Name _____Period _____ Date _____

Forensic Science

Chapter 13 – FORENSIC ANTHROPOLOGY – WHAT WE LEARN ABOUT BONES

Directions: Fill in the information from the Classroom Chart or the Online Chart.

Forensic Science Standard and element:

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).

2.) Put chart in Science Notebook behind the Charts section after it has been checked. ____yes ____no

3.) All parts were accurate and complete with no abbreviations. ____yes ____no

4.) Handwriting was neat. ____yes ____no

5.) Information was dark enough to be easily read, and chart was neat. ____yes ____no
(Part of Notebook Grade)

WHAT IS 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 OF ANTHROPOLOGY

1800s—scientists begin studying skulls
1897— Adolph Louis Luetgert, a sausage maker's wife was murdered; convicted after bone fragments found in his factory and he died in prison
1932—the FBI opens the first crime lab with the Smithsonian Institution partnering with the FBI
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 BONES

Bones are alive, carry on cellular respiration, and consume energy like other living cells
Marrow—creates all three types of blood cells • **Red blood cells – Erythrocytes** • **White blood cells – Leukocytes** • **Platelets – Thrombocytes**
Hormones affect the amount of calcium in the blood and bones

DEVELOPMENT OF BONE IN HUMANS

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

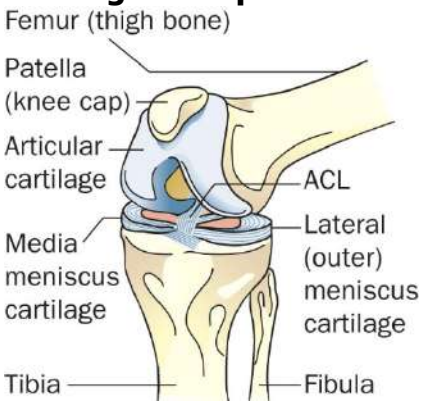
Osteoclasts—the 2nd type of bone cell, specialized to dissolve bone

- **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



ligaments—bands that connect two or more bones together

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 CAN BONES 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**

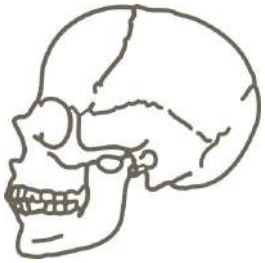
GENDER - SKULL

MALE

FEMALE

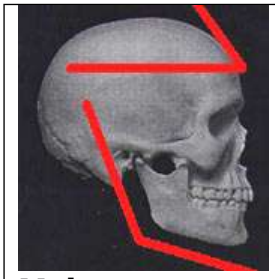
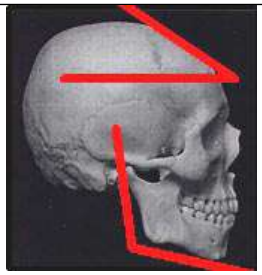
MALE CHARACTERISTICS	TRAIT	FEMALE CHARACTERISTICS
More square	Shape of eye	More rounded
More square	Mandible shape from underside	More V-shaped
Thick and larger	Upper brow ridge	Thin and smaller

MALE



FEMALE

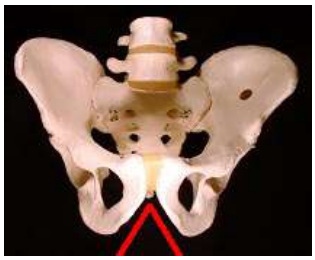
MALE CHARACTERISTICS	TRAIT	FEMALE CHARACTERISTICS
Present	Occipital protuberance	Absent
Low and sloping	Frontal bone	Higher and more rounded
Rough and bumpy	Surface of skull	Smooth
Straight	Ramus of mandible	Slanting
Rough and bumpy	Nuchal crest	Smooth

Male **Female**

- **The female skull is smoother than the male's**
- **The male frontal bone is lower and sloping and the female's is higher and rounded**
- **The male's eye orbits are squarer with the females more circular**
- **The male's lower jaw is square with about a 90° angle and males have square chins**
- **The female's lower jaw is sloped with an angle greater than 90° and females usually have rounder or more V-shaped chins**

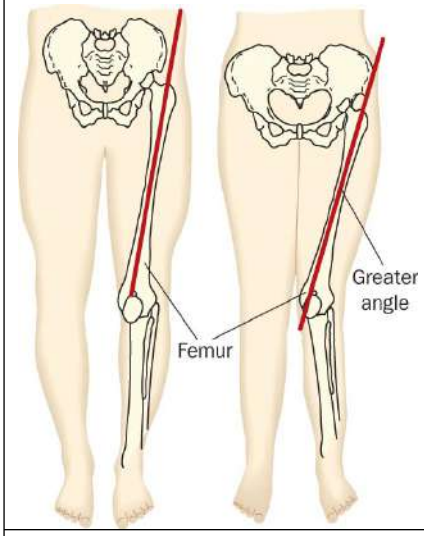
Gender – Pelvis

- **An easy method to determine gender**
- **The surface of a woman's pelvis can be scarred**
- **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



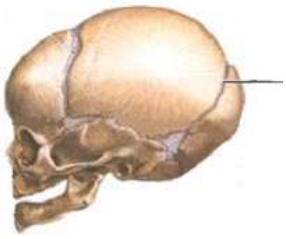
AGE - SKULL

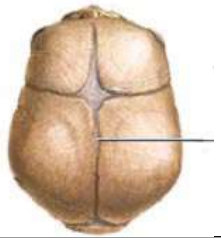
1.) By about age 30, the suture at the back of the skull closes

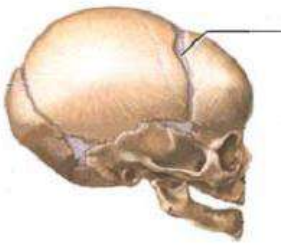
2.) By about age 32, the suture running across the top of the skull, back to front, closes

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

1.) **2.)** **3.)**

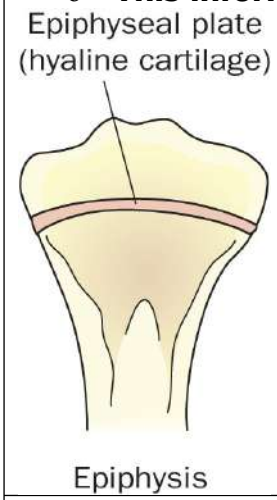




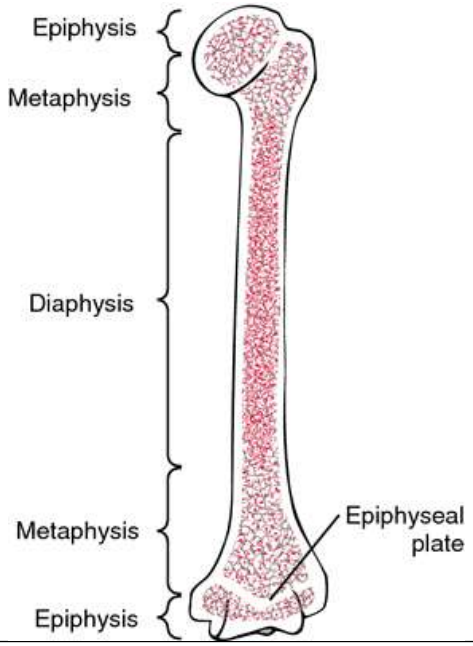


AGE - BIRTH

- **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 ***(THE EPIPHYSIS IS THE END OF A LONG BONE THAT INITIALLY GROWS SEPARATELY FROM THE SHAFT.)***



HEIGHT

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

ESTIMATION OF AGE USING BONES

REGION OF THE BODY	BONE	AGE
Arm	• **Humerus bones in the head fused** • **Humerus bones in the head fused to shaft**	**4-6** **18-20**
Leg	• **Femur: Greater trochanter first appears** ***(greater trochanter is one of the bony prominences toward the near end of the thighbone (the femur). There are two trochanters)*** • **Less trochanter first appears** • **Femur head fused to shaft** • **Condyles join shaft** ***(condyle is a rounded protrusion at the end of a bone that's designed to help it connect to another bone)***	**4** **13-14** **16-18** **20**
Shoulder	• **Clavicle and sternum close**	**18-24**
Pelvis	• **Pubis, ischium and almost completely united** ***(pubis is either of a pair of bones forming the two sides of the pelvis - ischium is curved bone forming the base of each half of the pelvis)*** • **Ileum, ischium, and pubic bones fully ossified** ***(ileum is part of the small intestine - ossified is when the bone is when fibrous tissue becomes bone)*** • **All segments of sacrum united** ***(sacrum is a triangular bone in the lower back formed from fused vertebrae and situated between the two hipbones of the pelvis)***	**7-8** **20-25** **25-30**
Skull	• **Lambdoidal suture close** • **Sagittal suture close** • **Coronal suture close**	**Begins 21** **Ends 30** **32** **50**

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**

SKELATAL 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**