Warm-Up Activity

- Fill in the names of the bones in the skeleton diagram.

Warm-Up

1. What are the 4 types of bones? Give an example of each.
2. Give 3 ways you can tell a female skeleton from a male skeleton.
3. What hormones are involved in the skeletal system?

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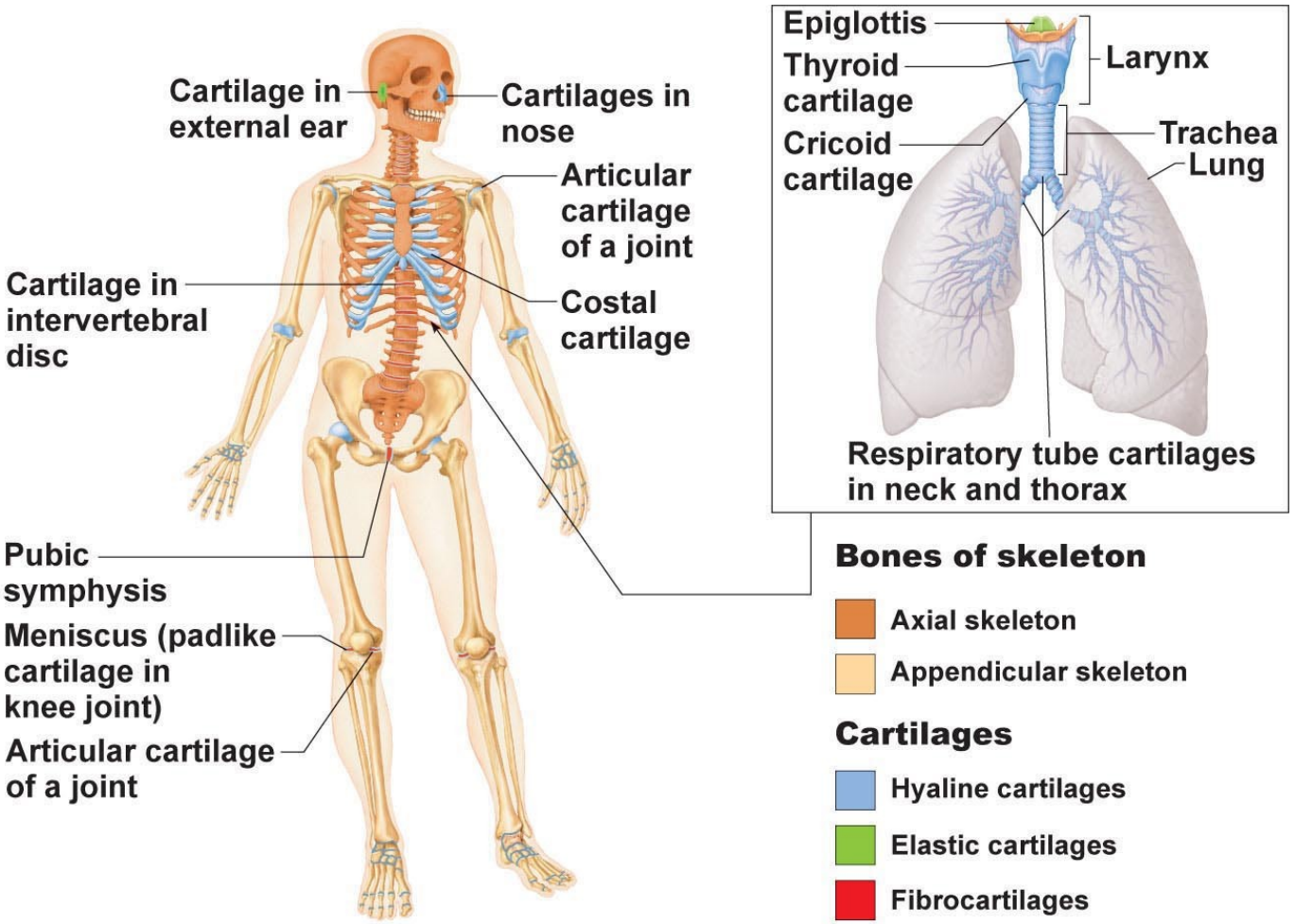
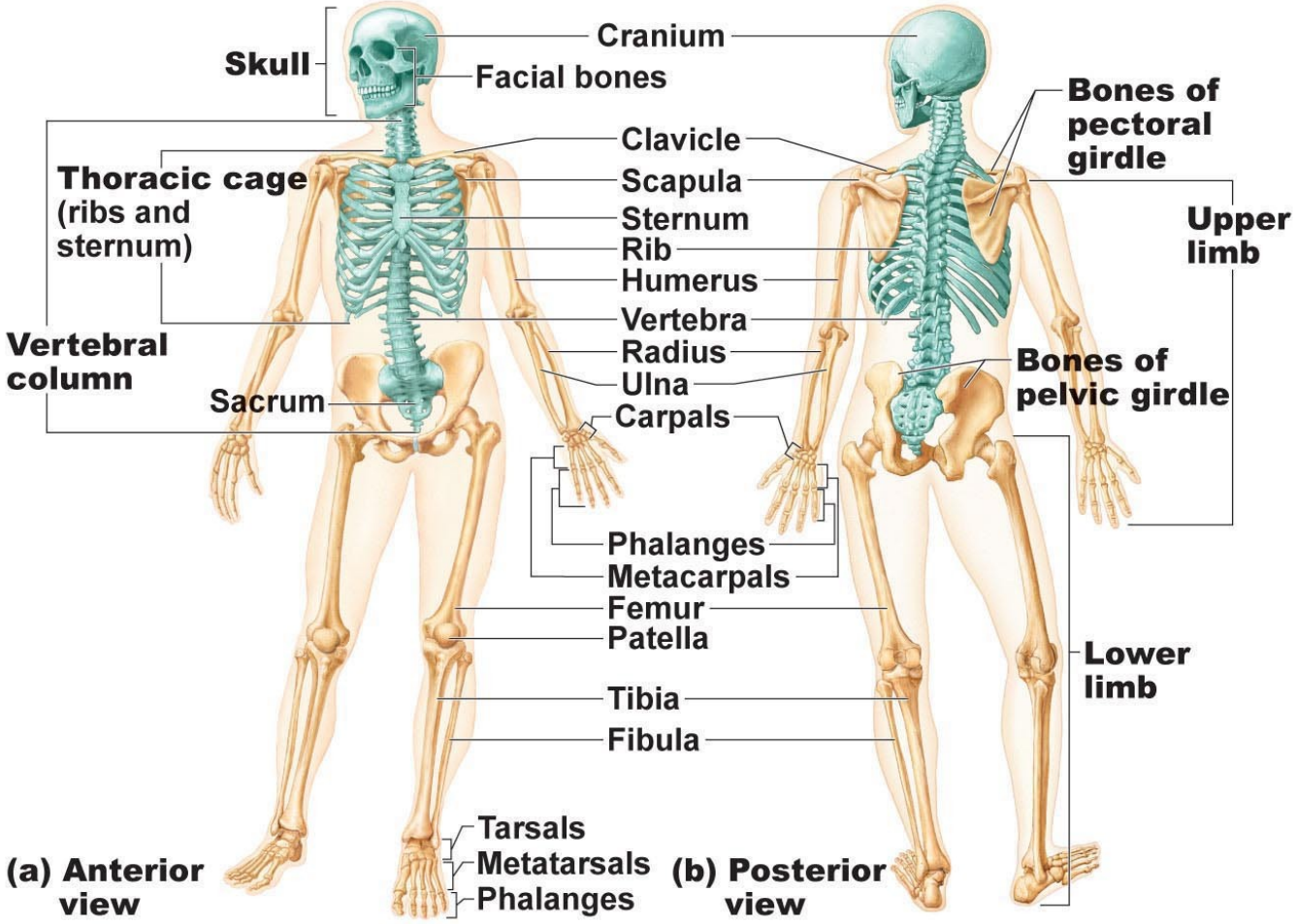
Skeletal System

Chapters 6 & 7

Skeletal System = bones, joints, cartilages, ligaments



- **Axial skeleton**: long axis (skull, vertebral column, rib cage)
- **Appendicular skeleton**: limbs and girdles



Axial Skeleton

- Cranium (skull)
- Mandible (jaw)
- Vertebral column (spine)
  - Cervical vertebrae
  - Thoracic vertebrae
  - Lumbar vertebrae
  - Sacrum
  - Coccyx
- Sternum (breastbone)
- Ribs

Appendicular Skeleton

- Clavicle (collarbone)
- Scapula (shoulder blade)
- Coxal (pelvic girdle)
- Humerus (arm)
- Radius, ulna (forearm)
- Carpals (wrist)
- Metacarpals (hand)
- Phalanges (fingers, toes)
- Femur (thigh)
- Tibia, fibula (leg)
- Tarsal, metatarsals (foot)
- Calcaneus (heel)
- Patella (knee)

Functions of the Bones

- **Support** body and cradle soft organs
- **Protect** vital organs
- **Movement**: muscles move bones
- **Storage** of minerals (calcium, phosphorus) & growth factors
- **Blood cell formation** in bone marrow
- **Triglyceride (fat) storage**

Classification of Bones

1. Long bones
   - Longer than they are wide (eg. femur, metacarpels)
1. Short bones
   - Cube-shaped bones (eg. wrist and ankle)
   - Sesamoid bones (within tendons – eg. patella)
1. Flat bones
   - Thin, flat, slightly curved (eg. sternum, skull)
1. Irregular bones
   - Complicated shapes (eg. vertebrae, hips)

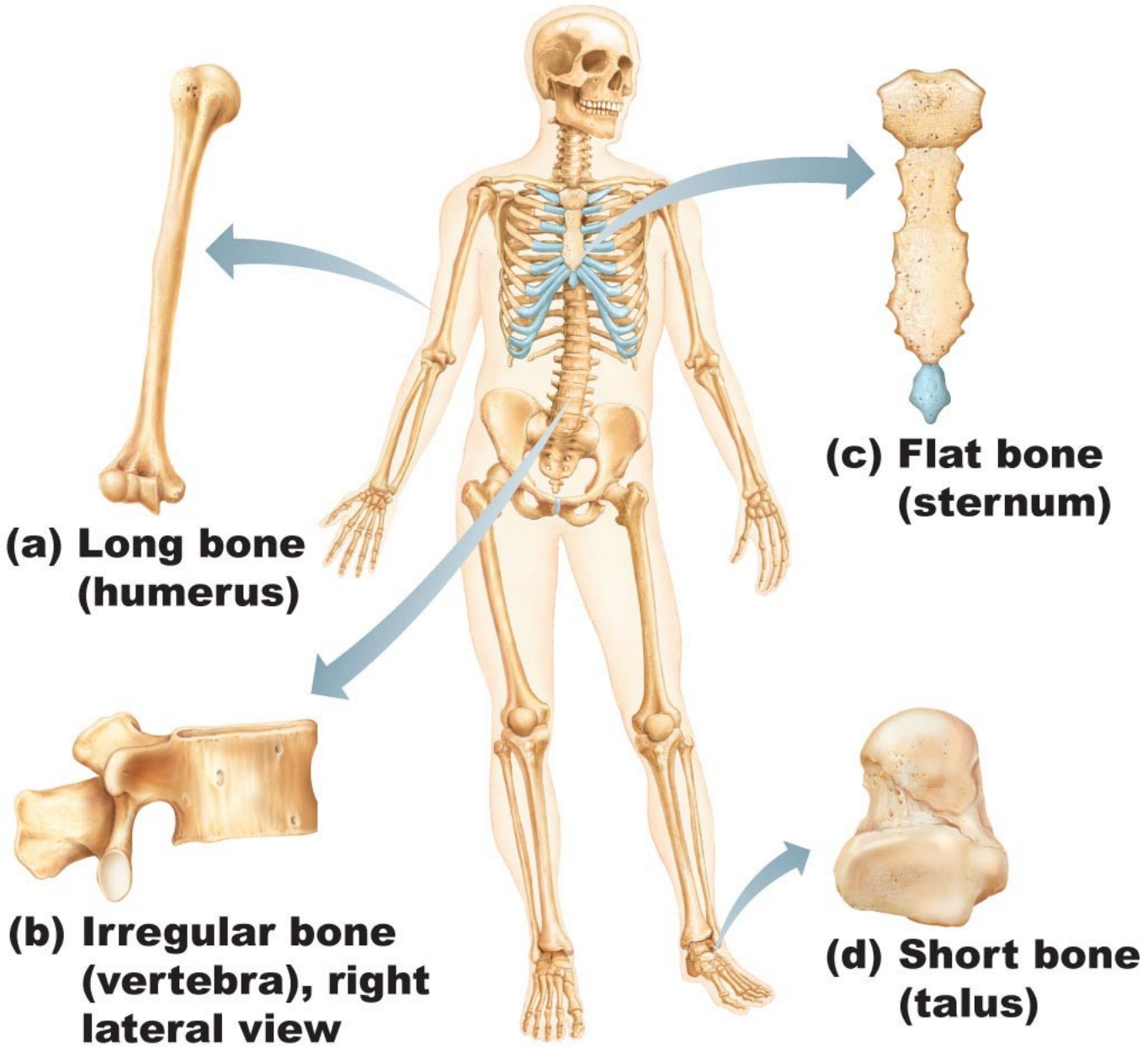
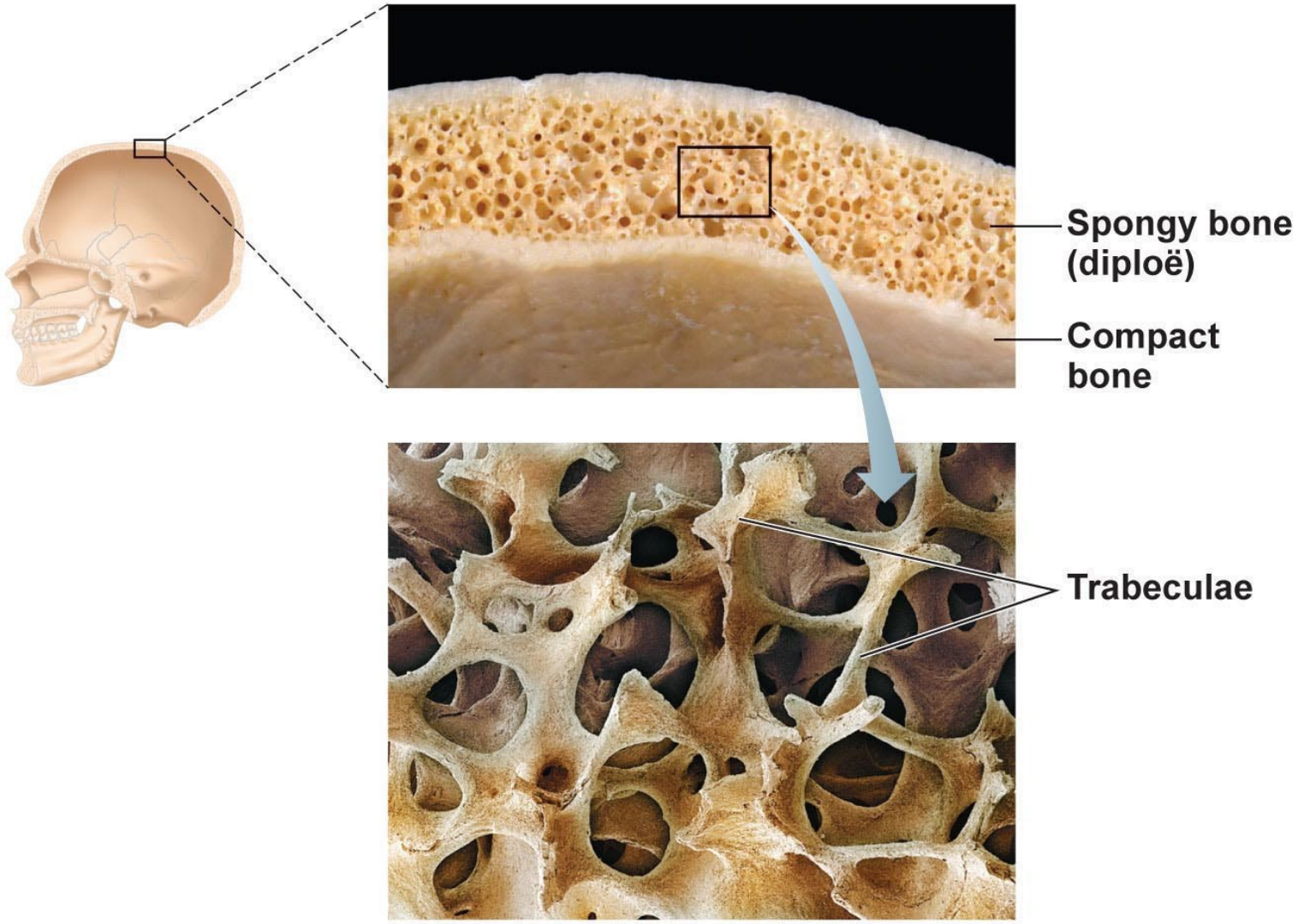


Figure 6.2

- Adult = 206 bones
- Types of bone tissue:
  - Compact bone: outer layer – dense & solid
  - Spongy bone: inner layer - open spaces, marrow
- Features:
  - Very hard (calcium salts)
  - Light weight
  - Ability to resist tension and forces (collagen fibers)

Spongy vs. Compact Bone



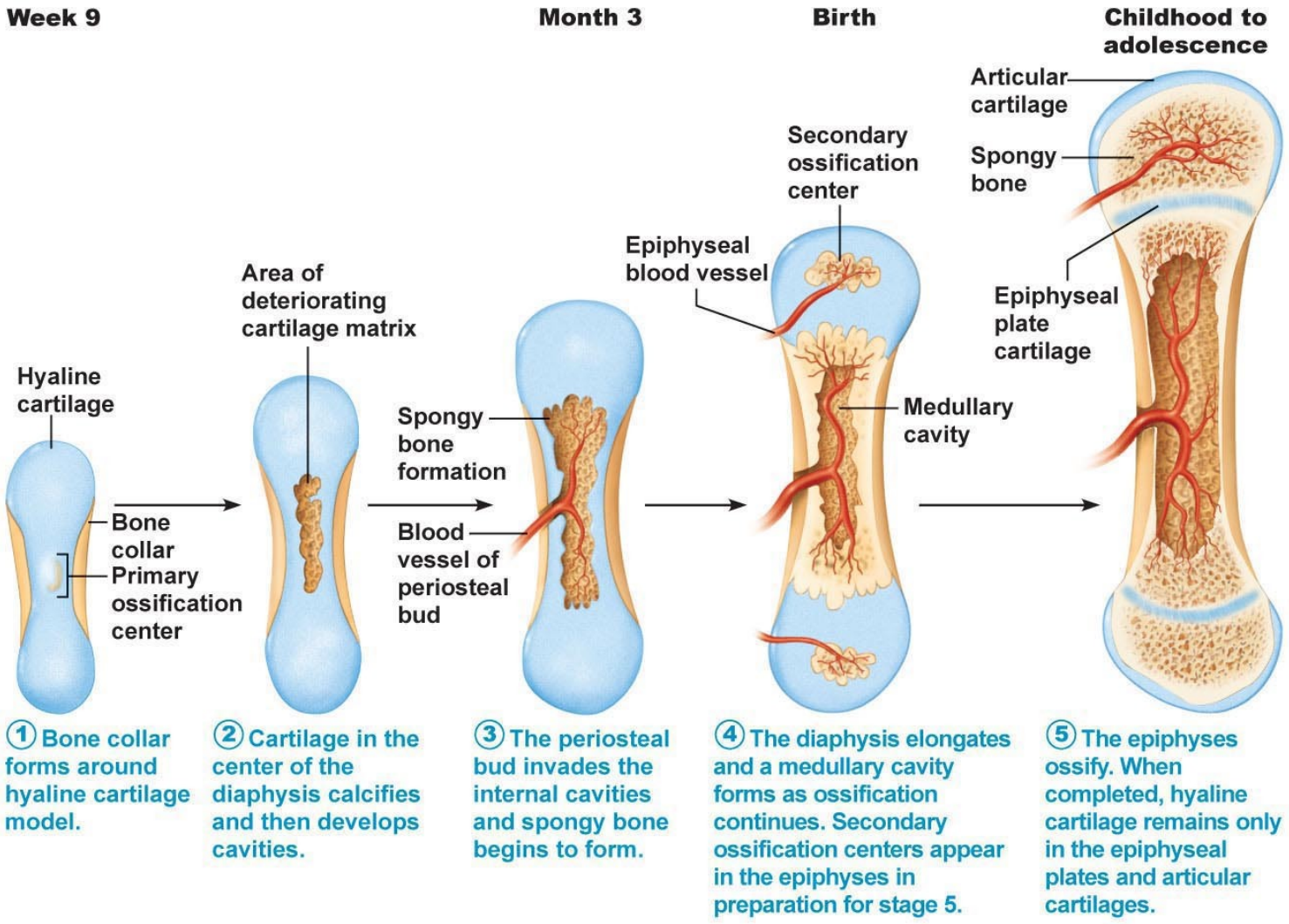
Bone Development

- Osteogenesis (ossification): bone tissue formation

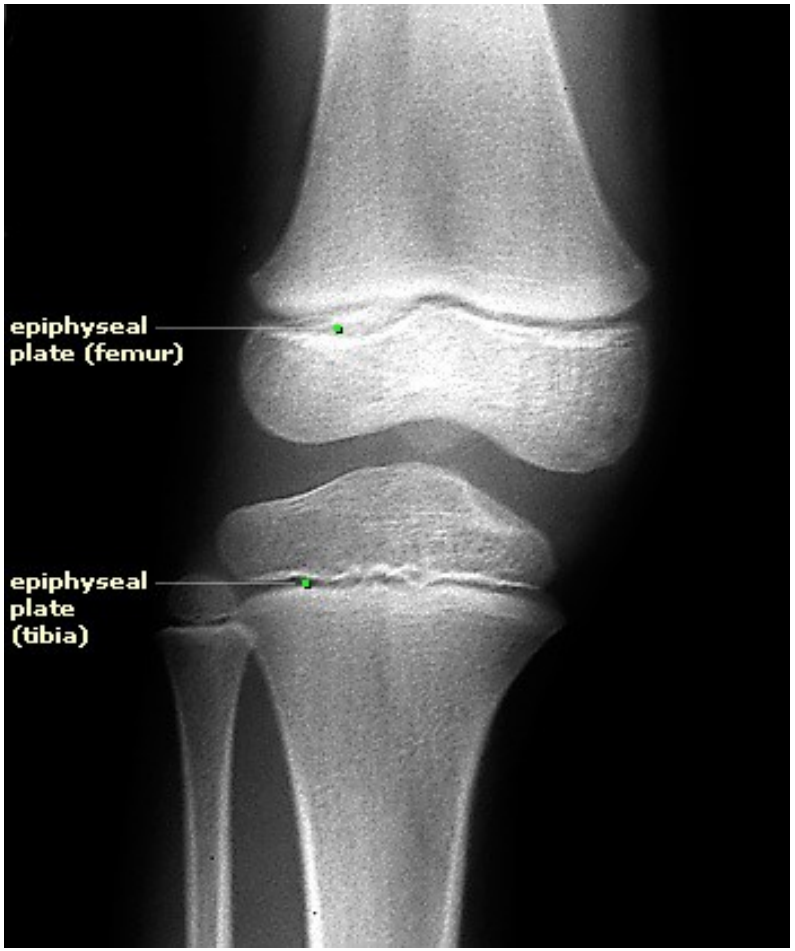
Stages:

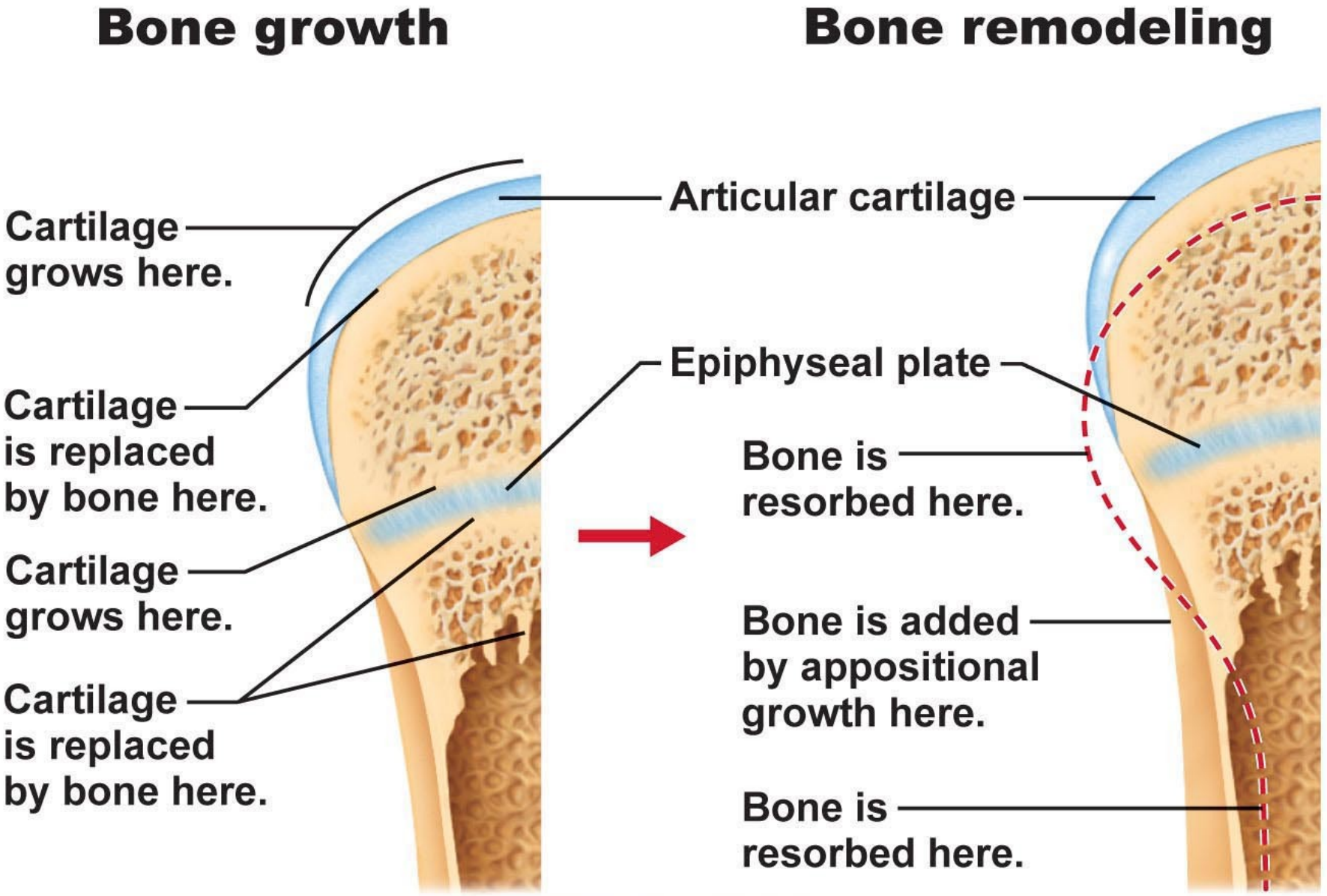
- Begins at 8 weeks gestation
  - Start as **cartilage** → replaced by **bone**
- Post-natal bone growth → early adulthood
  - Epiphyseal plates: (growth plates) regions where long bones lengthen
  - Appositional growth: bones increase in thickness
- Bone modeling and repair – lifelong

Formation of bony skeleton

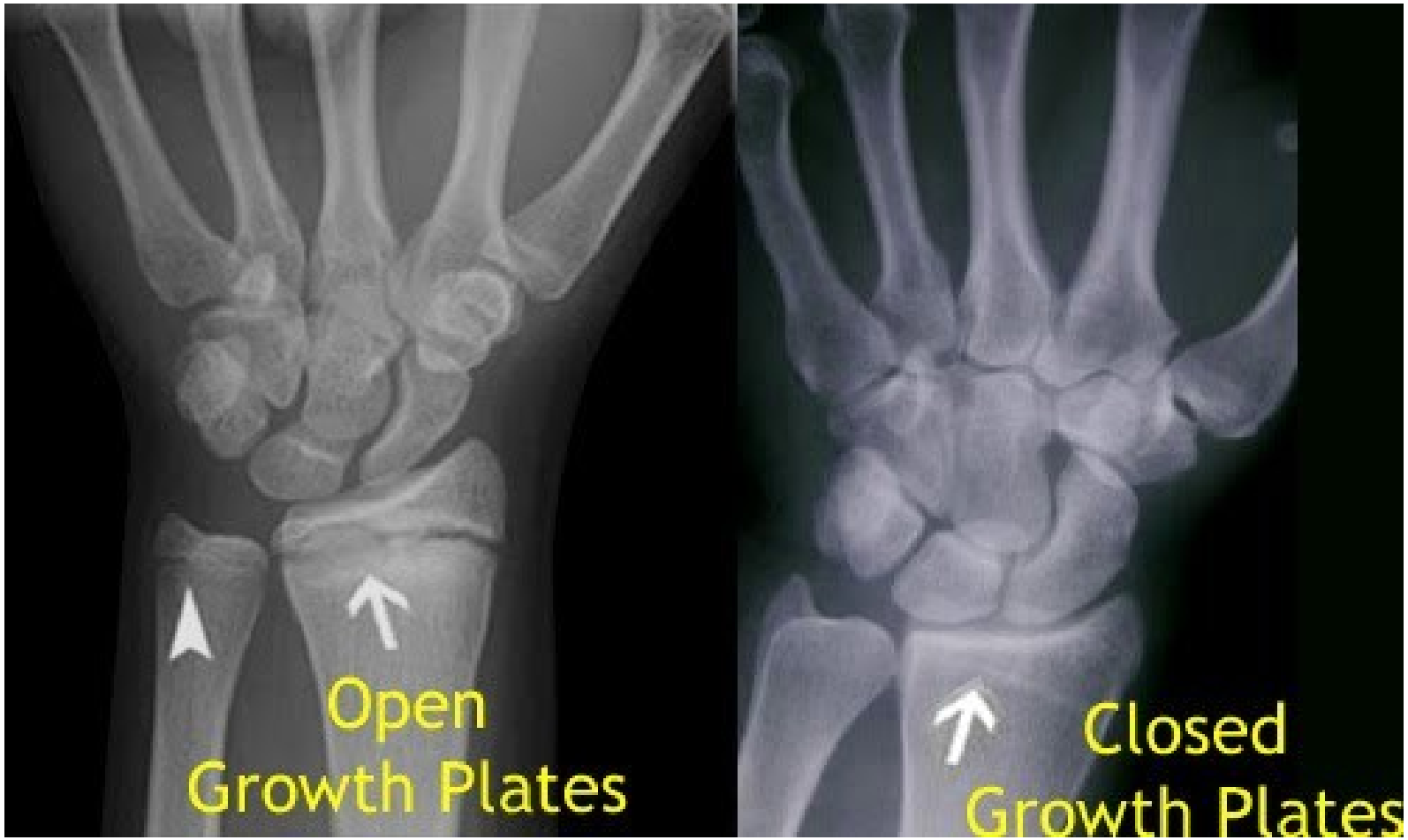


Epiphyseal plates





Epiphyseal plates

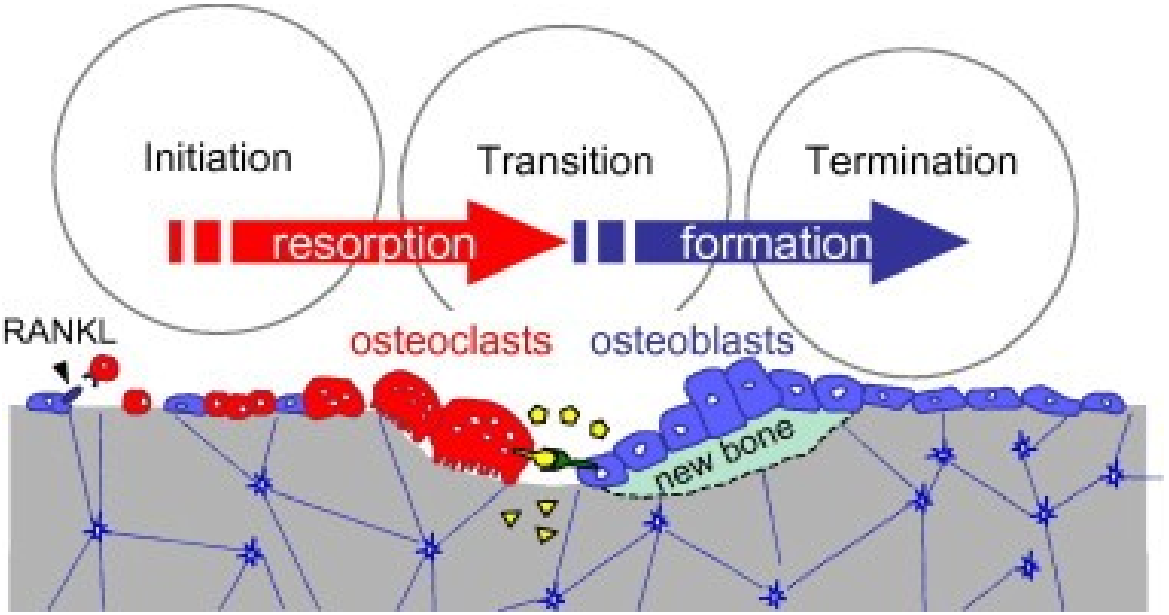


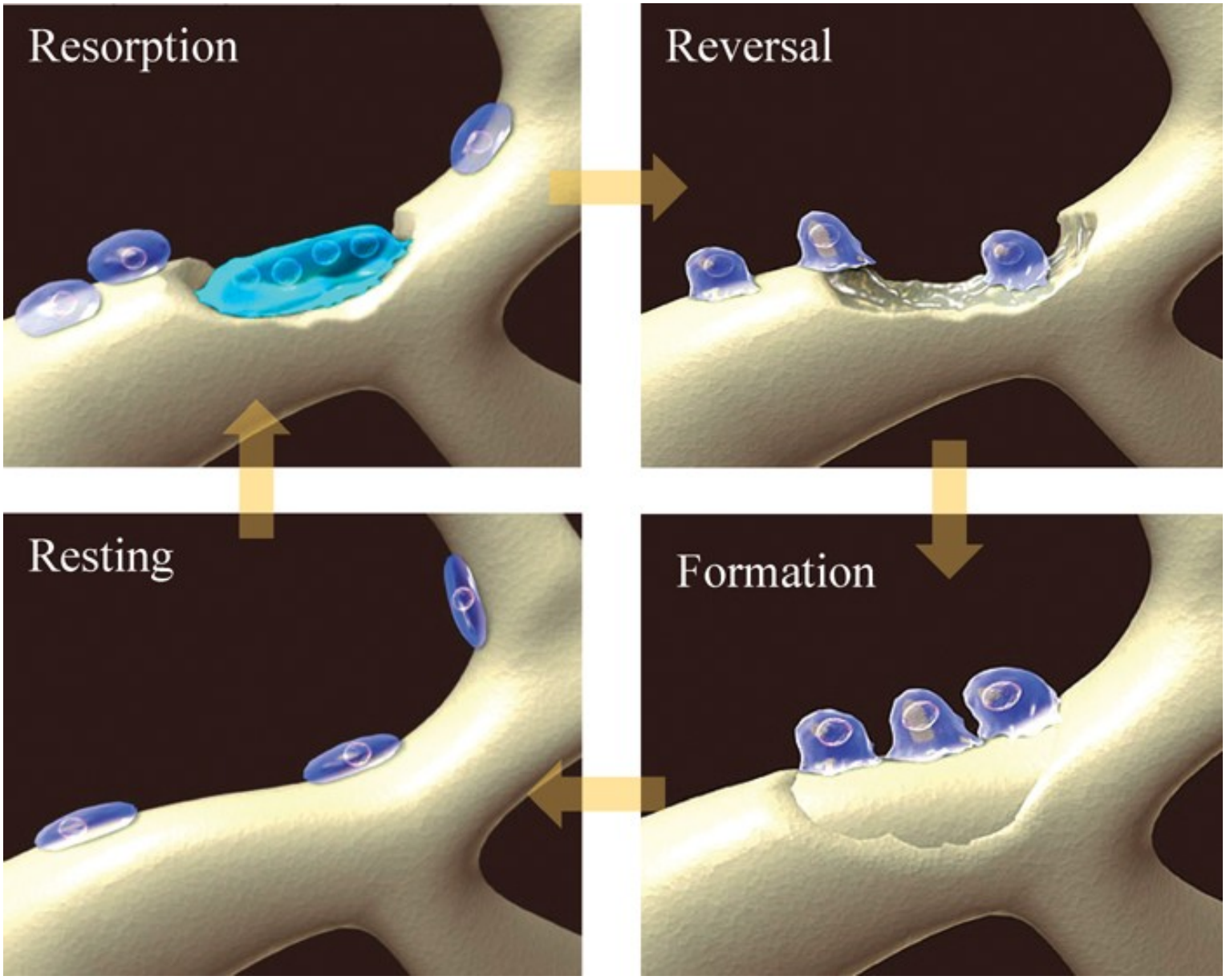
Hormonal Control

- Growth hormones: stimulate longitudinal bone growth
- Thyroid hormone: control activity of growth hormone
- Testosterone & estrogens (at puberty):
  - Adolescent growth spurt
  - Close epiphyseal plates → end growth

Bone Cells

- Osteoblasts: bone-forming cells
- Osteocytes: mature bone cell (doesn't divide)
- Osteoclasts: dissolve/break down bone (*bone resorption*)




Resorption
Reversal
Resting
Formation

Fractures (Breaks)

Classified by:

1. Position of bone – nondisplaced (normal) or displaced (bone out of alignment)
2. Completeness of break – complete (broken through) or incomplete
3. Orientation to long axis of bone – linear (parallel to bone) or transverse (perpendicular to bone)
4. If bone penetrates skin – open (compound) fracture or closed (simple) fracture

TABLE 6.2 Common Types of Fractures

FRACTURE TYPE	DESCRIPTION AND COMMENTS	FRACTURE TYPE	DESCRIPTION AND COMMENTS
Comminuted	Bone fragments into three or more pieces. Particularly common in the aged, whose bones are more brittle	**Compression**	Bone is crushed. Common in porous bones (i.e., osteoporotic bones) subjected to extreme trauma, as in a fall

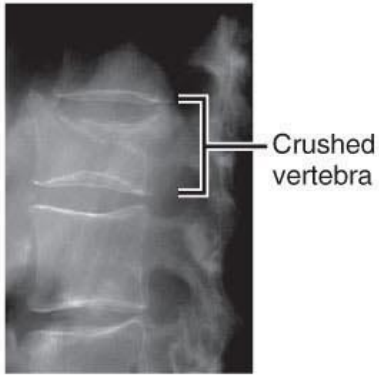


TABLE 6.2 Common Types of Fractures

FRACTURE TYPE	DESCRIPTION AND COMMENTS	FRACTURE TYPE	DESCRIPTION AND COMMENTS
Spiral	Ragged break occurs when excessive twisting forces are applied to a bone. Common sports fracture	**Epiphyseal**	Epiphysis separates from the diaphysis along the epiphyseal plate. Tends to occur where cartilage cells are dying and calcification of the matrix is occurring

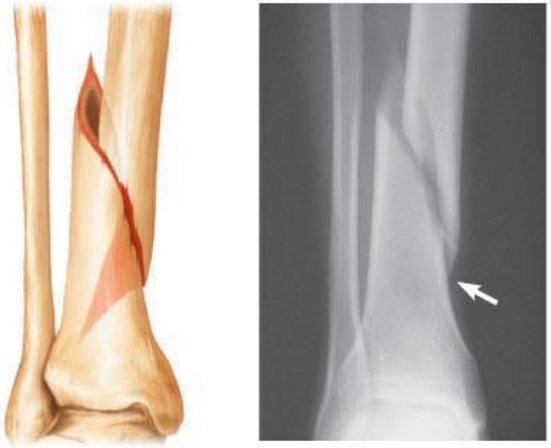
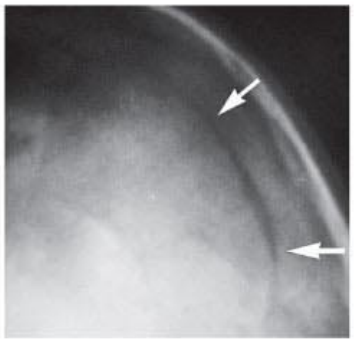


TABLE 6.2 Common Types of Fractures

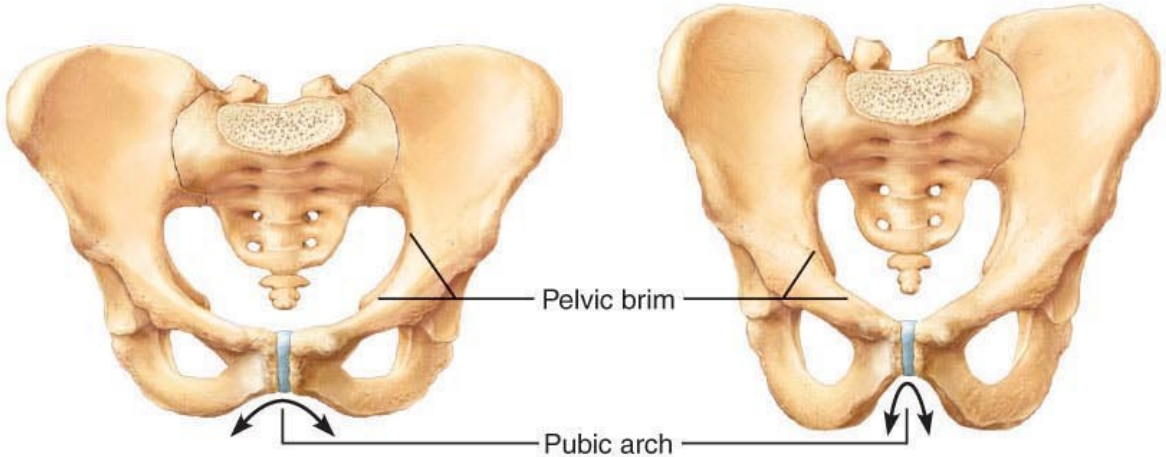
FRACTURE TYPE	DESCRIPTION AND COMMENTS	FRACTURE TYPE	DESCRIPTION AND COMMENTS
Depressed	Broken bone portion is pressed inward. Typical of skull fracture	**Greenstick**	Bone breaks incompletely, much in the way a green twig breaks. Only one side of the shaft breaks; the other side bends. Common in children, whose bones have relatively more organic matrix and are more flexible than those of adults



Male vs. Female Bone Structure

TABLE 7.4 Comparison of the Male and Female Pelves

CHARACTERISTIC	FEMALE	MALE
General structure and functional modifications	Tilted forward; adapted for childbearing; true pelvis defines the birth canal; cavity of the true pelvis is broad, shallow, and has a greater capacity	Tilted less far forward; adapted for support of a male's heavier build and stronger muscles; cavity of the true pelvis is narrow and deep
Bone thickness	Less; bones lighter, thinner, and smoother	Greater; bones heavier and thicker, and markings are more prominent
Acetabula	Smaller; farther apart	Larger; closer
Pubic angle/arch	Broader (80° to 90°); more rounded	Angle is more acute (50° to 60°)
Anterior view		



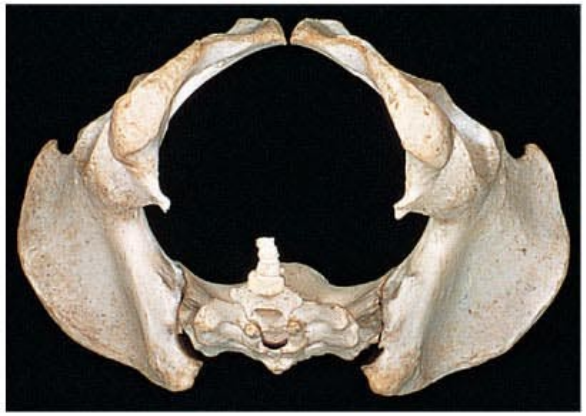
Male vs. Female Bone Structure

TABLE 7.4 Comparison of the Male and Female Pelves *(continued)*

CHARACTERISTIC	FEMALE	MALE
Sacrum	Wider; shorter; sacral curvature is accentuated	Narrow; longer; sacral promontory more ventral
Coccyx	More movable; straighter	Less movable; curves ventrally
Greater sciatic notch	Wide and shallow	Narrow and deep
Left lateral view		

Male vs. Female Bone Structure

TABLE 7.4 Comparison of the Male and Female Pelves *(continued)*

CHARACTERISTIC	FEMALE	MALE
Pelvic inlet (brim)	Wider; oval from side to side	Narrow; basically heart shaped
Pelvic outlet	Wider; ischial tuberosities shorter, farther apart and everted	Narrower; ischial tuberosities longer, sharper, and point more medially
Posteroinferior view		

Bone Structure: *Gender Differences*

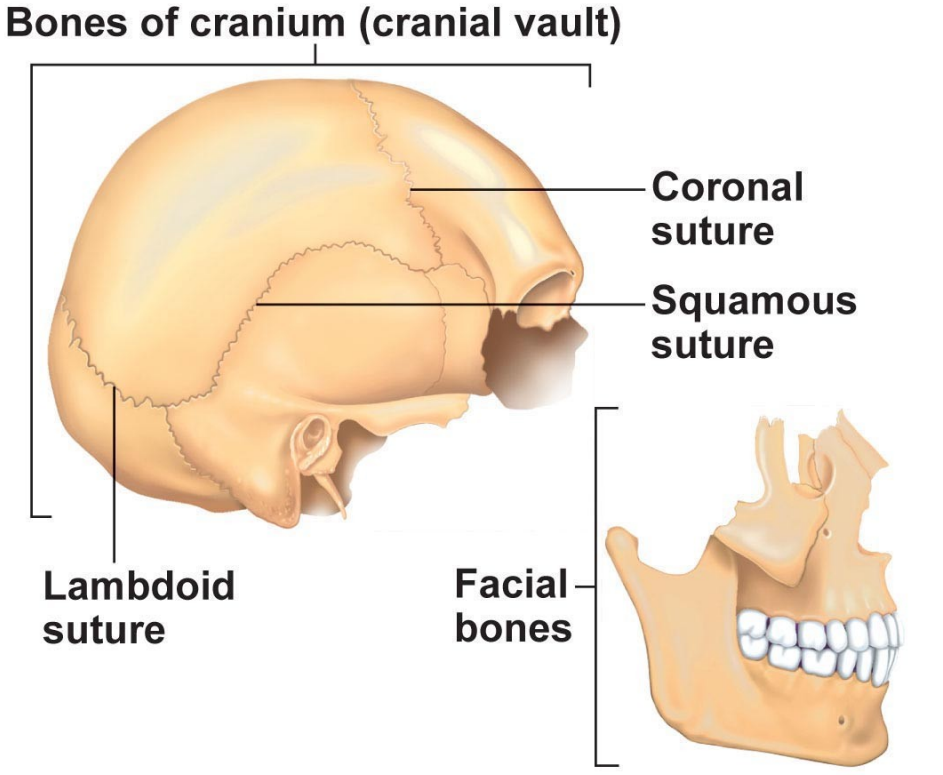
- **Male Skull**
  - Larger and heavier
  - Forehead shorter
  - Face less round
  - Jaw larger
  - Mastoid processes more prominent
- **Male pelvic bones**
  - Heavier and thicker
  - Obturator foramen and acetabula are larger and closer together

Bone Structure: *Gender Differences*

- **Male pelvic cavity**
  - Narrower and longer
  - Less roomy and more funnel shaped
- **Male sacrum**
  - Narrower
  - Sacral promontory projects forward
  - Sacral curvature is less sharp posteriorly
- **Male coccyx**
  - Less movable

The Skull

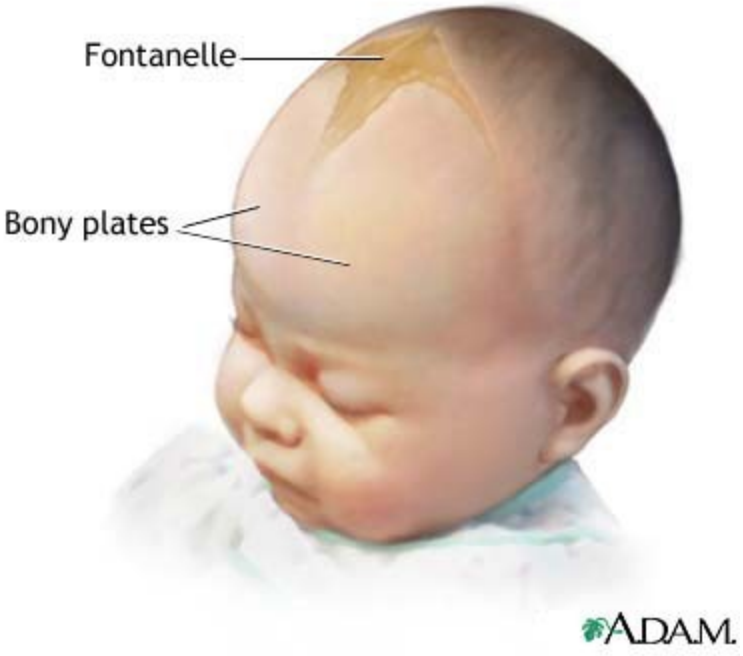
- **2 bone types:**
  - **Cranial** – form the top, sides, and back of the skull
  - **Facial** – form the face

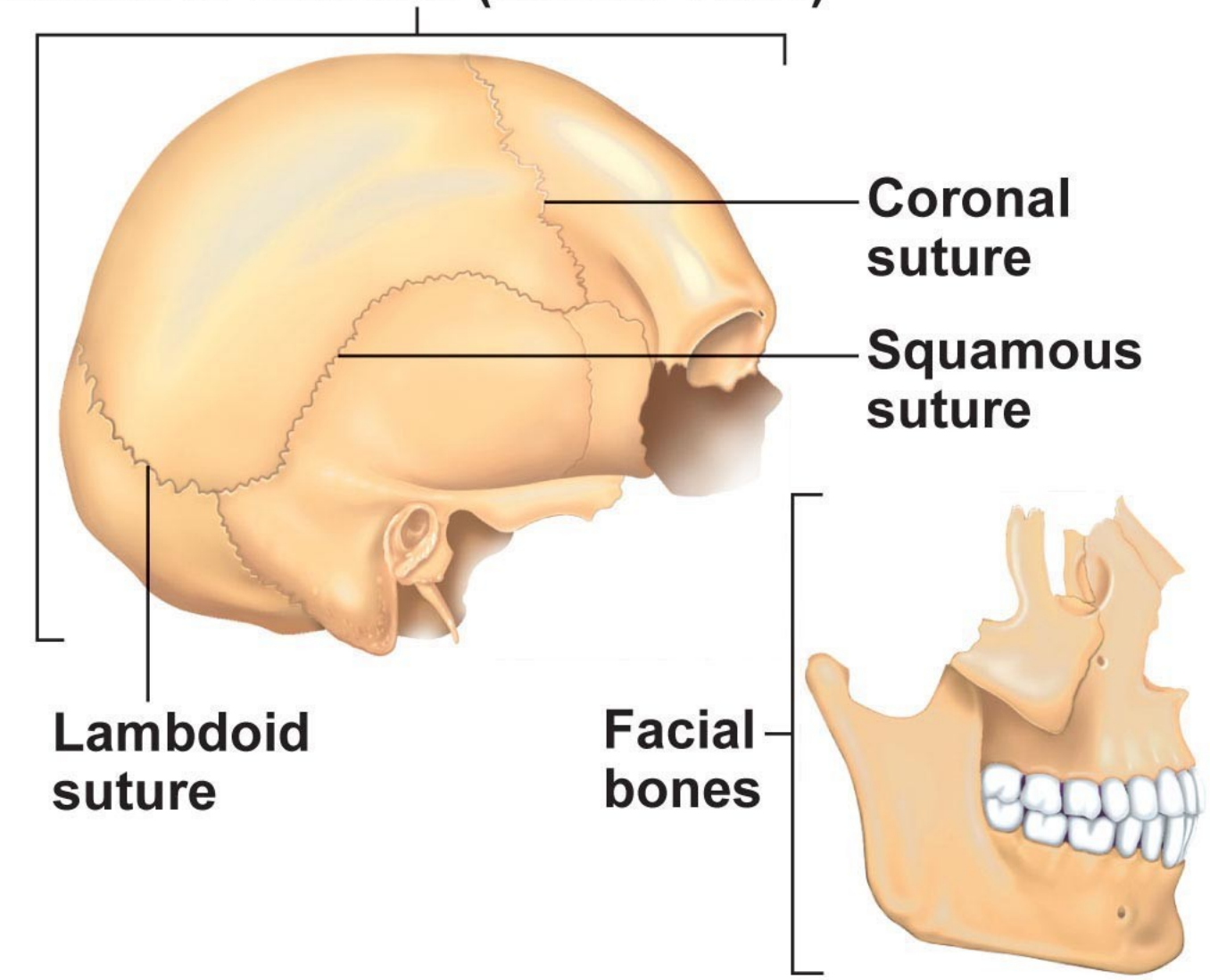


(a) Cranial and facial divisions of the skull

"Soft spots" felt on an infant's skull are actually ***fontanelles***

- Fibrous connective tissue that connect the incompletely developed flat bones





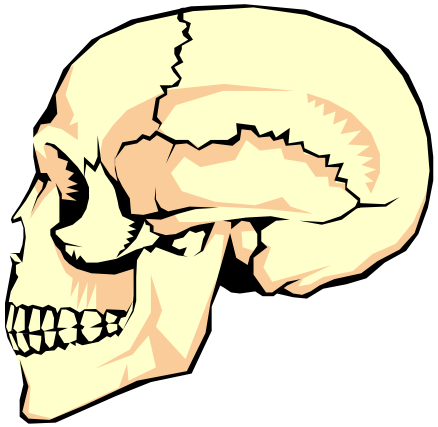
(a) Cranial and facial divisions of the skull

The Skull: *Cranial Bones*

- Frontal – anterior
- Parietal – top and most of the sides
- Occipital – back
- Temporal – form the lower sides of the skull
- Sphenoid and ethmoid bones – floor
- Ear ossicles are the smallest bones of the body
  - Malleus
  - Incus
  - Stapes

The Skull (cont.)

- Mandible – forms the lower jaw bone
- Maxillae – form the upper jawbone
- Zygomatic – form the prominence of the cheeks
- Nasal bones – fuse together to form the bridge of the nose
- Palatine – form the anterior portion of the palate
- Vomer – a thin bone that divides the nasal cavity



The Spinal Column

- 7 Cervical vertebrae
- 12 Thoracic vertebrae
- 5 Lumbar vertebrae
- Sacrum
- Coccyx

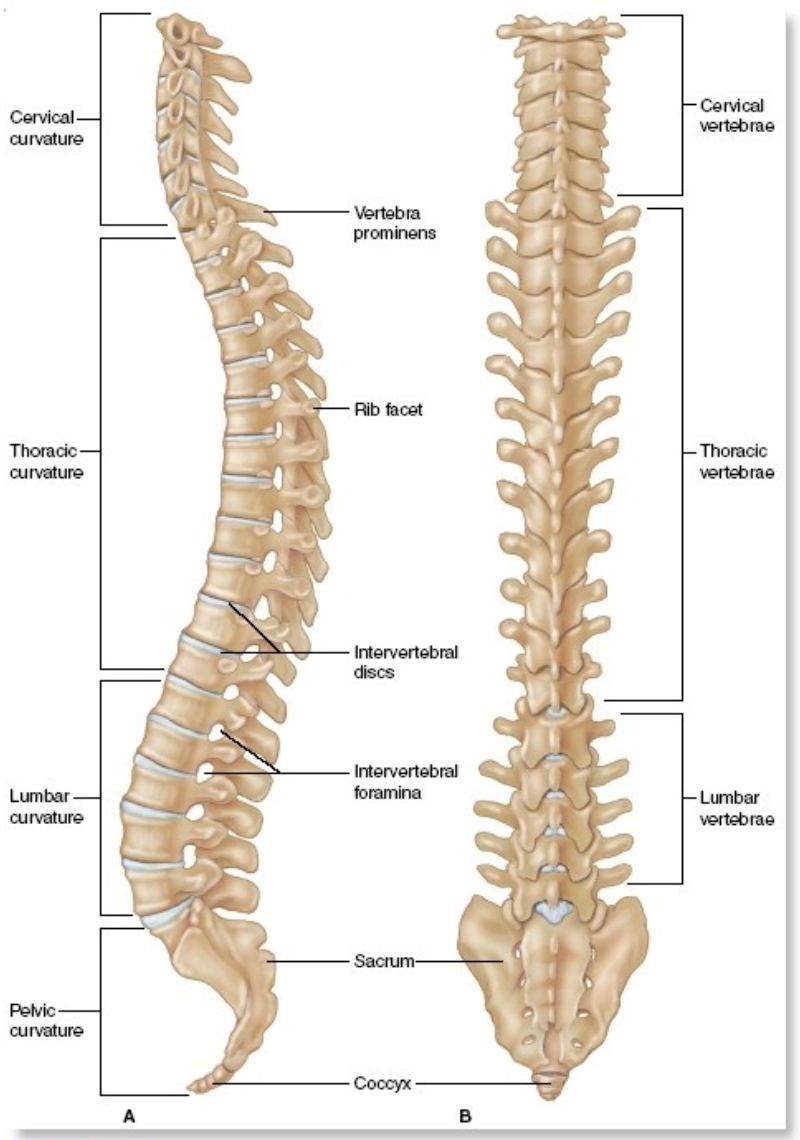


Figure 25-7. Vertebral column: (a) lateral view and (b) posterior view.

The Spinal Column (cont.)

- **Cervical vertebrae**
  - Smallest and lightest
  - Located in the neck region
  - C1 = Atlas
  - C2 = Axis

- **Thoracic vertebrae**
  - Join the 12 pairs of ribs

- **Lumbar vertebrae**
  - Have very sturdy structures
  - Weight-bearing

The Spinal Column (cont.)

- **Sacrum**
  - Triangular-shaped bone → 5 fused vertebrae
- **Coccyx**
  - Small, triangular bone → 3-5 fused vertebrae
  - Considered unnecessary
  - Also called the tailbone

Apply Your Knowledge

ANSWER:

Identify the sections of the spinal column and give the number of vertebrae for each.

Cervical – 7

Thoracic – 12

Lumbar – 5

Coccyx – 3 to 5 fused

Sacrum – 5 fused

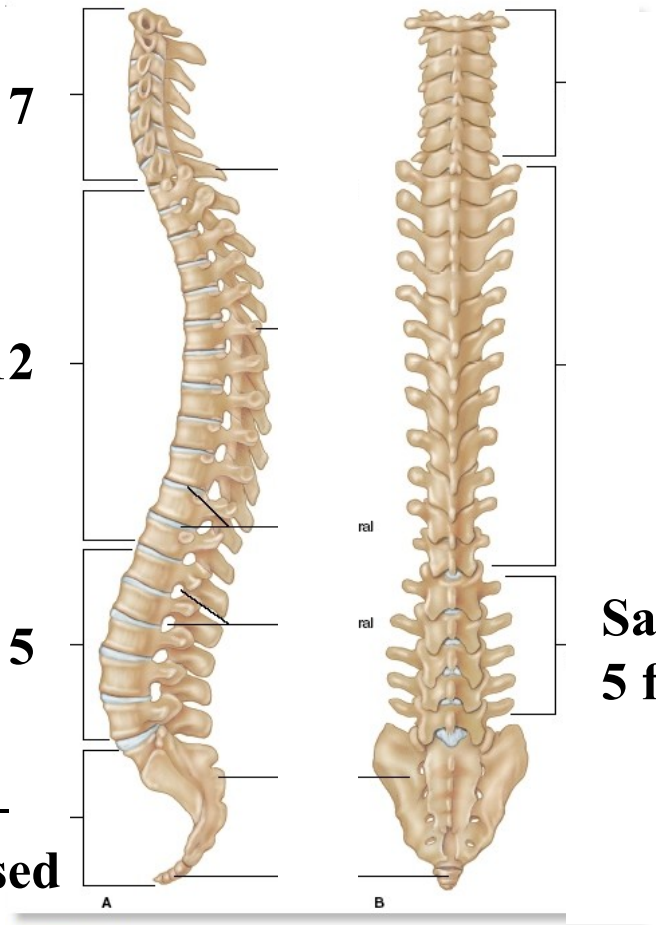


Figure 25-7. Vertebral column: (a) lateral view and (b) posterior view.

Right!

The Rib Cage

- ***Sternum***
  - Breastplate
  - Forms the front middle portion of the rib cage
  - Joins with the clavicles and most ribs
- ***Xyphoid process***
  - Cartilage tip in youth
  - Ossified by age 40

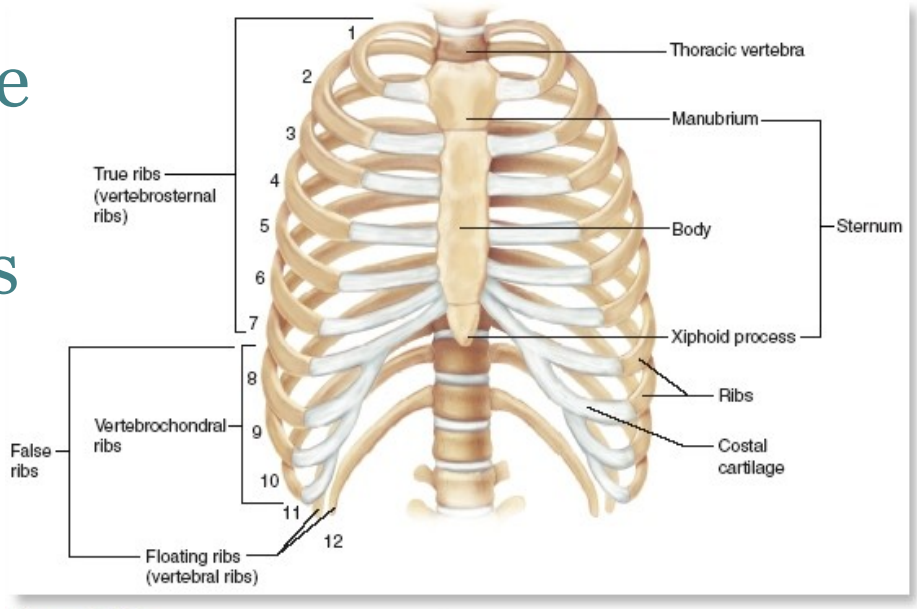
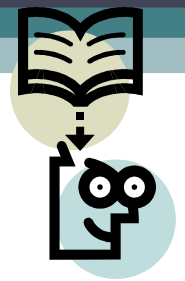


Figure 25-8. Rib cage.

The Rib Cage (cont.)

- **12 pairs of ribs**
  - All are attached posteriorly to thoracic vertebrae
- **True**
  - First 7 pairs of ribs
  - Attach to sternum by ***costal*** cartilage
- **False**
  - Rib pairs 8-10
  - Attach to the costal cartilage of rib pair 7
- **Floating**
  - Rib pairs 11-12
  - Do not attach anteriorly to any structure

Apply Your Knowledge



ANSWER:

True or False:

T The sternum forms the front middle portion of the rib cage.

F The xyphoid process is a ~~boney~~ tip of the sternum. **cartilaginous**

F The true ribs are the first ~~five~~ pairs of ribs. **seven**

T False ribs attach to the costal cartilage of rib pair seven.

F Floating ribs ~~attach to the xyphoid process.~~ **do not attach anteriorly to any structure.**

Common Diseases and Disorders

- ***Arthritis*** – general term meaning joint inflammation
- ***Osteoarthritis*** – degenerative joint disease, primarily of weight-bearing joints
- ***Rheumatoid Arthritis*** – chronic systemic inflammatory disease of smaller joints and surrounding tissues

Common Diseases and Disorders

- ***Bursitis*** – inflammation of a bursa (fluid-filled sac that cushions tendons)
- ***Carpal Tunnel Syndrome*** – overuse of wrist; the median nerve in the wrist becomes compressed
- ***Ewing's Family of Tumors (EFT)*** – a group of tumors that affect different tissue types; primarily bone
- ***Gout*** – a type of arthritis; deposits of uric acid crystals in the joints

Common Diseases and Disorders

- ***Kyphosis*** – abnormal curvature of the spine (humpback)
- ***Lordosis*** – exaggerated inward curvature of the lumbar spine (swayback)
- ***Osteogenesis imperfecta*** – brittle-bone disease
- ***Osteoporosis*** – a condition in which bones thin (become porous) over time

Common Diseases and Disorders

- ***Osteosarcoma*** – a type of bone cancer that originates from osteoblasts, the cells that make bony tissue

- ***Paget's disease*** – causes bones to enlarge and become deformed and weak

- ***Scoliosis*** – an abnormal S-shaped curvature of the spine