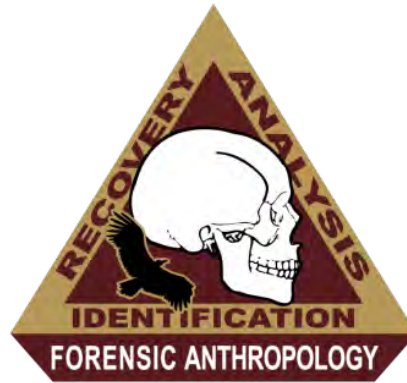


# TEXAS★STATE®

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## FORENSIC ANTHROPOLOGY CENTER



Workshop for Texas Justices of the Peace

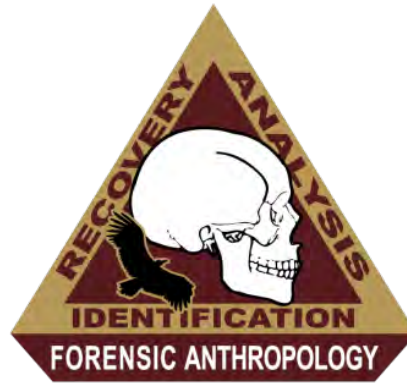
### **Cause and Manner of Death: Skeletal Trauma and Taphonomic Issues**

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## FORENSIC ANTHROPOLOGY CENTER



Daniel Wescott  
**Director of FACTS**  
[dwescott@txstate.edu](mailto:dwescott@txstate.edu)  
**512-245-1945**

All slides and photographs are property of the Forensic Anthropology Center at Texas State and may not be photographed or duplicated



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## SEARCH

- Locating bodies
- Pedestrian Searches
- Drone searches



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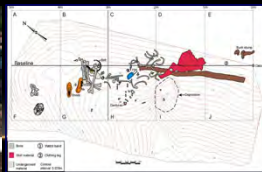
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## RECOVERY

- Excavation of remain and evidence
- Archaeological techniques
- Mapping



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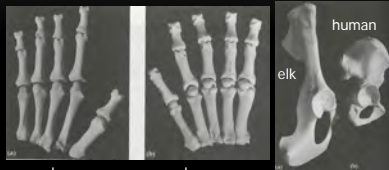
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## ESTABLISHING THE FORENSIC CONTEXT

- Is it human?
  - Morphology
- Are the remains contemporary?
  - Preservation
  - Artifacts
  - Morphology



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## INVENTORY AND MNI

- How many people?
- What parts of the skeleton?



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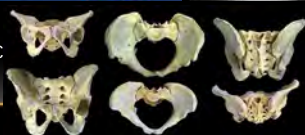
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## BIOLOGICAL CHARACTERISTICS

- Biological Profile
- Age
- Sex
- Ancestry
- Stature
- Weight
- Identifying Characteristic
- Antemortem trauma, disease, surgery



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## POSITIVE IDENTIFICATION

- Look for unique characteristics
- DNA
- Antemortem and Postmortem x-ray comparisons
- Health records



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### TIME-SINCE-DEATH

- Decomposition rates
- Insect evidence
- Animal evidence
- Botanical evidence
- Weathering



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### MANNER OF DEATH

- Murder, Suicide, Accident, Unknown
- Perimortem Trauma Analysis



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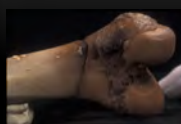
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### PERI- AND POST-MORTEM TREATMENT



Dismemberment



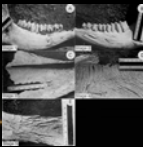
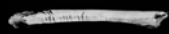
Animal scavenging



Fire Damage



Burial Damage



Weathering

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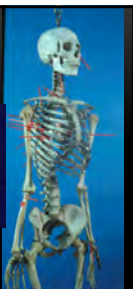
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## EXPERT TESTIMONY

- Medicolegal report
- Courtroom Testimony
- Daubert
  - Testimony on scientific techniques
  - Use "generally accepted" methodology and procedures.



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## MASS DISASTER / GENOCIDE



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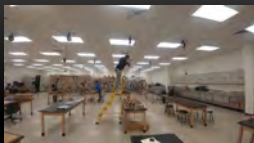
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## RESEARCH

- Conducting Research
  - Methods for determining biological characteristics based on studies of human variation
  - Trauma
  - Taphonomy
- Building Anatomical Collections and Databases



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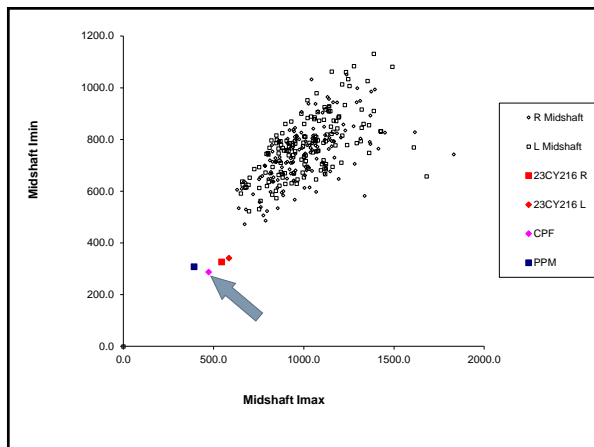
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### Callaway sheriff adds detail for mystery body

*Published Saturday, May 3, 2008*

A woman whose body was found April 20 in a shallow grave near the Mokane access along the Missouri River in Callaway County had been dead three to 30 days before the body was discovered, according to a report by a forensic anthropologist that was released yesterday by the Callaway County Sheriff's Department.

The unidentified woman was 30 to 50 years old, between 5 feet 2 inches and 5 feet 8 inches tall, and weighed between 90 and 120 pounds, the sheriff's department said.

The report also indicated the woman suffered from long-term immobilization - and possibly used a wheelchair - but there also is evidence she had been able to walk.

Anyone with information about the death is encouraged to call the Callaway County Sheriff's Department at (573) 642-7291.

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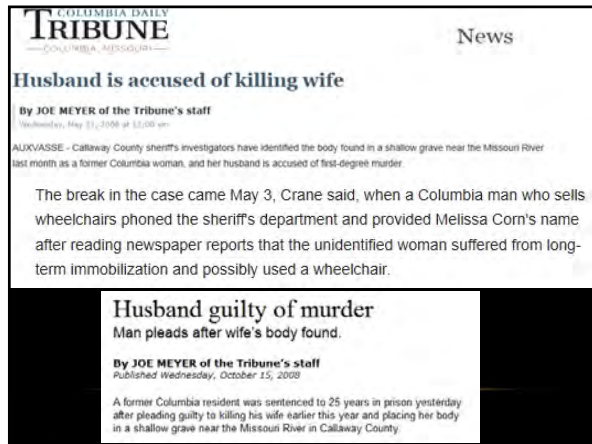
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### F.A.C.T.S. MISSION AND VISION

- **VISION** – To be the premier educational, research, and service center in forensic anthropology and taphonomy.
- **MISSION** - Advance forensic anthropology through world-class education, research, and outreach



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### WHAT WE DO

- Provide hands-on instruction to students, law enforcement, and the community
- Provide cold case expertise and consulting to the medicolegal community
- Conduct novel research in human decomposition and bone biology



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# TEXAS★STATE®

## FORENSIC ANTHROPOLOGY CENTER

GEFARL

ORPL

FARF



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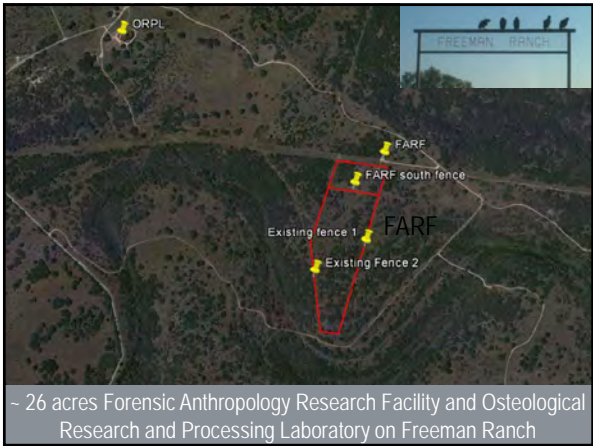
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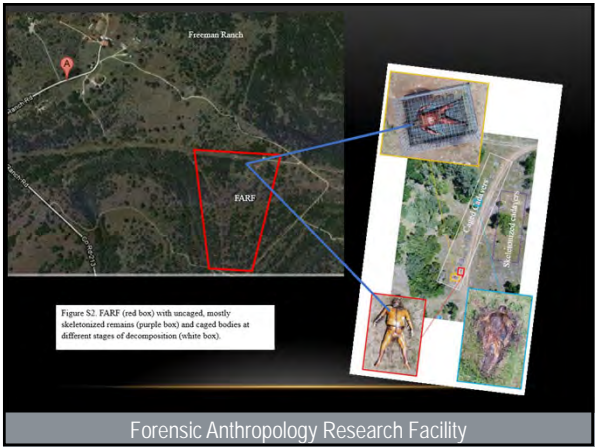
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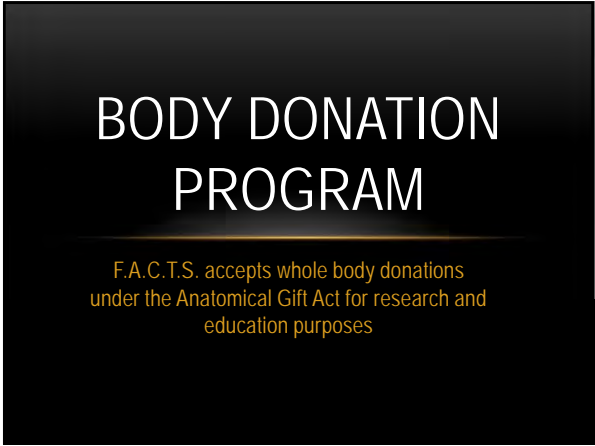
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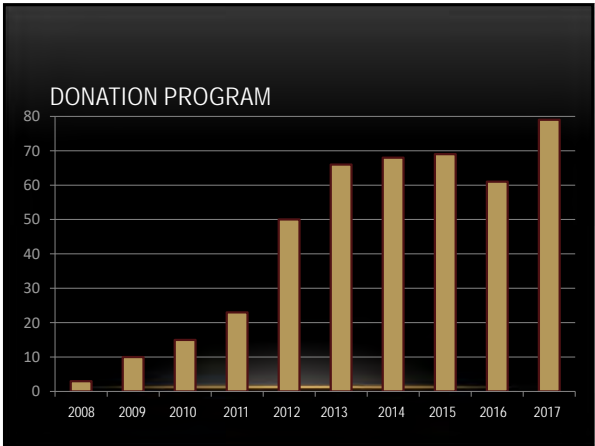
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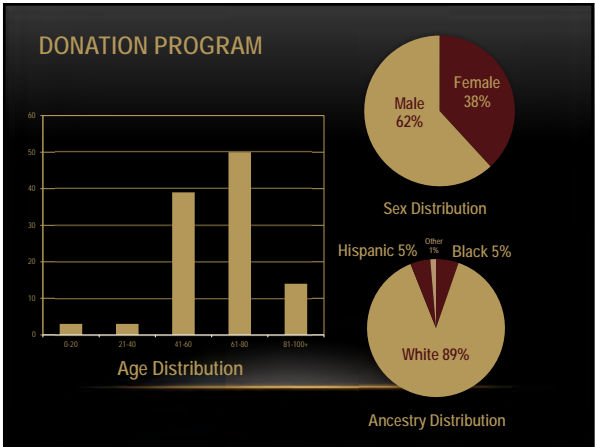
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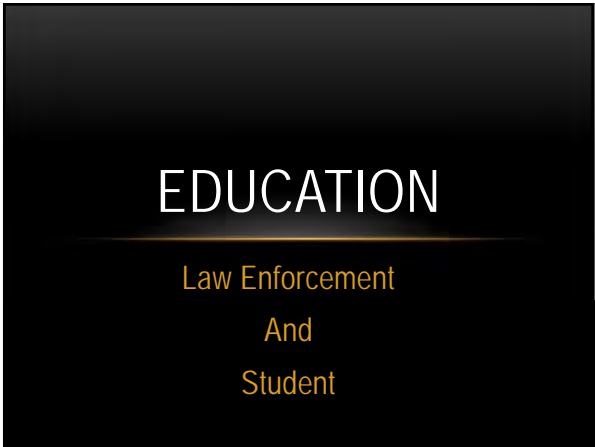
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# RESEARCH

Time-Since-Death

Biological Profile

Trauma

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## RESEARCH - TIME-SINCE-DEATH

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Multi-disciplinary team from Texas State A&M, Texas State, UK, and Canada examining microbial community on human remains

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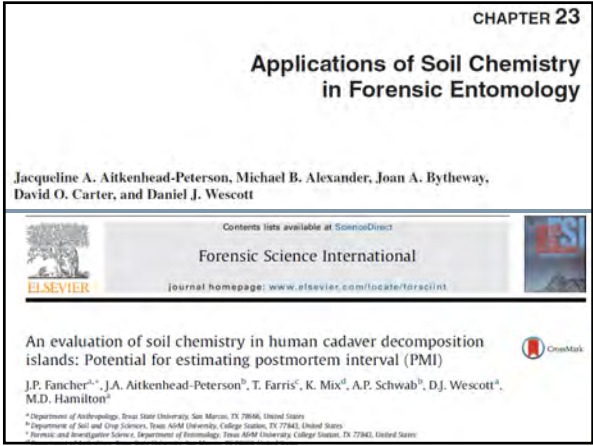
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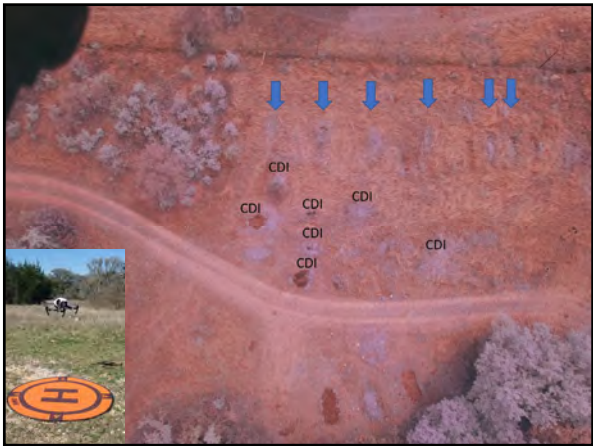
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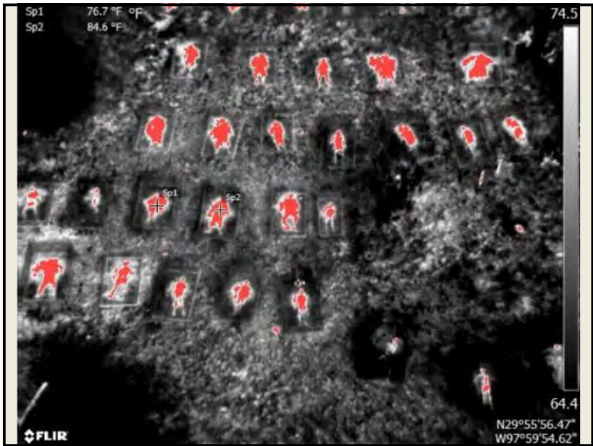
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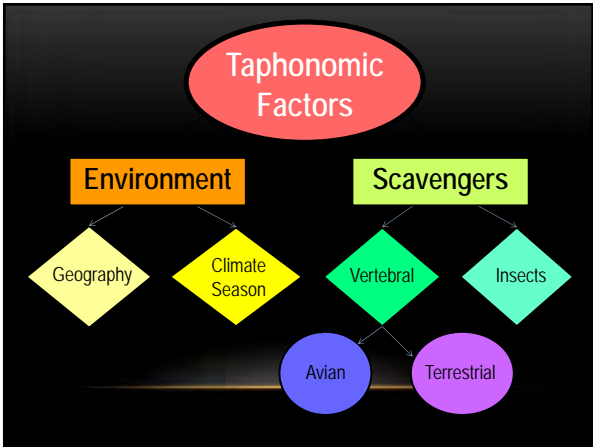
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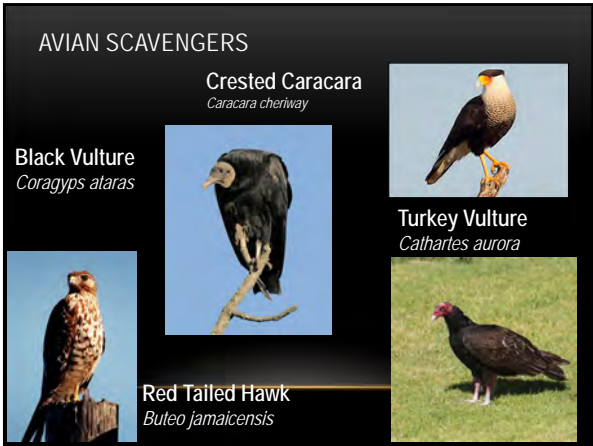
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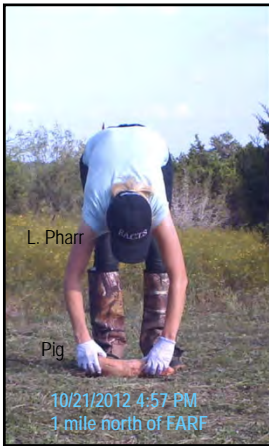
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L. Pharr

Pig

10/21/2012 4:57 PM  
1 mile north of FARF

### Variability in Scavenging

Lauren Pharr, LSU, dissertation research

- 2 year study; bi-weekly pig placements
- **Purpose:** compare scavenging rates at FARF versus offsite non-forensic locations
- Sites distributed across 2,430 sq. miles
- 43 pigs uncaged, not staked down, no fence protection except the FARF fence; game cameras used to monitor
- 2 pigs placed in cages (controls)

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Vulture cage to trap and tag birds

29.19 inHg 84°F 08/06/12 09:27 AM TRAP2 BT15

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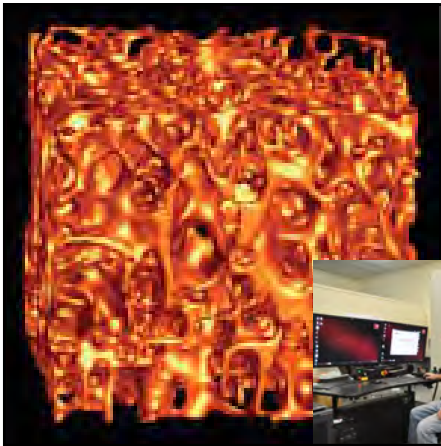
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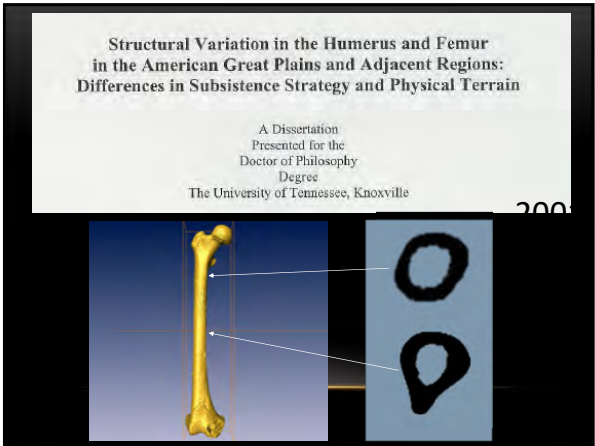
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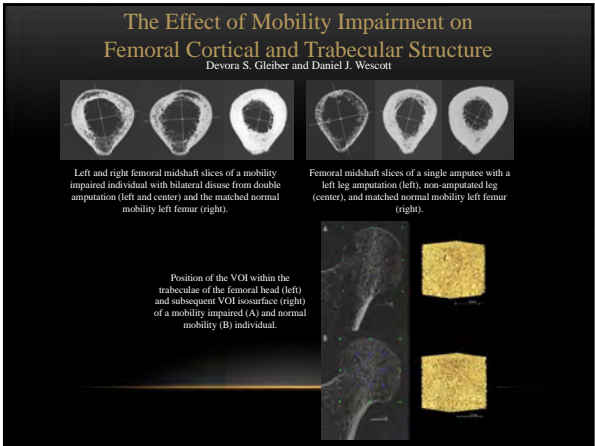
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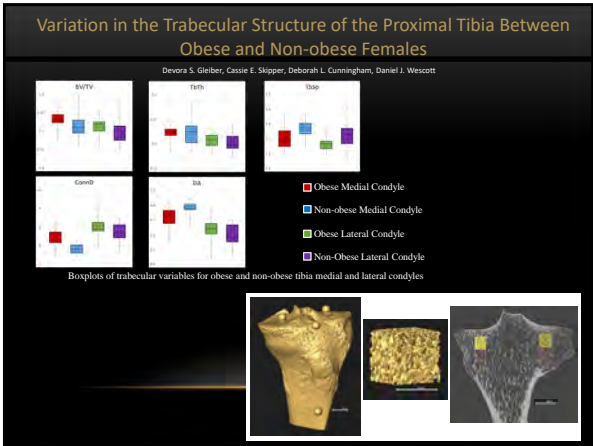
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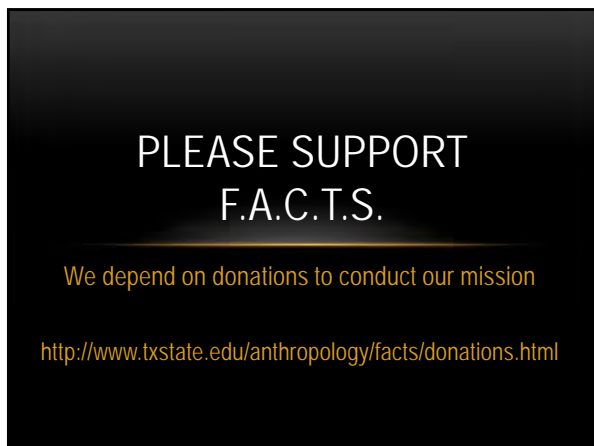
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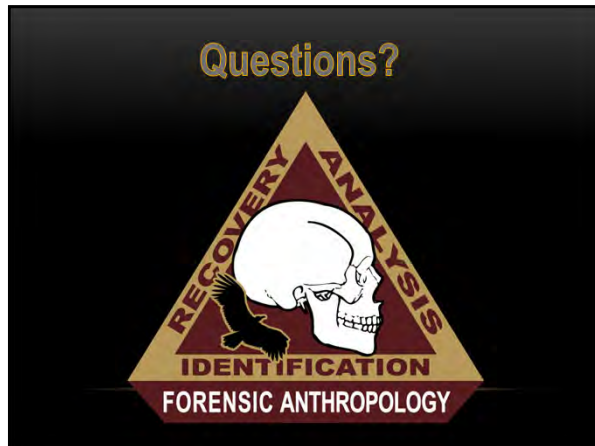
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## Trauma



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## Trauma Analysis

- Aids in determining the manner of death
- Differentiate antemortem, perimortem, and postmortem damage



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## Trauma

- Trauma
  - "Physical injury or wound caused by external force or violence"
- Types of Trauma
  - Blunt – impact by or with blunt object
  - Projectile – bullet etc.
  - Sharp – knife etc.
  - Fire – extreme heat
  - Chemical – acid etc.

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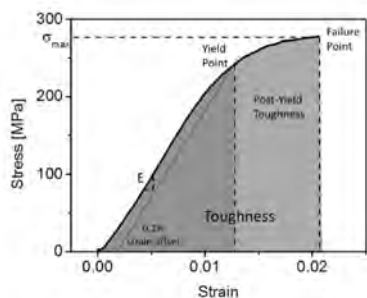
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## Mechanical Properties



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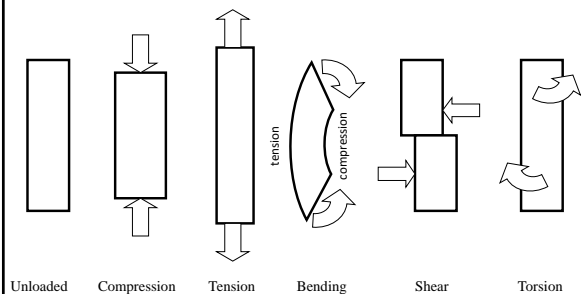
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## Types of Force



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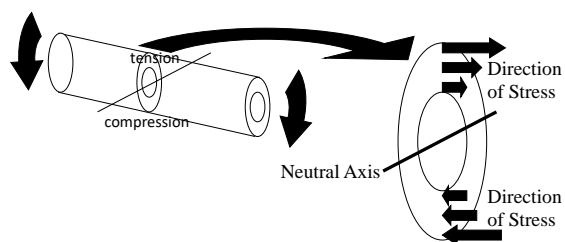
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## Bone Undergoing Bending



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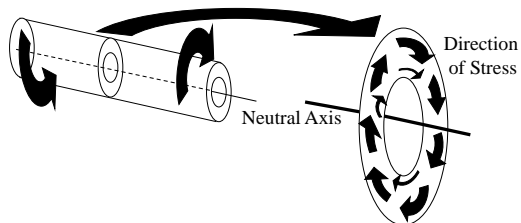
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## Bone Undergoing Torsion



Tension & compression at 45 degree angle to longitudinal axis and shear force in transverse plane

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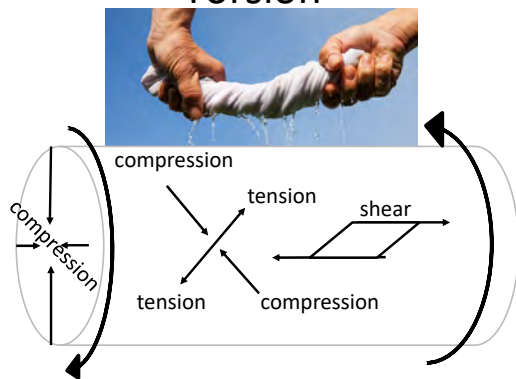
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## Torsion



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## Stress & Strain

- Stress – intensity of load per unit area
- Strain – amount of dimensional change in shape
- Bone will fail when the strain becomes too great regardless of the level of stress.

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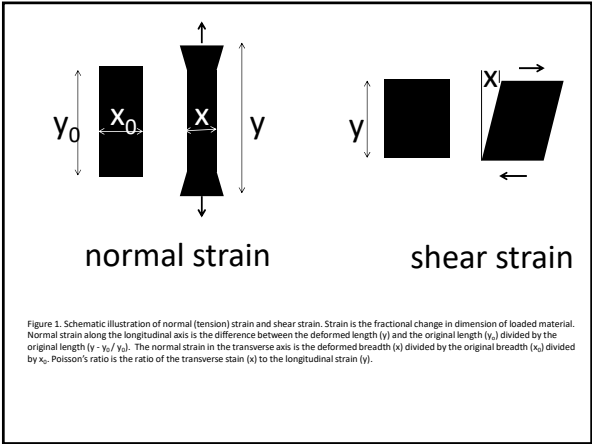
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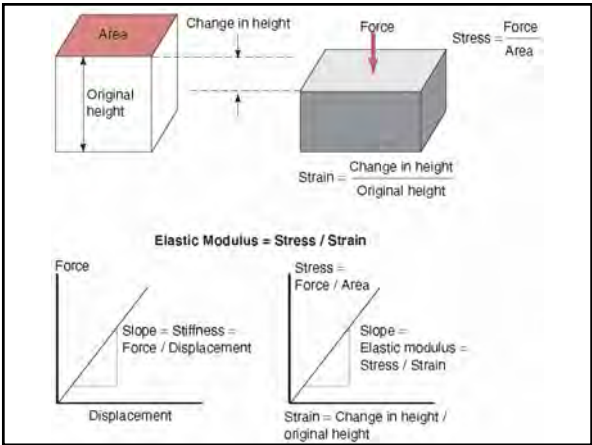
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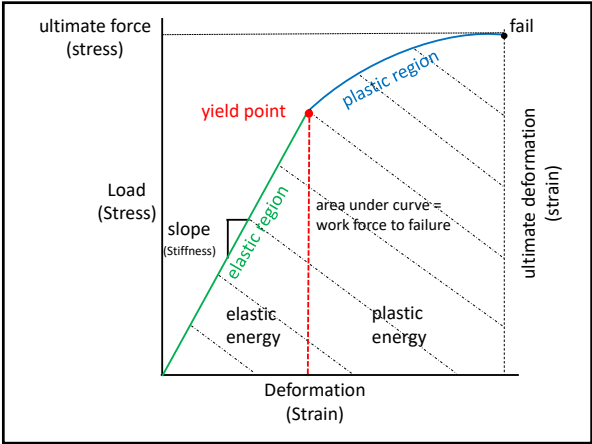
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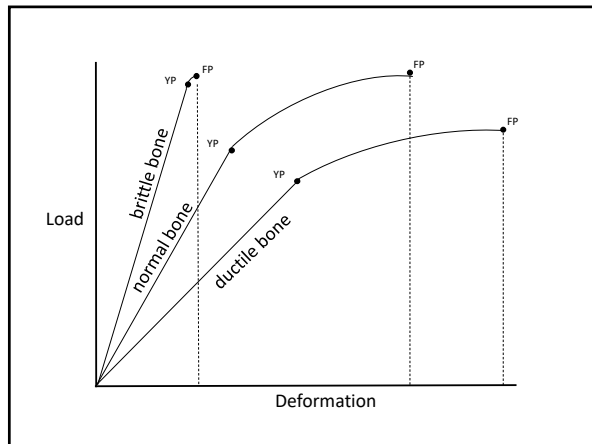
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## Trauma analysis fracturing

If the strain surpasses the ultimate strain  
the bone will fail  
Bone is weakest in shear, then tensile,  
then compression  
Fractures will start along shear or tension  
stresses  
Fractures follow the path of least  
resistance

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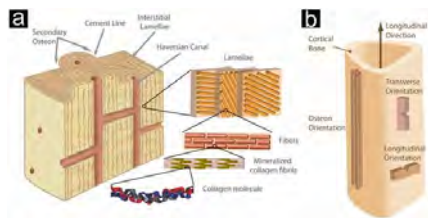
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## Material Properties of Bone

- Bone is a composite material with anisotropic and viscoelastic characteristics
- Anisotropic characteristic



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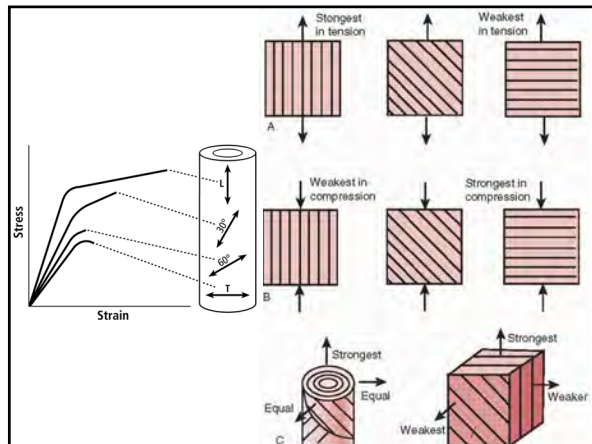
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### Viscoelastic

- Elastic
  - Deforms under load
  - Returns to original shape when load released
- Viscous
  - Creep – does not return to original shape when load released
  - Rapid application of force causes greater resistance to motion (increased stiffness)

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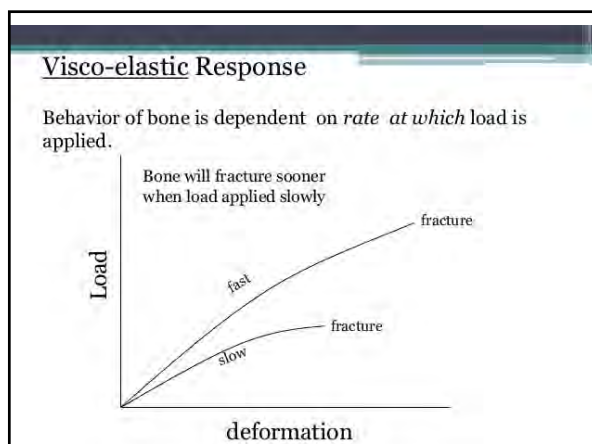
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## Trauma analysis blunt force trauma



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## Blunt Trauma

- Fracture
  - Complete break in bone
- Infraction
  - Incomplete break of a bone in which the parts do not become displaced

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## Energy absorbing mechanisms

- Contraction of muscles
- Deformation of soft tissue
- Deformation of bone
- Clothing

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## Fractures

- Bone affected
- Location
- Shape
  - Oblique, transverse, spiral
- Complete or incomplete
- Types and areas of force
- Healing

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LOADING MODE

Tension	Compression	Bending	Torsion
Transverse	Oblique	Butterfly	Spiral

FRACTURE TYPE

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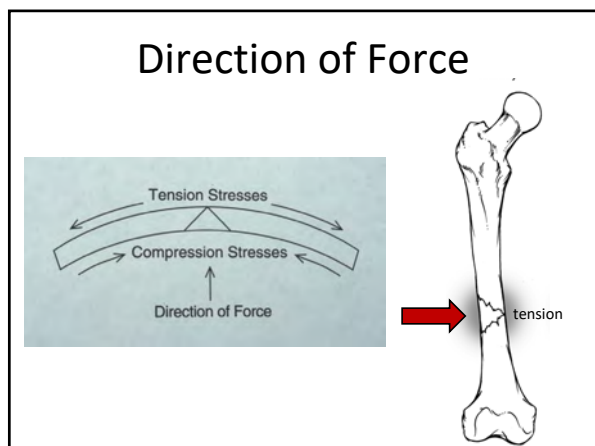
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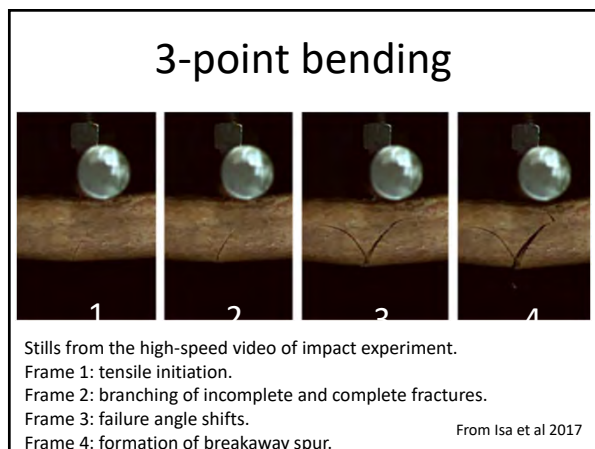
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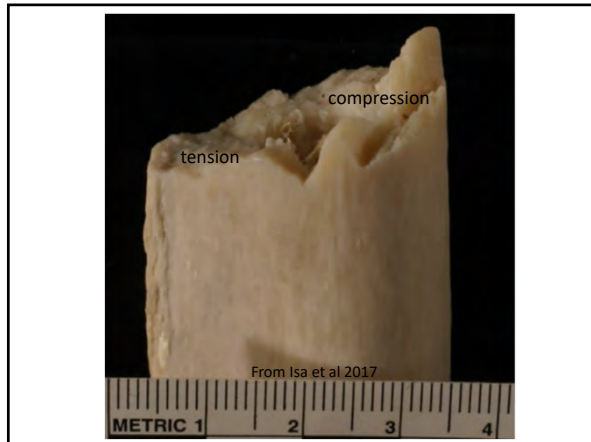
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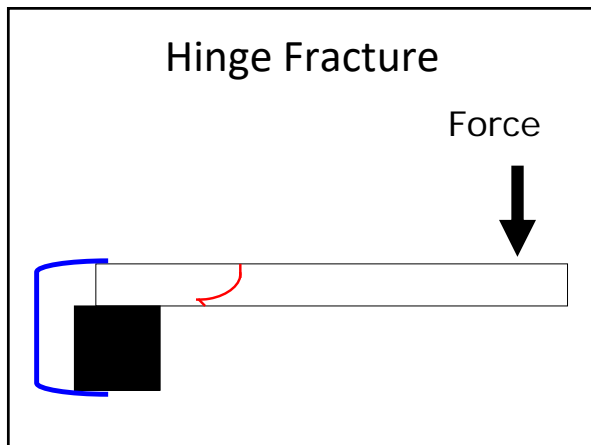
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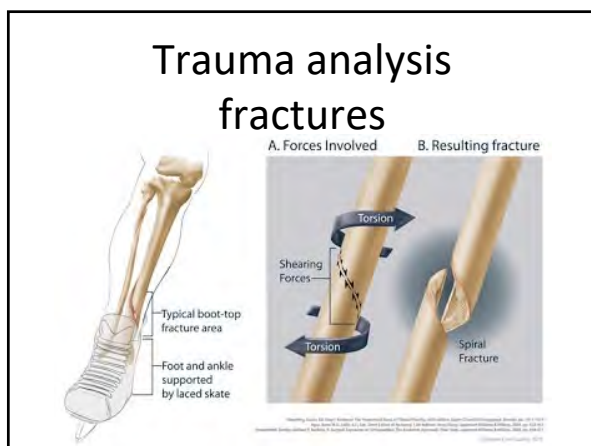
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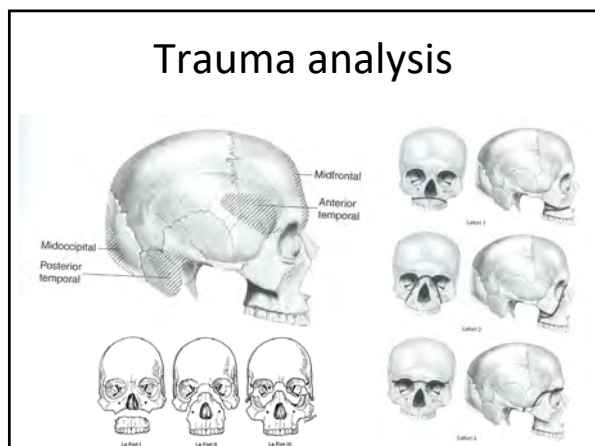
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### Blunt Trauma

- Need to evaluate 3 traits of the object causing blunt force trauma
  - Size
  - Shape
  - Weight
- Need to evaluate characteristics of the force
  - Type of force (tension, compression, etc)
  - Direction
  - Energy

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### Object Characteristics

- Size
  - Length & Width
  - Long & narrow objects require less force to cause bone failure (fracture)

The image contains two photographs of a human skull. The top photo shows a lateral view with a large, irregular fracture on the side of the head. The bottom photo shows a frontal view with a large, irregular fracture on the forehead and upper face area.

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## Object Characteristics

- Shape
  - Round
  - Angular
  - Patterned injuries



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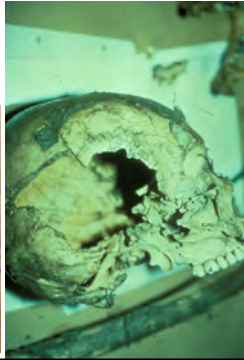
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## Object Characteristics

- Weight
  - Light – fewer fracture lines



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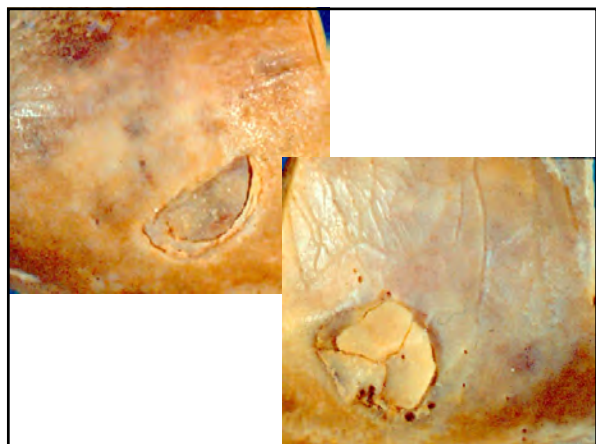
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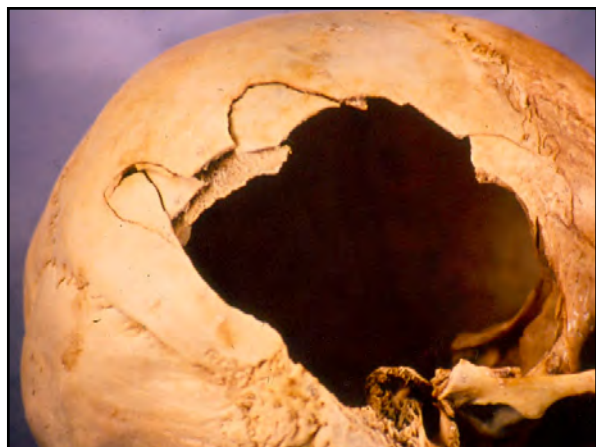
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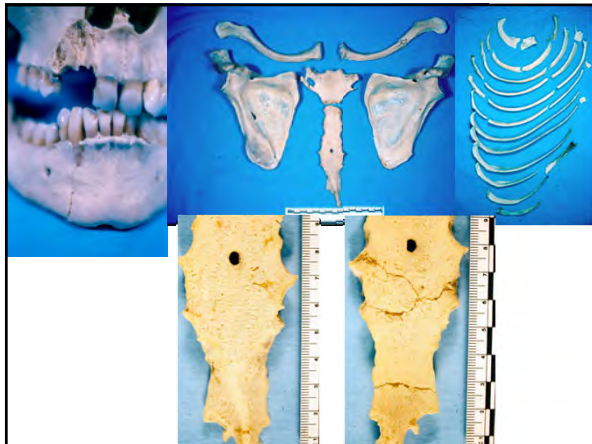
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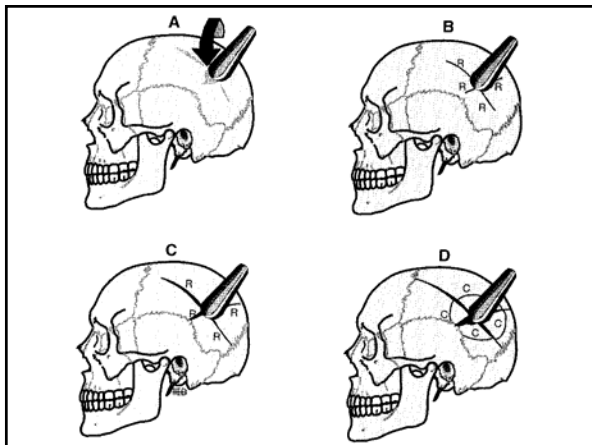
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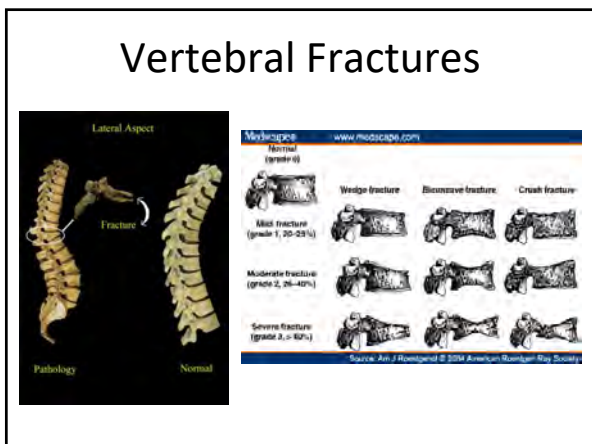
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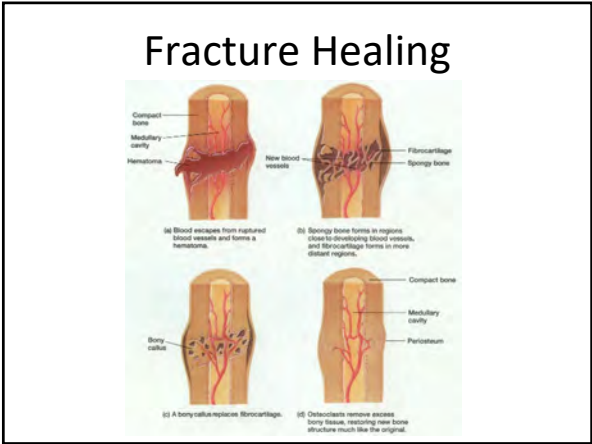
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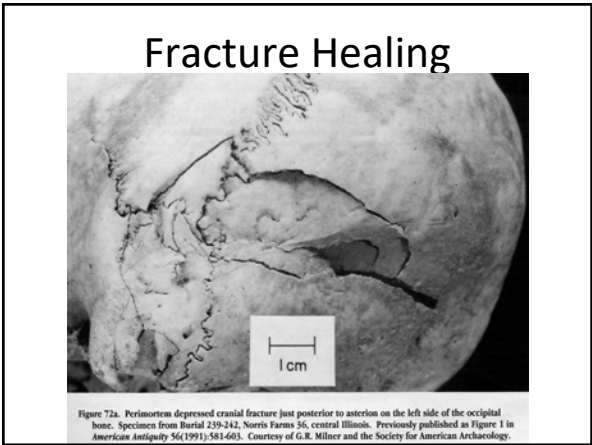
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### Fracture Healing



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### Antemortem



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### Fracture Healing



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### Fracture Healing



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### Fracture Healing



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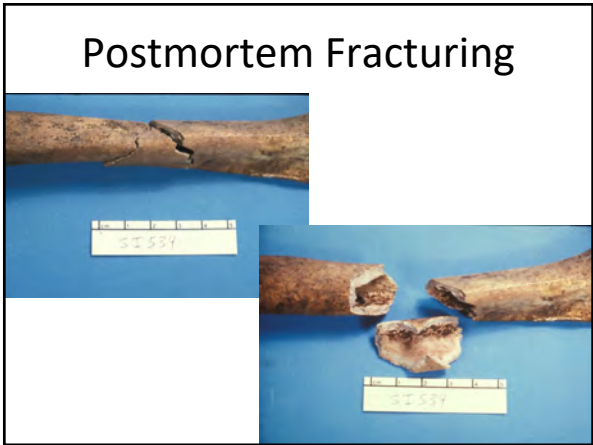
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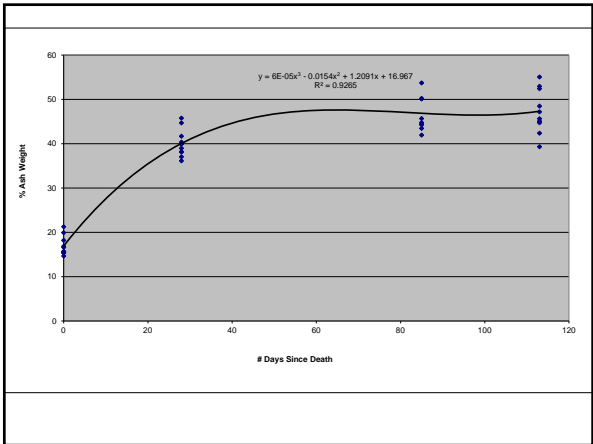
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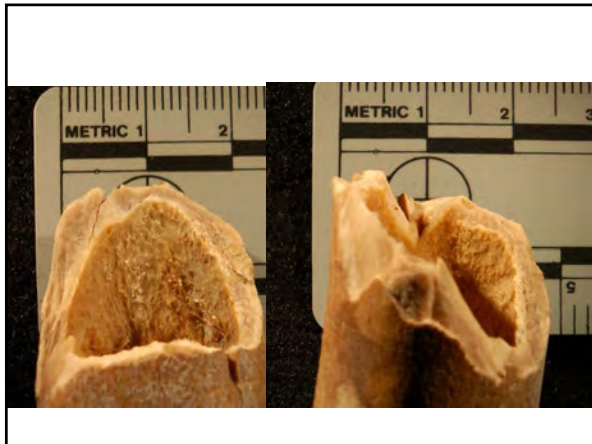
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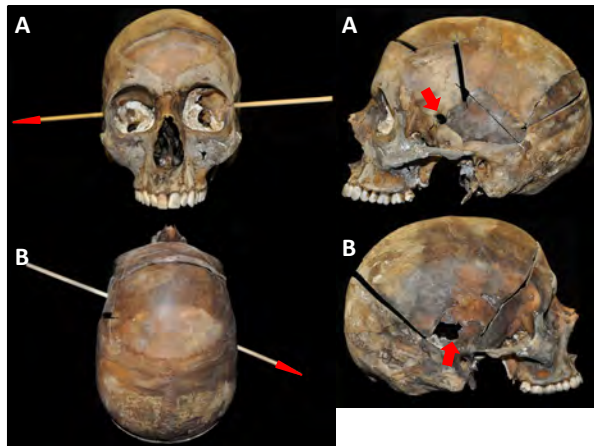
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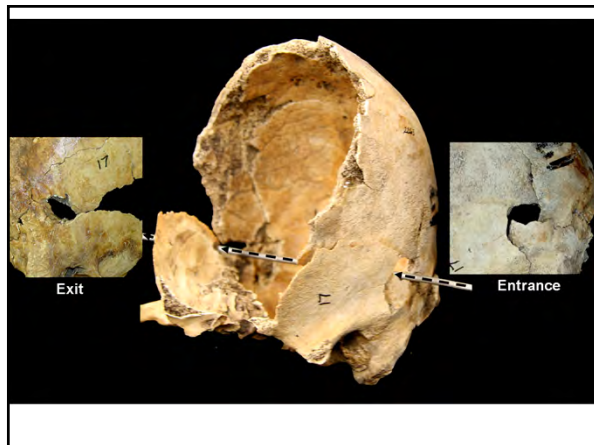
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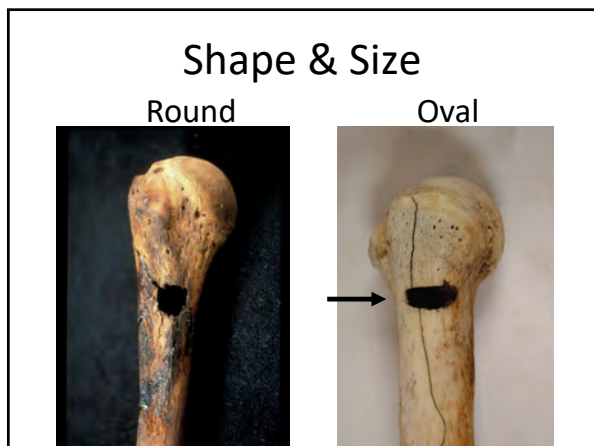
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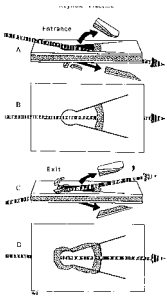
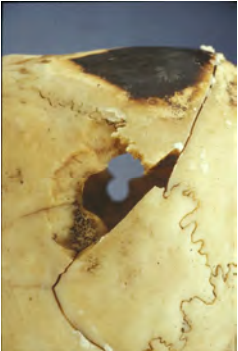
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Shape and Size



A bullet hole in a bone is shown. The diagram illustrates the bullet's path through the bone, with labels A, B, C, and D indicating different stages or views of the wound.

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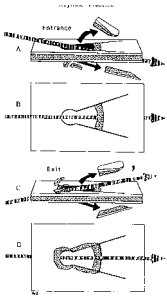
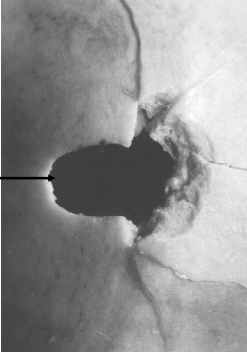
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Shape and Size



A bullet hole in a bone is shown. The diagram illustrates the bullet's path through the bone, with labels A, B, C, and D indicating different stages or views of the wound.

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Gunshot Wound



Two photographs of a gunshot wound on a bone. The left image shows the wound next to a ruler for scale. The right image is a close-up of the wound.

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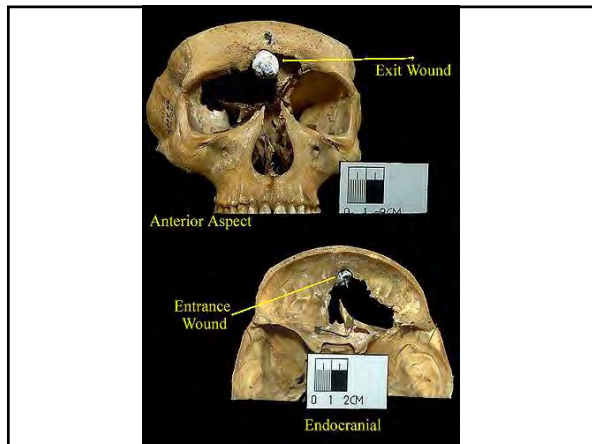
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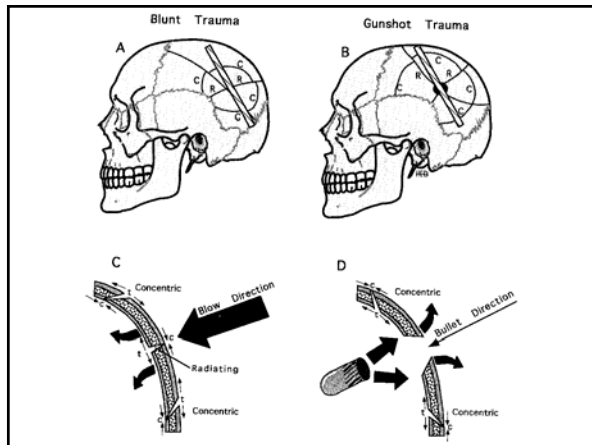
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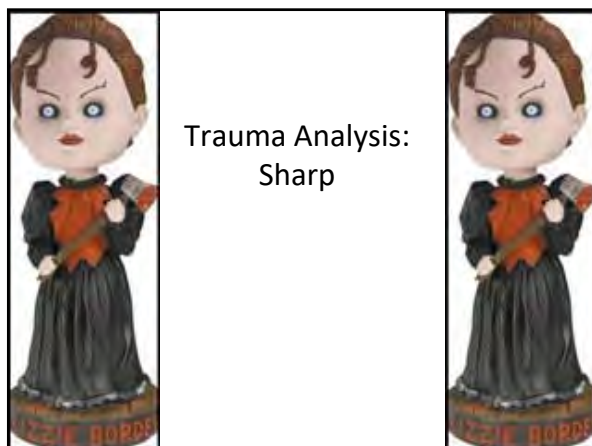
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## Sharp Force Trauma

- Narrowly focused compression force
- Common instruments
  - Knife, axe, ice pick, chain saw, etc.
- Discontinuity
  - Incision
  - Chop or Cleft
  - Puncture

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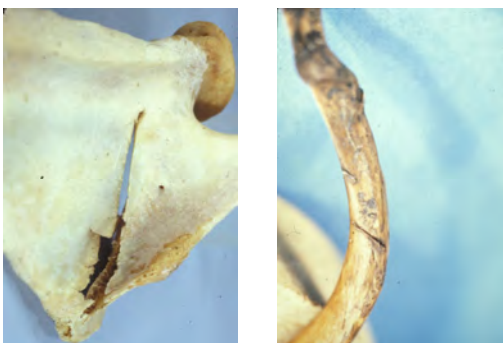
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## Sharp Force



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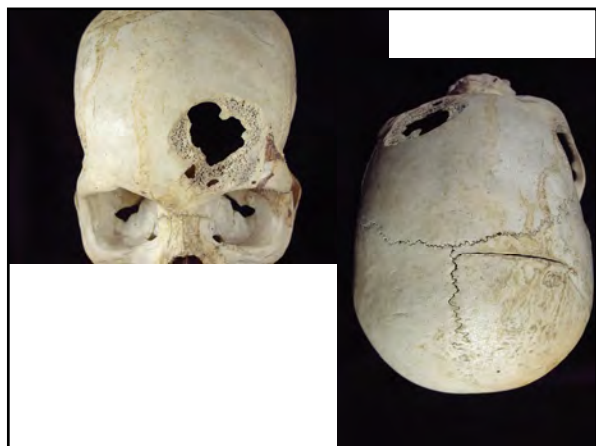
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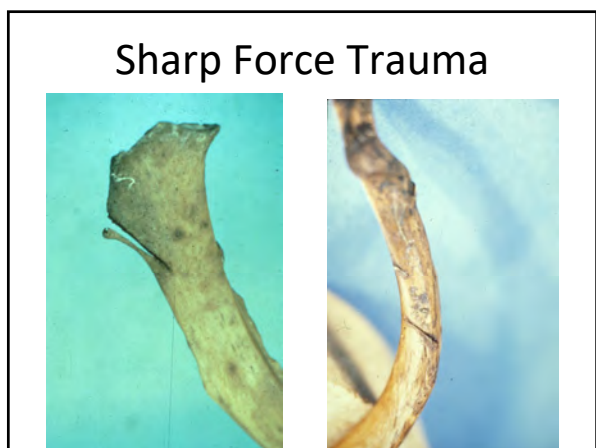
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### Decapitation



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### Dismemberment



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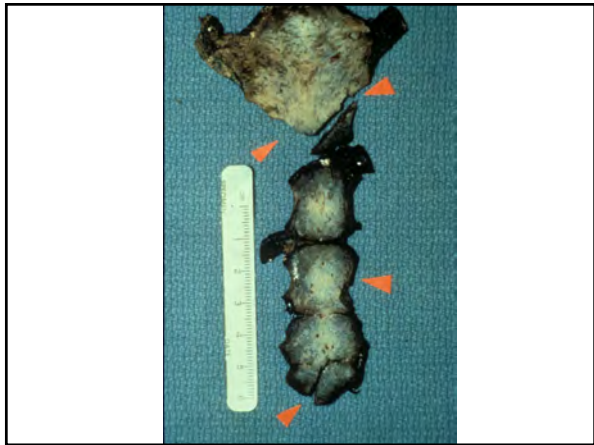
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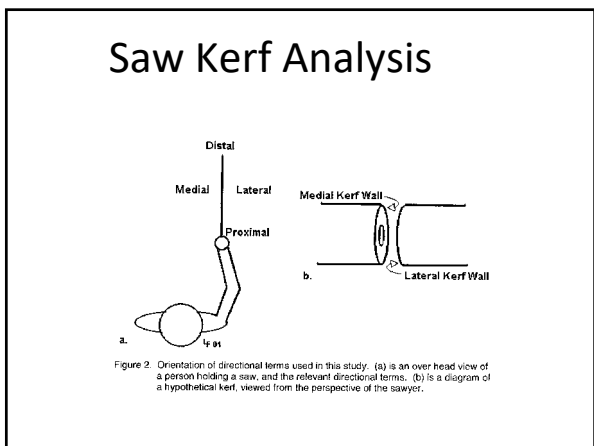
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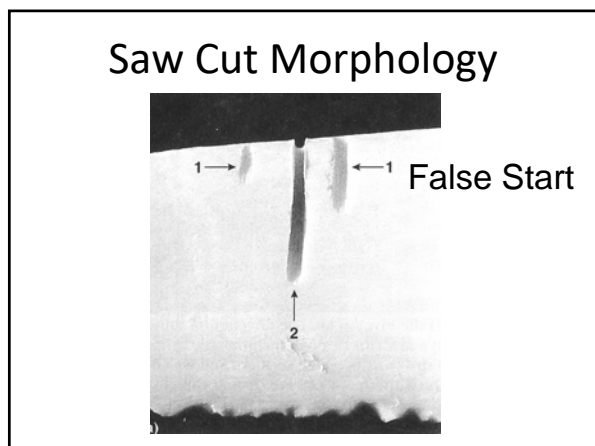
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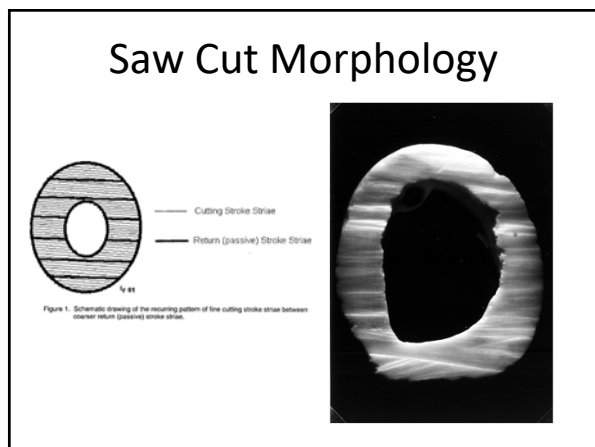
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*Burned Remains*

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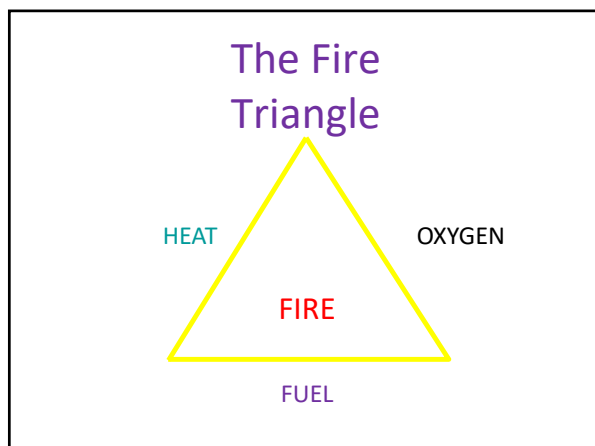
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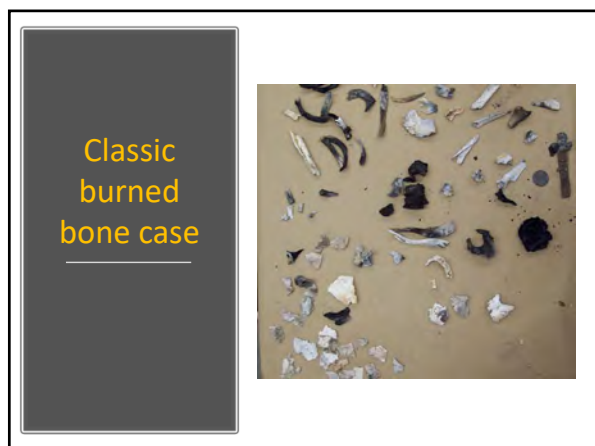
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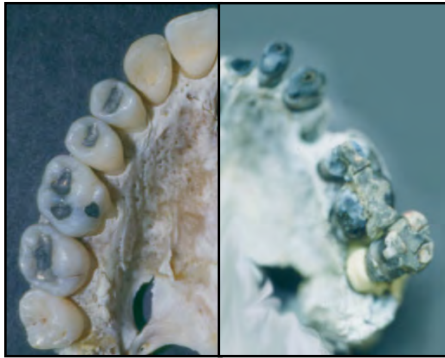
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## Dental Analysis



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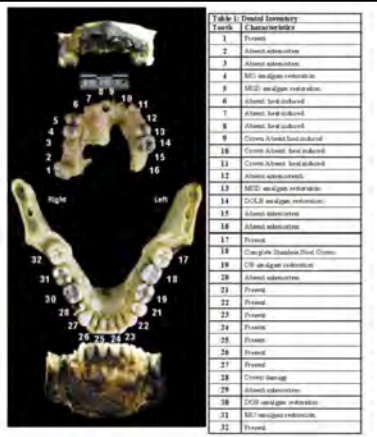
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## Dental Analysis



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## Types of Fractures

Green, Dry or Burned:

Burn Specific:

- Spiral/Oblique
- Longitudinal
- Step
- Transverse
- Splintering
- Patina
- Delamination
- Curved Transverse
- Burn Line Fracture

Symes et al 2008

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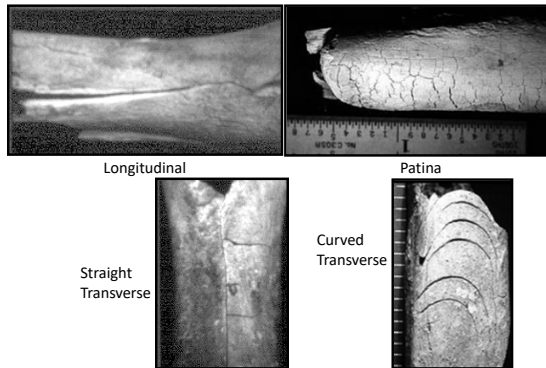
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## Heat Alteration of Bone



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## Splintering



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## Curved Transverse Fractures



- Symes et al. (2008) suggest that such fracture may indicate direction of heat

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## Shrinkage

- Experimental studies have suggested as much as 37% shrinkage (Thompson 2005)
- Shrinkage significant at temperatures more than 800 °C

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## Warping

- Plastic deformation of the bone – possible explanations:
  - caused by the stress and strain due to shrinking muscle tissue and periosteum
  - Reorganization of the inorganic component (crystalline structure) as a result of the loss of organic component in bone

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## Trauma-Induced Spiral Fracture



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## Sharp Force Trauma



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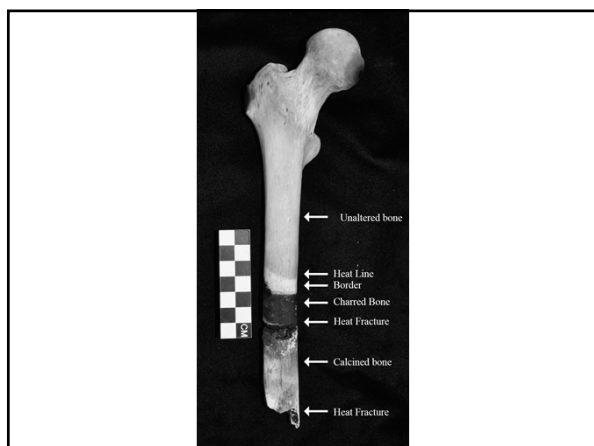
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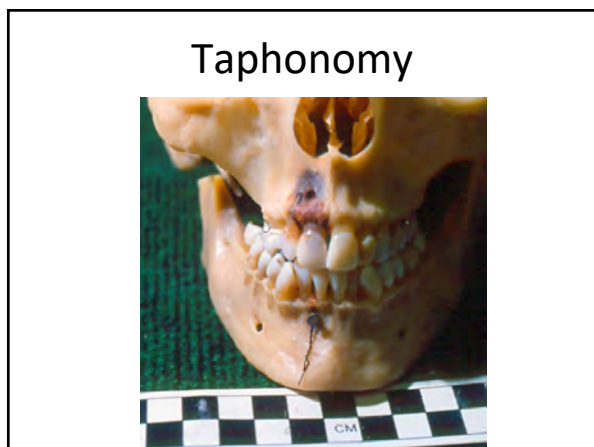
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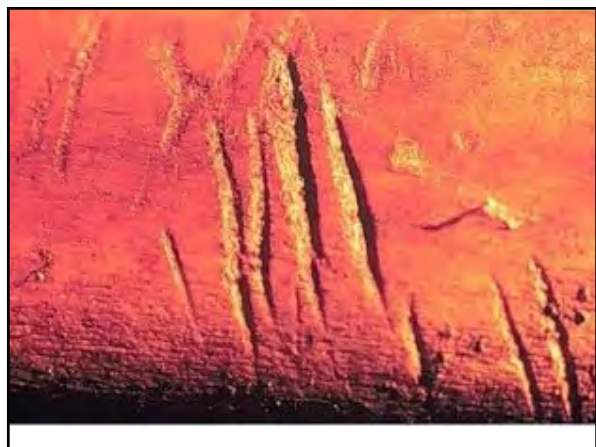
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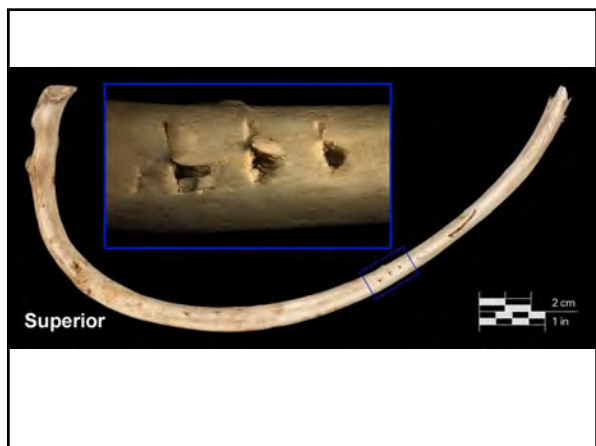
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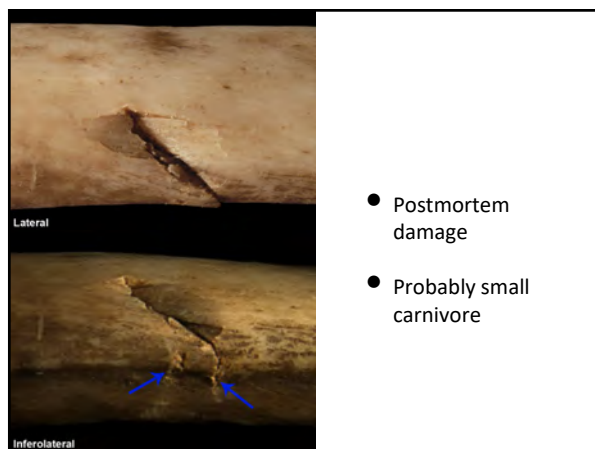
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