails weighing, dissecting, and sectioning each organ of the body.
- The internal examination is also where toxicological specimens are taken. These include samples of blood, stomach content, bile, and urine.
- Blood is often routinely tested to determine the presence and levels of alcohol and drugs.
- Some drugs redistribute or reenter the blood after death and thus may complicate the interpretation of postmortem blood levels of these drugs.

Autopsy Tools

- Bone saw – used to cut through bone or skull
- Bread Knife – used to slice small, thin sections of organs for microscopic examination.
- Enterotome – scissors used to cut open the intestines
- Hagedorn Needle – a thick, heavy needle used to stitch up the tissue flaps after examination
- Hammer with Hook – used to remove the skull cap
- Rib cutter – shears used specifically to cut through ribs
- Scalpel – tool for making incisions; the one used in autopsy has a large blade for making long, deep cuts.
- Scissors – standard surgical scissor used for cutting open organs and vessels
- Skull Chisel – assists in skull cap removal
- Stryker Saw – electric saw used to cut through the skull
- Toothed Forceps – similar to large tweezers, used to lift large organs.

Autopsy Tools (cont)

Frontline: Postmortem – Death investigations in America

- http://www.pbs.org/wgbh/pages/frontline/post-mortem/
- 53 mins

Virtual Autopsy Lab

- http://australianmuseum.net.au/interactive-tools/autopsy/

Manner of Death

- The *manner of death* relates to the circumstances that led to the fatal result.
- The manner in which death occurred is classified in death certificates as one of five categories:

1. Natural – death occurs due to a natural disease process such as heart attack, stroke, or cancer
2. Accident – when there is no evidence that the injury or poisoning occurred with intent to cause harm or death. Ex: car accident, accidental drug overdose, falls.
3. Homicide – intent to cause fear, harm, or death and results in death. Types of homicide:
   - 1st Degree Murder – homicide perpetrated by means of poison, lying in wait, or other kind of willful, deliberate, and premeditated act, or that which is committed while perpetrating a forcible felony – e.g. arson, rape, robbery, or burglary.
   - 2nd Degree Murder – homicide perpetrated with the intent to kill, but without evidence that is was pre-meditated. Often these are described as "Crimes of Passion."
   - 3rd Degree Murder – homicide committed with the intention of causing bodily harm, but not necessarily death. It can be killing that results from indifference or negligence or recklessness.
   - Manslaughter – Unlawful, unjustifiable, and/or inexcusable killing of one human by another, under circumstances lacking premeditation, deliberation, and express or implied malice.
   - Justifiable Homicide – killing without evil or criminal intent, for which there can be no blame, such as self-defense.
4. Suicide – fatal wounds that are self-inflicted.
5. Undetermined – death where cause and manner cannot be determined.

Estimating Time of Death

- A pathologist can never give an exact time of death. However, there are many characteristics that the examiner can analyze in order to arrive at an approximate time of death.
  - ***Algor mortis*** results in the loss of heat by a body.
    - As a general rule, the body loses heat by 1 to 1 1/2 degrees Fahrenheit per hour until the body reaches the environmental temperature.
  - *Livor mortis* results in the settling of blood in areas of the body closest to the ground (begins 20 minutes to three hours on death and continues up to 16 hours).

Livor mortis

Courtesy Elizabeth A. Laposata, MD, FCAP, FASCP, Forensic Pathology & Legal Medicine, Inc., Providence, RI

Estimating Time of Death

- *Rigor mortis* results in the shortening of muscle tissue and the stiffening of body parts in the position at death (occurs within the first 24 hours and disappears within 36 hours).
- Forensic pathologists can determine the amount of potassium in the vitreous humor and use it to approximate the time of death.
- Stomach contents may reveal the deceased's last meal. The extent of digestion can help with determining the time of death.

Rigor mortis in the arm of a decedent

Courtesy Elizabeth A. Laposata, MD, FCAP, FASCP, Forensic Pathology & Legal Medicine, Inc., Providence, RI

Autopsy Reports

- Written after the autopsy is complete to describe the findings and declare cause of death and manner of death.

Case Study: Conrad Murray case in the death of Michael Jackson

- https://en.wikipedia.org/wiki/California_v._Murray

Autopsy Reports Assignment

- Choose one of the following Autopsy reports and answer the questions provided:
  - Whitney Houston: http://www.autopsyfiles.org/reports/Celebs/houston,%20whitney_report.pdf
  - John Belushi: http://www.autopsyfiles.org/reports/Celebs/belushi,%20john_report.pdf
  - Brittany Murphy: http://www.autopsyfiles.org/reports/Celebs/murphy,%20brittany_report.pdf
  - Anna Nicole Smith: http://www.autopsyfiles.org/reports/Celebs/smith,%20anna%20nicole_report.pdf
  - Mary Corinne Peters: http://www.autopsyfiles.org/reports/Other/peters,%20corinne_report.pdf
  - Sousa Autopsy (Tiger Mauling): http://www.autopsyfiles.org/reports/Other/sousa,%20carlos_report%20.pdf

Manner of Death Review

- Sort the following into these categories
- Natural, Accident, Homicide, Suicide, Undetermined
  - Heart Attack due to heart disease
  - Self-inflicted injuries with the intention to harm oneself.
  - Fatal Car Crash
  - Unintentional Drug Overdose
  - Body is too decomposed to decipher a manner or cause of death.
  - Fall due to losing footing while mountain climbing.
  - Lung cancer
  - Fatal gunshot wounds by an armed intruder
  - Heart attack caused during mugging incident
  - Intentional injection with the wrong medication in a hospital patient.
  - Stroke

Manner of Death Review Answers

Accident	Natural	Homicide	Undetermined	Suicide
Fatal Car Crash	Stroke	Fatal gunshot wounds by an armed intruder	Body is too decomposed to decipher a manner or cause of death	Self-inflicted injuries with the intention to harm oneself.
Unintended drug overdose	Heart attack due to heart disease	Intentional injection with the wrong medication in patient at a hospital		
Fall due to losing footing while climbing a mountain	Lung cancer	Heart attack caused during mugging incident		

Forensic Anthropology
Human Remains Identification

GAVS 3 Human Remains

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c. Evaluate how post mortem changes are used to determine probable time of death:

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When investigating a death, investigators may include the use of established timelines of insect activity, body decomposition processes, visible markings on the body and environmental clues to determine what happened.

Learning Targets: I can

1. Describe how human remains are identified.
2. Determine what clues investigators might find that indicate a homicide rather than a natural or accidental death.
3. Estimate the time of death.
4. Describe the phases of decomposition in human remains.

Forensic Anthropology

Forensic anthropology is concerned primarily with the identification and examination of human skeletal remains.

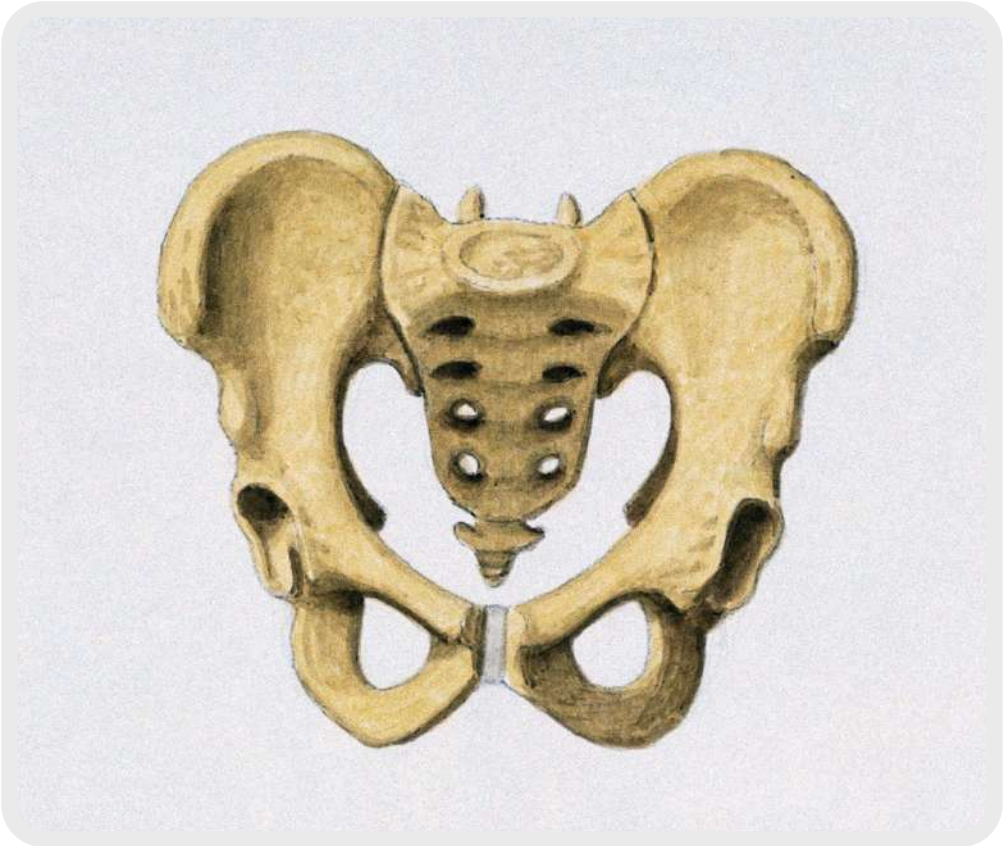
- An examination of bones may reveal their sex, approximate age, race, and skeletal injury.
  - The gender of a decedent can be determined by the size and shape of various skeletal features, especially those in the pelvis and skull.
  - Female pelvic bones tend to show a wider, more circular than that of a male pelvis because of a woman's child-bearing capabilities.
  - The possible racial ancestry of a decedent can be assessed by the appearance of various cranial features on the skeletal remains.

Frontal shot of female pelvis and hips. This view shows the wide, circular nature of the pelvic opening and the short, wide nature of the sacrum.

Geoff Brightling/Dorling Kindersley Media Library

Human male pelvis. This view shows the narrow pelvic opening and long, narrow sacrum.

Geoff Brightling /Dorling Kindersley Media Library



Male (left) and female (right) human skulls showing male skull's larger size and more pronounced brow bone.
Corbis

Forensic Anthropology

- The height of a victim when alive can be estimated by measuring the long bones of the skeleton.
- A forensic anthropologist may also help create facial reconstructions to identify skeletal remains.
- The sites where human remains are found must be treated as a crime scene.
- These scenes must be secured and thoroughly searched to locate all bones if they are scattered or other aspects of evidence such as footwear impressions or discarded items.
- All aspects of evidence must be documented and collected.

Process of Decay

- Body decomposition occurs in a predictable pattern if left unhindered.
- 5 stages of decomposition
  1. Fresh – begins right after heart and breathing stops.
     - Livor Mortis, Algor Mortis, and Rigor Mortis are all observed.
     - Cells lose shape and begin to breakdown (autolysis)
     - Not many obvious visible changes.
     - Obtain green coloration in abdomen
     - Insects begin to migrate to the body.

Process of Decay
5 Stages of Decomp (cont)

2. Bloat –
   - Caused by trapped gases including Methane, Carbon Dioxide, and Hydrogen Sulfide, created by the bacteria in the abdomen
   - Once pressure increases, liquids begin to escape from the body and the skin may rupture.
   - Maggots in the body hatch and start feeding on the tissues

Process of Decay
5 Stages of Decomp (cont)

3. Active Decay – Marked by loss of much body mass as maggots and other insects feed on the tissues and fluids are released.
   - Surrounding area is known as Cadaver Decomposition Island (CDI)
   - Strong odor
   - End of this stage is marked by maggots moving away from the body

Process of Decay
5 Stages of Decomp (cont)

4. Advanced Decay – most of the body mass is decomposed.
   - Marked by death of plant life n the area surrounding the body due to the leaking body fluids increasing levels of Carbon, Phosphorus, Potassium, Calcium, Nitrogen, and Magnesium, thereby increasing soil pH.

Process of Decay

5 Stages of Decomp (cont)

5. Dry Remains – plants begin regrowth as soil levels return to normal.

- Body is reduced to dry skin, cartilage and bone.
- If the body is outside, the skin, cartilage and bone will be dried and bleached by the sun and environmental exposure.
  - Skeletonization takes up to 2 years in temperate climate, as little as 2 weeks in hot climate, and possibly more than 2 years in cold climate.

The Body Farm

- Research facility using donor bodies to study and educate professionals about the decomp process.
  - Bodies are left to decompose in various settings and circumstances
  - National Geographic – The Body Farm https://www.youtube.com/watch?v=GCyiczAcRBY
  - The Body Farm Website http://www.jeffersonbass.com/videos.html

Postmortem Changes

- Skin – the largest organ of the human body
  - composed of various components
    - Melanin – responsible for skin color (more melanin = darker skin)
      - Produced in cells called melanocytes
  - protects the body from:
    - Harmful bacteria and viruses
    - Sun
    - Other organ damage
    - Blood loss
    - Water loss
  - vital to many bodily processes such as:
    - Insulation
    - Temperature regulation
    - Sensation
    - Production of Vitamin D

Post Mortem Skin Changes

- Skin undergoes many changes due to decomposition
  - Changes in skin coloration help estimates the time of death
  - Skin color patterns can help determine if a body has been moved after death.

Post Mortem Skin Changes (cont)

- Livor Mortis – a purple coloration
  - appearing within 30 minutes to 2 hours after death
  - a result of blood pooling in the lowest areas of the body as blood is no longer pumped by the heart.
  - Areas where the body touches another surface, such as the ground or a chair, would be much lighter in color as blood is forced from that area.
  - Used in investigation
    - If the dark purple areas turn pale again when pressed, the blood has not yet congealed meaning death occurred with in the past 12 hours.
    - If the area remains dark when pressed,
    - the victim has been dead more than
    - 12 hours.
    - If the purple areas are not on the lowest
    - areas of the body, the body has been
    - moved after death. Ex: the body was
    - found lying face up, but Livor Mortis
    - patterns are on the back = the body has
    - been turned over.

Post Mortem Skin Changes (cont)

- Tardieu Spots – Asphyxia Petechiae – dark purple small spots on the skin and some organs.
  - Caused by capillaries bursting under the skin
  - Common in asphyxiation deaths, some poisonings, and systemic infections like Septicemia and electrical shock

Post Mortem Skin Changes (cont)

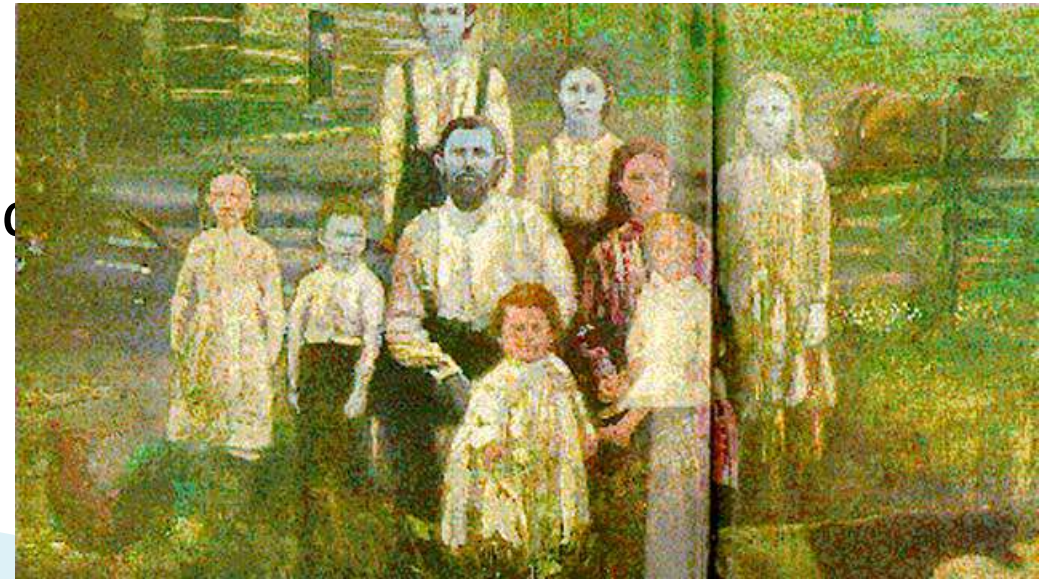
- Green Discolorations – color changes in the abdomen due to bacteria multiplying as the immune systems no longer functions to stop bacterial growth.
  - begins about 24-26 hours after death

Post Mortem Skin Changes (cont)

- Marbling – skin appears marbled or with dark colored veins vividly showing through the skin
  - Occurs 4-7 days after
  - death.

Post Mortem Skin Changes (cont)

- Unusual Skin Conditions
  - Pink Skin – bright pink coloring may indicate Cyanide poisoning or extended exposure to cold temperatures
  - Cherry Red – indicate Carbon Monoxide poisoning.
  - Brown – may have excess levels of Methemoglobin, a type of hemoglobin that is brown and blue and cannot carry oxygen.
  - (Fugate family of
  - Kentucky – inherited



Postmortem Changes

- Rigor Mortis – stiffening of a dead body
  - Depletion of ATP in the muscle fibers causes Actin and Myosin (proteins responsible for muscle contraction) to link causing the muscle to remain contracted.
  - Begins at the head and progress toward the feet in 12 to 18 hours
  - Fades in the next 24-48 hours as the rate of decomposition
  - increases.
  - Affected by
  - temperature
  - (progresses quickly
  - in warmer temps a
  - is suspended in
  - freezing temps)

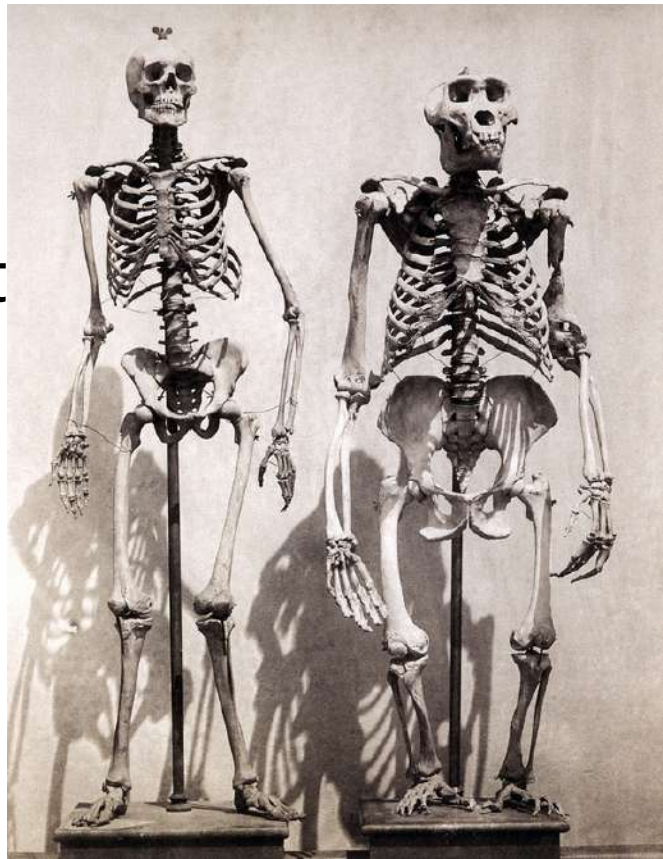
Postmortem Changes (cont)

- Algor Mortis – reduction in body temperature and loss of skin elasticity
  - A body generally loses heat in a predictable way after death.
    - -1.5° C per hour until it equalizes with ambient temperature.
    - Can be greatly impacted by the temperature of the environment, surface body in lying on (conductive or insulating), diseases or drugs that may raise body temp
  - Temperature measurements are obtained rectally or liver probe.
  - Glaister equation to estimate time (in hours) since death:

$$\frac{98.4° - \text{rectal temperature in °Fahrenheit}}{1.5}$$

Human or Non-human Remains?

- Is it bone? It could be pottery, wood, plastic, or stone that only appears to be bone.
  - Can be more difficult if the pieces are damaged, burned, or warped.
- Is it human bone? All mammal
- bones are very similar.
- To determine, forensic scientist
- examine:
  - Gross Skeletal Anatomy
  - Bone Macrostructure
  - Bone Microstructure



Human or Non-human Remains? (cont)

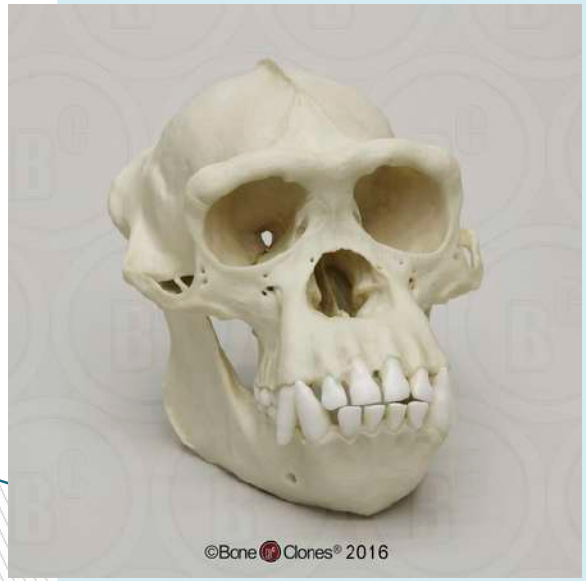
- Gross Skeletal Anatomy – characterizes of bone that can be observed by the unaided eye such as the number and orientation of the bones.

	Human	Non-human
Cranium (Head) 	-Large skull area for brain -Have chin -Orbits (eye sockets) are at the front and above the nose area. -U-shaped Mandible -Relatively small face	-Small skull area for brain -Chin is absent -Orbits are at sides of face and behind or posterior to nose area. -V-shaped Mandible

Human or Non-human Remains? (cont)

Gross Skeletal Anatomy (cont)

	Human	Non-human
Dentition (Teeth)	-Omnivorous -Dental Formula of 2:1:2:3 (meaning 2 incisors, 1 canine, 2 pre-molars and 3 molars) -Large incisors -Small canines Molars are low and rounded with grooves	-Can be carnivorous, herbivorous or omnivorous. -Other Dental Formulas such as 3:1:4:3 (bear), 3:0:3:0 (horse) or 5:1:3:4 (Opossum). Teeth vary by diet; for example, carnivores have large canines, herbivores have small or no canines.



Human or Non-human Remains? (cont)

Gross Skeletal Anatomy (cont)

	Human	Non-human
Post-Cranium (Rest of the Body)	-Upper limbs are smaller and less muscular. -Separate radius and ulna arm bones. -Vertebrae are broad and flat with short spiny processes. -Pelvis is broad, short and bowl-shaped. -Separate tibia and fibula leg bones. -Long, narrow foot that bears weight on heels and toes.	-Larger or proportional upper limbs. -Radius and ulna are often fused into one bone. -Small vertebrae that are either concave or convex with long spiny processes. -Long, narrow blade shaped pelvis. -Often the tibia and fibula leg bones are fused. -Broad foot that bears most of the weight on the toes.

Human or Non-human Remains? (cont)

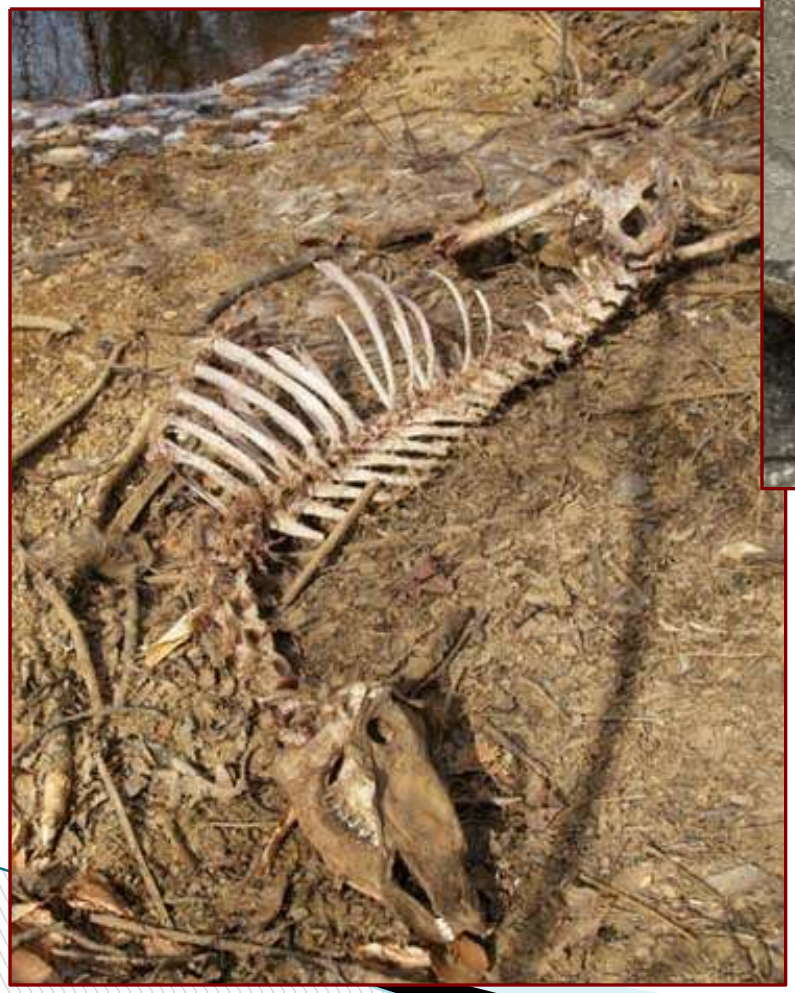
Gross Skeletal Anatomy (cont)

Which hand is human versus bear?

Human or Non-human Remains? (cont)

Gross Skeletal Anatomy (cont)

- Easy identifications



Human or Non-human Remains? (cont)

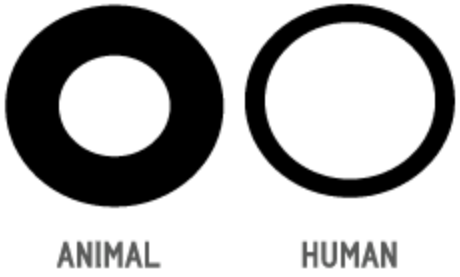
Gross Skeletal Anatomy (cont)

- But what if you come across bones like these?

Human or Non-human Remains? (cont)

- Bone Macrostructure – the structure of the individual bone that can be seen without magnification such as the shape, thickness, or color of the bone.

Human Bone Macrostructure	Non-human Bone Macrostructure
- More porous - 1/4 the thickness of the diameter of long bone.	-Less porous - 1/2 the thickness of the diameter of the long bone.



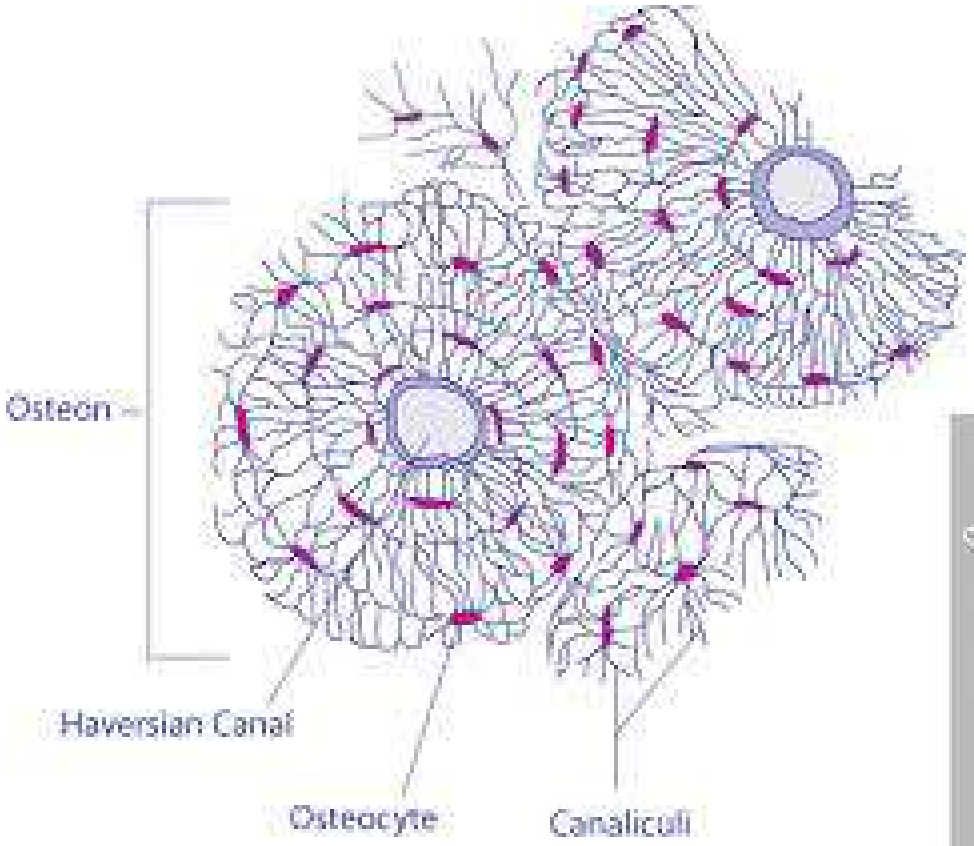
Human or Non-human Remains? (cont)

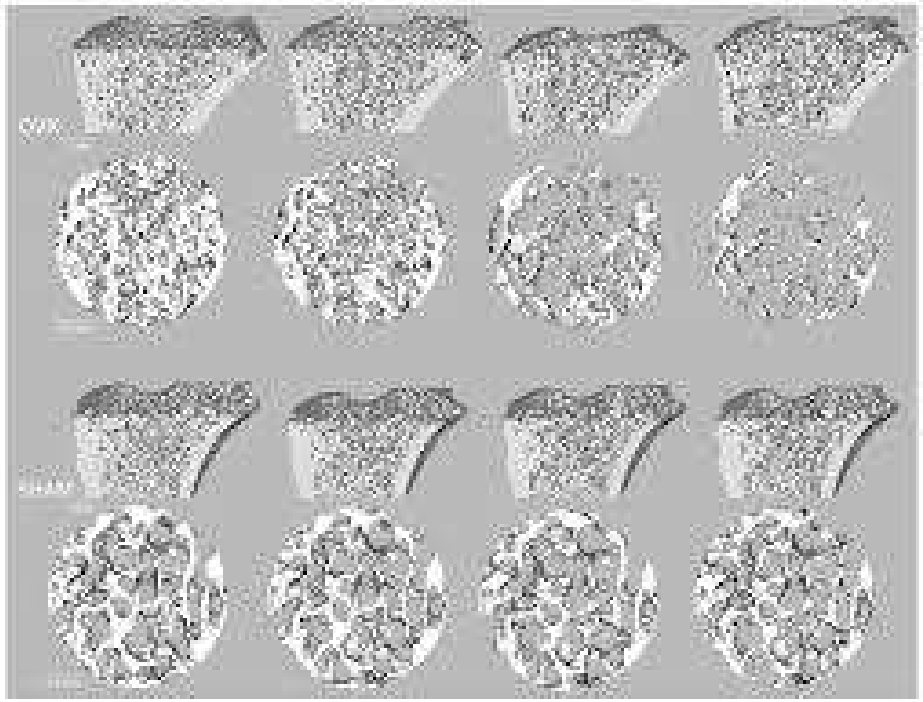
- Bone Microstructure – the microscopic structure and characteristics of the bone.
  - Most interested in Osteons or Haversian Systems.
    - Osteons are units of bone that include bone cells, known as Osteocytes, surrounding Haversian Canals.
    - Haversian Canals are openings in the center of compact bone that surround blood vessels and nerves within the bone.

Human Osteons	Non-human Osteons
Osteons are scattered and evenly spaced.	– Osteons are aligned in rows or in rectangular patterns.

Human or Non-human Remains? (cont)

Bone microstructures (cont)





Other Considerations of Skeleton Remains

- How many bones are represented in the remains?
  - Duplicates?

Mass grave of bubonic plague victims in France from around 1720-1721.

- How old are the remains?
  - North America was occupied by Native Americans for thousands of years prior to European colonization.

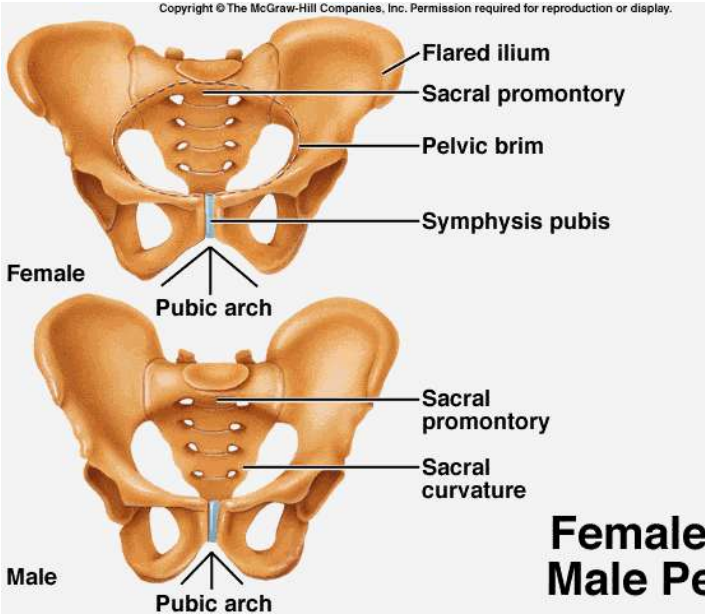
Approximately 10,000 year old Skull of Native American woman Unearthed in Minnesota in 1931.

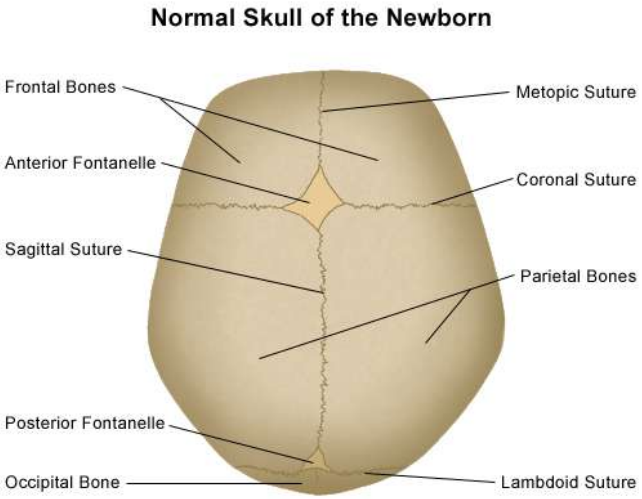
Determining Age From Skeletal Remains

- Growth and development progress predictably through several stages that can often be observed in the remains.
  - At birth – bones are composed mostly of cartilage. With age, the cartilage is replaced by bone, ossification, in a predictable pattern and in known regions :
  - Young adults have fewer, but larger osteons (regions of functional bone) than older adults
  - The clavicle, collar bone, is the last bone to stop growing – around age 25.
  - The tibia (large, lower leg bone) stops growing at age 16-17 in girls and 18-9 in boys.
  - Once full grown, degeneration begins in the form of arthritis and thinning of the bones indicating adult bones.

Determining Age From Skeletal Remains (cont)

- Pubic Symphysis – the growing together of bones originally separate such as the two pubic ones
- Cranial Structures – infants are born with 6 skull bones and gaps in the skull which fuse by 18 months old.
- Sternal rib ends –In children the sternal rib ends are more rounded and solid. As the bones age, they become more elongated and irregular at the ends.

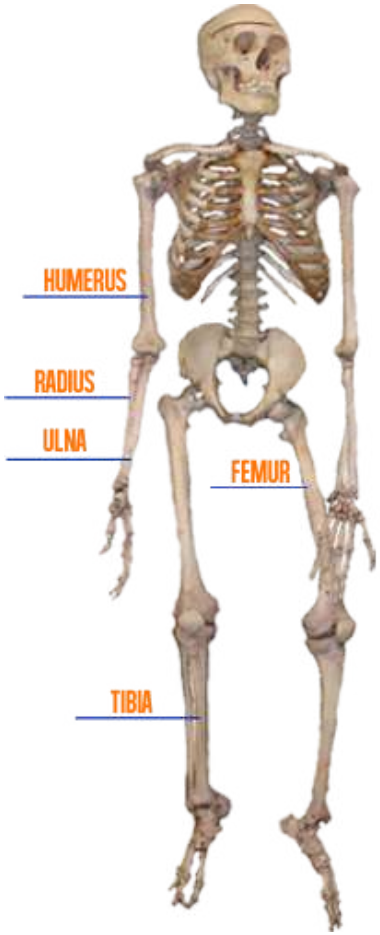




Determining Age From Skeletal Remains (cont)

- Stature – the height of a person can be estimated/calculated using bone measurements.

Sex	Tibia Equation	Radius Equation	Femur Equation	Humerus Equation
Female	(Tibia length x 2.9) + 61.53 = Height (cm)	c	(Femur length x 2.6) + 65 = Height (cm)	(Humerus length x 3.06) + 64.26 = Height (cm)
Male	(Tibia length x 2.42) + 81.93 = Height (cm)	(Radius length x 3.65) + 80.40 = Height (cm)	Femur length x 2.6) + 65 = Height (cm)	(Humerus length x 3.27) + 59.41 = Height (cm)



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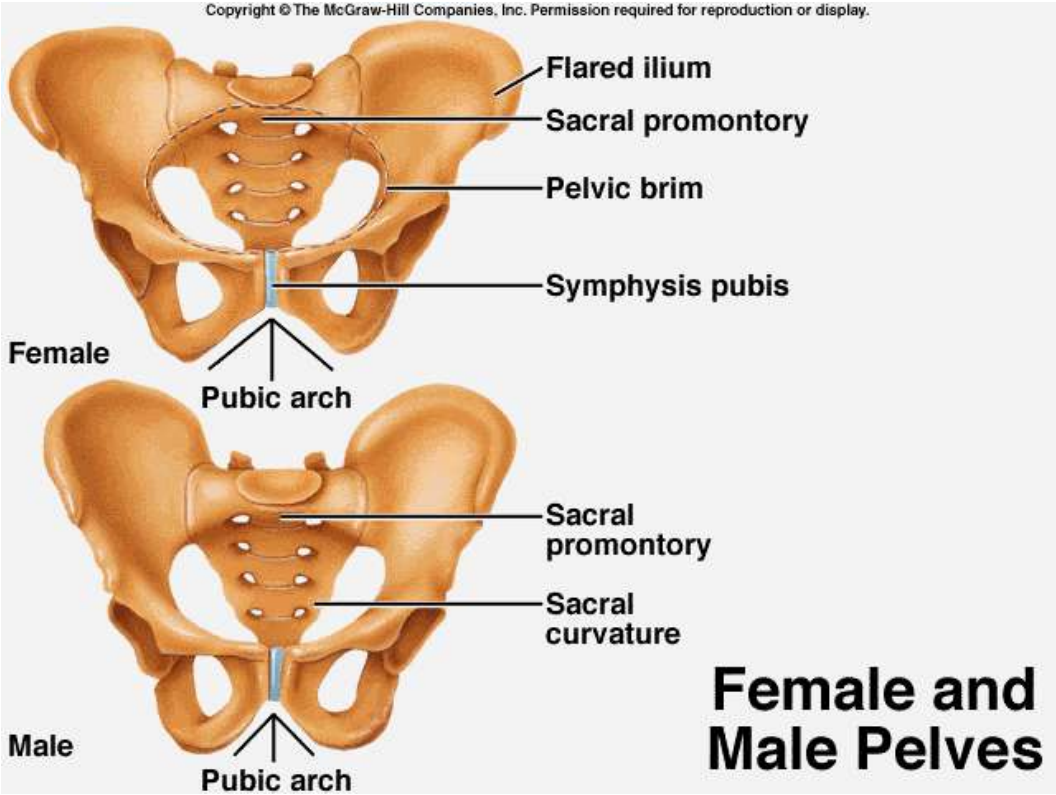
Forensic Odontology

- Using teeth to estimate age or identification
- Estimating age based on tooth eruption patterns in the mouth as well as wear patterns on the teeth.
- Primary Teeth Eruption Patterns
  - Incisors = 6-16 months
  - Canines = 16-23 months
  - 1st Molars = 13-19 months
  - 2nd Molars = 23-33 months
- Permanent Teeth Eruption Patterns
  - Incisors = 6-9 years
  - Canines = 9-11 years
  - 1st Pre-Molar = 10-12 years
  - 2nd Pre-Molar = 11-13 years
  - 1st Molar = 6-7 years
  - 2nd Molar - 11-13 years
  - 3rd Molar (Wisdom Teeth) = 17-21 years
- Beyond the age of 21, tooth wear patterns are used to estimate age.

Determining Gender

- Specific bones can distinguish male or female.
- The most reliable is the pelvis
  - The public inlet is larger and more circular in females.



Determining Gender

- The skull is also used, although more subjective.

	Male	Female
Pelvis	Angle at the Sciatic Notch is less than 90° More narrow and deep Sacrum tilted forward *Field Thumb Test* : If you stick your thumb in the Sciatic Notch and have room to move the thumb around, it is a female pelvis. If your thumb does not have room to move around, it is a male pelvis. Pelvis outlet is small	Wider, oval or circular pelvic inlet Angle at the Sciatic Notch is 90° or greater Hip bones flare outward Pelvis is wider and more shallow; adapted to carry a baby and facilitates childbirth Sacrum is tilted backward Pelvis outlet is large
Skull	Larger skull Greater muscle development and rugged features Square chin Forehead is receding Prominent brow ridges Rounded edges of eye sockets Back corner of Mandible (lower jaw) is about 90°	Small Mastoid Process Smaller skull Rounded chin Forehead is more vertical Less defined brow ridges Sharp edges of eye sockets Back corner of Mandible (lower jaw) is greater than 90°

Ancestry From Skeletal Remains

- Determining the genetic heritage of an individual. Some include:

	African Ancestry	European Ancestry	Asian Ancestry
Maxilla Shape (the upper jaw bone)	Hyperbola shape (more square)	Parabola shape	Rounded shape
Teeth	Larger, more forward on face, wrinkled molars	Flat to face, not projected	Projected moderately forward
Incisor shape (front teeth)	Spatula shape	Spatula shape	Shovel shape
Nasal Aperture & Structure	Wider, larger. Smooth and gutted nasal border Smaller nasal spine	Sharp inferior nasal border Prominent nasal spine Narrow, high aperture	Tented nasals Flared nasal base
Orbit Shape (shape of the eye socket)	Rectangular	Sloped	Round
Face Shape	Wide to very wide	Long, narrow	Moderate width

Forensic Anthropology Lab

- See Handout
- Requires a partner whom you are willing to touch and you are willing to be touched by or the purposes of measuring.

Trauma Observed on Skeletal Remains

- Skeletal remains can be examined for signs of fractures, blunt force trauma, sharp force trauma, and projectile trauma.
- Bones can also be examined to determine whether those injuries occurred before death, at death, or after death.
  - Compression – caused by force that pushes downward on the bone. There are many lines of fracture and may be widespread. Most common in spine and head.
  - Shearing – when a bending type of force is applied to the bone, it will shear off in a path parallel to the fracture. These are common in falls, but can be caused by a sharp instrument such as a saw.
  - Bending – most common – force striking the bone at a right angle usually resulting in a complete break in adults and a greenstick fracture in children (one side is broken while the other side is bent)
  - Torsion – cuased by a twisting force on a bone. Most commonly seen in accidents, but also seen in cases of child abuse.
  - Tension – caused by a pulling force on the bone. In most cases, a pulling force will only cause dislocation of the joint. Most common in accidents.
  - Sharp force trauma – a narrow or pointed object strikes the bone, such as with stabs or slashes. This leaves cut marks on the bone
  - Blunt force trauma – results from a large object hitting a large area of the body resulting in crushed bones.
  - Projectile trauma – results from an object moving at high rate of speed and applying force over a small area of the body such as with bullets or arrows. The direction of travel can sometimes be determined by the trauma to the bone.

More info: http://resource.rockyview.ab.ca/t4t/forensicscience35-3cr/Module6/L2/M6L2P03-Trauma.html

Trauma Observed on Skeletal Remains (cont)

- Antemortem Trauma – (Ante = before) occurred before death. Typically not indicative of the cause or manner of death, but may be important in identification. Some indicators include:
  - Degenerative joint disease
  - Infections that healed
  - Fractures in teeth with worn edges surrounding the fracture
- Perimortem Truama– (Peri = during) occurred at or duing the event that caused death.
  - Broken bones that show no signs of repair or healing
  - Infections that show no sign of immune response
  - Overall pattern of fractures seems consistent with fatality, such as a broken neck
  - Bones fracture in a pattern that living bones exhibit known as "Plastic Response." This indicates that eh bones were still supplied with circulated blood and they fractured in a more flexible manner. Though it was living at the time of fracture, the bone would show no signs of healing.
- Postmortem trauma – (Post = after) occurs after death and is generally referred to as "damage."
  - Patterns of stained or exposed areas on skeletal remains with different ages.
  - No evidence of healing of any damage to the bone
  - Breakages in the bone are not consistent with "Plastic Response."
  - Evidence of animal tooth marks on bones

Case Study: Boulder Jane Doe/Dorothy Gay Howard

- Conduct an internet search on the Dorothy Gay Howard case, or use the link below, and complete the case study worksheet.

  http://www.denverpost.com/2009/11/14/after-55-years-boulder-jane-does-story-finally-coming-together/

- She was known for 55 years simply as the "Boulder Jane Doe" until, with the help of DNA analysis and Forensic Anthropology, she was finally identified.

Case Study: Green Beret Murders

- Case of Dr. Jeffrey MacDonald
- Conduct an Internet search or use the following link
- Complete the Case Study Report based on the template

- http://murderpedia.org/male.M/m/macdonald-jeffrey.htm

Human Remains Lab

Human Remains Assignment

- Fisherman off the coast of New Providence Island in the Bahamas made a gruesome discovery in 2010. While removing the hook from the mouth of a Tiger shark they caught, the shark regurgitated a human foot and leg intact from the knee down. They called the police. Inside the shark was the remains of a man.
- What would you look for the determine the time of death, and what likely happened to the man.
- Read the article below:

  http://www.seeker.com/man-eaten-by-shark-near-jaws-movie-site-1765109002.html#news.discovery.com

Human Remains Portfolio

Human Remains Review
Stages of Decomposition

Match the following:		
Fresh		Plants begin to re-grow around the CDI
Bloat		This stage begins right after the heart and breathing stop
Active Decay		This stage is marked by the death of plant life all around the decomposing body
Advanced Decay		This stage is marked by loss of much of the body mass
Dry Remains		Obvious swelling of the body

Human Remains Review
Stages of Decomposition Answer

Match the following:		
Fresh		This stage begins right after the heart and breathing stop
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Advanced Decay		This stage is marked by the death of plant life all around the decomposing body
Dry Remains		Plants begin to re-grow around the CDI

Human Remains Review
Stages of Decomposition

Match the following:		
Fresh		Trapped gasesi n the body such as methane and CO_2 cause decomposing liquids to leak from the mouth and nose
Bloat		Increase in soil concentrations of Carbon, Phosphorus, Potassium, Calcium, Nitrogen, and Magnesium
Active Decay		Livor, Algor, and Rigor Mortis all happen in this stage
Advanced Decay		CDI develops
Dry Remains		Body is reduced to skin, cartilage and bones

Human Remains Review
Stages of Decomposition Answer

Match the following:		
Fresh		Livor, Algor, and Rigor Mortis all happen in this stage
Bloat		Trapped gases in the body such as methane and CO_2 cause decomposing liquids to leak from the mouth and nose
Active Decay		Increase in soil concentrations of Carbon, Phosphorus, Potassium, Calcium, Nitrogen, and Magnesium
Advanced Decay		CDI develops
Dry Remains		Body is reduced to skin, cartilage and bones

Human Remains Review
Stages of Decomposition

Match the following:		
Fresh		Autolysis begins
Bloat		Distinct pungent smell of decomp develops due to the emission of gases
Active Decay		Soils pH increases around CDI
Advanced Decay		At the end of this stage maggots move away from the body to pupate
Dry Remains		Skeletonization eventually happens in this stage; it may take as little as 2 weeks or more than 2 years.

Human Remains Review
Stages of Decomposition Answer

Match the following:		
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Human Remains Review
Stages of Decomposition

Match the following:		
Fresh		Maggots and other insects feed on the tissues causing a large loss in body mass
Bloat		Insects are not very active in or around the body in this stage
Active Decay		Maggots propel this stage forward by causing skin to slip and hair to detach from the scalp
Advanced Decay		Cartilage and bone become dried and bleached
Dry Remains		Overgrowth of anaerobic bacteria cause green discoloration in abdomen

Human Remains Review
Stages of Decomposition Answer

Match the following:		
Fresh		Overgrowth of anaerobic bacteria cause green discoloration in abdomen
Bloat		Maggots propel this stage forward by causing skin to slip and hair to detach from the scalp
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Dry Remains		Cartilage and bone become dried and bleached

Post Mortem Changes Review

Match the following:		
Melanin		"Mortis" is Latin for this
Melanocyte		Mostly responsible for skin color
Tardieu Spots		Melanin is produced in these cells
Marbling		Bacteria proliferation in the abdomen causes areas of what color discoloration?
Green		About 4-7 days into the decomp process, the dark colored veins show through the thinned skin of the corpse.
Death		Small dark purple spots caused by capillaries bursting under the skin

Post Mortem Changes Review Answer

Match the following:		
Melanin		Mostly responsible for skin color
Melanocyte		Melanin is produced in these cells
Tardieu Spots		Small dark purple spots caused by capillaries bursting under the skin
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Green		Bacteria proliferation in the abdomen causes areas of what color discoloration?
Death		“Mortis” is Latin for this

Post Mortem Changes Review

Match the following:		
Livor Mortis		Muscles contract and stiffen within 2-3 hours of death and remain contracted for another 24-48 hours.
Rigor Mortis		After death, a body loses about 1.5°C per hour until the ambient temperature is reached.
Algor Mortis		A bright pink skin coloring of the skin might indicate poisoning by ….
Asphyxiation		Tardieu Spots are common in cases of _____, which is also known as strangulation.
Cyanide		Cherry red coloring of the skin indicates possible poisoning by ---
Carbon Monoxide		Dark purple or red areas on the lowest point of the body where blood pools within hours of

Post Mortem Changes Review Answer

Match the following:		
Livor Mortis		Dark purple or red areas on the lowest point of the body where blood pools within hours of death.
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Cyanide		A bright pink skin coloring of the skin might indicate poisoning by ….
Carbon Monoxide		Cherry red coloring of the skin indicates

Forensic Entomology
Determining Time of Death

GAVS 7

SFS2. Students will use various scientific techniques to analyze physical and trace evidence.

c. Evaluate how post mortem changes are used to determine probable time of death:

- Rigor mortis
- Livor mortis
- Algor mortis
- Gastric contents

SFS5 Students will evaluate the role of Forensics as it pertains to Medicolegal Death Investigation.

- a. Identify various causes of death (blunt force trauma, heart attack, bleeding, etc.).
- b. Analyze evidence that pertains to the manner of death (natural, homicide, suicide, accidental, or undetermined).

Learning Targets: I can

1. Describe the information can a Forensic Entomologist determine from the crime scene and victim's body.
2. Identify the insects are commonly found on a corpse.
3. Calculate the time of death using entomological data?
4. Describe how insects can provide information about toxins in the body?

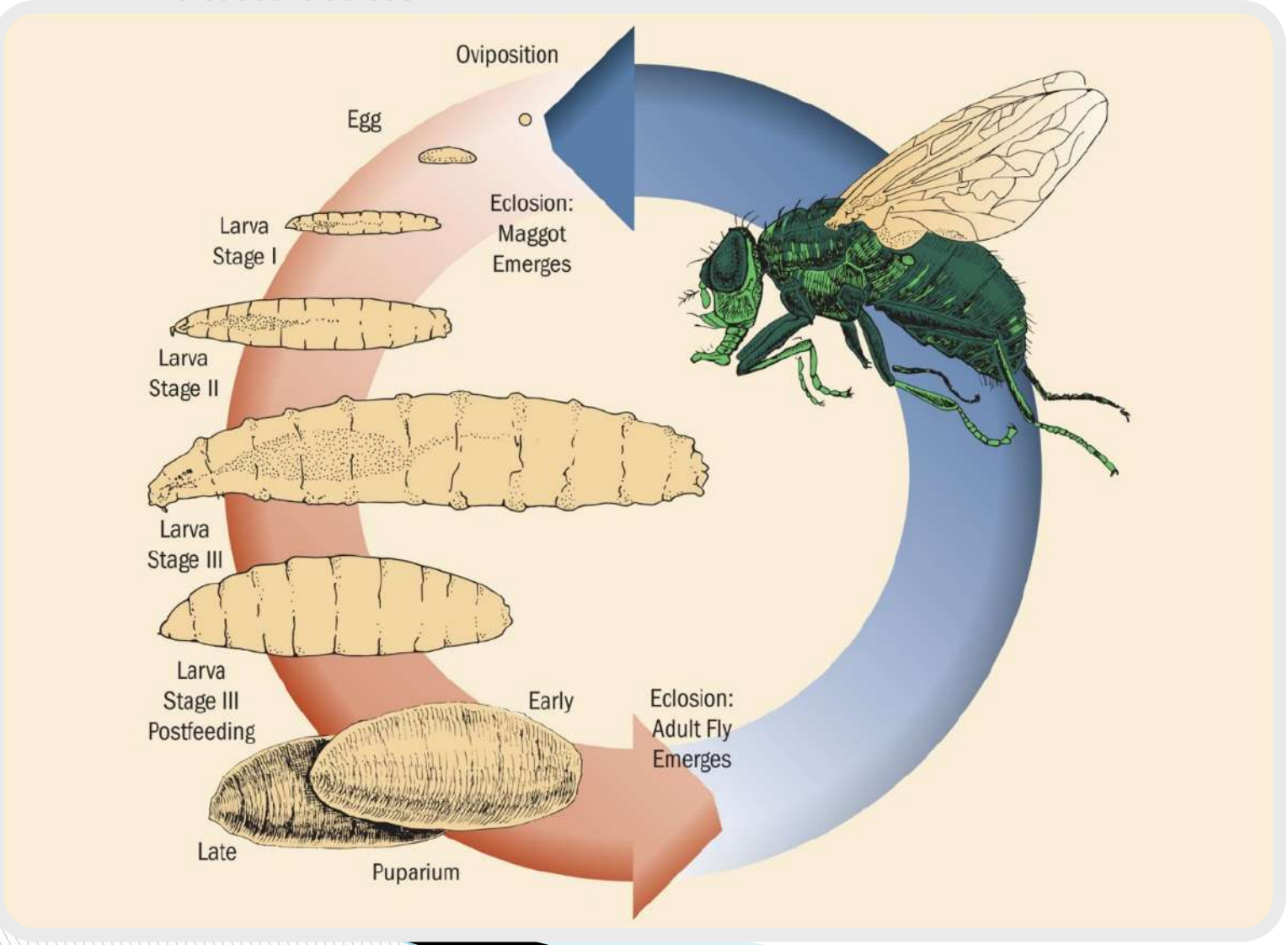
Forensic Entomology

- *Forensic entomology* is the study of insects and their relation to a criminal investigation, commonly used to estimate the time of death.
- The study of insects and their relation to criminal investigations.
- When a crime scene involves a dead body, it is not uncommon that it is accompanied by insect evidence, most often flies and beetles.
- These organisms have a defined life cycle that can be used to calculate the post mortem interval.

Forensic Entomology

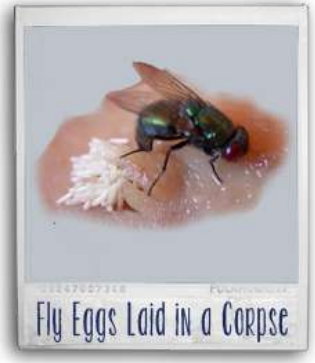
- By determining the oldest stage of fly found on a body, entomologists can approximate the postmortem interval (PMI).
  - The sequence of arrival of different insect species can be used to estimate PMI.
  - The most common and important is the blowfly recognized by its green or blue color.
- Blowfly eggs are laid in human remains and ultimately hatch into maggots, or fly larvae, which consume human tissues and organs.
- Forensic entomologists can approximate how long a body a body has been left exposed by examining the stage of development of the fly larvae.

deposition to adult fly emergence. This cycle is representative of any one of nearly ninety species of blowflies in North America.



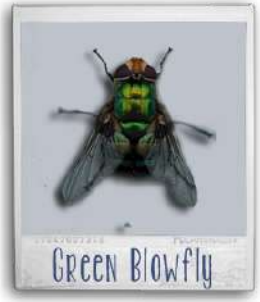
Metamorphis of a Fly

- Eggs are laid in the corpse by flies within hours after the death. The eggs develop based on the temperature of the surroundings and from the eggs, immature larvae emerge.
- Larvae are the active, immature form of an insect between the egg and pupa phase. Their bodies are generally soft and tube-shaped. Larvae are also known as “maggots” and are responsible for much of the decomposition process. Larvae are found within a few days after death.
- Pupa, is the inactive form of an insect between the larval and adult phase. This is the point at which the insect forms a chrysalis or “cocoon.” The presence of pupae indicate the body has been dead for about one week. Other insects, beetles in particular, indicate the body has been dead for more than one week.
- The insect later emerges from the chrysalis as a mature adult insect. This, Green Blowfly, is commonly found near a corpse soon after death to lay eggs.


Fly Eggs Laid in a Corpse


Larvae


Pupa


Green Blowfly

How Insects Aid Investigations

- Insect Succession – predictable patterns of based on the specific species and the weather at the time
- Accumulated Degree Days – ADD- thermal input needed for an insect to grow and develop. Can be measured in hours rather than days (ADH).
- The size of the maggot indicates age. Large larva generally means it is older.
- Beetles are usually found at the later stages of decomposition – active and advanced stages.
- Insects can help narrow down the location of death if there is suspicion the body has been moved. If an insect is found outside of its established typical habitat, it may warrant additional investigation. (Ex: a body found in a corn field with larva found only in urban areas may be been dumped in the corn field.)
- A lack of insect infestation may indicate the body has been frozen, been in a tightly sealed container, or buried deep in the ground.
- Some species may indicate neglect. The Green Bottle Fly, False Stable Fly, and Lesser House Fly are all attracted to urine and feces. Finding these insects in a corpse can signal prolonged neglect or abuse that contributed to death and generally regarded as suspicious. DNA can be taken from blood in the insects' digestive tract and tested to possibly establish a link between victim and suspect.
- The size and stages of development of insects can be affected by toxin such as cocaine (accelerates the growth), Methamphetamine (decrease in average pupae size)
- The feces of the insects can be tested for toxins and environmental factors such as abnormal amounts of Mercury.

Forensic Entomology Lab

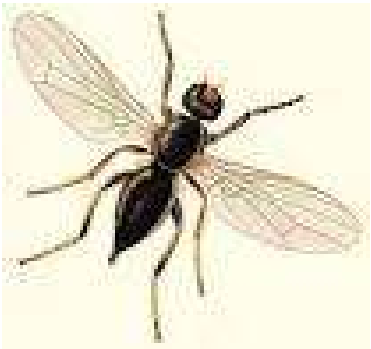
- See Handout and Information Packet

Insects of Death

- **Blow Fly** – Calliphoridae – metallic blue or green. Typically found on the corpse: First to arrive within minutes of death or exposure to the environment and deposit eggs within 1-3 hours. Larvae are responsible for decomposition of much of the flesh on a corpse through advanced decay stages.
- **Flesh Fly** – Sarcophagidae– ovovivparous – eggs develop and hatch inside the parent and young are released near a body opening for immediate source of food. Typically found within hours of death near the mouth or near wounds. Larvae decompose flesh by feeding throughout the active decay phase.
- **House Fly** – Muscidae – There are about 12 generations produced in one year; each time a female lays about 150 eggs. Typically found within hours of death; it lays eggs in decomposing matter including flesh or dung. Larvae decompose flesh by feeding throughout the active decay phase

Insects of Death (cont)

- **Adult Ants**– Various families – the biomass of all ants on Earth is about equal to the biomass of all humans on Earth! Typically found during the fresh stage of decomposition. Adults feed on decomposing flesh and fly eggs/larvae of the early arriving flies.



- **Cheese Fly** – Piophilidae – Often arrive during the bloat stage and lay eggs.

- **Lesser House Fly** – Fanniidae – Typically breed in feces or decomposing carcasses. Arrive during the bloat stage of decay.

Insects of Death (cont)

- **Rove Beetle** – Staphylinidae – often put their abdomen in the air to mimic a scorpion when threatened, but most species do not bite or sting. Arrive during bloat and are most active during active decay.

- **Carrion Beetle** – Silphidae – they have bright red or orange bands on their backs to warn other predators not to eat them. Carrion beetles "taste like death" because of what they constantly consume. Typically arrive during bloat stage and feed on fly eggs and larvae.

- **Hister Beetle (or Clown Beetle)** – Histeridae – They will "play dead" when threatened. They do not feed on the corpse, but they will prey on the many other insects present. Typically arrive during the bloat phase and are often found under the remains. They are most prevalent during the active decay phase, but have been found from fresh stage through dry decay stages.

Insects of Death (cont)

- **Black Scavenger Flies** – Sepsidae – Because they have a "waist" they mimic ants. They tend to wave their winds constantly. They typically arrive during active decay as the larvae feed on and decompose both flesh and feces.
- **Skin Beetle** – Dermestidae – In addition to skin, these beetles feed on natural fibers found in carpeting or clothing (wool, cotton, silk, etc) and chocolate. The larvae are used in museums to clean tissue from bones before displaying. During advanced decay , the adult insects feed on dried tissues and skin on the corpse. This is typically 5-11 days after death, but dependent on weather and insect activity.

More info:
http://www.santoshraut.com/forensic/entomology.htm
http://australianmuseum.net.au/decomposition-corpse-fauna
Crime Scene Creatures Game
http://www.pbs.org/wnet/nature/crime-scene-creatures-interactive-determine-the-time-of-death/4390/

Forensic Entomology

- These determinations are not always straightforward, however.
- The time required for stage development is affected by environmental influences such as geographical location, climate, weather conditions, and the presence of drugs.
- If resources allow, all entomological, or insect, evidence should be collected by a forensic entomology expert who will take temperature readings and collect specimens from every area in which they are found.

Case Study: Sylvia Hunt

Forensic Entomology Assignment

- You have been asked to complete an interview for a local high school newspaper. As a Forensic Entomologist, they are interested to know what you do and how you are able to estimate Post Mortem Intervals. Answer the following interview questions included in the handout.

Forensic Entomology Review

- Choose the best answer:

1. The study of life cycles of insects that feed on the flesh of the dead, to establish time of death and occasionally identify chemicals present in a person's body a the time of death.
   a) Pupa
   b) Insects
   c) Larva
   d) Forensic Entomology
   e) Post Mortem Interval

Forensic Entomology Review Answer

- Choose the best answer:

1. The study of life cycles of insects that feed on the flesh of the dead, to establish time of death and occasionally identify chemicals present in a person's body a the time of death.
   a) Pupa
   b) Insects
   c) Larva
   d) Forensic Entomology
   e) Post Mortem Interval

Forensic Entomology Review

- Choose the best answer:

2. Represent more than 2/3 of all known species on Earth
   a) Pupa
   b) Insects
   c) Larva
   d) Forensic Entomology
   e) Post Mortem Interval

Forensic Entomology Review Answer

- Choose the best answer:

2. Represent more than 2/3 of all known species on Earth
   a) Pupa
   b) Insects
   c) Larva
   d) Forensic Entomology
   e) Post Mortem Interval

Forensic Entomology Review

- Choose the best answer:

3. The active, immature form of an insect between the egg and pupa phase. Their bodies are generally tube-shaped and soft. They are sometimes known as “maggots.”
   a) Pupa
   b) Insects
   c) Larva
   d) Forensic Entomology
   e) Post Mortem Interval

Forensic Entomology Review Answer

- Choose the best answer:

3. The active, immature form of an insect between the egg and pupa phase. Their bodies are generally tube-shaped and soft. They are sometimes known as “maggots.”
   a) Pupa
   b) Insects
   c) Larva
   d) Forensic Entomology
   e) Post Mortem Interval

Forensic Entomology Review

- Choose the best answer:

4. The inactive, immature form of an insect between the larval and adult phase. The insect forms a chrysalis during this phase which provides protection while it is inactive.
   a) Pupa
   b) Insects
   c) Larva
   d) Forensic Entomology
   e) Post Mortem Interval

Forensic Entomology Review Answer

- Choose the best answer:

4. The inactive, immature form of an insect between the larval and adult phase. The insect forms a chrysalis during this phase which provides protection while it is inactive.
   a) Pupa
   b) Insects
   c) Larva
   d) Forensic Entomology
   e) Post Mortem Interval

Forensic Entomology Review

- Choose the best answer:

5. An estimation of time since death calculated by using the presence (or absence) of certain insects in the body.
   a) Pupa
   b) Insects
   c) Larva
   d) Forensic Entomology
   e) Post Mortem Interval

Forensic Entomology Review Answer

- Choose the best answer:

5. An estimation of time since death calculated by using the presence (or absence) of certain insects in the body.
   a) Pupa
   b) Insects
   c) Larva
   d) Forensic Entomology
   e) Post Mortem Interval

Forensic Entomology Review

- Choose the best answer:

6. The thermal input needed for an insect to grow and develop, in days
   a) Flesh Fly
   b) Rove Beetle
   c) Accumulated Degree Hours
   d) Blow Fly
   e) Entomotoxicology
   f) Accumulated Degree Days
   g) Skin Beetles
   h) Hister Beetles

Forensic Entomology Review Answer

- Choose the best answer:

6. The thermal input needed for an insect to grow and develop, in days
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   c) Accumulated Degree Hours
   d) Blow Fly
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Forensic Entomology Review

- Choose the best answer:

7. The thermal input needed for an insect to grow and develop, in hours
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Forensic Entomology Review

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   d) Blow Fly
   e) Entomotoxicology
   f) Accumulated Degree Days
   g) Skin Beetles
   h) Hister Beetles

Forensic Entomology Review

- Choose the best answer:

8. The analysis of toxins in arthropods (mainly flies and beetles) that feed on carrion.
   a) Flesh Fly
   b) Rove Beetle
   c) Accumulated Degree Hours
   d) Blow Fly
   e) Entomotoxicology
   f) Accumulated Degree Days
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   h) Hister Beetles

Forensic Entomology Review Answer

- Choose the best answer:

8. The analysis of toxins in arthropods (mainly flies and beetles) that feed on carrion.
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   d) Blow Fly
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   f) Accumulated Degree Days
   g) Skin Beetles
   h) Hister Beetles

Forensic Entomology Review

- Choose the best answer:

9. Usually the first insect to arrive on a corpse, within minutes to a few hours. It comes from the family Calliphoridae
   a) Flesh Fly
   b) Rove Beetle
   c) Accumulated Degree Hours
   d) Blow Fly
   e) Entomotoxicology
   f) Accumulated Degree Days
   g) Skin Beetles
   h) Hister Beetles

Forensic Entomology Review Answer

- Choose the best answer:

9. Usually the first insect to arrive on a corpse, within minutes to a few hours. It comes from the family Calliphoridae
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   c) Accumulated Degree Hours
   d) Blow Fly
   e) Entomotoxicology
   f) Accumulated Degree Days
   g) Skin Beetles
   h) Hister Beetles

Forensic Entomology Review

- Choose the best answer:

10. Lay hatching eggs or newly hatched larvae near body openings such as the mouth or nose. These insects come from the faimly Sarcophagidae and arrive in the corpse within a few hours of death.
    a) Flesh Fly
    b) Rove Beetle
    c) Accumulated Degree Hours
    d) Blow Fly
    e) Entomotoxicology
    f) Accumulated Degree Days
    g) Skin Beetles
    h) Hister Beetles

Forensic Entomology Review Answer

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d) Blow Fly
e) Entomotoxicology
f) Accumulated Degree Days
g) Skin Beetles
h) Hister Beetles

Forensic Entomology Review

- Choose the best answer:

11. Arrive during the bloat stage, but are most active during the active decay stage. These beetles will put their abdomen in the air to mimic a scorpion when threatened.
    a) Flesh Fly
    b) Rove Beetle
    c) Accumulated Degree Hours
    d) Blow Fly
    e) Entomotoxicology
    f) Accumulated Degree Days
    g) Skin Beetles
    h) Hister Beetles

Forensic Entomology Review Answer

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    b) Rove Beetle
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    f) Accumulated Degree Days
    g) Skin Beetles
    h) Hister Beetles

Forensic Entomology Review

- Choose the best answer:

12. From the family, Dermestidae, these beetles are found in advanced decay and they feed on dried skin and tissues.
    a) Flesh Fly
    b) Rove Beetle
    c) Accumulated Degree Hours
    d) Blow Fly
    e) Entomotoxicology
    f) Accumulated Degree Days
    g) Skin Beetles
    h) Hister Beetles

Forensic Entomology Review Answer

- Choose the best answer:

12. From the family, Dermestidae, these beetles are found in advanced decay and they feed on dried skin and tissues.
    a) Flesh Fly
    b) Rove Beetle
    c) Accumulated Degree Hours
    d) Blow Fly
    e) Entomotoxicology
    f) Accumulated Degree Days
    g) Skin Beetles
    h) Hister Beetles

Forensic Entomology Review

- Choose the best answer:

13. From the family, Histeridae, these beetles feed on insects in the corpse and will “play dead” when threatened. They can be found in or under a corpse from fresh through advanced decay stages, but are most active during active decay.
    a) Flesh Fly
    b) Rove Beetle
    c) Accumulated Degree Hours
    d) Blow Fly
    e) Entomotoxicology
    f) Accumulated Degree Days
    g) Skin Beetles
    h) Hister Beetles

Forensic Entomology Review Answer

- Choose the best answer:

13. From the family, Histeridae, these beetles feed on insects in the corpse and will “play dead” when threatened. They can be found in or under a corpse from fresh through advanced decay stages, but are most active during active decay.
    a) Flesh Fly
    b) Rove Beetle
    c) Accumulated Degree Hours
    d) Blow Fly
    e) Entomotoxicology
    f) Accumulated Degree Days
    g) Skin Beetles
    h) Hister Beetles