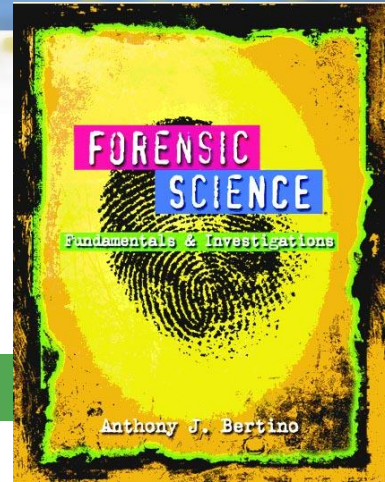


Chapter 13 *Forensic Anthropology: What We Learn from Bones*

By the end of this chapter you will be able to:

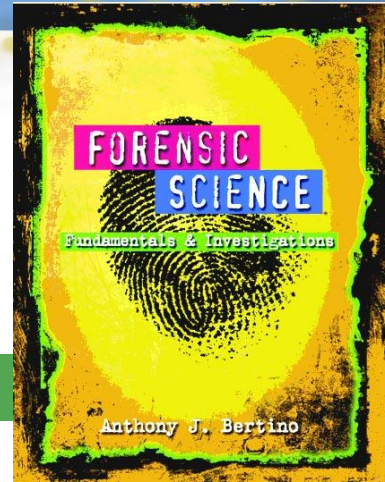


- Describe how bone is formed
- Distinguish between male and female skeletal remains
- Explain how bones contain a record of injuries and disease

All Rights Reserved South-Western / Cengage Learning © 2012, 2009

Chapter 13 *Forensic Anthropology: What We Learn from Bones*

By the end of this chapter you will be able to:



- Describe how a person's approximate age could be determined
- Explain the differences in facial structures among races
- Discuss the role of mitochondrial DNA in bone identification



Forensic Anthropology

- **Anthropology**—the scientific study of all aspects of human development and interaction
- **Physical anthropology**—studies human differences
- **Forensic anthropology**—studies these identifying characteristics on the remains of an individual



Historical Development



- **1800s**—scientists begin studying skulls
- **1897**—sausage maker's wife murdered; bone fragments found in his factory
- **1932**—the FBI opens the first crime lab
- Smithsonian Institution partners with FBI



Historical Development

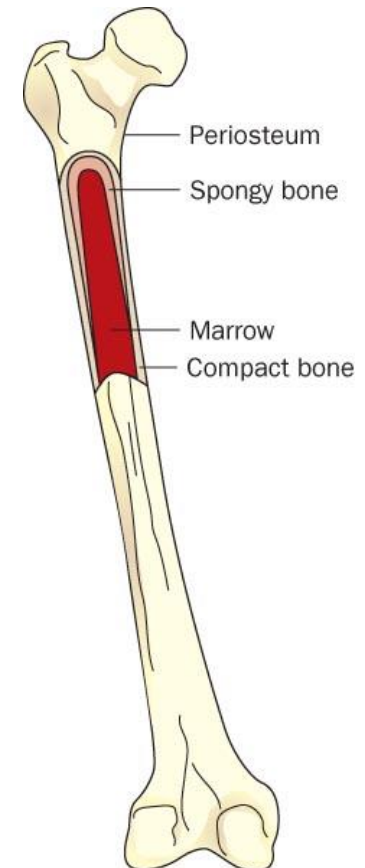


- **1939**—William Krogman publishes *Guide to the Identification of Human Skeletal Material*
- Soldiers killed in World War II are identified using anthropologic techniques
- DNA—new tool to analyze skeletons



Characteristics of Bone

- Bones are alive
- Marrow—creates blood cells
- Hormones affect the amount of calcium in the blood and bones





Development of Bone

- **Osteoblast cells**—where bones originate
- **Ossification**—when osteoblast cells migrate to the center of cartilage production and deposit minerals
- **Life cycle**—bone is deposited, breaks down, and replaced
- **Osteoclasts**—the 2nd type of bone cell, specialized to dissolve bone



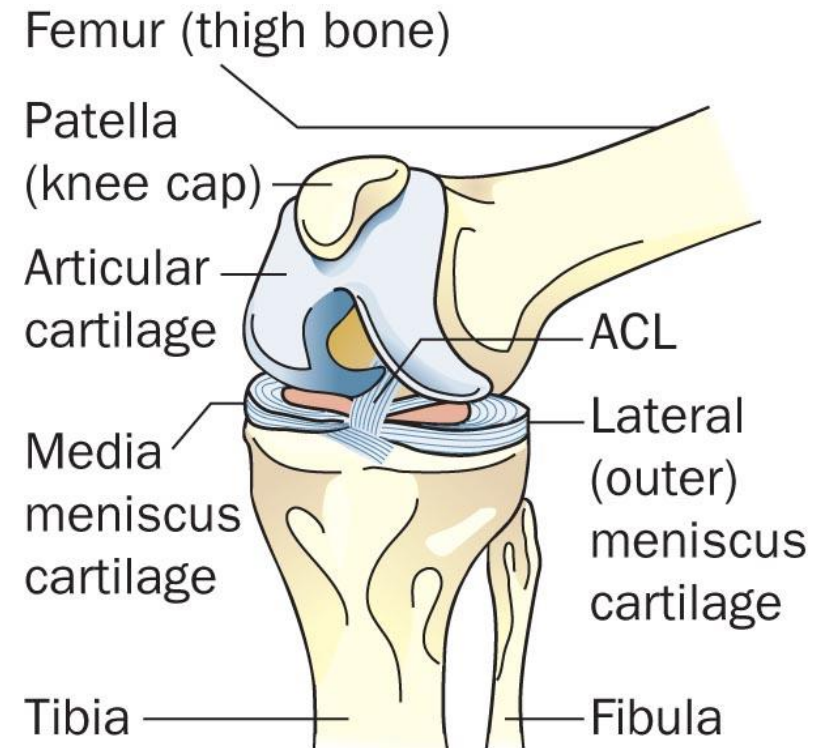
Development of Bone

- **Osteoclasts**—the 2nd type of bone cell
 - Specialized to dissolve bone
 - Allows bones to reshape as they grow
 - Balances calcium levels in blood
 - Removes cellular wastes and debris from bones
- **Osteoporosis**—a deficiency of calcium in the bones



How Bones Connect

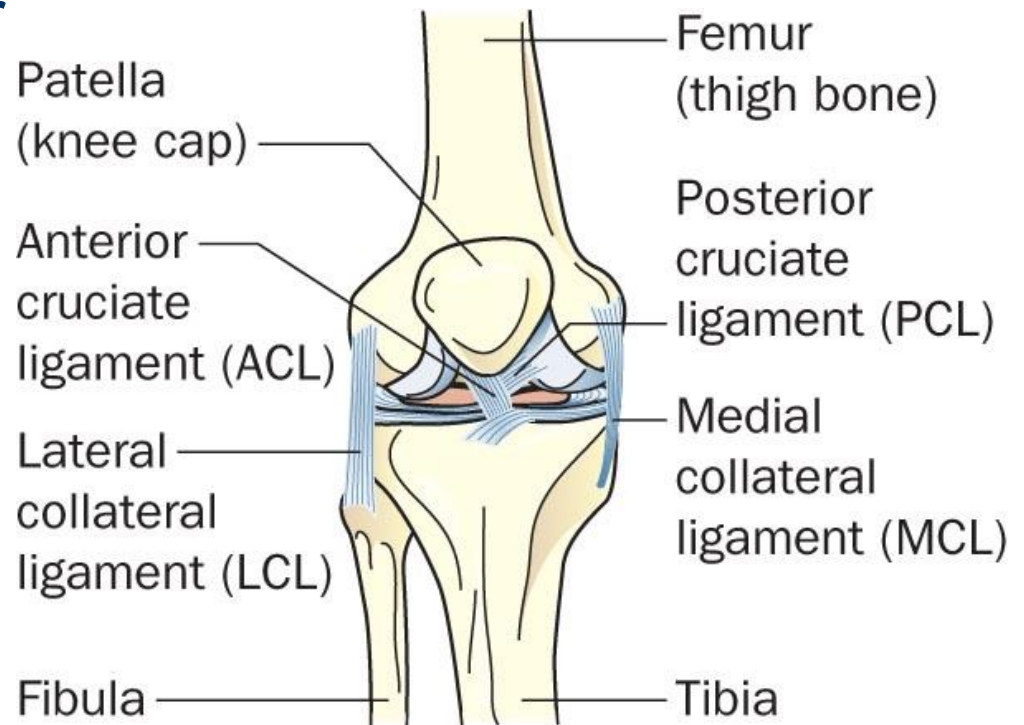
cartilage—wraps the ends of bones for protection and prevents scraping



How Bones Connect



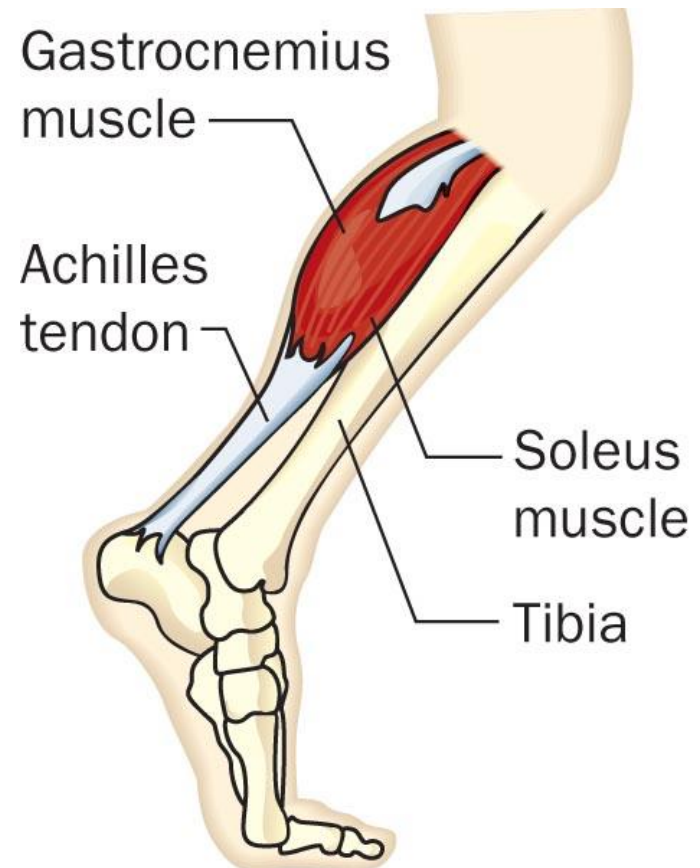
ligaments—bands that connect two or more bones together



How Bones Connect



tendons—connect
muscle to bone





Aging of Bone

- Under 30 years of age—bones increase in size
- Over 30—process reverses
- Exercise slows deterioration

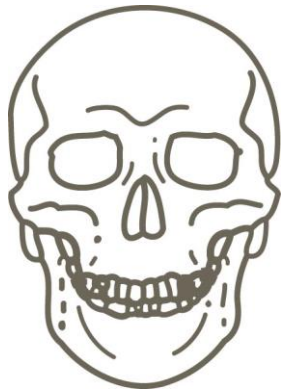


What Bones Can Tell Us

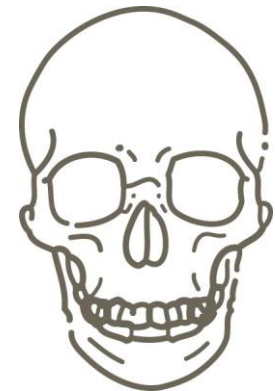
- **Osteobiography**—bones contain a record of the physical life
- Analyzing bones reveals clues to gender, age, height, and health
- Examples:
 - In a right-handed person, right arm bones might be slightly larger than the bones of the left arm
 - X-rays may identify prior fractures, pins, artificial joints



Gender—Skull

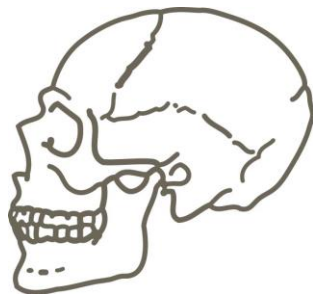


Male Characteristics	Trait	Female Characteristics
More square	Shape of eye	More rounded
More square	Mandible shape from underside	More V-shaped
Thick and larger	Upper brow ridge	Thin and smaller

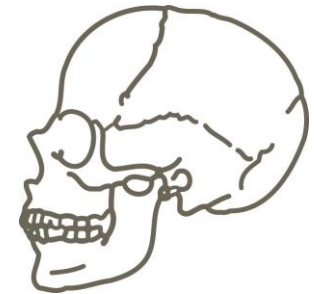




Gender—Skull

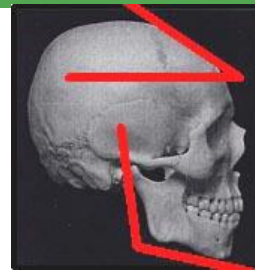
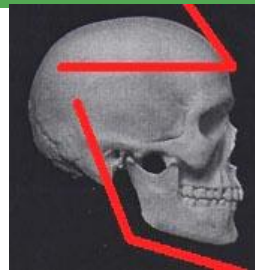


Male Characteristics	Trait	Female Characteristics
Present	Occipital protuberance	Absent
Low and sloping	Frontal bone	Higher and more rounded
Rough and bumpy	Surface of skull	Smooth
Straight	Ramus of mandible	Slanting
Rough and bumpy	Nuchal crest	Smooth





Gender—Skull



- Is the female skull smoother than the male's?
- Which frontal bone is lower and sloping?
- Are the male's eye orbits more circular?
- Which jaw is more square, with an angle that is closer to 90°?

Gender—Pelvis

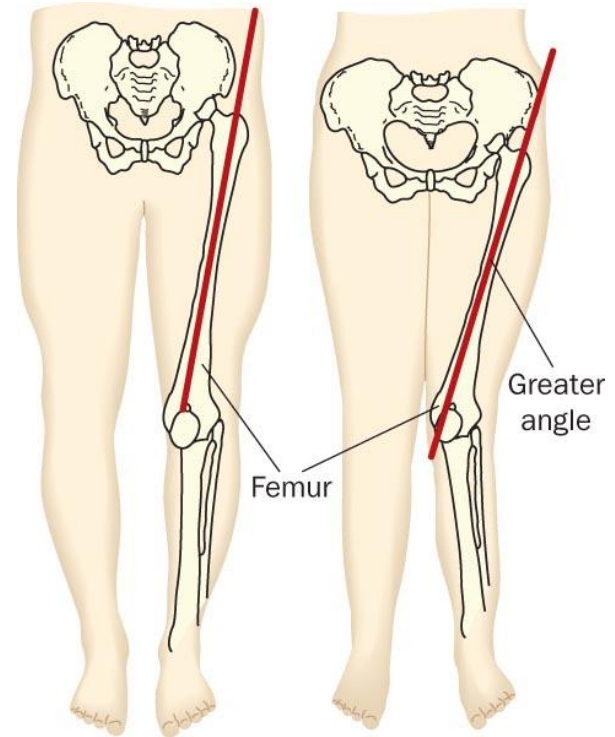


- An easy method to determine gender
- The surface of a woman's pelvis can be scared
- The sub pubic angle of the female pelvis is greater than 90° ; the male's, less



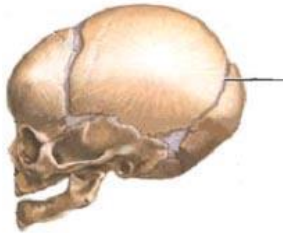
Gender—Thigh bones

The male femur is thicker and joins the pelvis at a straighter angle than the female femur

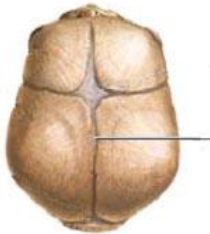




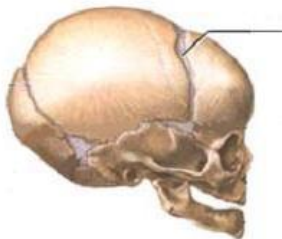
Age—Skull



- By about age 30, the suture at the back of the skull closes



- By about age 32, the suture running across the top of the skull, back to front, closes

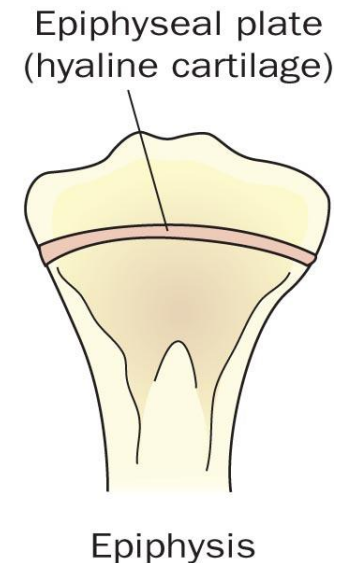


- By about age 50, the suture running side to side over the top of the skull, near the front, closes

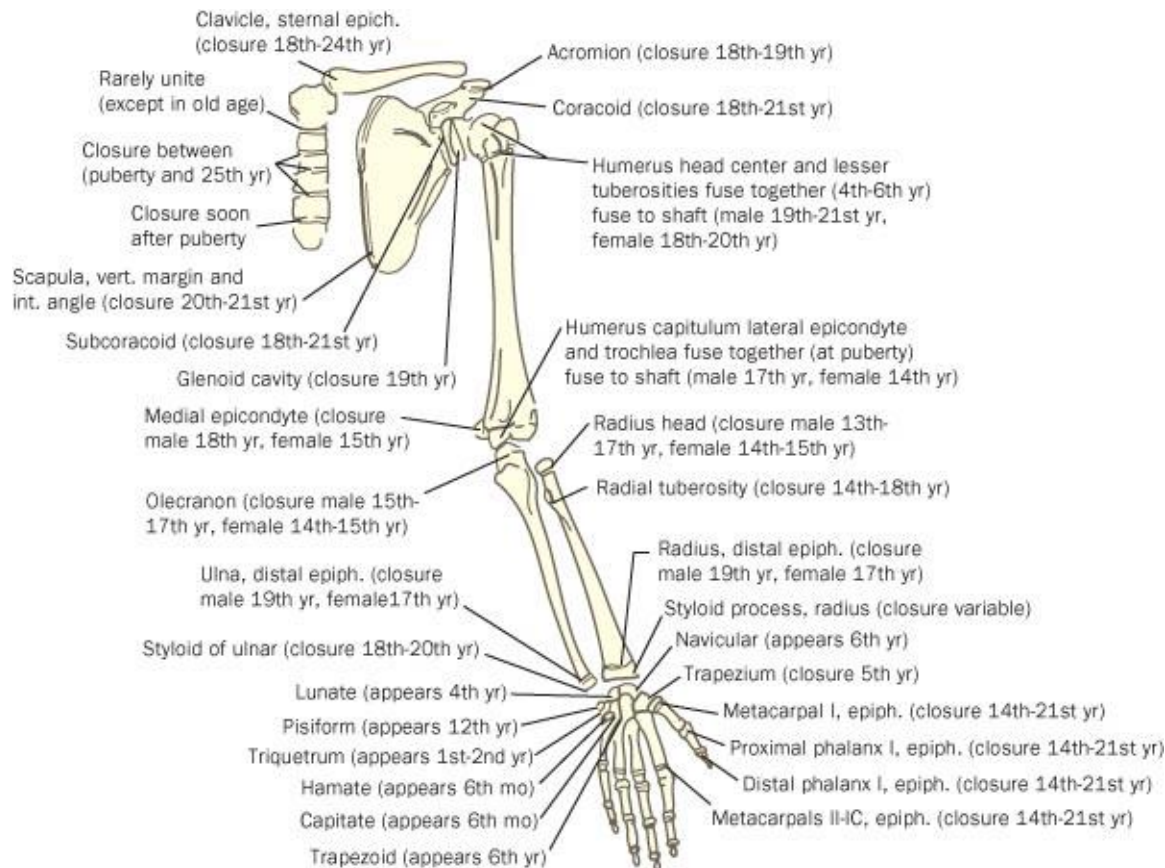
Age



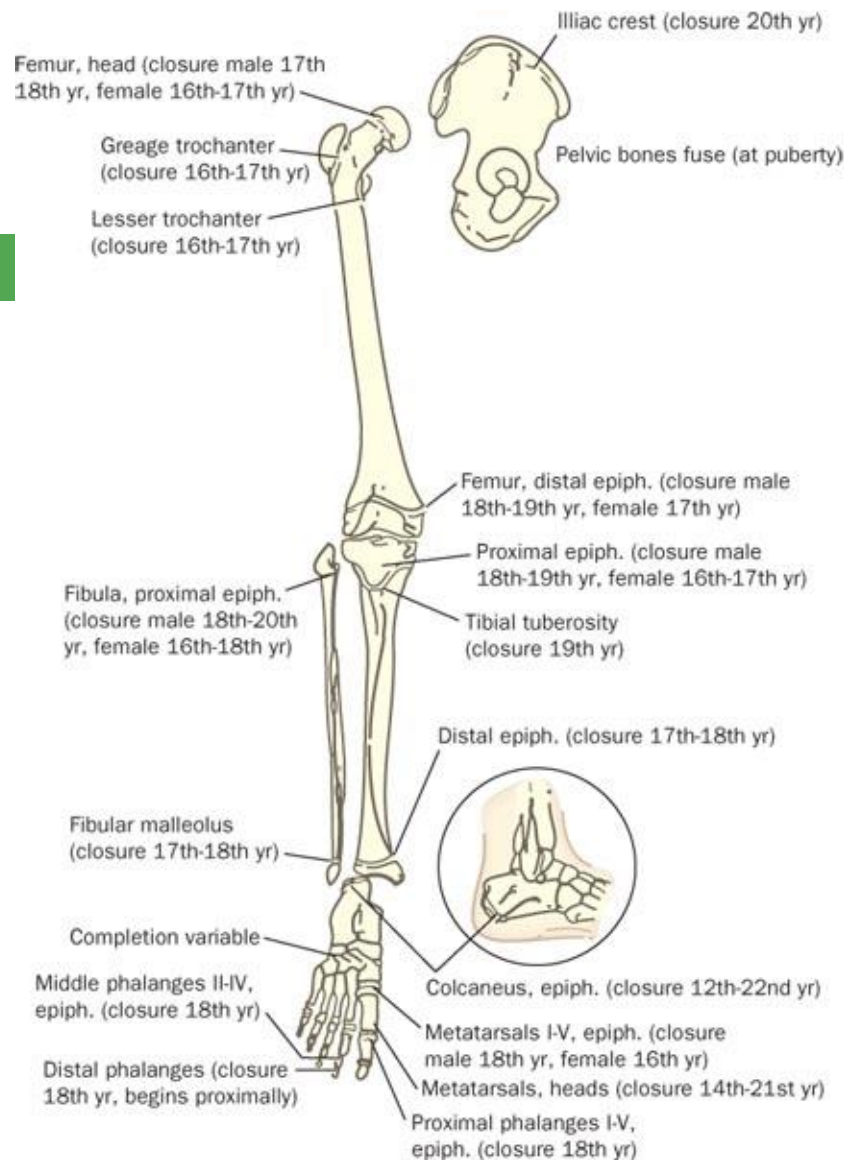
- At birth—450+ bones in the skeleton
- Adults— 206 bones
- **Epiphysis line**—appears where cartilage is replaced by bone
- When the cartilage is fully replaced, the line is no longer visible
- This information can be used to approximate a skeleton's age



Age—Epiphysis



Age— Epiphysis





Height

- An estimate of height can be made by measuring one of the long bones
- Gender and race is taken into consideration



How to Distinguish Race

- Shape of the eye sockets
- Absence or presence of a nasal spine
- Measurements of the nasal index
- Prognathism
- Width of the face
- Angulation of the jaw and face



Facial Reconstruction

- Facial muscles follow the contour of the skull
- A face can be rebuilt from just skeletal remains
 - Facial markers are positioned at critical locations
 - Clay is contoured to follow the height of the markers
- Computer programs perform a similar function
- Computer programs also can “age” missing persons and criminals



DNA Evidence

- Bone contains little nuclear DNA but it does contain mitochondrial DNA
- Nuclear DNA degenerates before mitochondrial DNA
- Mitochondrial DNA is inherited only from the mother
- Compare results with living relatives on the mother's side of the family



Skeletal Trauma Analysis

- Forensic anthropologists determine if damage to bones occurred before or after death
- Distinct patterns exist for damage by
 - Environment
 - Sharp-force trauma
 - Blunt-force trauma
 - Gunshot wounds
 - Knife wounds



..... Summary

- Bones are live and carry on all life functions.
- Bone condition can tell investigators about a person's health and nutrition during life.
- Male and female skeletons differ.
- The age of a person at death can be estimated by analyzing bones.



..... Summary

- A person's height can be estimated by the length of long bones.
- Facial reconstruction is possible to some extent.
- Mitochondrial DNA can be extracted to help identify skeletal remains.
- Skeletal trauma analysis examines bones for evidence of damage.