

## Anatomical terms

Standard anatomical position=initial reference point

1. **Axial part** =head, neck& trunk
2. **Appendicular part** =appendages or limbs

### Body planes & Sections

1. **Sagittal plane**: divides into Right/Left  
Midsagittal=Median runs the midline/divide 2 halves  
Parasagittal: parallel to the sagittal plane
2. **Frontal plane(coronal)**: divides into Anterior/Posterior (front/back)
3. **Transverse/horizontal plane**: divides into Superior/Inferior (up/down)  
Oblique section: divide Diagonal [rare]

**Diaphragm** divides the two cavities

The weakest protection point is the abdominal pelvic cavity

1. Dorsal body cavity	
Cranial cavity	Skull with brain
Vertebral (spinal) cavity	delicate spinal cord

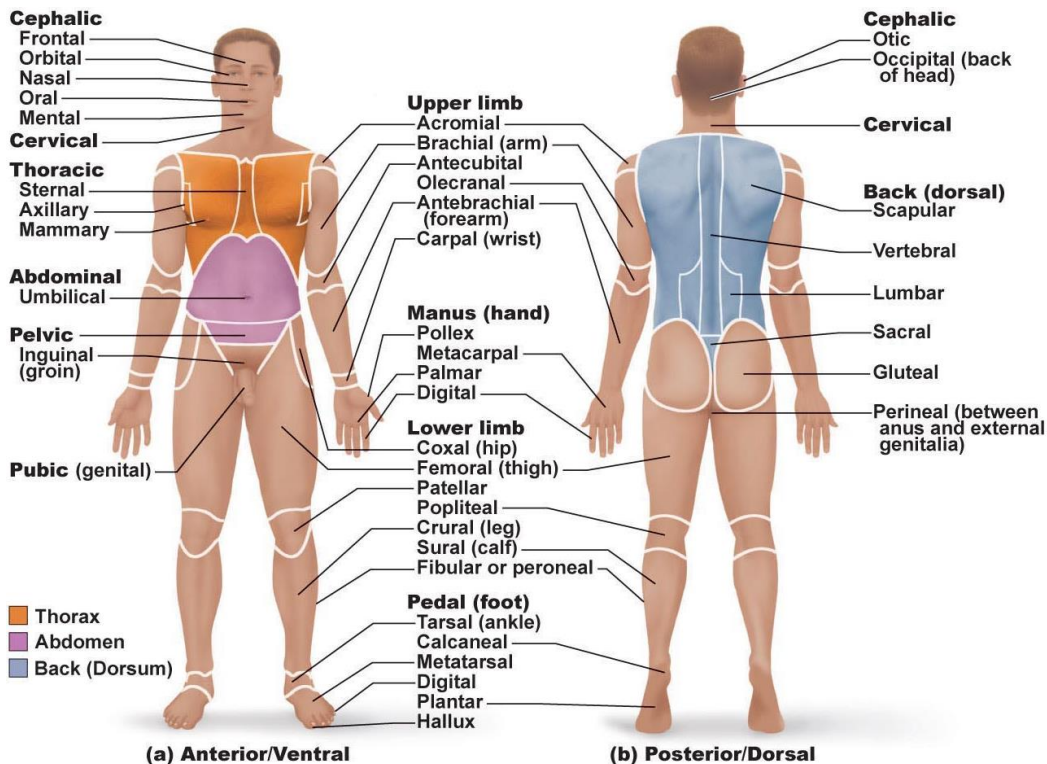
  

2. Ventral body cavity	
Thoracic cavity	2 pleural cavities+ central pericardial cavity
Abdominopelvic cavity	<u>Superior abdominal cavity</u> -(Liver, Stomach, intestines, spleen) <u>Inferior pelvic cavity</u> -(Bladder, Reproductive organs, Rectum)

Abdominopelvic Quadrants	
R. Upper quadrant	L upper quadrant
R. Lower quadrant	L. Lower quadrant

### Abdominopelvic regions

R Hypochondriac region	Epigastric region	LHypochondriac region
R Lumbar region	Umbilical region	L Lumbar region
R Iliac region	Hypogastric region	L Iliac region



<b>Superior</b> : Up
<b>Inferior</b> : Down
<b>Anterior</b> : Front
<b>Posterior</b> : Back, Behind
<b>Medial</b> : Toward midline, inner side
<b>Lateral</b> : Away from midline, outer side
<b>Intermediate</b> : Between medial lateral
<b>Proximal</b> : Close to the point of attachment
<b>Distal</b> : Far from the point of attachment
<b>Superficial</b> : Toward the surface
<b>Deep</b> : Away from the surface

## Integumentary system = skin

**Structure: epidermis dermis**

### **Epidermal cells**

1. **Keratinocytes:** The outermost layer of the skin, holds the epidermis
2. **Melanocytes:** Produces melanin in deepest layer of dermis
3. **Dendritic cells:** Protect skin from any foreign organisms that can enter the body, located in the middle of the body
4. **Tactile cells:** How the touch receptor with sensory nerve ending

### **4 Main epidermal layers Thin Skin**

**Stratum corneum:** Outermost layers that has large amount of multiple layers of dead cells

**Stratum lucidum:** only on joints where skin are **only found in thick skin**

**Stratum granulosum:**

**Stratum spinosum**

**Stratum basale:** Innermost layer

**DERMIS:** strong, flexible connective tissue layer have fibroblasts, macrophages, and mast cells

**Thick skin:** involves main 2 layers

**Papillary layer:** Allows tight fit between thick/thin layers with bumpy layer

**Dermal papillae:** Upper part of the bumpy layer of papillary layer, have capillaries/nerve endings for touch/pain

**Dermal ridges:** gives friction ridges for skin to be tight and holds the epidermis in place.

**Reticular layer:** Deeper thick layer of dermis(Dense irregular CT) has the cleavage(tension)lines that gives

Involves collagen giving strength/hydration and elastic fibers giving stretch/recoil

**Stretch mark/striae:** Due to rapid skin increase and stretch pressure

**Blister:** Fluid formed inside the space between epidermis and papillary dermis/reticular dermis -happens by constant rubbing and making lots of friction.

**Flexure lines:** tight epithelium connects with bones and allow bending of the joints and etc

**Hypodermis:** added layer that has areolar CT, Blood vessels/adipose tissues

Involves anchors skin that allows the sliding/cushioning/holding movement of skin and stores fat

### **Three main pigments**

1. **Melanin:** only pigment made in skin gives variety of different colours that depends on by type/amounts + keratinocyte
2. Carotene: changing colour depending on the pigments found in plant products
3. Hemoglobin: From capillary circulation that gives skin pinkish colour

**Cyanosis:** turning bluish colour by lack of oxygen rich blood circulating the body

## Hairs & follicles

**Functions of hair:** senses anything that touches a tip of hair before touching the skin, cushioning body, protect from

small particles entering body parts, prevent heat loss

Hard keratin protein: gives much stronger hair, protecting epithelial cells from damage or stress that has potential to kill the cell

### Hair Structure:

**Shaft:** part where hair is exposed out of skin 3 layers

**Root:** within hair follicle, under skin

**Bulb:** deep end of follicle, has papilla+ root hair plexus

**Follicle:** outer CT that surrounds hair, hair matrix

**Arrector pili muscle:** contracts to pull hair up and generate heat, also making goosebumps

**Sebaceous gland:** secrete the oily substance sebum- waterproofs and lubricates the skin/hair

+ protect skin from bacteria, give slow water loss

### **3 layers of Shaft**

- **Medulla:** large cells separated by air spaces-not in fine thin hairs, only in thick hairs

- **Cortex:** Several layers of flat keratinocytes-contain pigment

- **Cuticle:** Single layer of overlapping cells

- **Split ends** is dead end hairs

- Hair turning **white/grey** due to loss of pigment melanin and instead there is a hair follicle's space filled with air

### Hair Thinning/Baldness

**Vellus hair:** finer hair with no medulla vs **terminal hair:** thicker body hairs

-hair growth depends on hormones, nutrition      hirsutism: unusual excessive hair for women

**Growth cycles:** each hair follicles have Active growth phase -> regressive/resting phase

eg. Head hair has longer cycles than eyebrows

**Alopecia:** Patches/spots baldness

**Male pattern baldness:** baldness due to testosterone constantly changing DHT

-Loss of active growth phase genetic problem

**Nails:** modified epidermis that is protective and helpful tool

**Lunula:** inner white crescent part of nail

**Free edge:** Ends part of nail

**Nail Body:** exposed part of the nail distal to the root

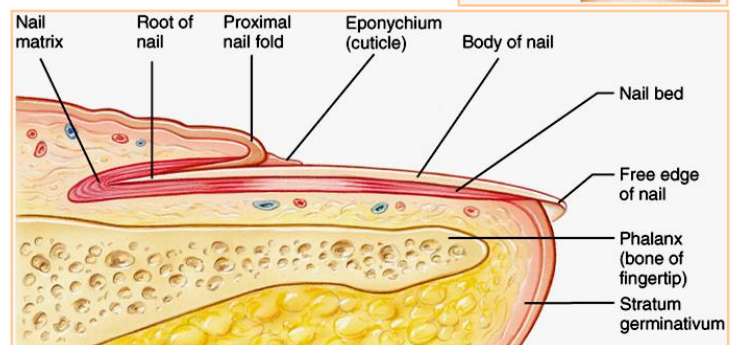
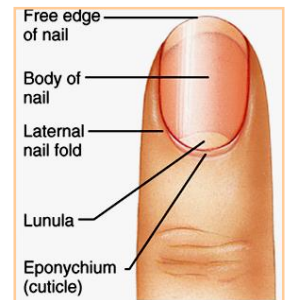
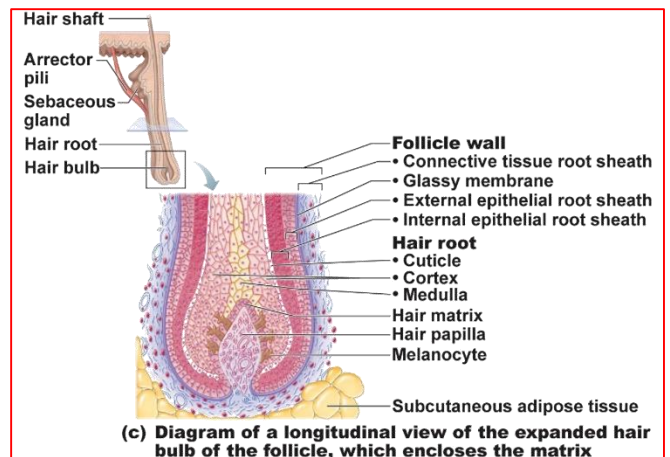
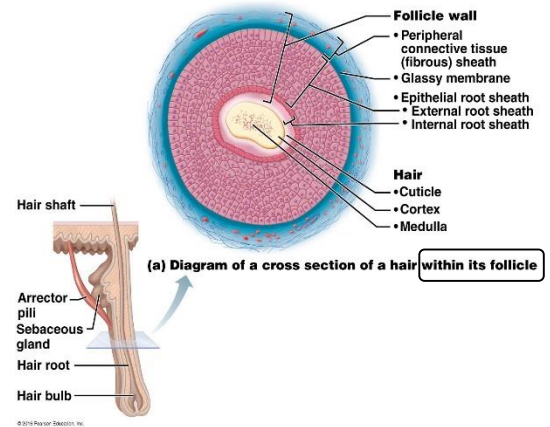
**Nail folds:** end part of skin on top of nail

**Hyponychium:** under distal part of finger nail

### **Health Status from Nail**

-Yellow-tinged: Fungal infection, or fungal infection or a serious respiratory or thyroid gland disorder

-Thickening: Fungal infection



-Spoon nail: possible iron deficiency

-Horizontal lines: malnutrition; irregular stoppage of matrix growth

**Sweat Glands(Sudoriferous glands)**: located mostly all over skin surface giving Na<sup>+</sup>, H<sub>2</sub>O, urine-waste product

-Giving sweat fluid secretion by the control of **SNS** eg. From stress

i)**Merocrine**: common simple coiled tubular glands with pore at surface

ii)**Apocrine**: larger glands with ducts links to hair follicles, have fatty substances & some proteins which is odourless until when bacteria is present

**Modified sweat glands**: **Ceruminous(cerumen)** – secrete ear wax, **mammary** – secrete milk

## Major Function of Skin

1. **Protection**: 3 barriers-chemical: acidic skin; sweat, physical: barrier from injury & bacterial invasion + waterproof, biological: langerhans cells of epidermis and macrophages in dermis
2. **Body temperature**: sweating vasoconstriction
3. **Cutaneous sensation**: know the texture, temperature, pain by sensory receptor etc
4. **Metabolic**: vitamin D, carcinogens
5. **Blood reservoir**: skin blood vessels stores some blood
6. **Excretion**: nitrogenous acid waste excreted as sweat

## Burns –heat, electricity, radiation, chemicals

First concern: dehydration Second concern: Infection into deeper layer

1<sup>st</sup> degree: only epidermis

2<sup>st</sup> degree: epidermis & upper dermis

3<sup>rd</sup> degree: entire thickness of skin all of dermis

-repair by skin graft etc, concern of rejection

Rule of nines: information on show much body surface area has been burned on a person

## Anatomy of Skeletal System- A. Bone Tissues

**Function of bone:** Support-framework for body support Protect-preventing damage to inner organs, Anchor & move- allows the muscle to hold and move, Mineral & fat storage-holds the mineral from distribution of blood also holds growth factors & fat gives energy to the body if necessary, Blood cell formation-hematopoiesis occurs in red bone marrow, Hormone production-hormone for regulating insulin secretion, glucose homeostasis

- Bone contains calcium, it is resorbed & transferred to bloodstream when need

### Structure of Bony Tissues VS Cartilages

**Cartilage:** has dense CT and bone, giving toughness with flexibility –stronger than CT

-It is avascular-no blood, nerve supply needed

-It is well hydrated

-It has lots of substances ex. GAGs, chondroitin sulfate

-It has collagen fibers giving some elastic fibers

**Perichondrium:** is dense irregular CT that surrounds the cartilage of developing bone

**Chondroblasts:** Immature cartilage cells – developing form

**Chondrocytes:** Mature cartilage cells – developed form

**Lacunae:** (little hole) Clusters of chondrocytes in cartilage for osteocytes

### 3 Types of Cartilages

1. **Hyaline Cartilage:** Most common skeletal cartilage, provides support with flexibility and cushioning

Ex. In ends of long bones

2. **Elastic Cartilage:** Similar to hyaline, but contain more stretchy elastic fibers-lots of flexibility with keeping shape

Ex. In ears

3. **Fibrocartilage:** has strength with absorbance to compressive shock

Ex. In discs of knee joints

**Bone: Calcium salts** –hardness/strength for support + protection

Osteogenic cell (Stem cell) – Osteoblast (Matrix cell) – Osteocyte (mature bone cell) – Osteoclast (bone resorbing cell)

### Calcified tissue

**Compact bone:** dense, thick outer layer

### Microscopic Structure of Compact Bones

- **Osteon System:** structural unit of compact bone

- **Osteon:** long cylinder running parallel to the long axis of bone

- **Lamellae:** tiny group of tubes of bone matrix

-different orientation of collagen fibers for sturdy strength of bones

**Spongy bone** (trabeculae; honeycomb shaped): formed from red bone marrow, inner layer

### Microscopic Structure of Spongy Bones

-have osteocytes & canaliculi arranged along with lamellae

-trabeculae is thin layer arranged along lines of stress; helps bone to resist stress

-there are no **osteons**

-nutrients diffuse by canaliculi from the marrow spaces between trabeculae for osteocytes

### Linings

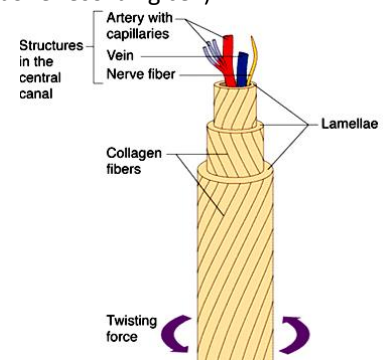
- **Periosteum:** A membrane that surrounds outer surface of bone with fibrous

- **Endosteum:** A membrane that surrounds spongy bone(inner surface) + and give complex canals of compact bone

### Classification of Bones

1. **Long Bones:** Longer than width a shaft with 2 ends – typical eg. Compact bones; joint ends

2. **Short Bones:** Close to cube shape – typical eg. Spongy bone; ankle



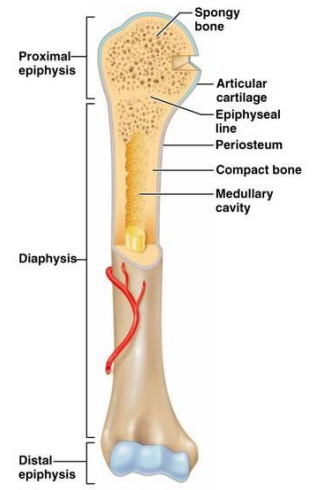
3. **Flat Bones:** Thin, some curvature – typical eg. skull
4. **Irregular Bones:** any other bones with complex shapes

### Structure of Long Bones

- 1) **Diaphysis:** Tubular shaft, central part of a long bone
- 2) **Epiphysis:** End parts of a long bone +grows separately from shaft-bone growth
- 3) **Epiphyseal line:** Between diaphysis and each epiphysis
- 4) **Membranes:** Covers outer & inner surfaces of long bones
  - Periosteum and Endosteum both have osteoblasts & osteoclasts

### Structure of Other Bones

- Similar structures to long bones
  - periosteum/endosteum cover compact/spongy bone
- But no shaft, marrow cavity but there is a bone marrow between spongy bone (trabeculae)



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### 2 Canals

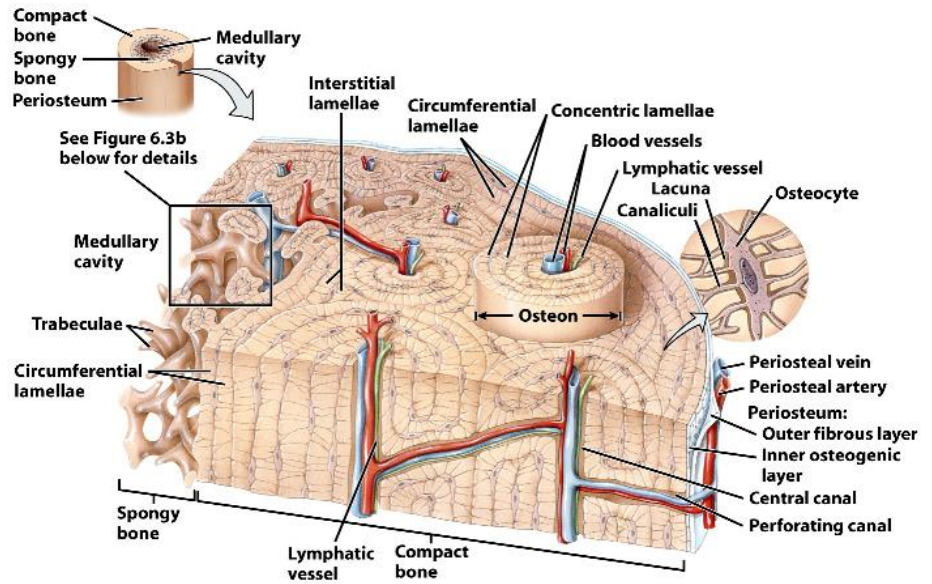
- **Central Canal:** Long axis of bone
- **Perforating Canal:** Perpendicular to long axis of bone

**Osteocytes:** mature bone cells within lacunae

**Canaliculi:** small canals that connects each lacunae + central canal

**Interstitial lamellae:** fill the gaps between forming osteons or left over osteons from bone remodeling

**Circumferential lamellae:** sheets of bone inside periosteum



**Osteons (haversian systems) in compact bone and trabeculae in spongy bone**

### Bone Formation and remodeling

Osteogenesis or ossification

-forming skeleton in embryos, bone growth in childhood, remodeling repair in adulthood

#### 1) Intramembranous Ossification:

- bone develops from fibrous CT membrane that has mesenchymal cells
- During embryonic development-give birth space
- cranial bone of skull

#### 2) Endochondral Ossification:

- bone development by replacement of hyaline cartilage
- all bones below the skull except clavicles
- after 2<sup>nd</sup> month of development
- more complex by change to hyaline cartilage

Short bones :only primary ossification centre is formed

Irregular bones: formed by various ossification centres

Secondary ossification is complete hyaline cartilage remains:

- on epiphyseal surfaces as the articular cartilage (support growth of bones + cushioning)
- at the junctions of diaphysis and epiphyses where it forms the epiphyseal plates (area for long bones to continue growing)

Bone Growth

- During infant, youth, long bones lengthen entirely by interstitial growth of epiphyseal plates and gain thickness by appositional growth
- most bones stop growing during adulthood, some facial bones continue to grow throughout life

### Bone Remodeling

- as bone lengthens, the ends keep the size wider than the shaft
- external ends get slimmer and internal surface get thicker
- bone destroyed by osteoclasts and formed by osteoblasts working both inner and outer surface of growing long bone
- epiphyseal plate stays same size to give the sturdiness
- longitudinal growth ends when bone of the epiphysis and diaphysis fuses =epiphyseal plate closure

Growth in width = appositional growth

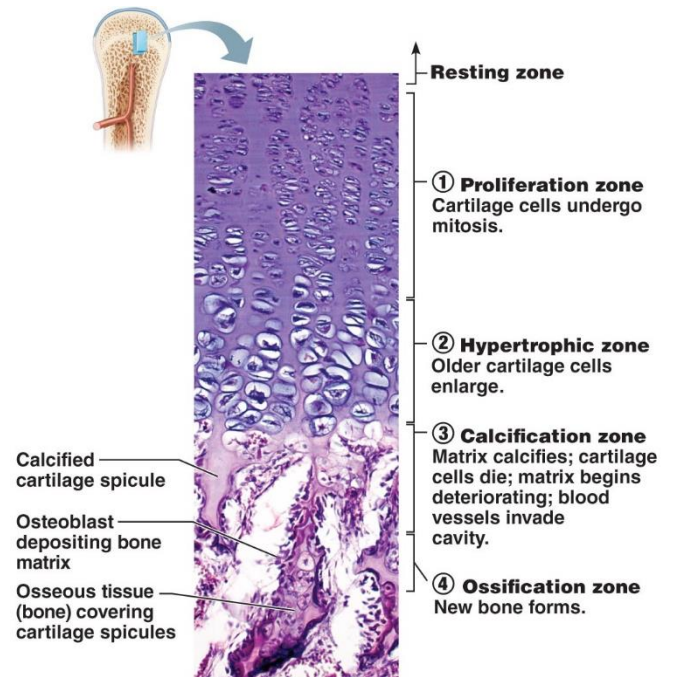
- osteoblasts, osteoclasts work rate is not always same rate
- the epiphyseal plate of the long bones of children closes too early due to elevated levels of sex hormones

### Parathyroid hormone control of blood calcium

- As stimulus detect decrease  $Ca^{2+}$  in blood,
- Thyroid/Parathyroid glands release parathyroid hormone for increase osteoclast level
- Osteoclasts then chew up bone matrix and release  $Ca^{2+}$  into blood

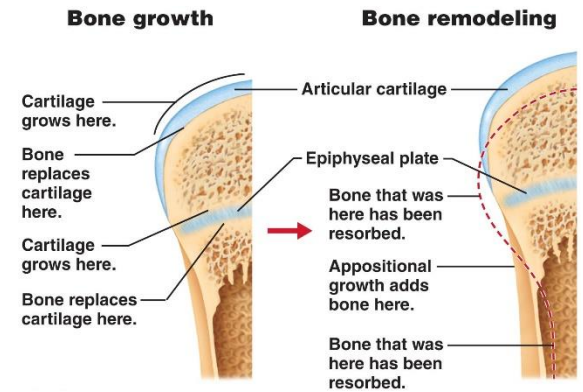
Osteoporosis

- bone resorption giving porous bone
  - areas are vulnerable on spine, neck of femur
- Also age is a factor as estrogen/testosterone promote bone health by preventing osteoclast activity (lost  $Ca^{+}$ )
- Other factors includes: insufficient exercise, poor diet  $Ca^{+}$ , protein, abnormal vit D receptors, smoking



Growth in length of a long bone

Endochondral ossification process



## Anatomy of Skeletal System- B.

206 bones in human skeleton

### Axial and appendicular skeletons

### Axial skeleton = bones of skull

Appendicular skeleton = bones of upper/lower limbs + pelvic girdles [Attachment to axial skeletons]

**Cranium:** skull divided into **Vault:** superior part(lateral/posterior) & **Base:** inferior -surround/protects brain

3 bony ridges of the base: anterior(high), middle, posterior(low) fossa

**Cranium:** 8 bones: paired(2) **parietal & temporal** Unpaired(1) **frontal, occipital, sphenoid, ethmoid**

-curvature of skull gives strong outer surface for protection

#### Frontal Bone parts

**Supraorbital margin:** end of frontal bone below eye brow

**Supraorbital foramen:** hole/notch under eye brow

**Glabella:** right above nasal cavity

#### Parietal Bone parts:

-forms bulk of cranial vault

#### Occipital Bone parts:

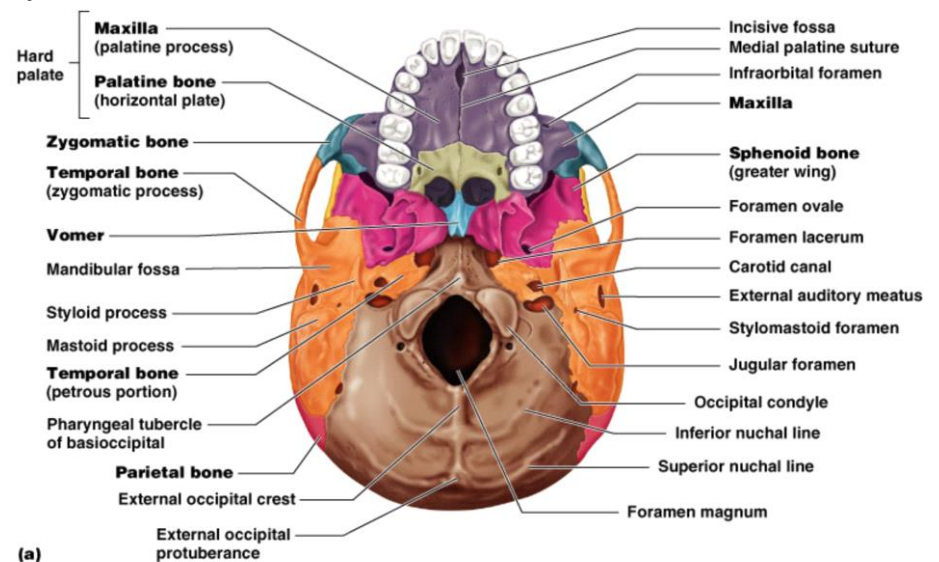
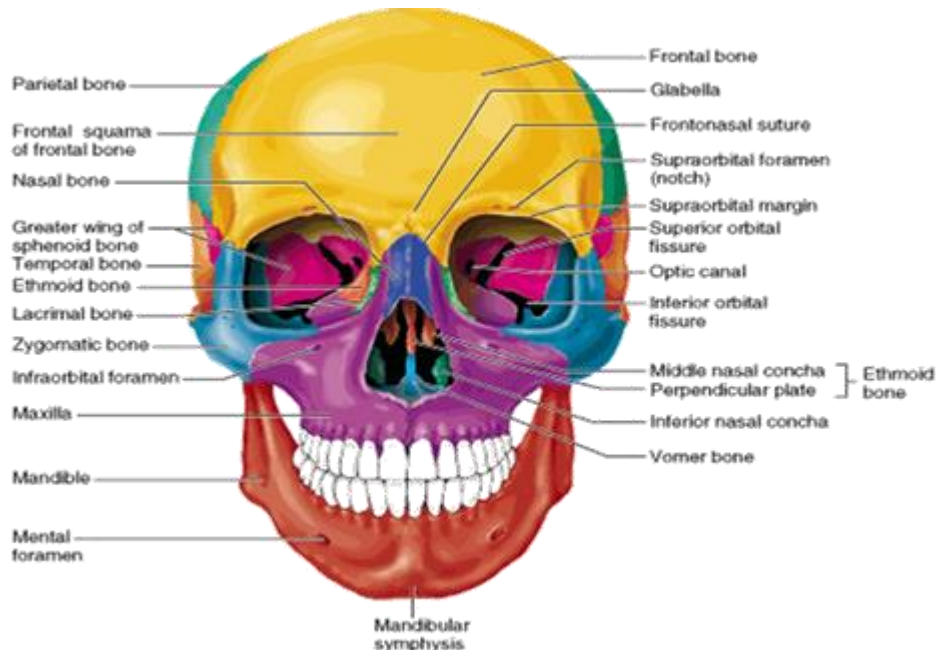
**Foramen magnum:** hole for spinal cord

**Occipital condyles:** on both sides of magnum – site for articulation with first cervical vertebra

**External occipital protuberance:** lines of projection at the back of skull

#### Temporal Bone parts:

1. **Squamous region:** big flattened zygomatic process to cheekbone
2. **Tympanic region:** surround ear (external acoustic meatus-opening)
3. **Petrous region:** inside temporal bone
  - Mastoid process:** attach some neck muscles
  - Styloid process:** attach muscles of the tongue



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## Sphenoid Bone parts:

1. **Sphenoid sinuses:**
2. **Greater/lesser wings:** greater wing are on outer surface of skull
3. **Pterygoid processes:** for chewing muscles
4. **Optic foramina (canals):** for optic nerves for eyes
5. **Superior orbital fissure:** between greater/lesser wings -cranial nerves for eye movement

## Ethmoid Bone parts: inside orbits/nasal cavities

1. **Cribriform plate:** make roof of nasal cavity  
(Olfactory foramina: tiny hole for olfactory nerves)
2. **Perpendicular plate:** points downward -part of nasal septum
3. **Crista galli:** points upward –attachment part of brain

**Ethmoid sinuses:** on the lateral part of ethmoid bone

**Nasal conchae:** on medial part of ethmoid bone

**Orbital plates:** on lateral part – part of medial walls of orbits

## Major Cranial Sutures: skull bones are joined by sutures

1. **Coronal suture:** frontal/2 parietals, 2. **Squamous suture:** parietal/temporal, 3. **Lambdoid suture:** occipital/2 parietals, 4. **Sagittal suture:** 2 parietals

**Sutural bones:** tiny irregular bones that are added during fetal development

**Facial Bones** have 14 bones [unpaired(1) mandible & Vomer]  
[paired(2) maxillae, zygomatic, nasal, lacrimal, palatine & inferior]

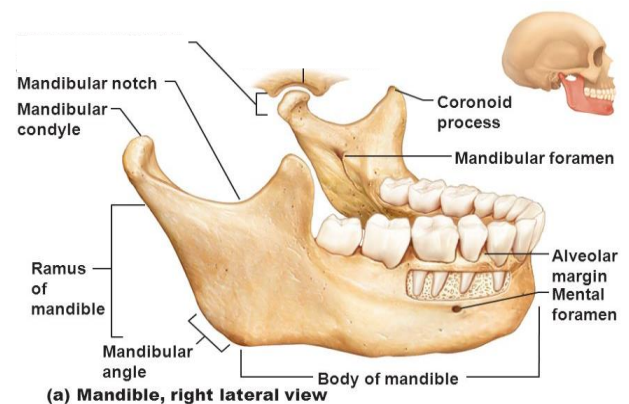
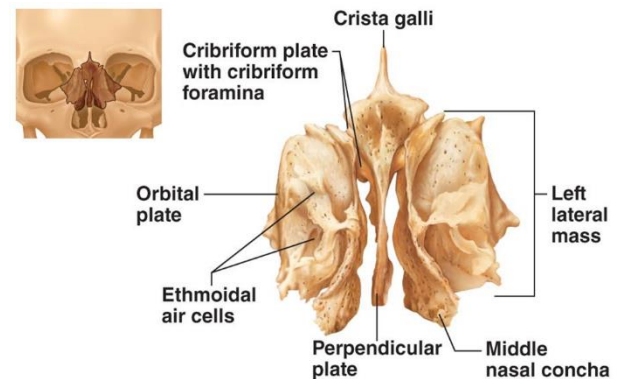
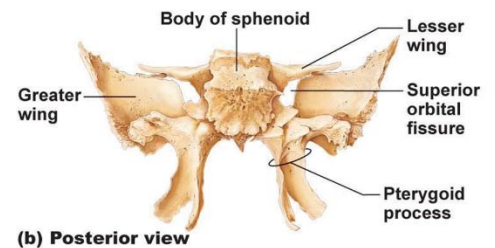
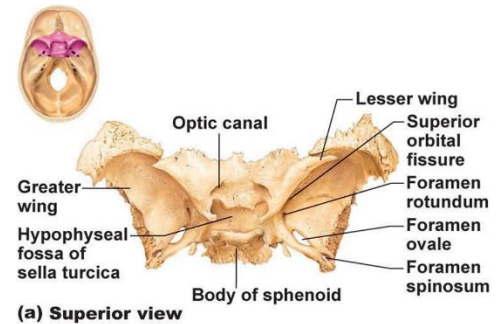
### 1) **Mandible:** lower jaw bone

- Strongest & largest facial bone
- only movable part on face

- **Body of mandible:** horizontal(Chin) part (left & right side of jawbone) at mandibular angle
- **Mandibular notch:** Hollow part
- **Mandibular condyle:** joining part with temporal bone
- **Coronoid process:** (temporalis) chewing muscle attachment part
- **Mandibular foramina:** teeth nerve part
- **Alveolar margin:** teeth root part
- **Mental foramina:** part for blood vessels nerve to chin

### 2) **Maxillary bone:** paired(2) part fused medially

- alveolar margin also holds upper teeth



- Lower jaw
- Largest, strongest bone of face
- Temporomandibular joint: only freely movable joint in skull

- palatine processes: top mouth 2/3 of front(anterior) hard palate
- incisive fossa: gives blood vessels & nerves for upper jaw, frontal/zygomatic processes
- both sides with maxillary sinus – easily get infected

3) **Zygomatic bones** = cheek bone

- zygomatic processes of maxilla, frontal & temporal bones
- inferolateral margins of orbits

4) **Nasal bones:** 2 tiny rectangular bones fused to form bridge of nose

- frontal bone superiorly & maxillary bones laterally

5) **Lacrimal bones:** 2 fingernail shaped bones in anterior, inner medial part of orbit

- Joint with frontal, ethmoid bone maxillae
- each has curvature (lacrimal fossa) for lacrimal sac

6) **Palatine bones:** Right & Left L-shaped bones

**Horizontal plates** form part of hard palate

**Vertical plates** form part of nasal cavity & orbit

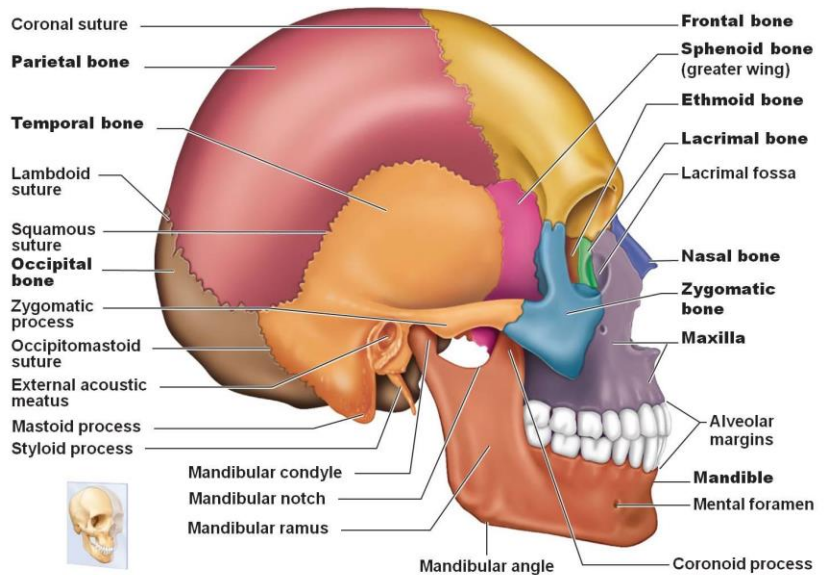
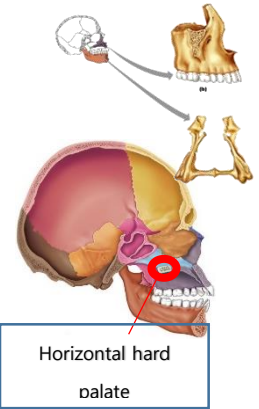
7) **Vomer:** single thin bone forms (nasal septum; that separate the 2 nasal cavities)

8) **Inferior nasal conchae:** Superior and middle nasal conchae under ethmoid bone,

- thin, curved largest 3 pairs of conchae

**Orbits:** Zygomatic, frontal, maxilla, ethmoid, lacrimal, sphenoid, palatine (orbital process)

Exam Q. Give names & locations only



**Paranasal Sinuses:**

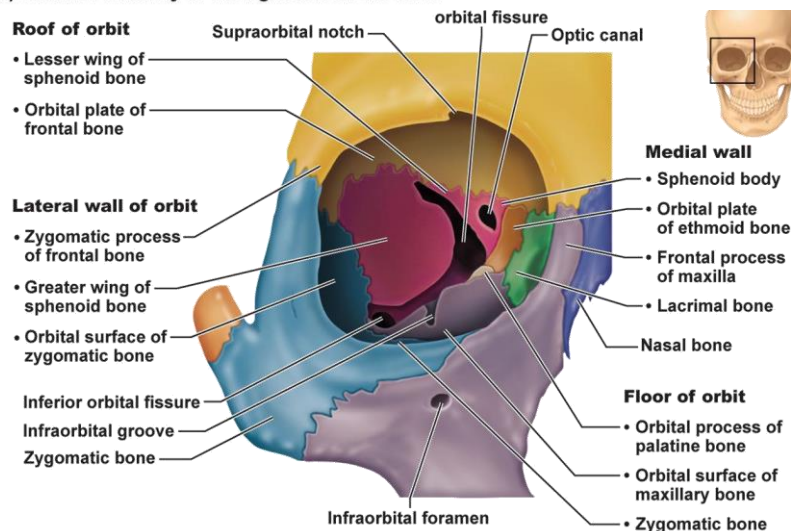
Frontal, Maxillary, Sphenoid, Ethmoid

- Make skull lighter, enhance voice, connect to nasal cavity + warm/humidify intake air

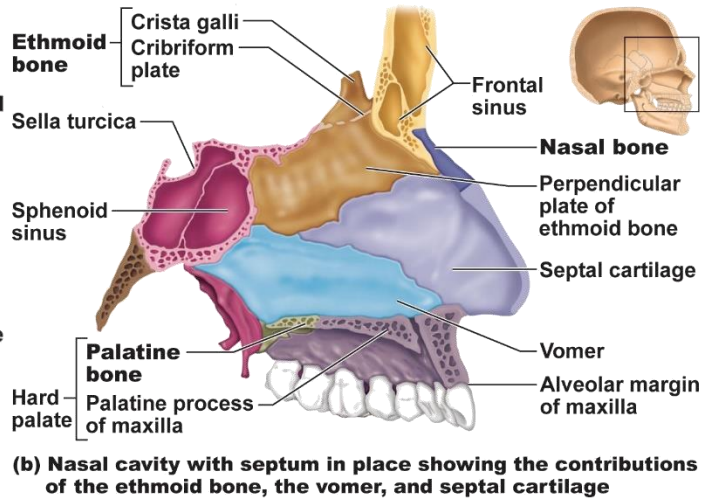
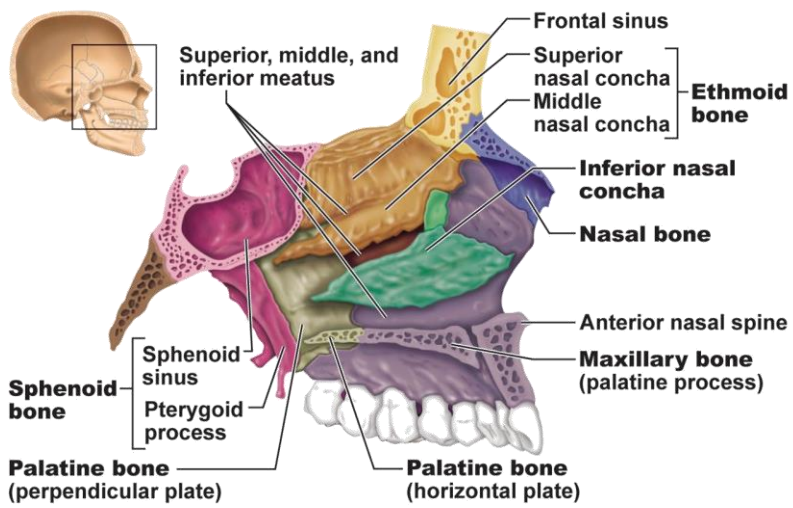
**Hyoid:**

- Only bone that does not form joint, have 4 horns, located under chin
- Supports tongue, attaches (anchors) to muscles for swallowing & speech

(a) External anatomy of the right side of the skull



(b) Contribution of each of the seven bones forming the right orbit



## Vertebral Column

33 bones: **7** cervical, **12** thoracic, **5** lumbar, **5** sacral, **4** coccyx

3 main functions: **weight bearing, anchor for muscles/ligaments, protection of spinal cord**

Curvatures: for sturdiness and flexibility cervical/Lumbar-concave, thoracic/sacral-convex

### Supporting elements

#### 1. Ligaments:

**Anterior/posterior longitudinal ligaments:** major supporting ligaments

-**Anterior** is strong and attached to bony vertebrae/discs prevent Hyperextension limited backward motion of spine

-**posterior** is thin and only attached to discs preventing hyperflexion limited forward motion of spine

#### 2. Intervertebral Discs

- cushions vertebral bodies-prevent from shock

**nucleus pulposus** in centre –gives elasticity/compressibility

**annulus fibrosus** around periphery –resists tension in spine

Discs thickest in **Lumbar/cervical** region for flexibility requires lots of movement

Herniated disc is broken/ruptured disc, giving pressure on the spinal nerve

**Typical Vertebra**-larger as one descends

**Vertebral foramen:** - **Vertebral canal:** spinal cord passage

**Vertebral arch:** including paired **pedicles & laminae**

**Intervertebral foramina:** Spinal nerve passage between 2 vertebrae connects to spinal cord

#### 7 Processes from each vertebral arch

**1 spinous process:** muscle attachment

**2 transverse processes:** 1/side muscle attachment

**Paired superior/inferior articular processes:** vertebrae linkage

– smooth/collagen coated facets for articulation

**Cervical Vertebrae** -7 parts- C 1<sup>st</sup>: **Atlas** C2<sup>nd</sup>: **Axis**

**Transverse foramen:** gives passage of vertebral artery to brain

**Atlas**-no body, spinous process facet for dens giving hook connection with axis

**Axis**-dens or odontoid process for neck movement

**Thoracic Vertebrae**-12 part-all ribs attached

**2 Demi-facets:** joins thoracic vertebrae and rib

**Vertebral foramen:** circular **Spinous process:** long pointing downward

### Lumbar Vertebrae

-short & thick pedicles/laminae for support/strength

### Sacral Vertebrae

5 vertebrae fused to form **sacrum**

**Sacroiliac joint** with hip bone

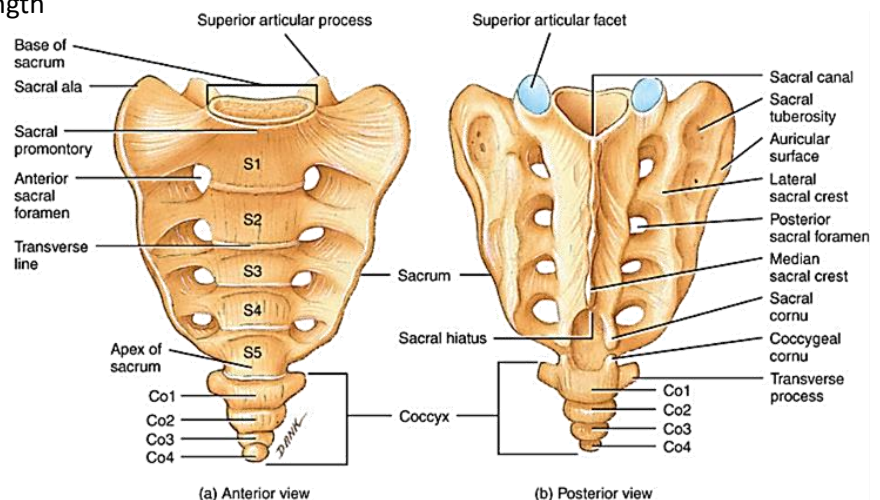
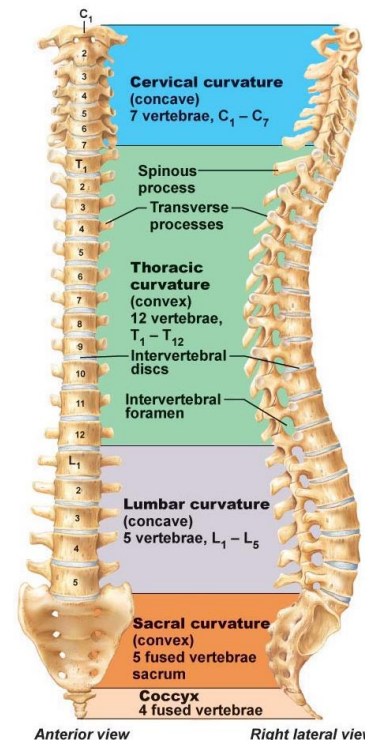
**Sacral promontory, transverse lines, sacral foramina**

Median **sacral crest, sacral canal, sacral hiatus**

### Coccygeal Vertebrae

-Tail bone 3-4 fused vertebrae

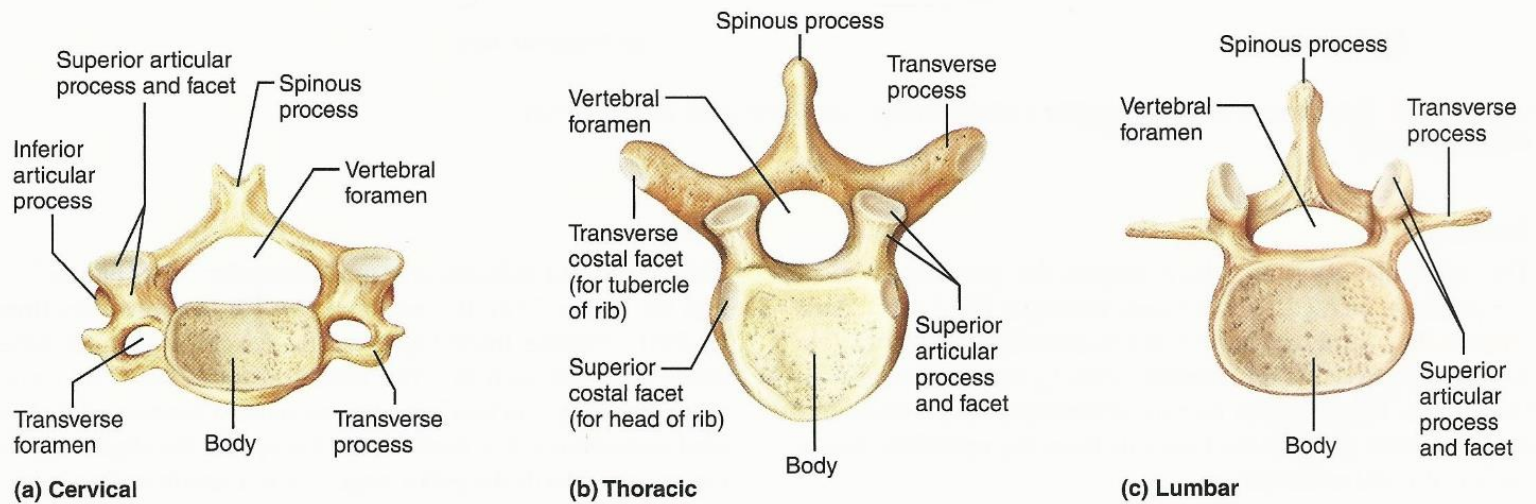
–attach some pelvic ligaments



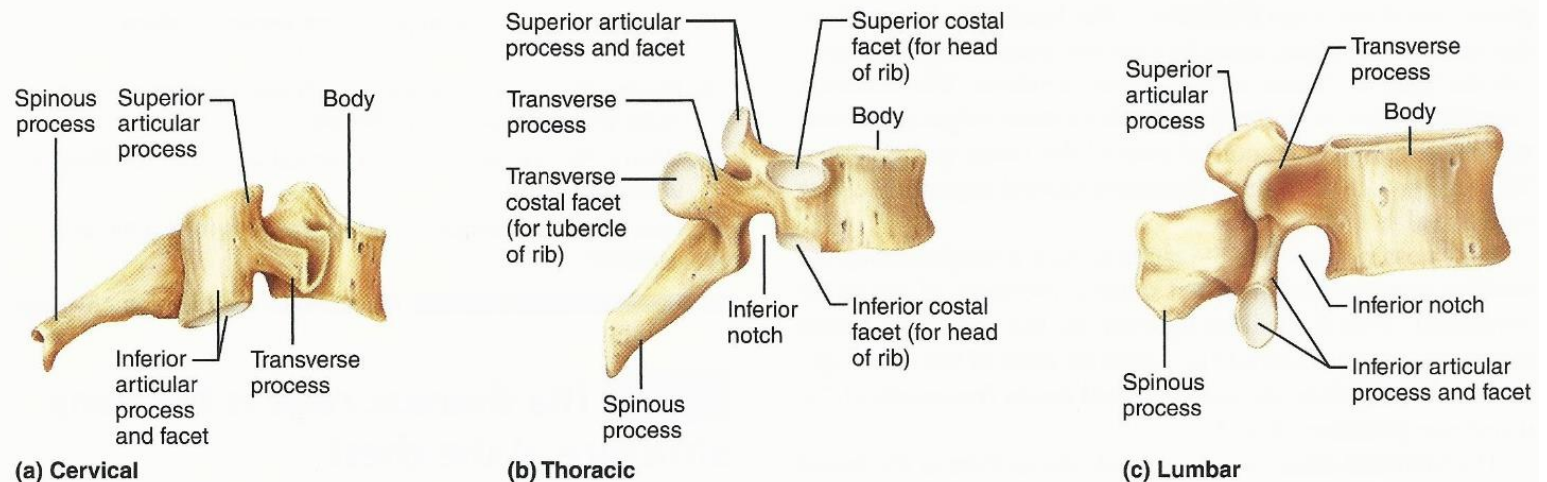
**Table 7.2 Regional Characteristics of Cervical, Thoracic, and Lumbar Vertebrae**

CHARACTERISTIC	CERVICAL (3-7)	THORACIC	LUMBAR
Body	Small, oval, wide side to side	Larger than cervical; heart shaped; bears two costal facets	Massive; kidney shaped
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**Sternum:**

**Manubrium:** articulates with clavicles by **clavicular notches**

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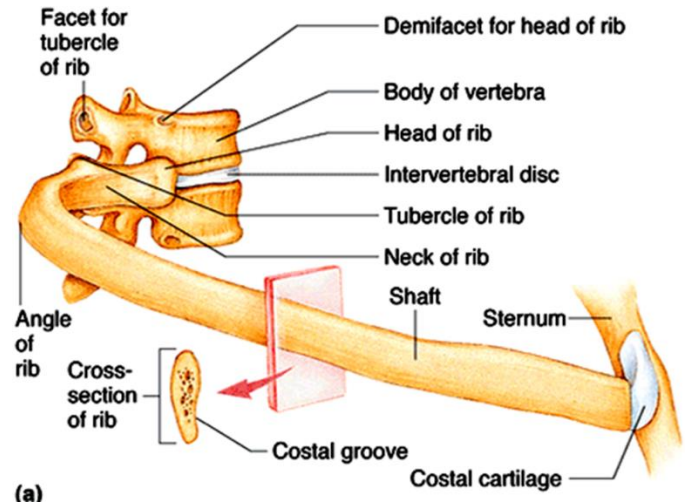
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**Pectoral girdle; pelvic girdle**

**Pectoral Girdle for upper limbs**

**2pairs of bones: Clavicles & Scapulae**

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30 bones in **upper limb**

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-articulate with Ulna/Radius and scapula

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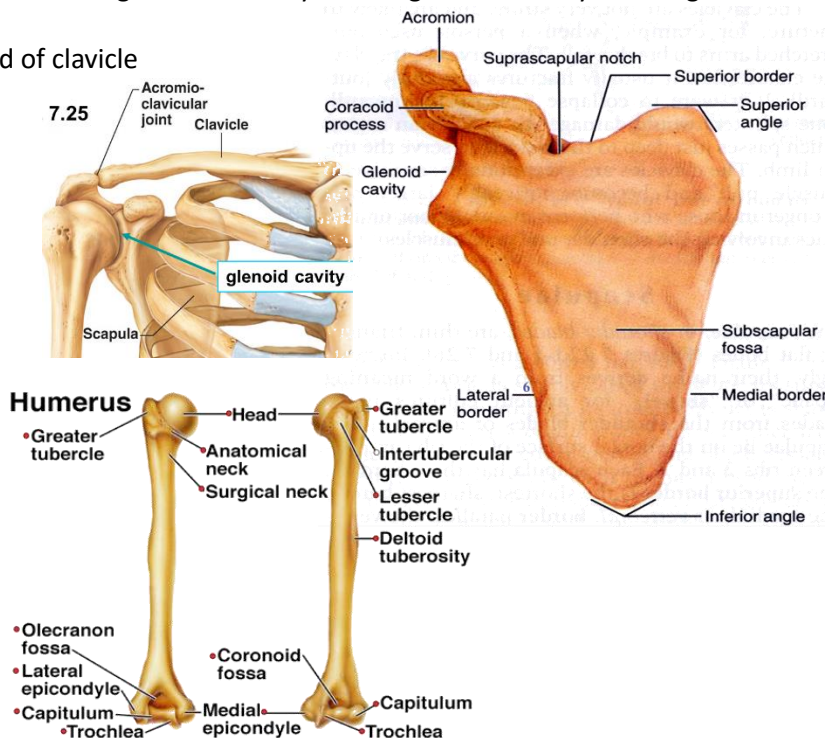
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**8 carpels**

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Syngnyuk Left The Pc To Take Crockery Home

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**Acetabulum:** area where all 3 bones join

– forms socket of hip joint

Women with larger hips for child birth

**Ilium-** large bone that forms most of os coxa

**Iliac crest:**

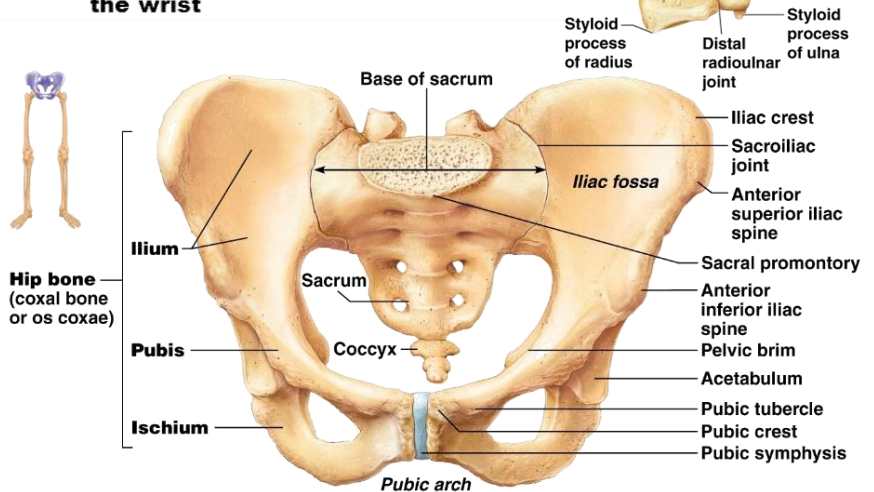
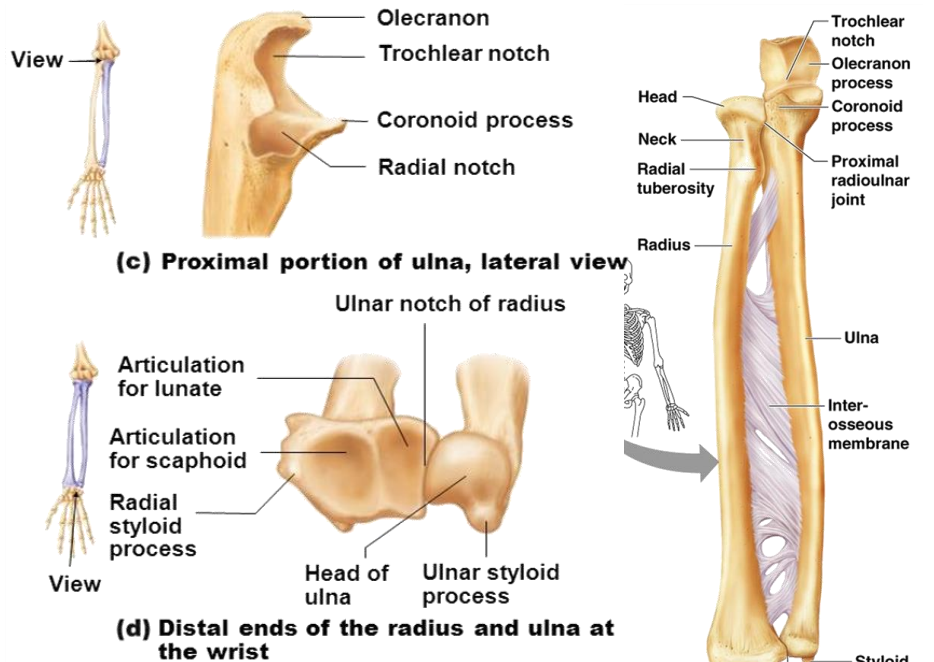
**Iliac Spines:**

**Pelvic brim:**

**True pelvis:**

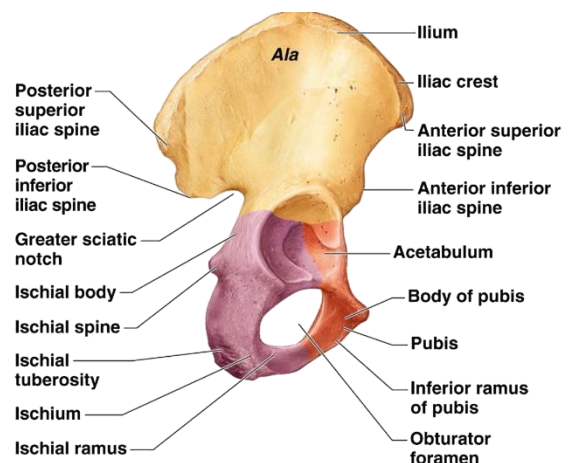
**Ischium:**

**Pubis:**



**False (greater) pelvis**

**True (lesser) pelvis**



**Lower Limb**

**Thigh: femur= largest, longest, strongest bone**

**Hea**

**Fovia capitis:** ligament for acetabulum

**Neck**

**Linea aspera:**

**Condyles**

**Epicondyles:**

**Patellar surface:**

**Leg: tibia and fibula**

**Interosseus membrane + proximal&distal tibiofibular joints**

**Tibia:**

**NB: Condyles, anterior crest, tibial tuberosity**

**Fibula: head & lateral malleolus**

**Foot: Tarsus**

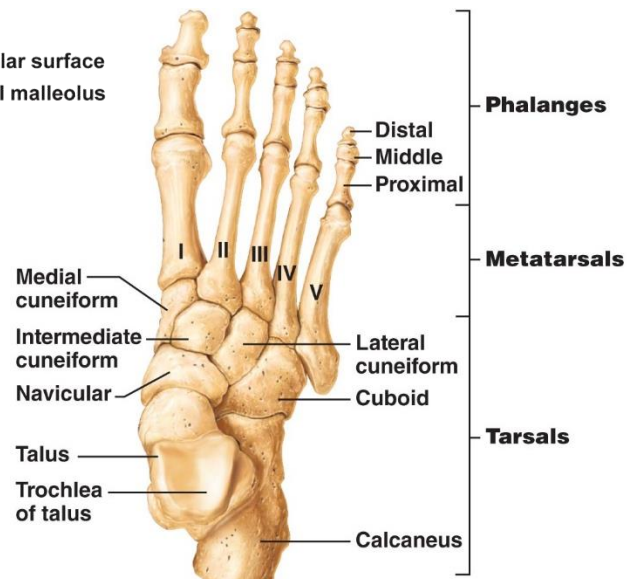
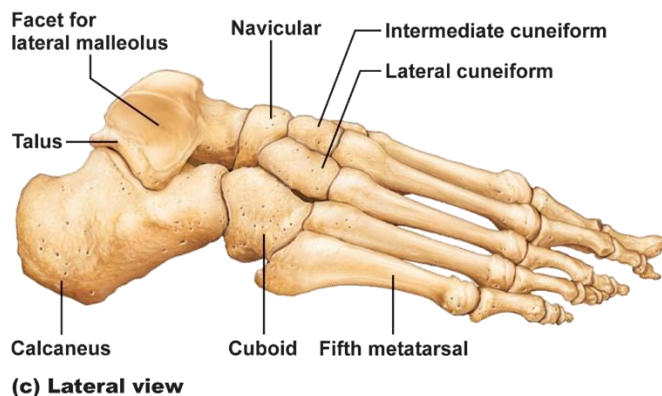
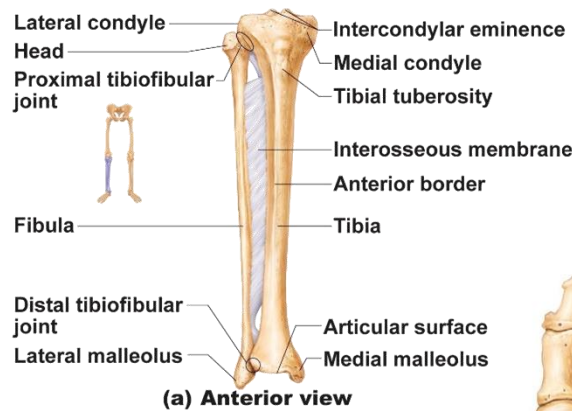
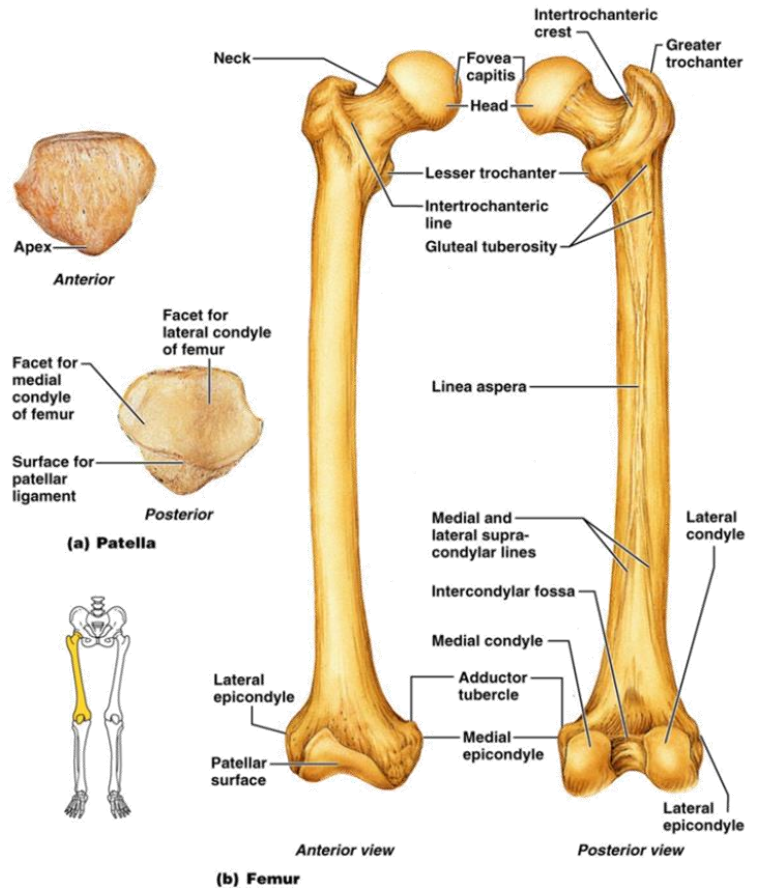
**7 Tarsus: including**

**Calcaneus: largest heel bone / Talus: part of ankle joint**

**Metatarsus: 1-5**

**Phalanges: proximal, middle, distal**

**big toe: Hallux – 3phalange missing**



## Vertebral Column

33 bones: **7** cervical, **12** thoracic, **5** lumbar, **5** sacral, **4** coccyx

3 main functions: **weight bearing, anchor for muscles/ligaments, protection of spinal cord**

Curvatures: for sturdiness and flexibility cervical/Lumbar-concave, thoracic/sacral-convex

### Supporting elements

#### 1. Ligaments:

**Anterior/posterior longitudinal ligaments:** major supporting ligaments

-**Anterior** is strong and attached to bony vertebrae/discs prevent Hyperextension limited backward motion of spine

-**posterior** is thin and only attached to discs preventing hyperflexion limited forward motion of spine

#### 2. Intervertebral Discs

- cushions vertebral bodies-prevent from shock

**nucleus pulposus** in centre –gives elasticity/compressibility

**annulus fibrosus** around periphery –resists tension in spine

Discs thickest in **Lumbar/cervical** region for flexibility requires lots of movement

Herniated disc is broken/ruptured disc, giving pressure on the spinal nerve

Typical Vertebra-larger as one descends

**Vertebral foramen:** - **Vertebral canal:** spinal cord passage

**Vertebral arch:** including paired **pedicles & laminae**

**Intervertebral foramina:** Spinal nerve passage between 2 vertebrae connects to spinal cord

#### 7 Processes from each vertebral arch

**1 spinous process:** muscle attachment

**2 transverse processes:** 1/side muscle attachment

**Paired superior/inferior articular processes:** vertebrae linkage

– smooth/collagen coated facets for articulation

Cervical Vertebrae -7 parts- C 1<sup>st</sup>: **Atlas** C2<sup>nd</sup>: **Axis**

**Transverse foramen:** gives passage of vertebral artery to brain

**Atlas**-no body, spinous process facet for dens giving hook connection with axis

**Axis**-dens or odontoid process for neck movement

Thoracic Vertebrae-12 part-all ribs attached

**2 Demi-facets:** joins thoracic vertebrae and rib

**Vertebral foramen:** circular **Spinous process:** long pointing downward

## Lumbar Vertebrae

-short & thick pedicles/laminae for support/strength

## Sacral Vertebrae

5 vertebrae fused to form **sacrum**

**Sacroiliac joint** with hip bone

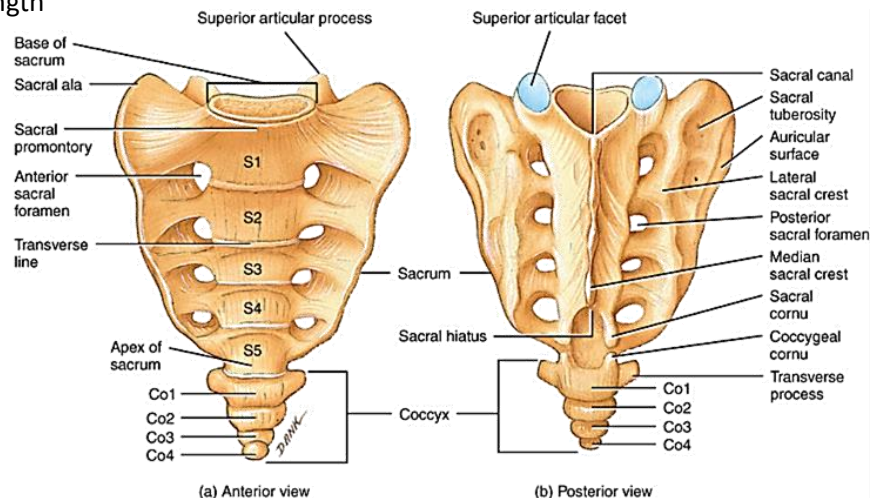
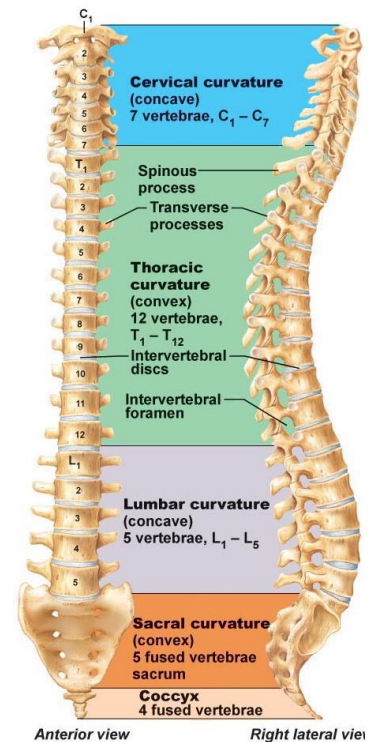
**Sacral promontory, transverse lines, sacral foramina**

Median **sacral crest, sacral canal, sacral hiatus**

## Coccygeal Vertebrae

-Tail bone 3-4 fused vertebrae

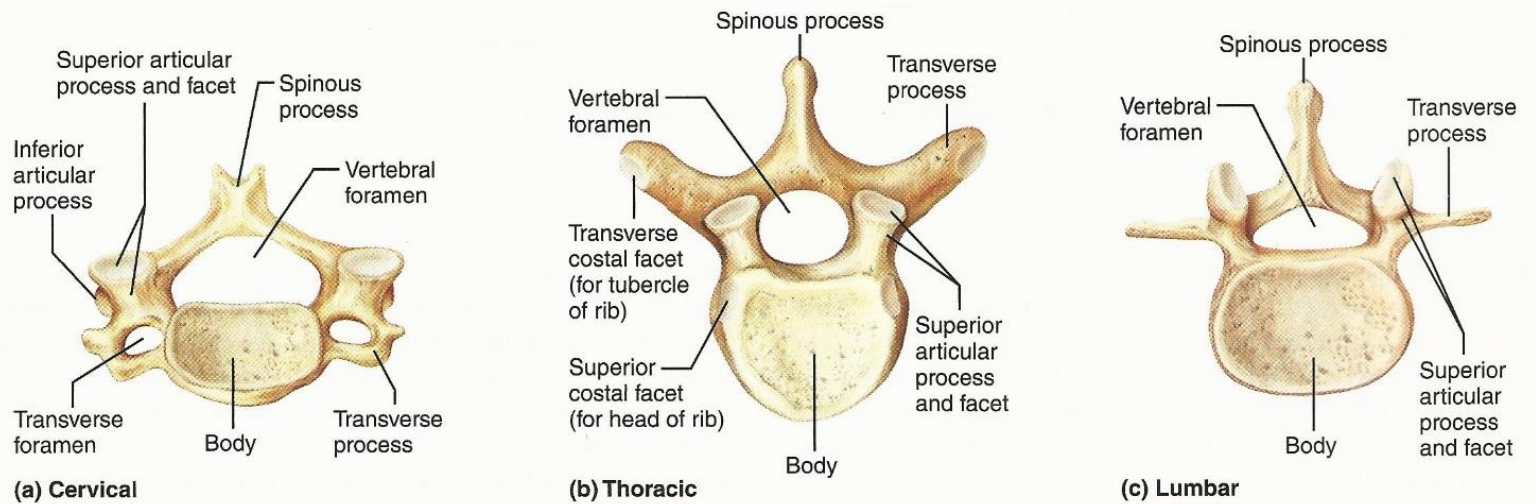
–attach some pelvic ligaments



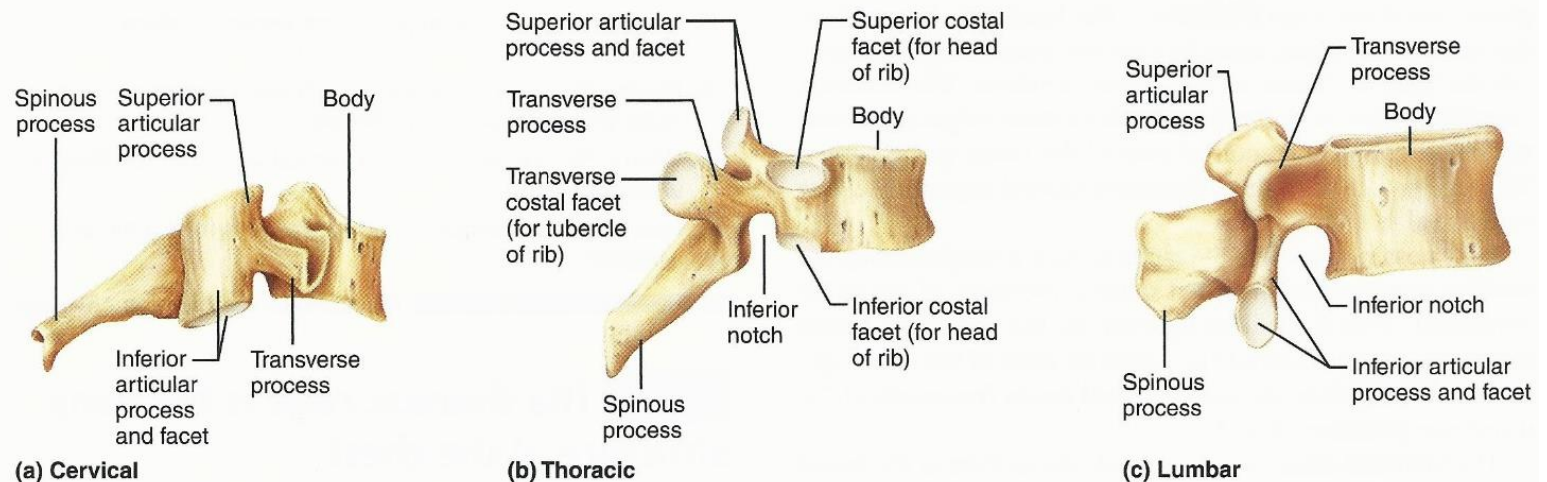
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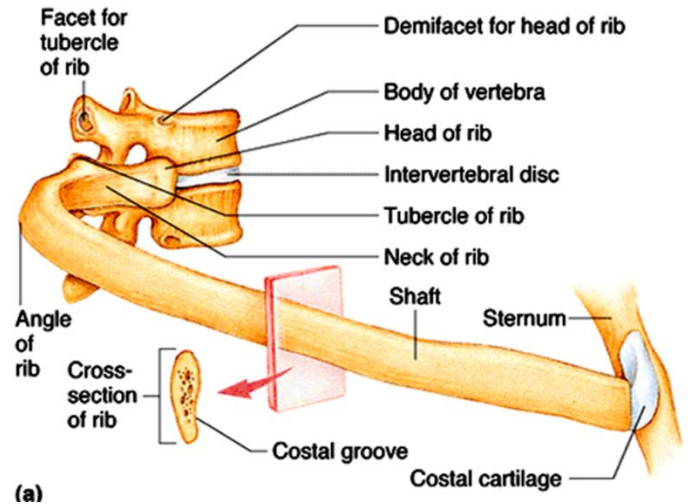
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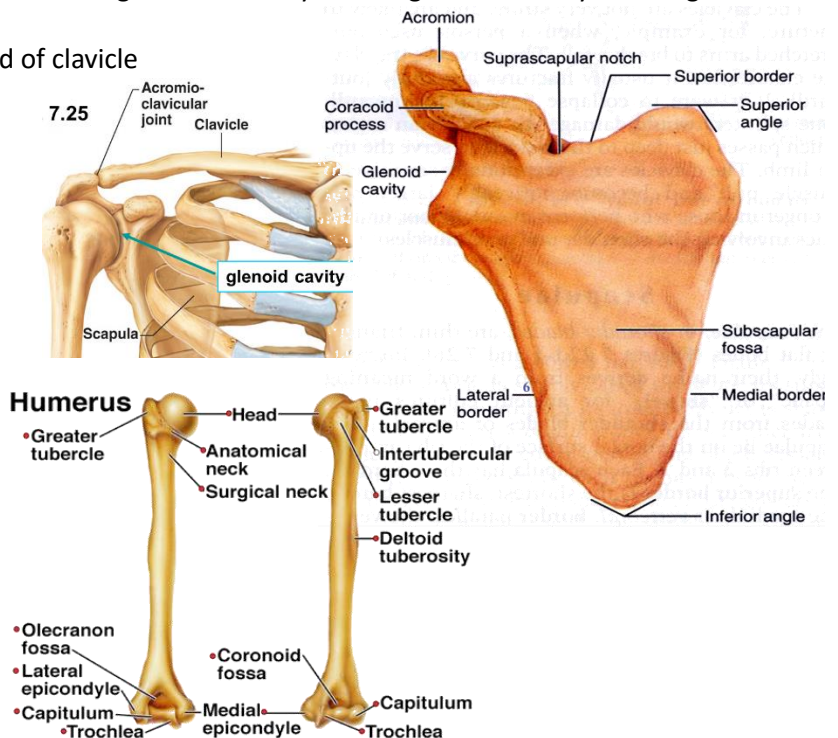
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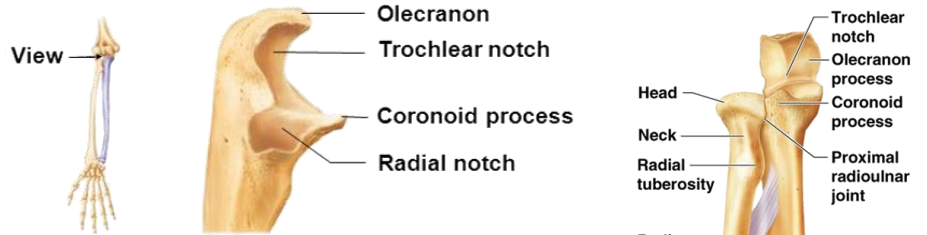
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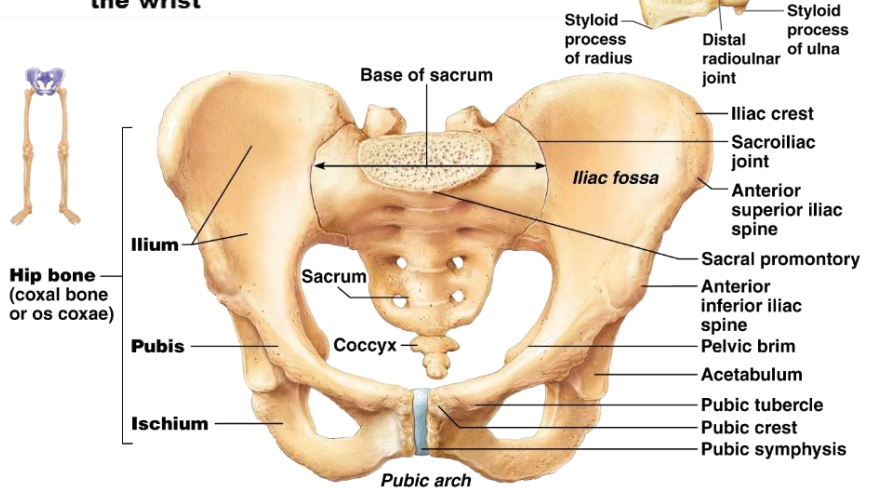
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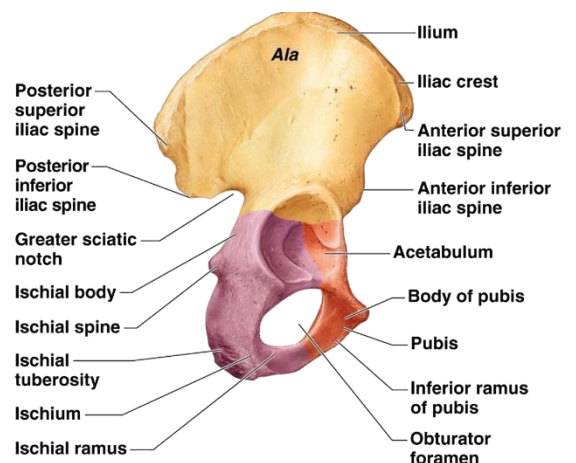
**(c) Proximal portion of ulna, lateral view**

**(d) Distal ends of the radius and ulna at the wrist**



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