

UNIT – II

INTEGUMENTARY SYSTEM



Presented By

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INTRODUCTION

- The integument as an organ, and is an alternative name for skin.
- The human skin is outer covering of the body and largest organ of the human body.
- 16% of body weight and 1.5 to 2m square in area.
- Containing four major types of cells.
 - Keratinocytes
 - Melonocytes
 - Langerhans cells
 - Markel cells

- 
- The integumentary system includes the skin and the skin derivatives hair, nails, and glands.
 - The integumentary system helps to maintain a constant body temperature, protects the body and provides sensory information about surrounding environment.
 - Dermatology : It is branch of medical science that deals with the diagnosis and treatment of skin disorders.

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- The integument is made up of two parts

Cutaneous membrane

- Epidermis – superficial epithelium
- Dermis – underlying CT with blood supply
- Endodermis – Contain large blood vessels

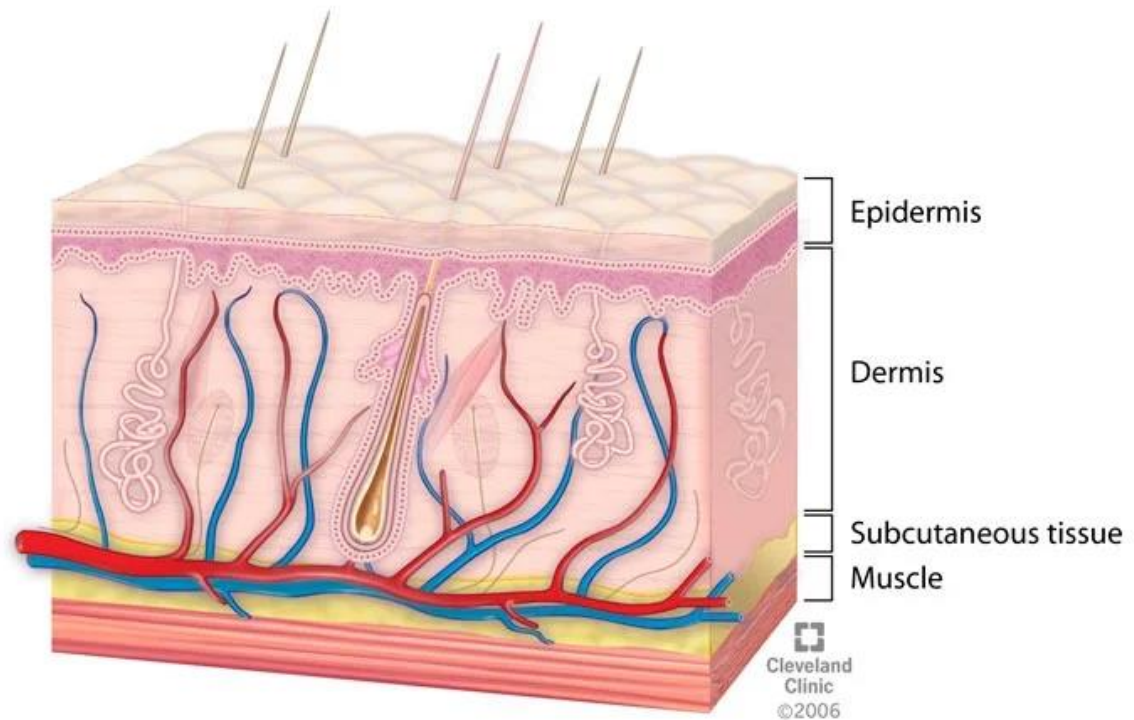
Accessory structures

- Hair
- Nails
- Exocrine glands

PARTS OF SKIN

- Understanding how the skin can function in these many ways starts with understanding the structure of the 3 layers of skin
- The Epidermis – Epidermis tissue
- Dermis – Dense connective tissue proper
- Hypodermis (Subcutaneous tissue) - loose connective tissue proper and adipose tissue

STRUCTURE OF SKIN



EPIDERMIS

- Epidermis is a vascular stratified squamous epithelium
- Nutrients and oxygen diffuse from capillaries in the dermis
- Cell of the epidermis keratinocytes
- Contain large amounts of keratin
- Are the most abundant cells in the epidermis

EPIDERMIS

Thin Skin

- Cover most of the body
- Has four layers of keratinocytes

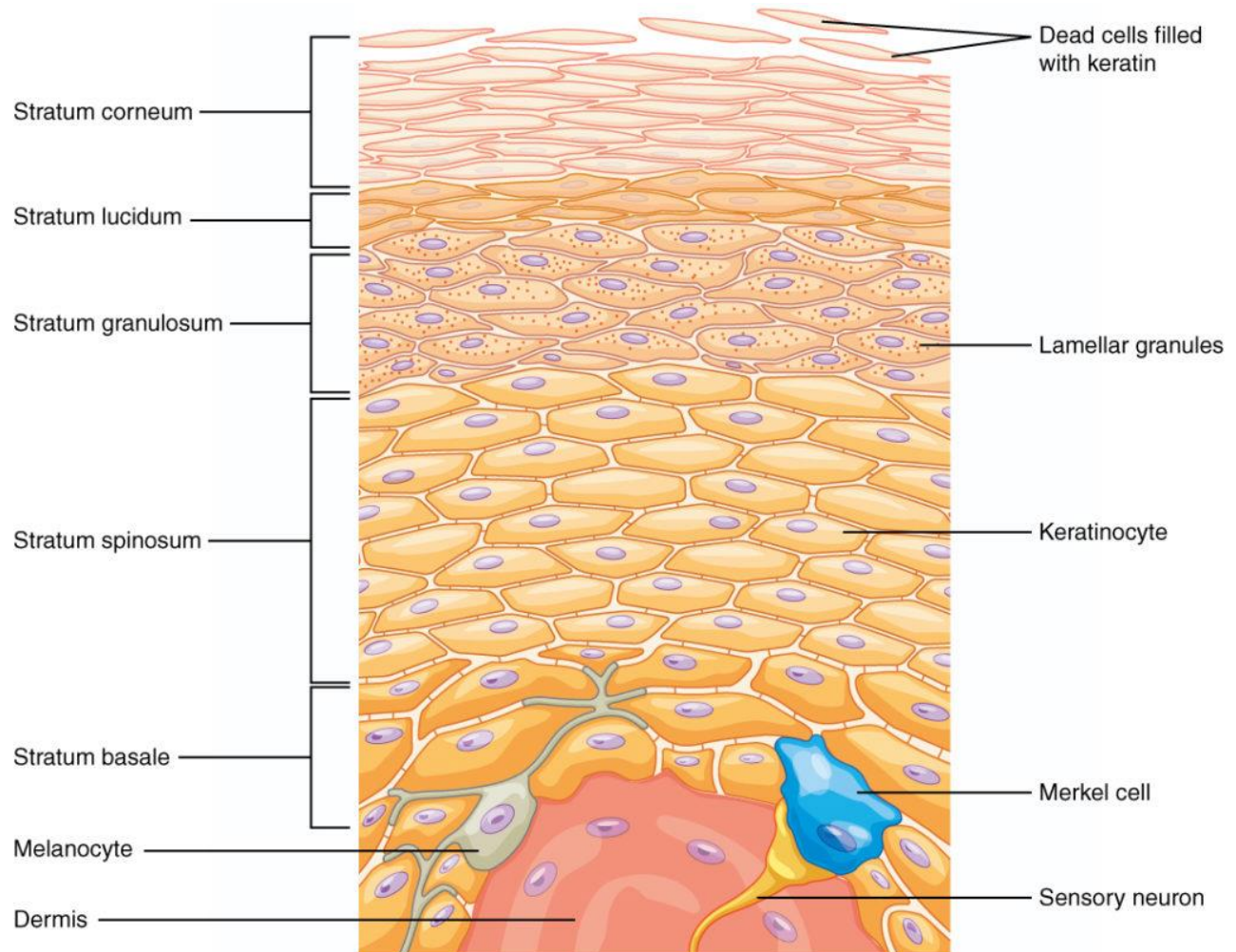
Thick Skin

- Covers the palms of the hands soles of the feet
- Has five layers of keratinocytes

PARTS OF EPIDERMIS

- The five strata of keratinocytes in thick skin
- From basal lamina to free surface
- Stratum basale
- Stratum spinosum
- Stratum granulosum
- Stratum lucidum
- Stratum corneum

LAYER OF EPIDERMIS



STRATUM BASALE

- It is attached to basement membrane by hemi-desmosomes
- Forms a strong bond between epidermis and dermis
- Forms epidermal ridges (e.g. fingerprints)
- Dermal papillae (tiny mounds)
 - Increase the area of basement membrane
 - Strengthen attachment between epidermis and dermis.
- Has many basal cells or germinative cells

Epidermal ridges



Pores of sweat gland ducts

Epidermal ridge

Thick skin

STRATUM SPINOSUM

- Produced by division of stratum basale
- Eight to ten layers of keratinocytes bound by desmosomes
- Cell shrink until cytoskeletons stick out (spiny)
- Continue to divide, increasing thickness of epithelium
- Contain dendritic (Langerhans) cells, active in immune response

STRATUM GRANULOSUM

- The grainy layer
- Stops dividing, starts producing

Keratin

- A tough, fibrous protein
- Makes up hair and nails

Keratohyalin

- Dense granules
- Cross-link keratin fibers

STRATUM LUCIDUM

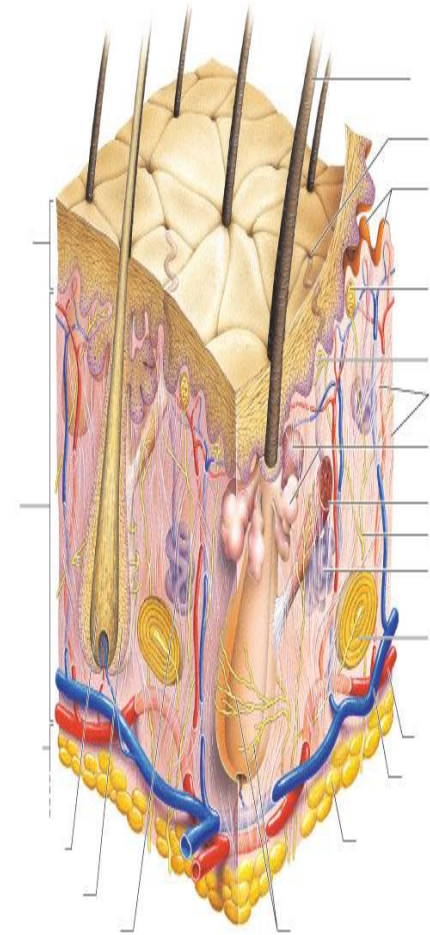
- The clear layer
- Found only in thick skin
- Covers stratum granulosum

STRATUM CORNEUM

- The horn layer
- Exposed surface of skin
- 15 to 30 layers of keratinized cells
- Water resistant
- Shed and replaced every 2 weeks

DERMIS

- Locked between epidermis and subcutaneous layer
- Anchors epidermal accessory structure (hair follicle, sweat glands)
- **Two components**
 1. **Outer papillary layer**
 2. **Deep reticular layer**



PAPILLARY LAYER

- Consists of areolar tissue
- Contains smaller capillaries, lymphatic, and sensory neurons
- Has dermal papillae projecting between epidermal ridges

RETICULAR LAYER

- Consists of dense irregular connective tissue
- Contains larger blood vessels, lymphatic vessels, and nerve fibers
- Contains collagen and elastic fibers
- Contains connection tissue proper

DERMATITIS

- An inflammation of the papillary layer
- Caused by
 - Infection, radiation, mechanical irritation, or chemicals (e.g. poison ivy)
- Characterized by (itch or pain)
- Characteristics
 - Strong, due to collagen fibers
 - Elastic, due to elastic fibers
 - Flexible

HYPODERMIS

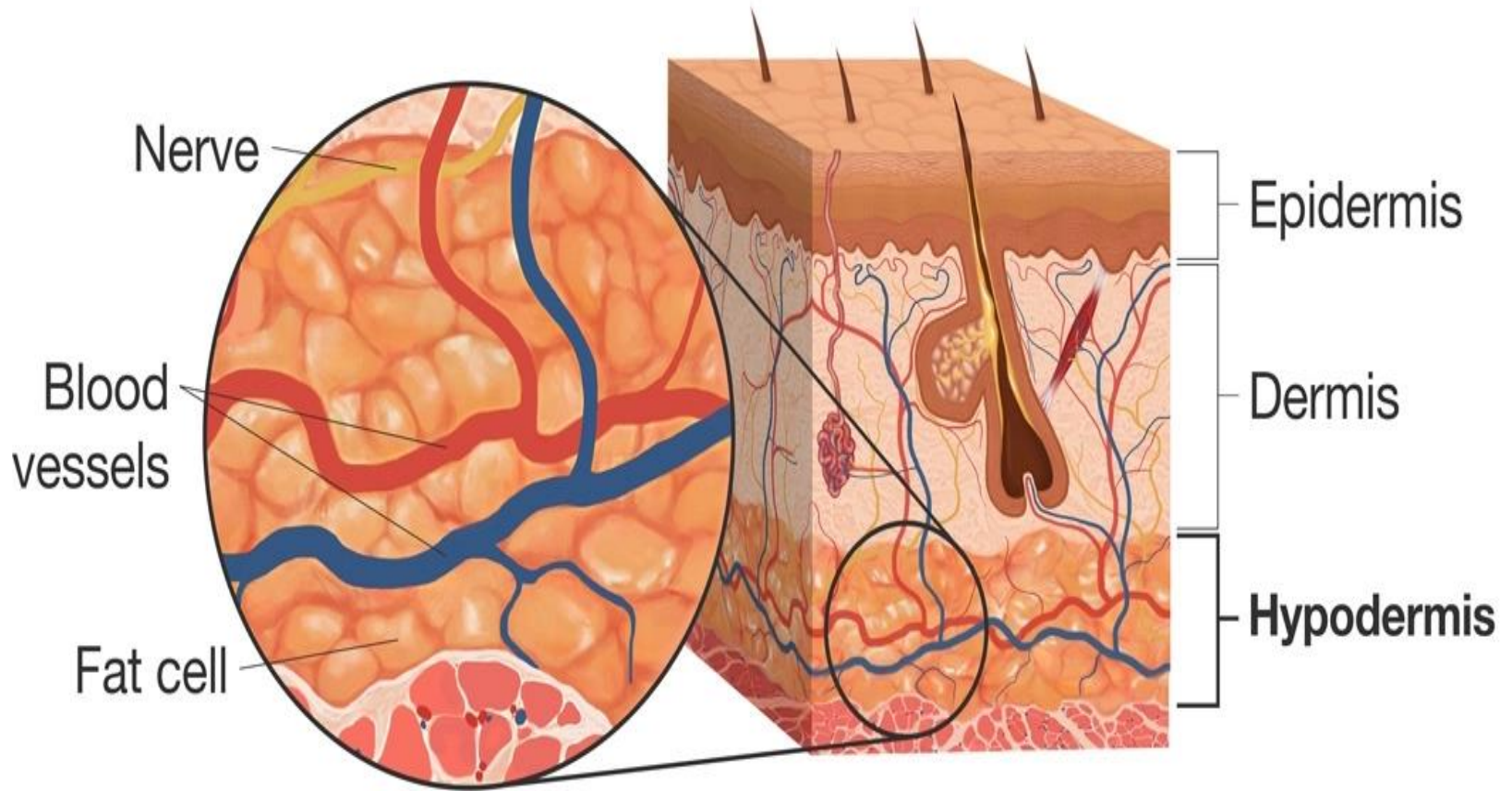
The Hypodermis (Subcutaneous Layer)

- Lives below the integument
- Stabilizes the skin
- Allows separate movement
- Made of elastic areolar and adipose tissues
- Connected to the reticular layers of integument by connective tissue fibers

Deposits of subcutaneous fat

- Distribution patterns determined by hormones
- Reduced by cosmetic Liposuction (lipoplasty)

The Hypodermis



FUNCTION OF SKIN

Protection

- First line of defense against (Bacteria and Viruses)
- Protects underlying structures from (Ultraviolet radiation and Dehydration)

Vitamin D production

- Needed for calcium absorption

Sensation

- Sensory receptors

Body temperature regulation

- If too hot
 - Dermal blood vessels dilate
 - Vessels carry more blood to surface to heat can escape
- If too cold
 - Dermal blood vessels constrict
 - Prevent heat from escaping

Excretion

- Small amounts of waste products are lost through perspiration

HAIR

The hair follicle

- Hair follicles are the organs that form the hairs.
- Hair follicles are the organs that the hairs.
- Located deep in dermis.
- Produces nonliving hairs.
- Wrapped in a dense connective tissue sheath.

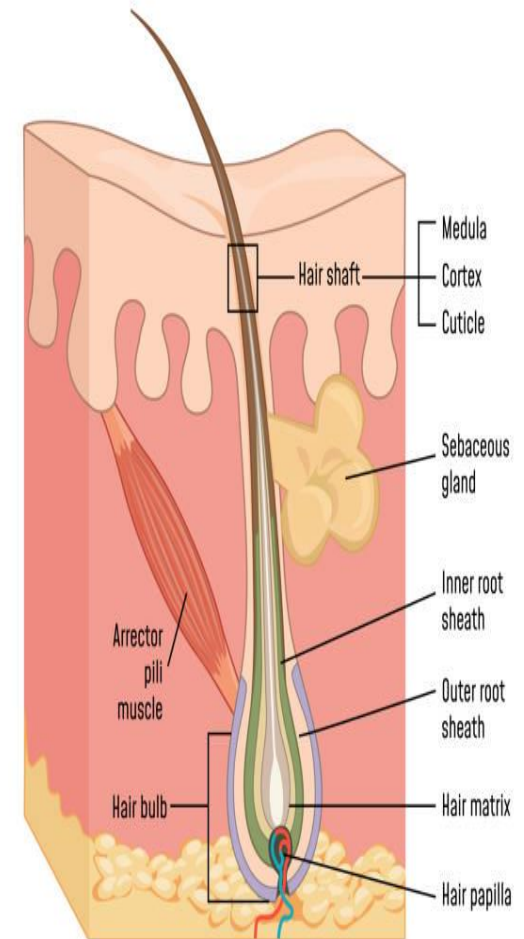
STRUCTURE OF HAIR

Arrector pili

- Involuntary smooth muscle
- Causes hairs to stand up
- Produces goose bumps

Sebaceous glands

- Lubricate the hair



Regions of the hair

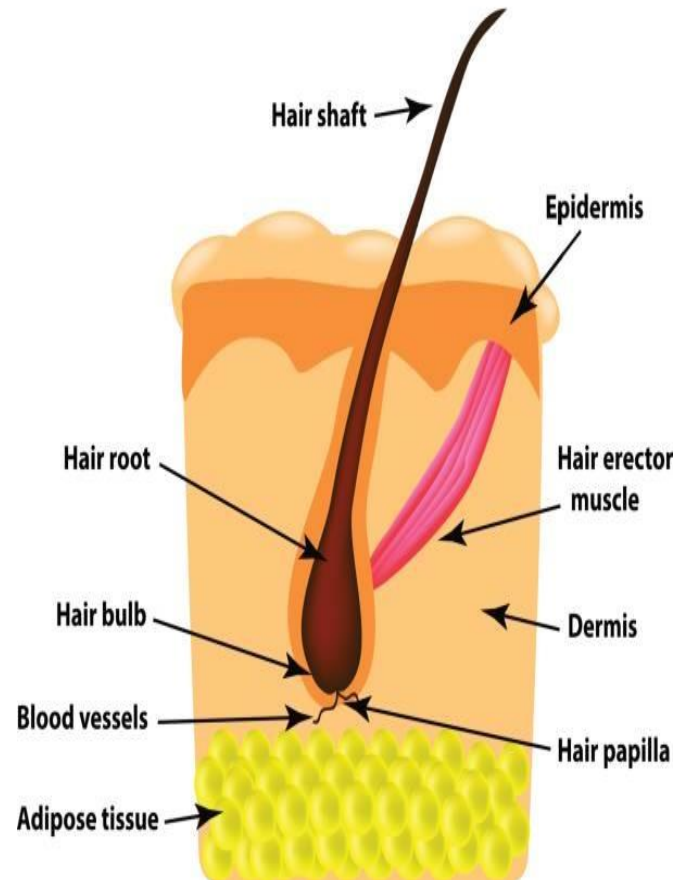
Hair root

- Lower part of the hair
- Attached to the integument

Hair shaft

- Upper part of the hair
- Not attached to the integument

HAIR STRUCTURE



LAYERS OF CELL

Modulla

- Core, dead cell contain soft keratin and air to provide flexible

Cortex

- Middle layer, dead cells contain hard keratin to provide stiffness

Cuticle

- Outermost, overlapping dead keratinized cells form shiny surface

FUNCTIONS OF HAIR

Head

- UV protection
- Cushion from trauma
- Insulation

Nostrils, Ear canals, Eyelashes

- Prevent entry of foreign material

Body hair

- Sensory detection

Root hair plexus

- Sensory nerves at base of hair follicle that detect slight

Arrector pili muscle

- Attached to every hair follicle
- Contract to stand hair perpendicular to skin surface

NAILS

- Protect fingers and toes
- Made of dead cells packed with keratin
- Metabolic disorders can change nail structure

Nail Production

- Occurs in a deep epidermal fold near the bone called the nail root

PARTS OF NAIL

Nail Body

- The visible portion of the nail
- Covers the nail bed

Lunula

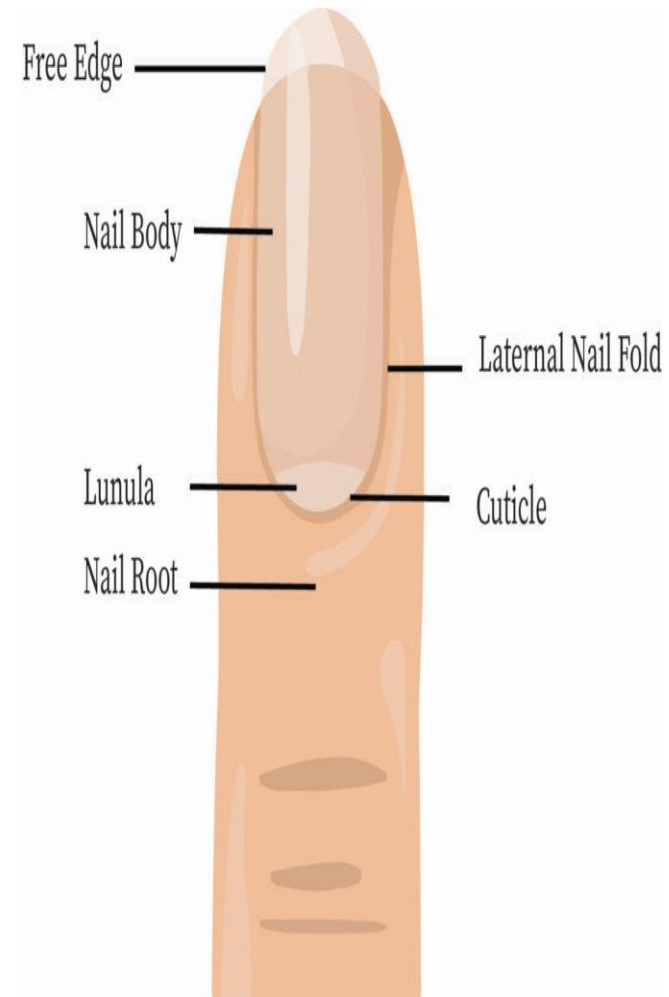
- The pale crescent at the base of the nail

Sides of nails

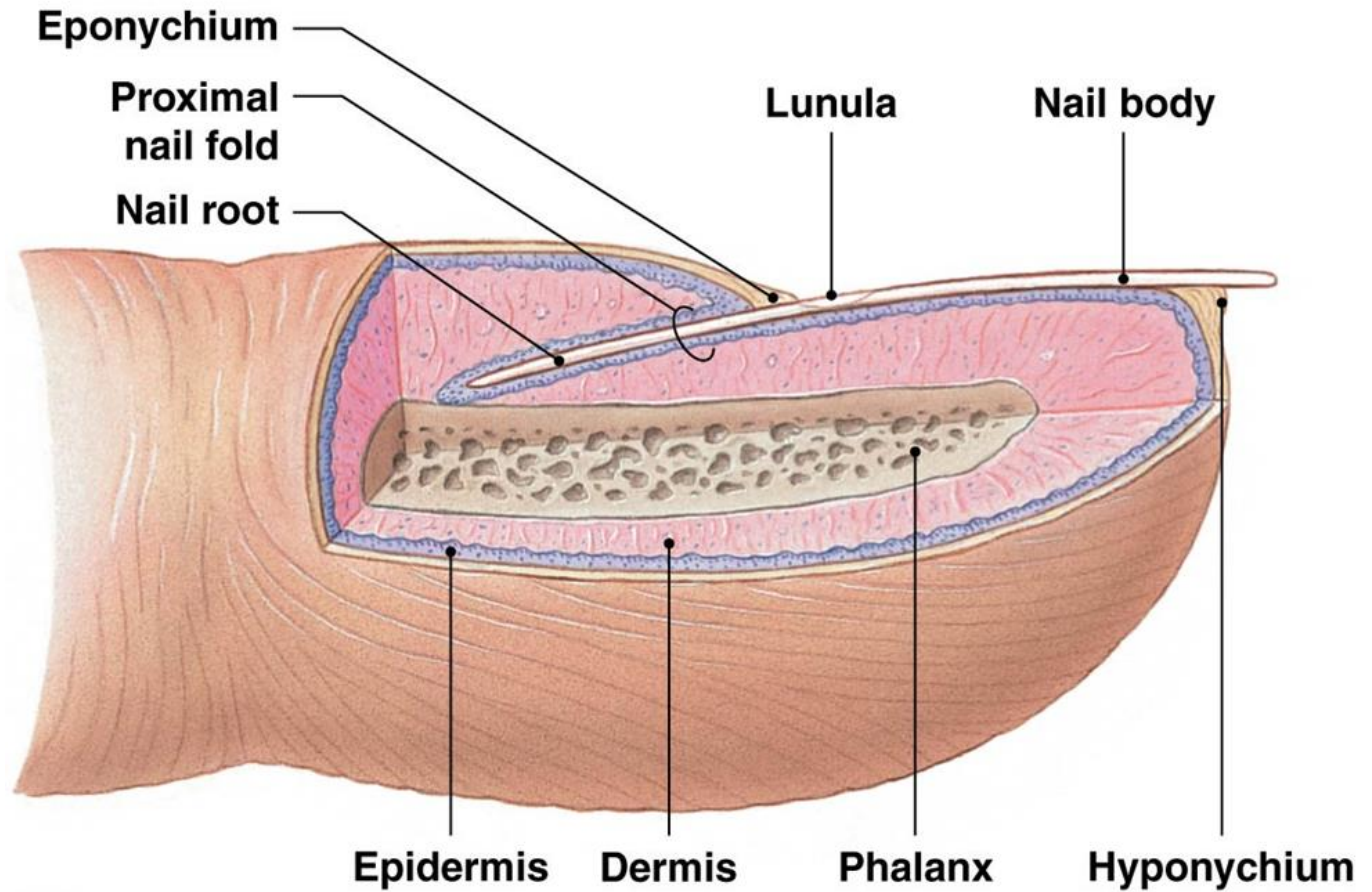
- Lie in lateral nail grooves
- Surrounded by lateral nail folds
- Free Edge

The free part of nail

- It is white because of no blood capillaries



Structure of nail



c A longitudinal section

SKIN GLANDS

- Two types of skin glands are present
 1. Sebaceous gland (oil)
 2. Sudoriferous glands (sweat)
 - Eccrine Sweat Glands
 - Apocrine Sweat Glands
- Located in subcutaneous layer and excretory duct opens into hair follicles

SEBACEOUS GLANDS

- The sebaceous gland or oil glands are simple, branched acinar glands.
- These are associated with hair follicles

FUNCTION

- Prevents excessive evaporation of water from the skin

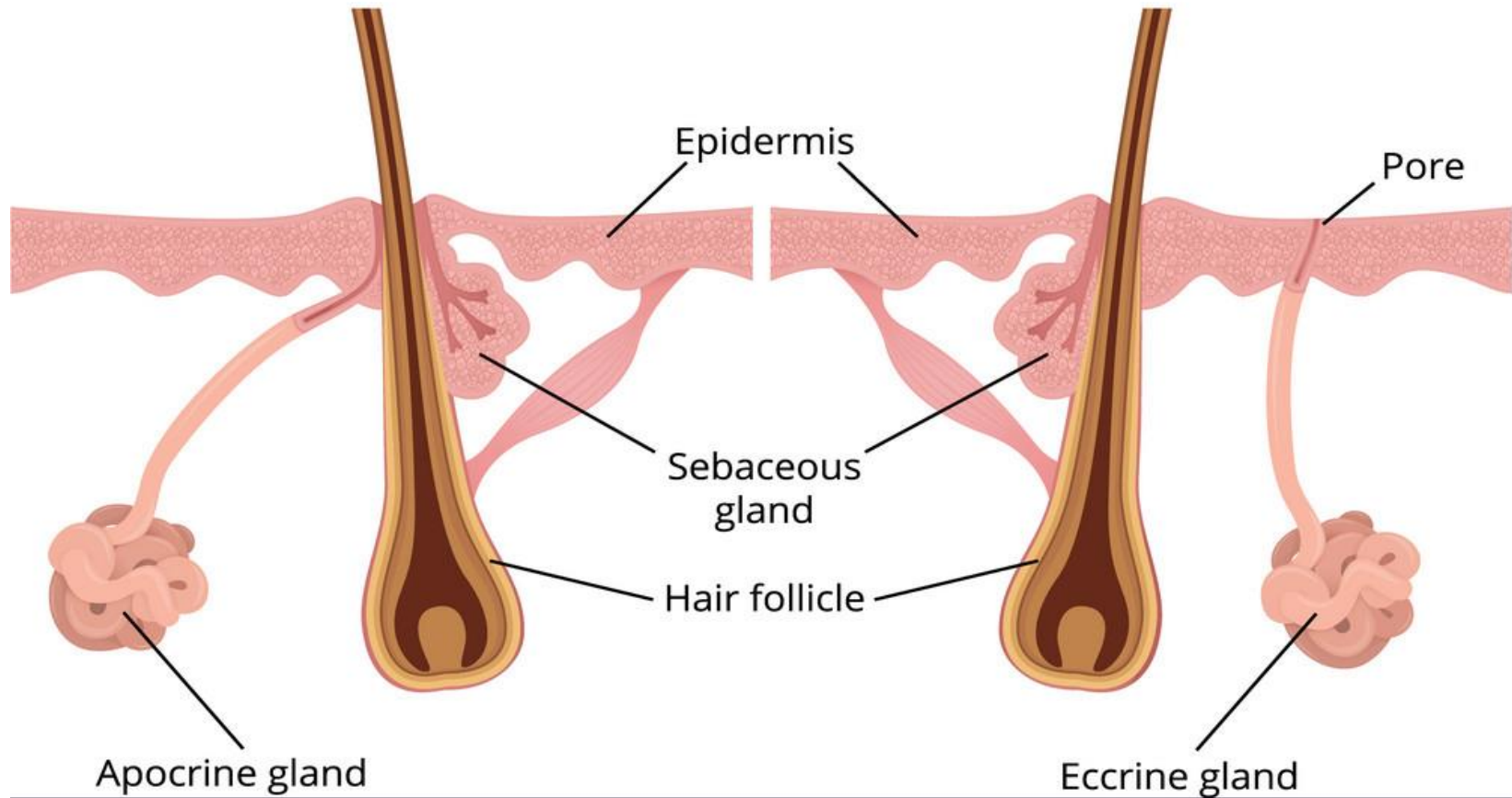
SWEAT GLANDS

- These are called as sudoriferous glands
- These glands release sweat into skin surface through pores.

SWEAT GLANDS ARE TWO TYPES

- Eccrine sweat glands – 600ml per day (water, urea, uric acid, Sodium and Chloride)
- Apocrine Sweat glands – These are simple, coiled and tubular glands

SWEAT GLANDS





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UNIT – II

SKELETAL SYSTEM



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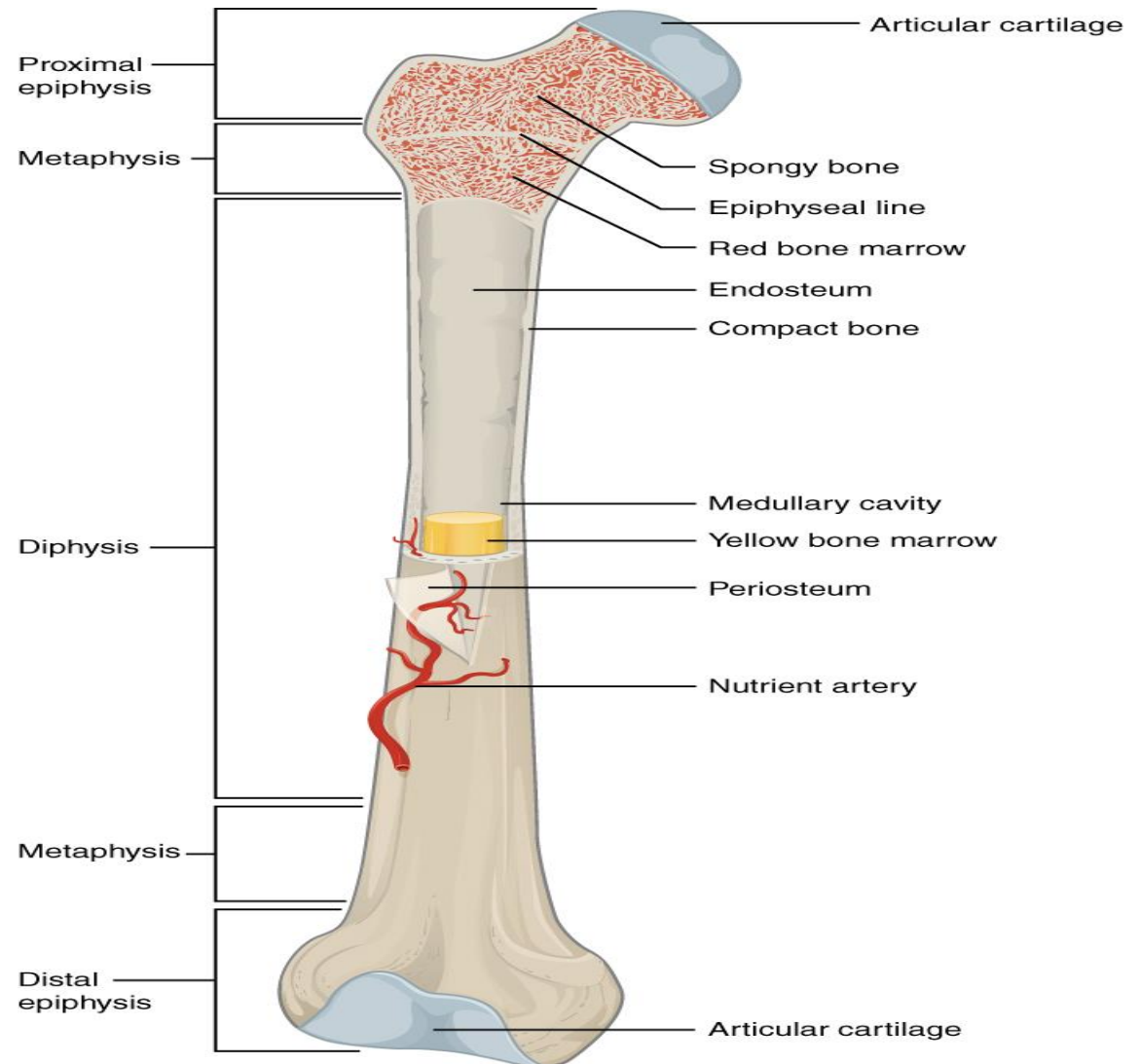
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INTRODUCTION OF SKELETON

- The bony framework of body which protects the inner delicate parts of the body is known as skeleton.
- Four types of cell are present in bone tissue
 1. Osteogenic cells
 2. Osteoblasts
 3. Osteocytes
 4. Osteoclasts

STRUCTURE OF BONE TISSUE

- Diaphysis
- Epiphysis
- Metaphysis



CLASSIFICATION OF BONE BASED ON SHAPE

Short Bones

- Carpal bones
- Tarsal bones

Flat Bones

- Sternum and Ribs
- Thorax and Scapulae

Irregular Bones

- Vertebrae
- Facial bones

Sesamoid Bones

- Patella bones

Long Bones

- Femur
- Humerus

DIVISIONS OF SKELETON

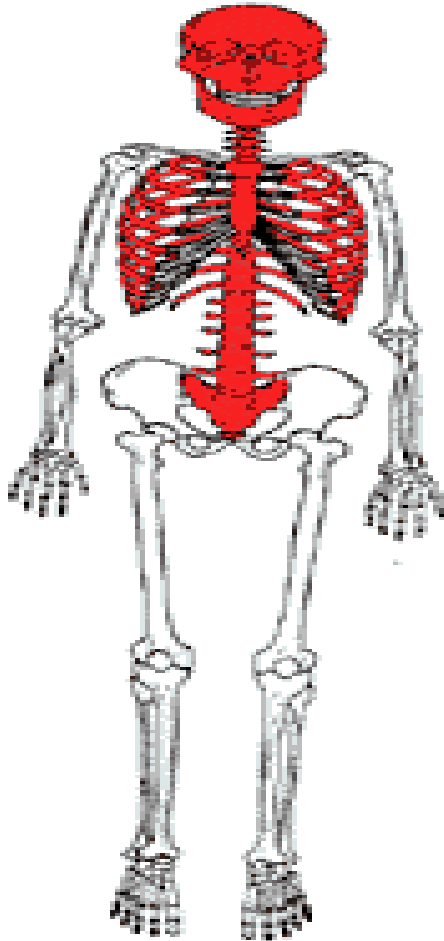


SKELETON
(206)

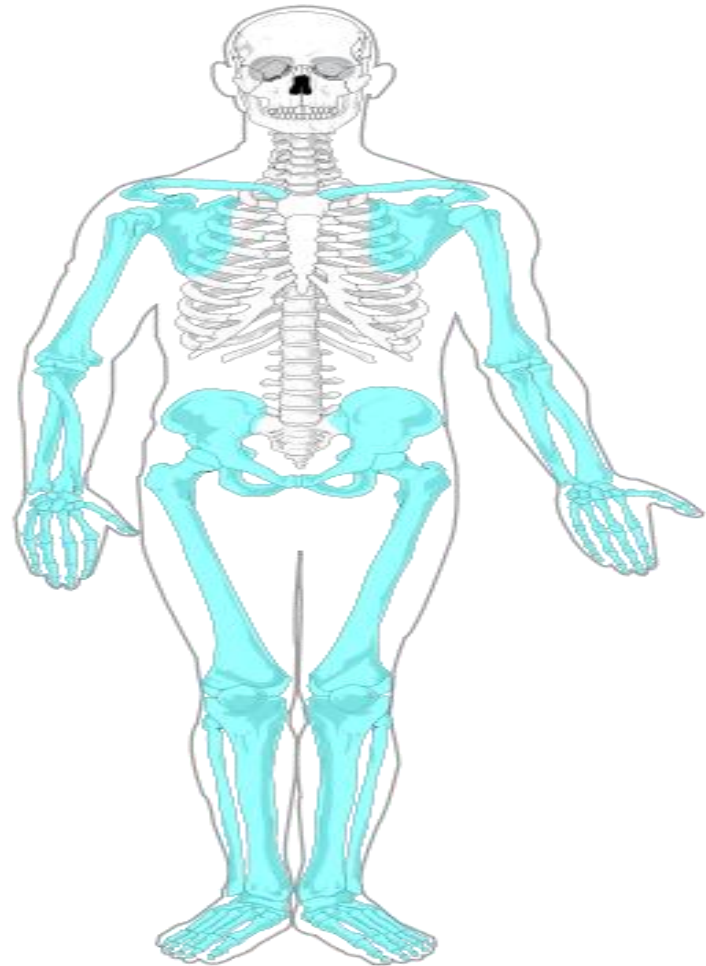
AXIAL (80)

APPENDICULAR (126)

Axial



Appendicular



Axial skeleton (80 bones)

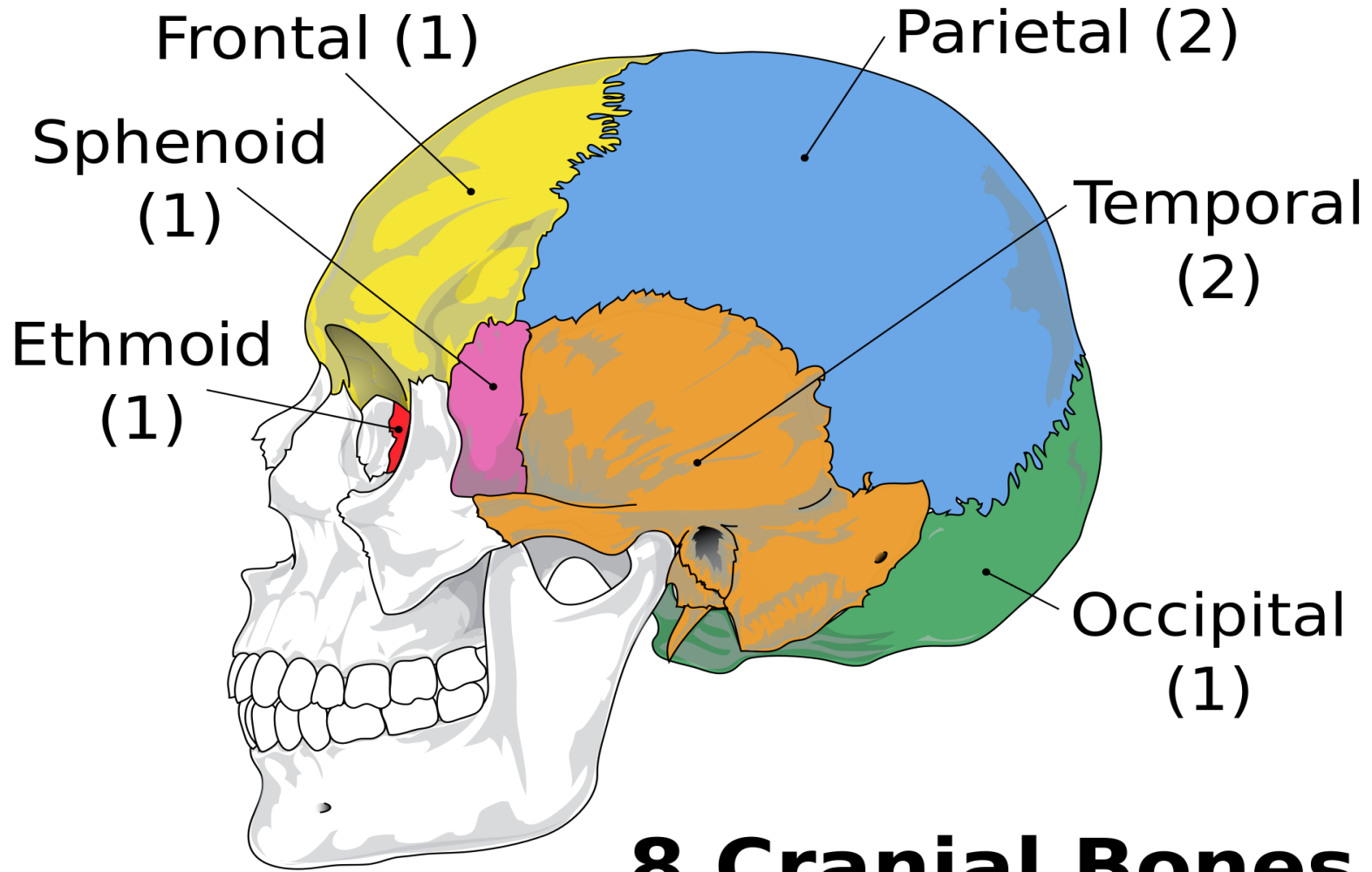
1. Skull	- 28	}	+ Hyoid Bone	
2. Thoracic cage	- 25			
3. Vertebral column	- 26			
<hr/>				
	79	+	1	= 80

Skull (28 Bones)

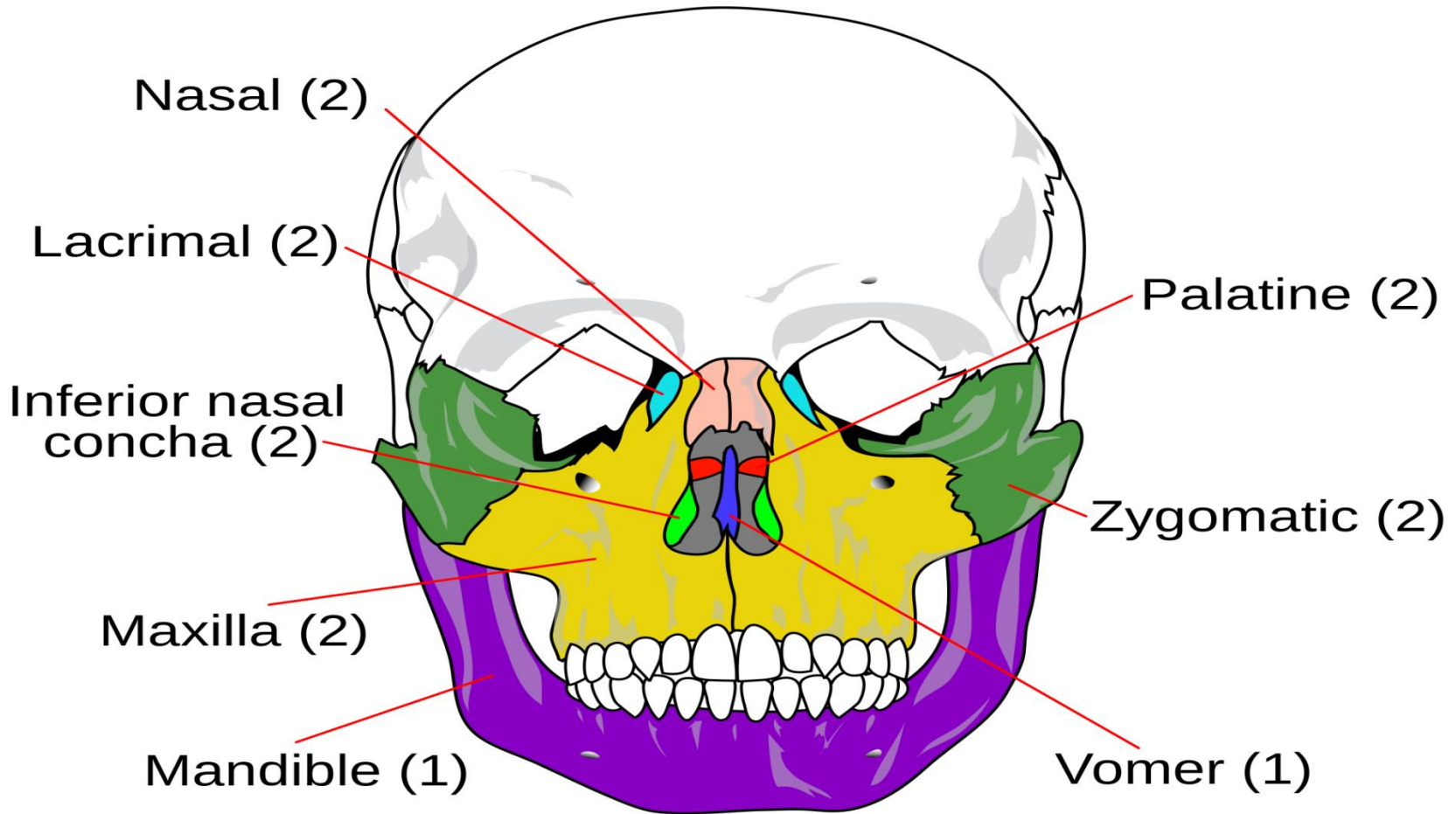
1. Cranium (8 Bones)
2. Facial bones (14)
3. Ear ossicles (6)



Cranium (8 Bones)

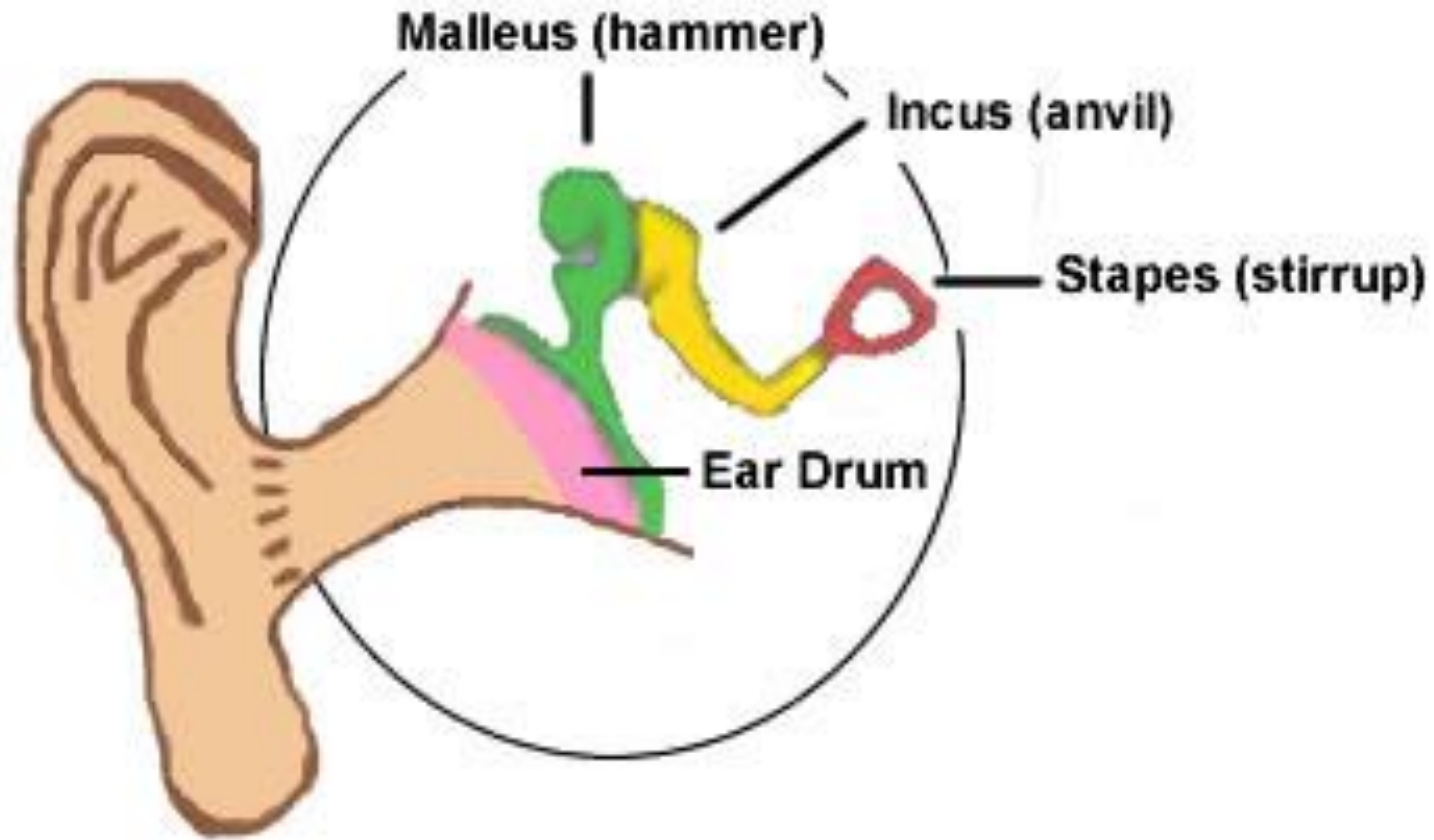


Facial bones (14)



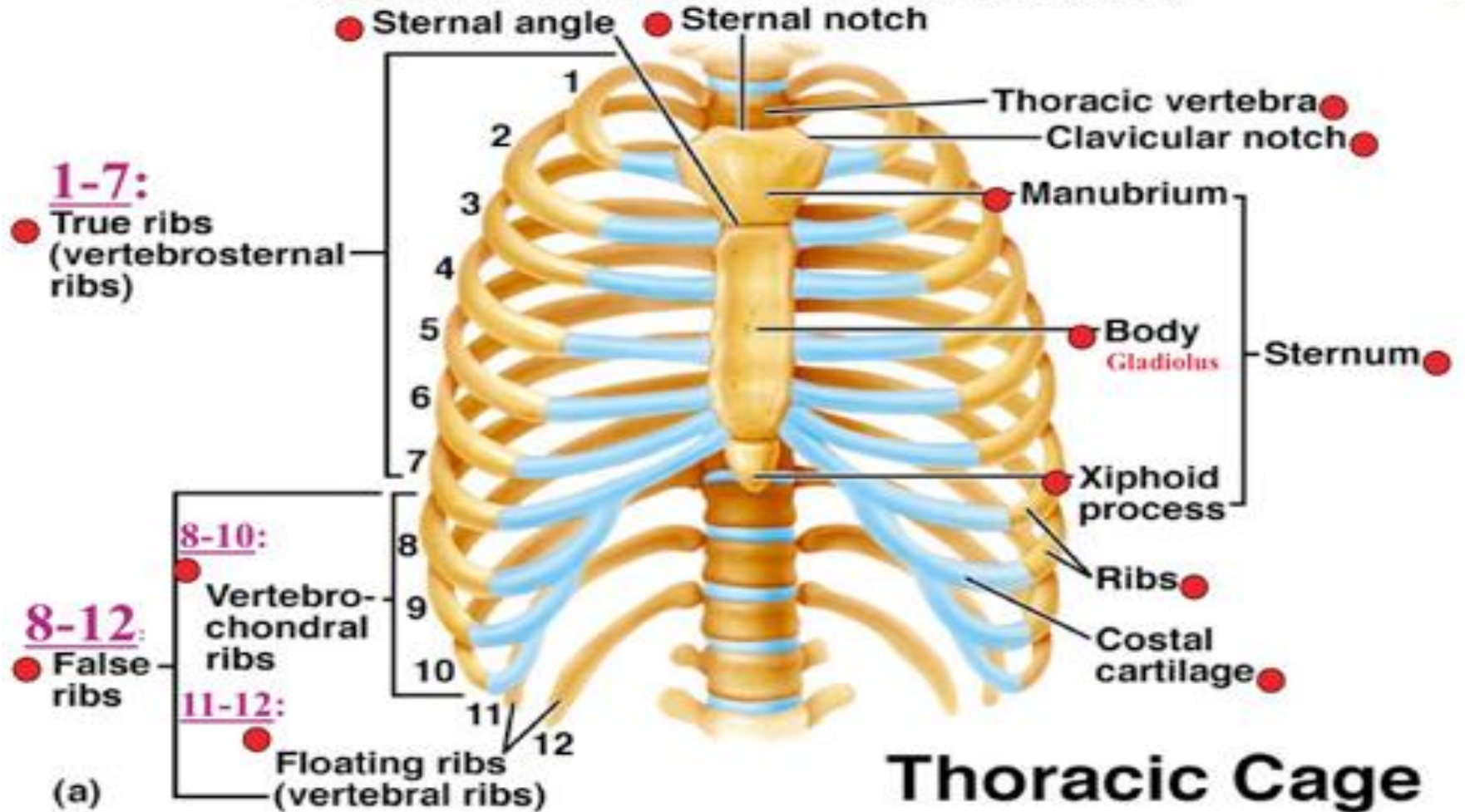
14 Facial Bones

Ear Bones (06)



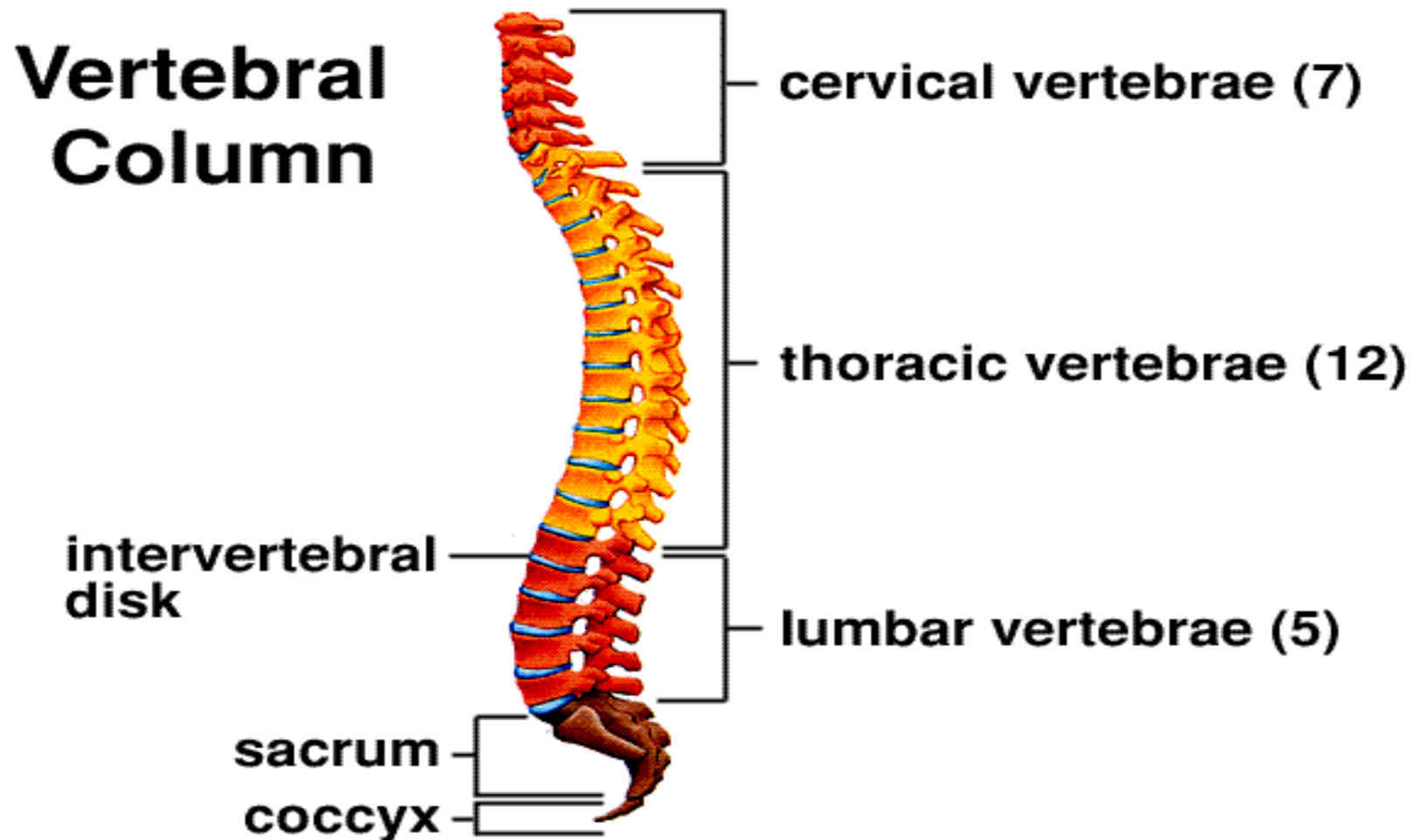
Thoracic cage (25)

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Vertebral column (26)

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**Appendicular
skeleton (126 bones)**

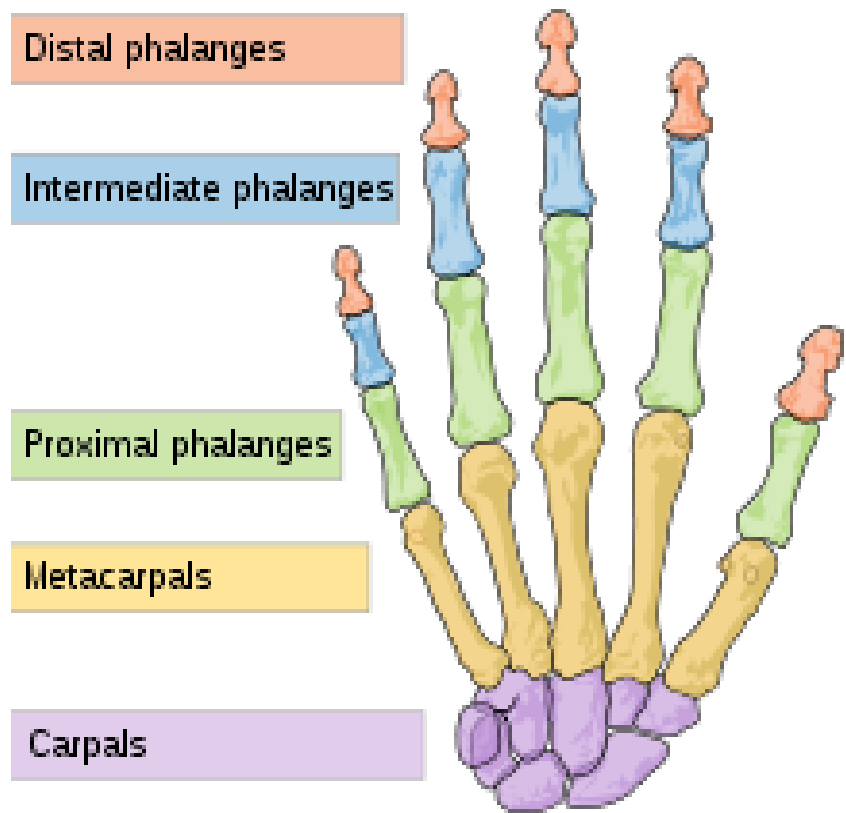
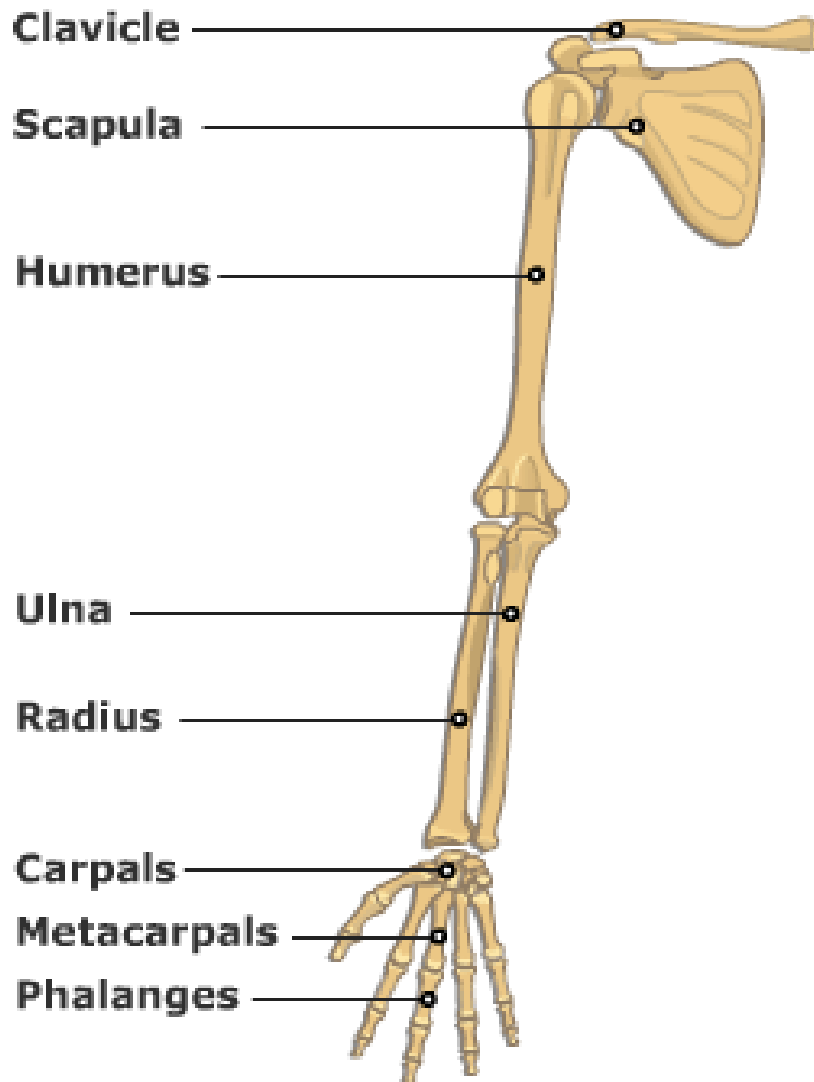
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graph TD; A["Appendicular skeleton (126 bones)"] --- B["Upper limb (64)"]; A --- C["Lower limb (62)"]
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The diagram is a hierarchical tree structure. At the top is a yellow rounded rectangle containing the text "Appendicular skeleton (126 bones)" in green. A vertical line descends from the bottom center of this box, then splits into two horizontal lines. From the left end of the left horizontal line, a vertical line descends to a second yellow rounded rectangle containing the text "Upper limb (64)" in blue. From the right end of the right horizontal line, a vertical line descends to a third yellow rounded rectangle containing the text "Lower limb (62)" in red. All boxes have a white shadow effect.

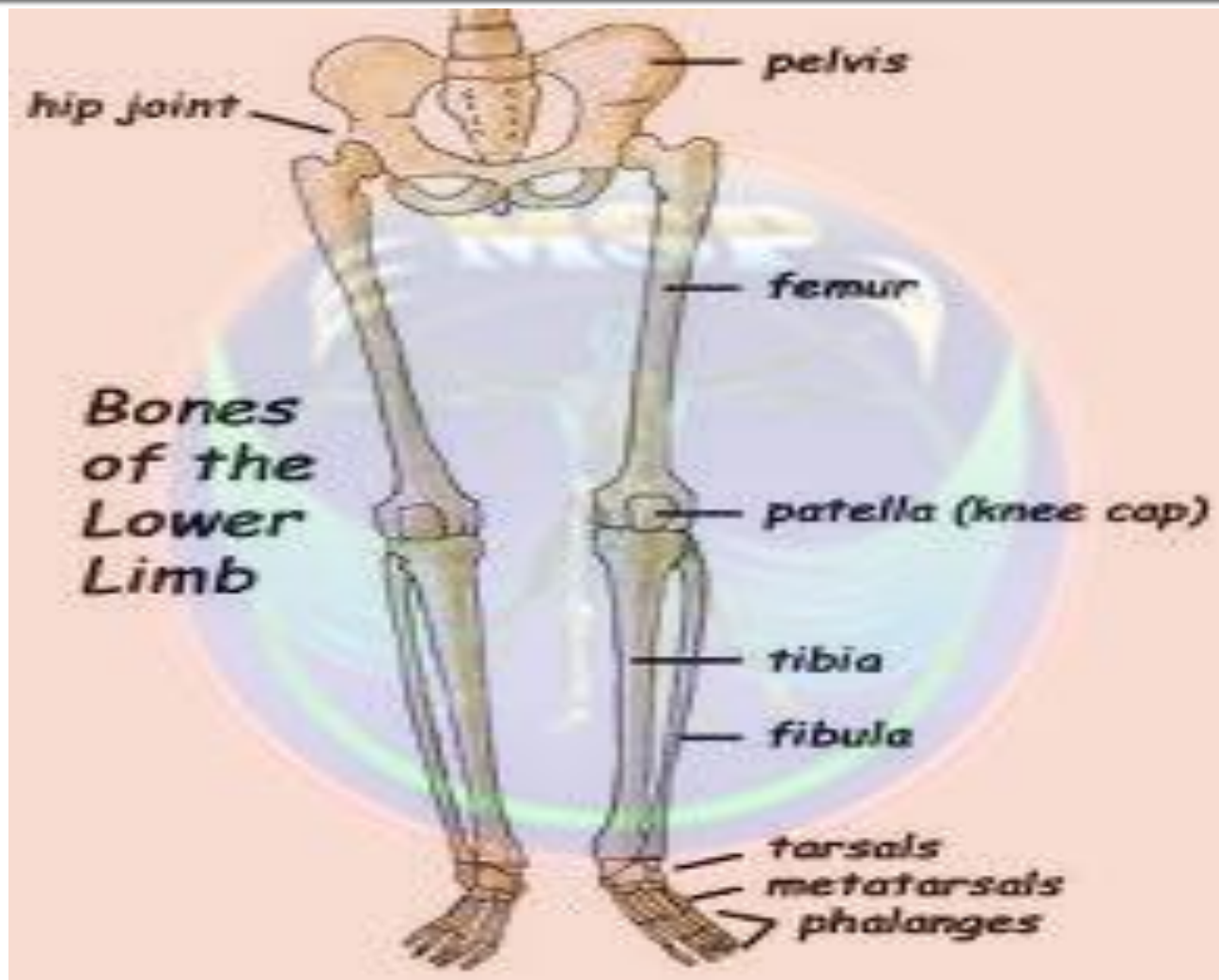
Upper limb (64)

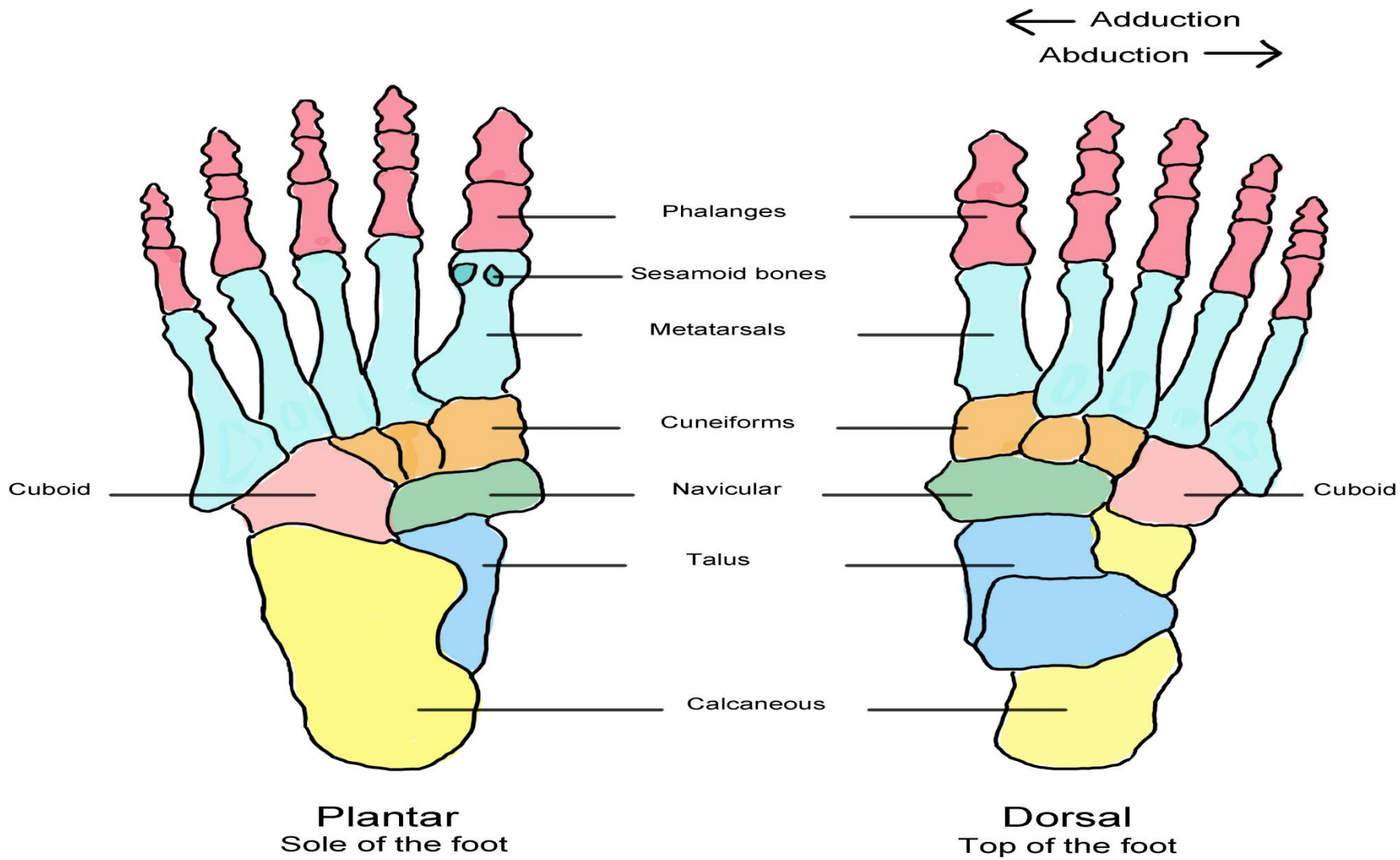
Lower limb (62)

Upper Limb (32+32=64)



Lower Limb (31+31=62)





Bones of the foot (right)

Functions of bone



1. They form **supporting framework** for the body.
2. They give **protection** to delicate organs.
3. They form joints which are essential for the **movement** of the body.
4. They provide **attachment** for the voluntary muscles (muscles & tendons). This helps in the movement of joints.

5. They form blood cells in red bone marrow in cancellous bone (**Haemopoiesis**).

6. They act as a **storehouse of calcium salts**.

7. They form **boundaries** for the cranial, thoracic and pelvic cavities.

ORGANIZATION OF SKELETAL MUSCLE

- All activities that involve movement depend on muscles
- 650 muscles in human body
- Various purposes for muscles for:
 - Locomotion
 - Balancing on two legs
 - Support of internal organs
 - Production heat

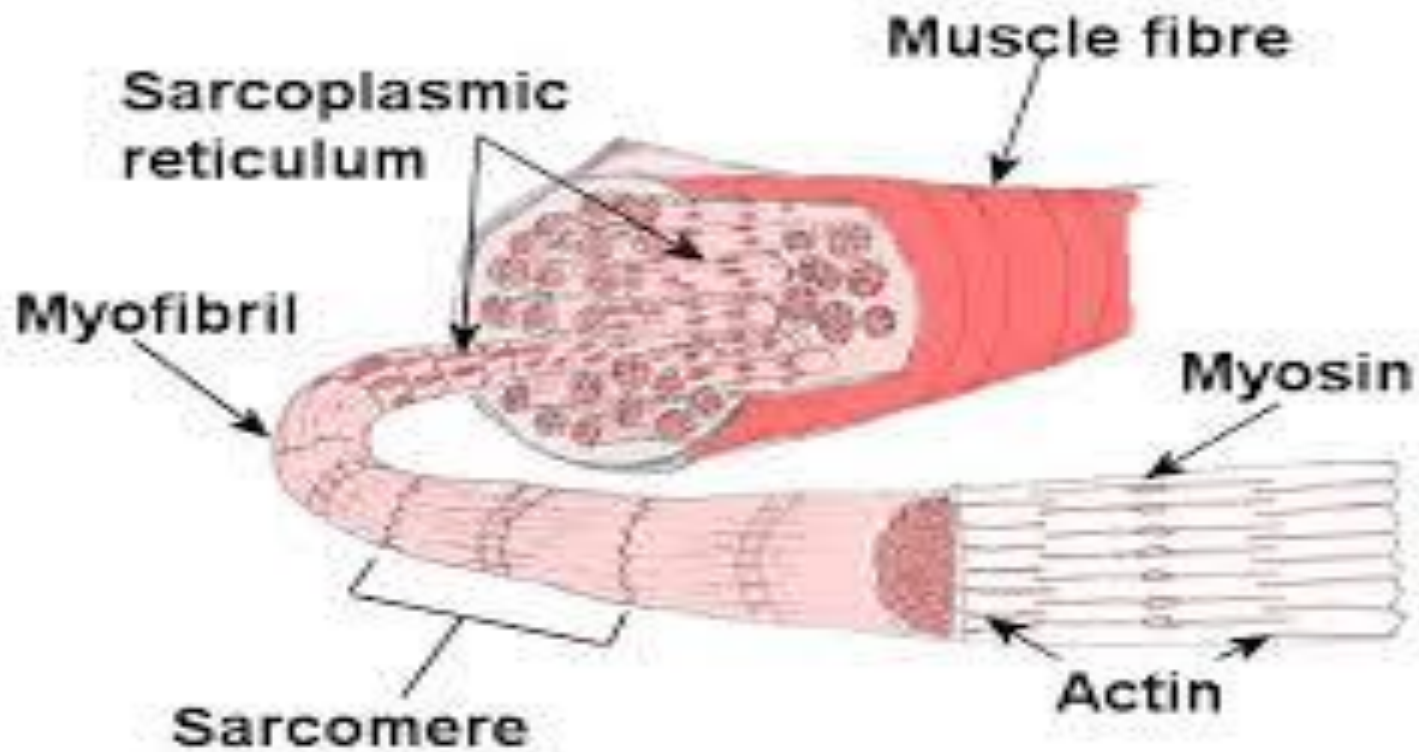
ORGANIZATION OF SKELETAL MUSCLE

- Three types of muscles in the human body
 1. Skeletal
 2. Cardiac
 3. Smooth
- Skeletal muscles are muscles which are attached to the skeleton.
- 40% of human body mass
- Skeletal muscles are responsible for locomotion, voluntary contraction and relaxation.

ORGANIZATION OF SKELETAL MUSCLE

- Muscle (whole organ)
- Fascicle (portion of muscle)
- Muscle Fiber (single muscle cell)
- Myofibril (muscle cell organelle)
- Sarcomere (portion of myofibril)
- Myofilament (Part of sarcomere)

STRUCTURE OF SKELETAL MUSCLE



PHYSIOLOGY OF MUSCLE CONTRACTION

SLIDING FILAMENT MECHANISM :

- The length of skeletal muscle shortens during contraction because the thick and thin filaments slide over one another. The process is known as the sliding filament mechanism.
- The thick filament contains 300 myosin molecules.

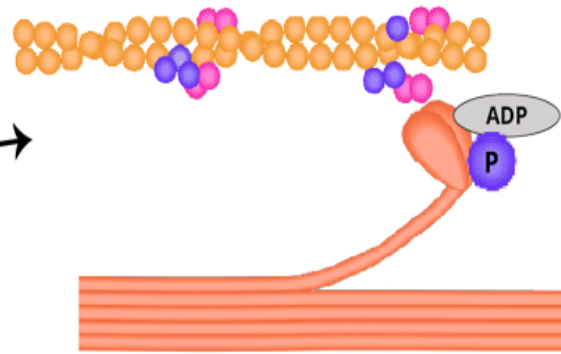
PHYSIOLOGY OF MUSCLE CONTRACTION

- It contains two parts :
 1. Myosin tail
 2. Myosin heads
- Myosin tail forms the shaft of the thick filament and projects towards the thin filament.
- Thin filaments contain actin, troponin, and tropomyosin.

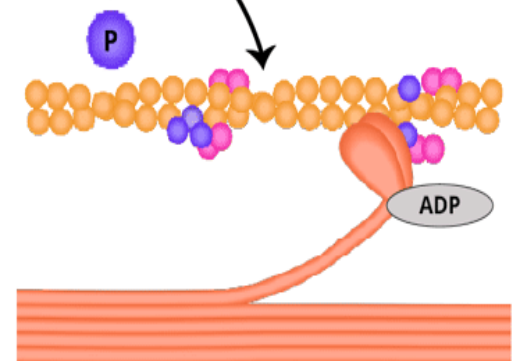
PHYSIOLOGY OF MUSCLE CONTRACTION

- The contraction cycle consists of 4 steps
 1. ATP hydrolysis.
 2. Attachment of myosin to actin to form cross-bridges.
 3. Power stroke.
 4. Detachment of myosin from actin.

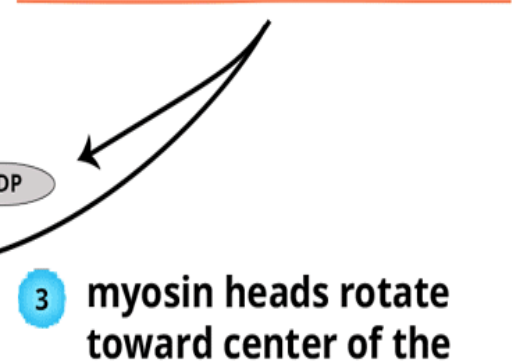
1 Myosin heads split ATP and become reoriented and energized



2 Myosin heads bind to actin, forming crossbridges

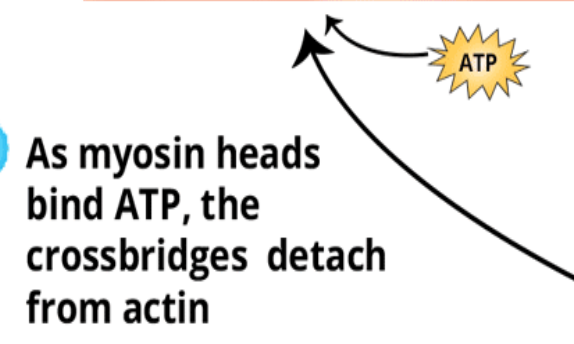
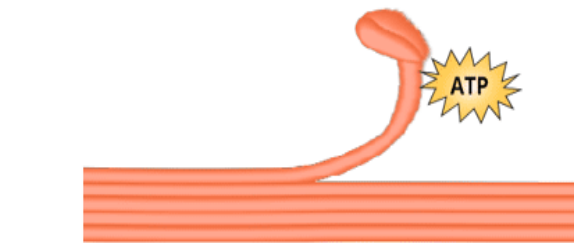


Contraction cycle continues if ATP is available and Ca^{2+} level in the sarcoplasm is high



3 myosin heads rotate toward center of the sarcomere (power stroke)

4 As myosin heads bind ATP, the crossbridges detach from actin



PHYSIOLOGY OF MUSCLE CONTRACTION

ATP Hydrolysis :

- Myosin heads split ATP and become reoriented and energized

Attachment of myosin to actin to cross-bridges

- Myosin heads bind to actin, forming cross bridges

PHYSIOLOGY OF MUSCLE CONTRACTION

Power stroke :

- Myosin heads rotate toward center of the sarcomere (power stroke)

Detachment of myosin from actin :

- As myosin heads bind ATP, the cross bridges detach from actin

thanks



UNIT – II

JOINTS



Presented By

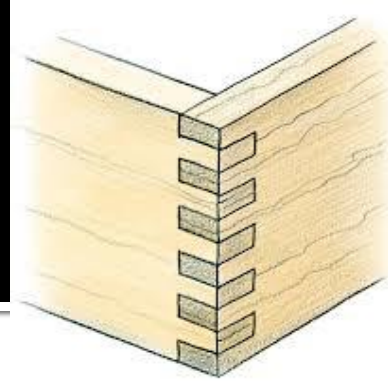
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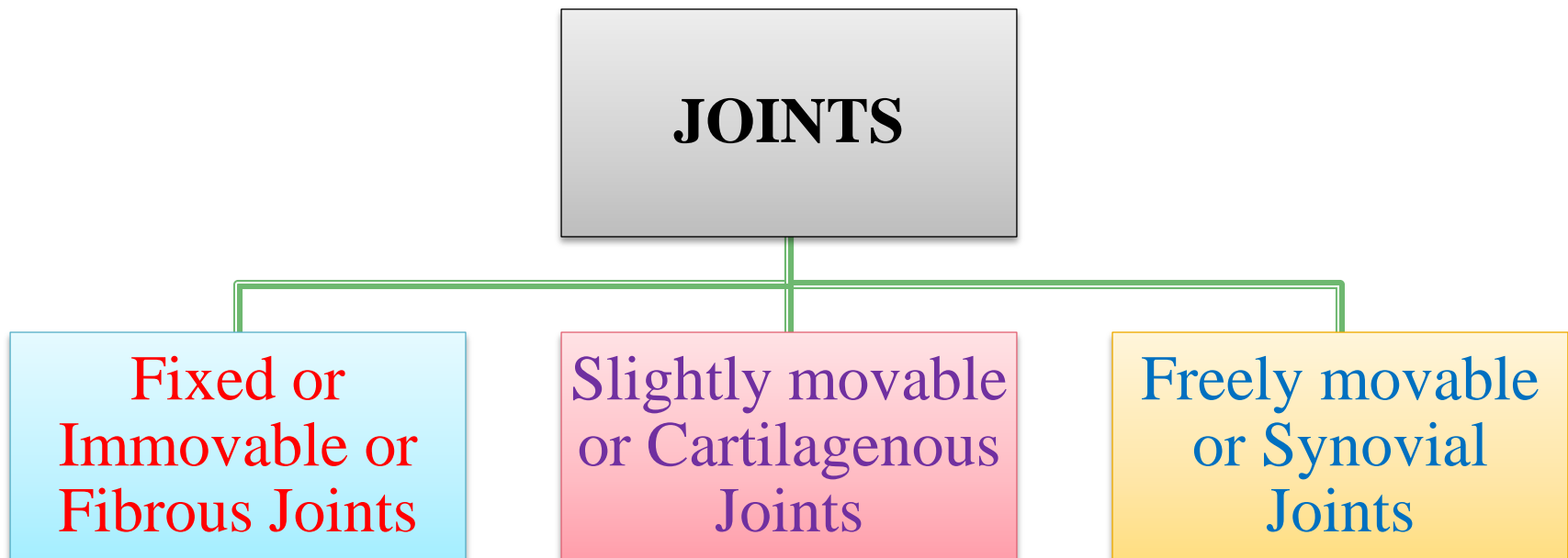
JOINTS



- ❖ The union of two or more bones of skeleton is called as Joint or Articulation. OR
- ❖ A joint is the site at which any two or more bones articulate or come together.

TYPES OF JOINTS

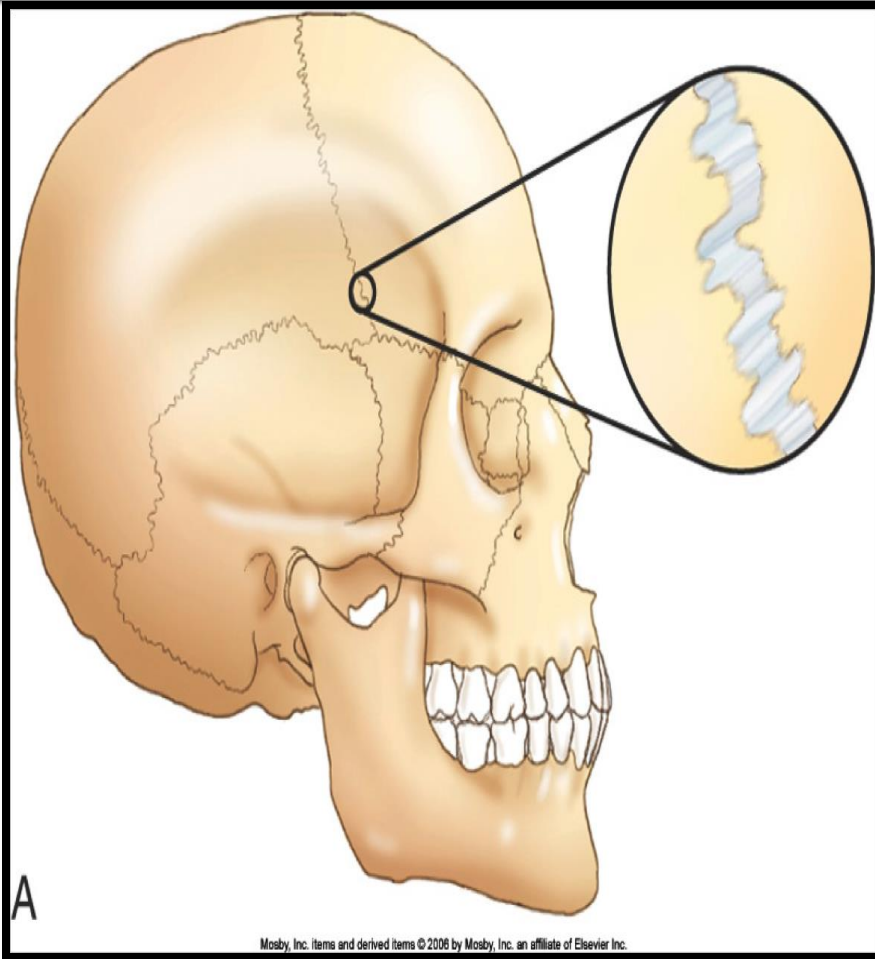
- Joints are classified on the basis of **degree** or **type** or **movements** which they perform.



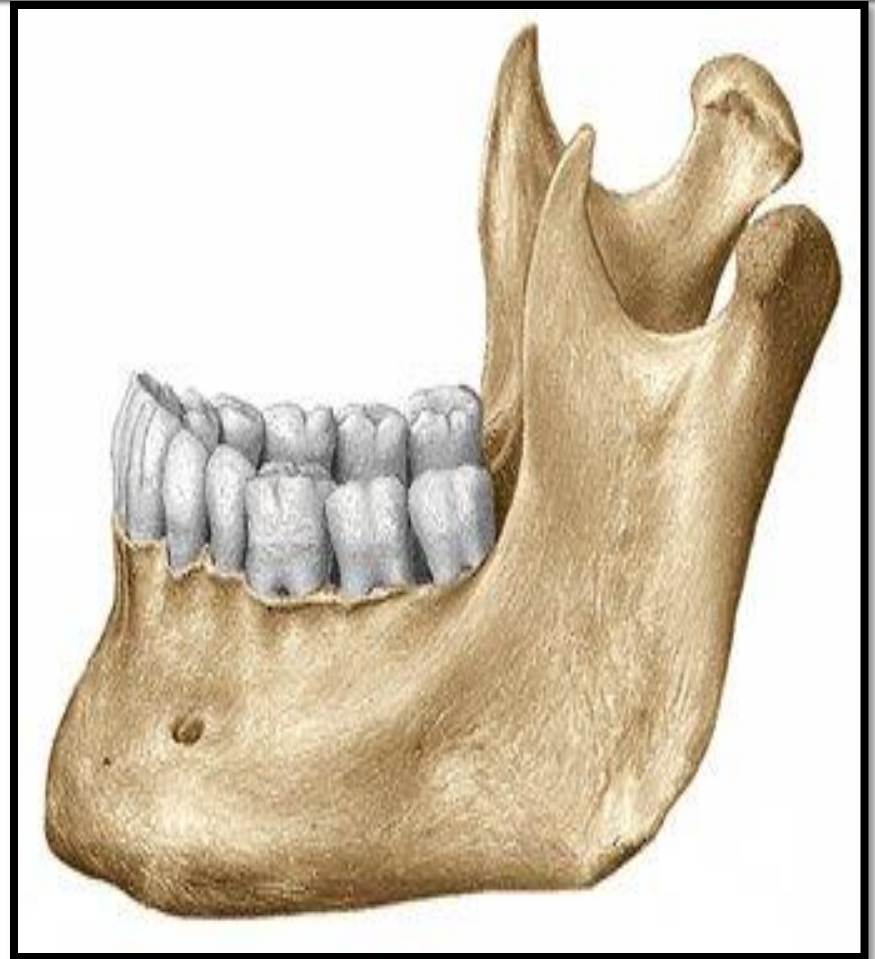
Fixed or Immovable or Fibrous Joints



- Bones forming these joints are linked with tough, fibrous material (rich in collagen fibers).
- No synovial cavity.
- Such arrangement often permit **no movement**.
- E.g.: 1) Joints between **skull bones** (Sutures).
- 2) **Teeth** are cemented into **mandible** and **maxilla**.



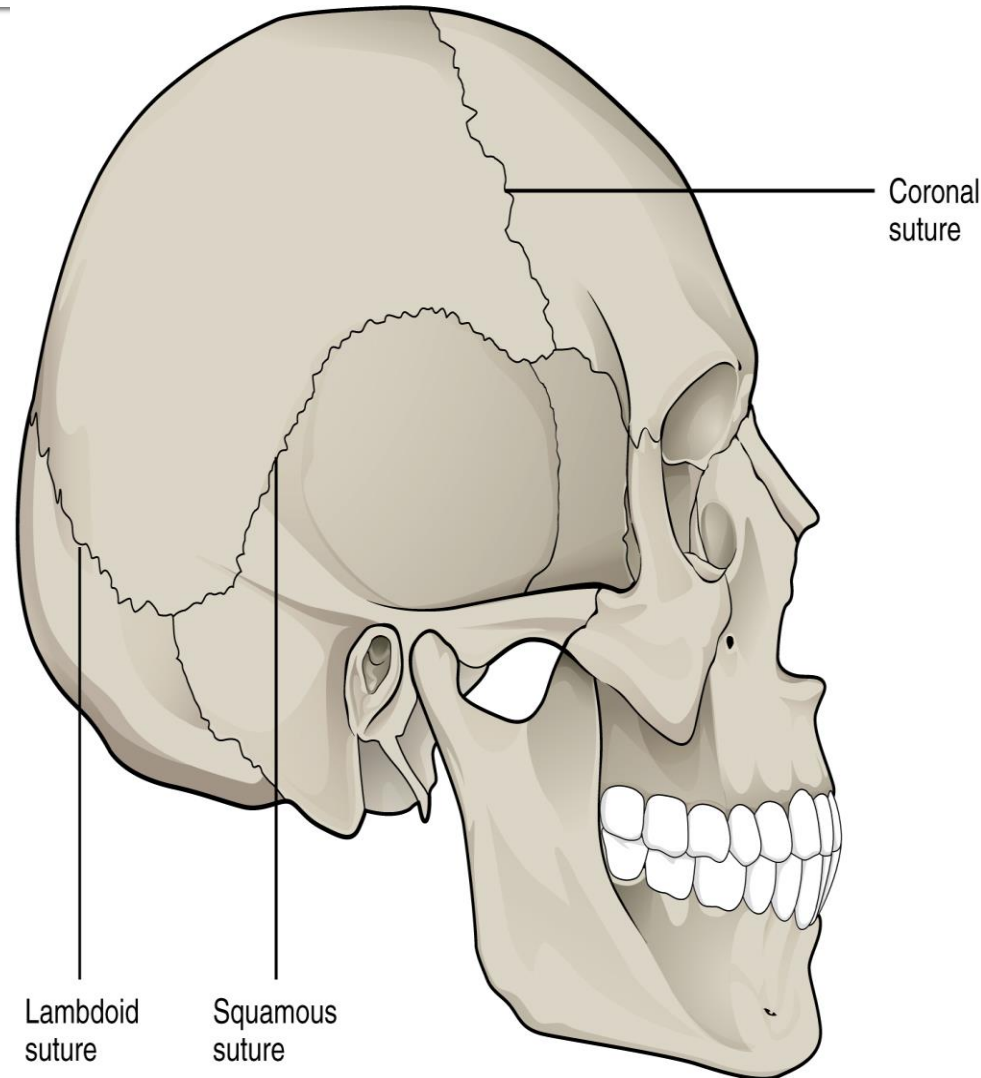
Joints between **skull bones** (Sutures).

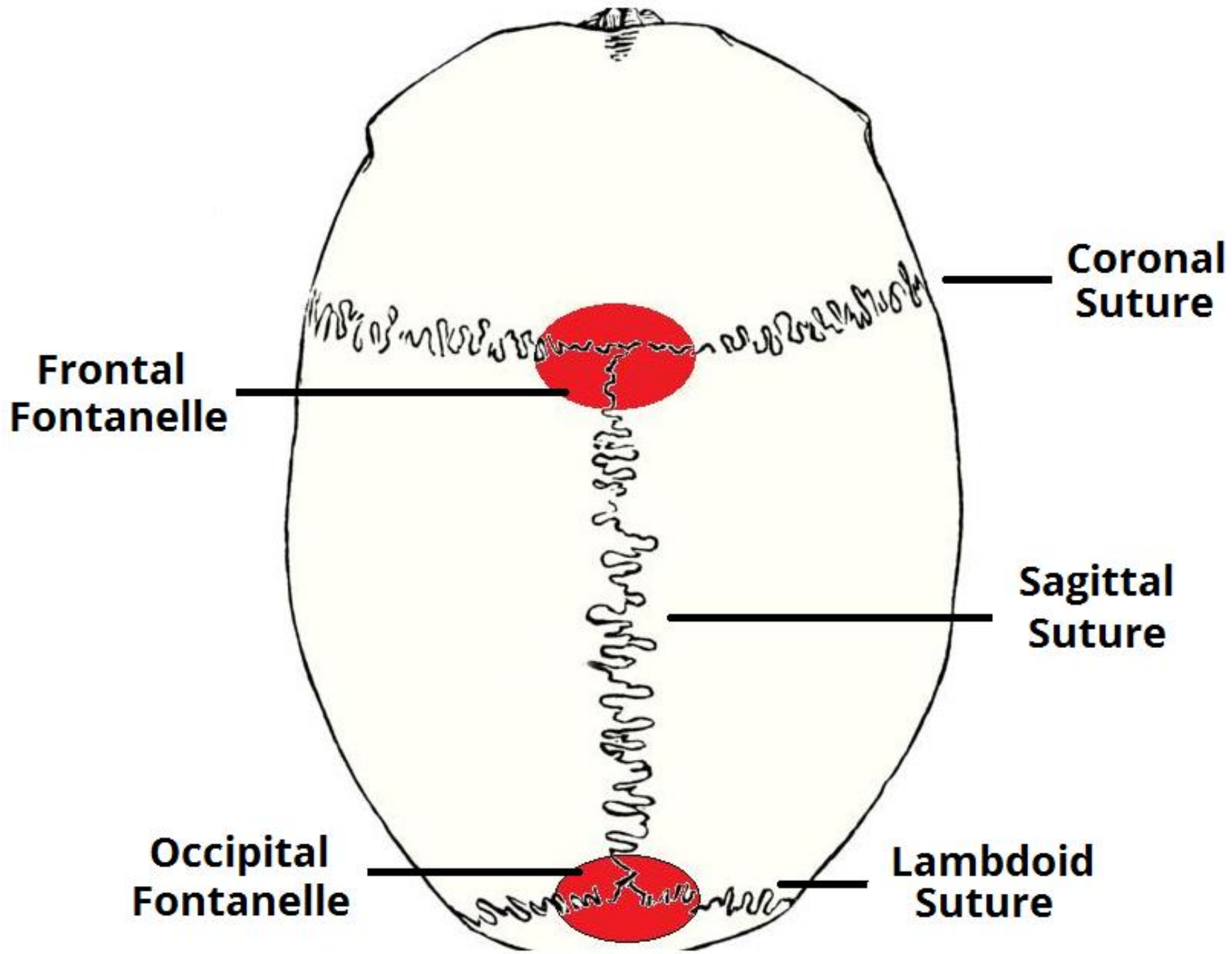


Teeth are cemented into **mandible**

Types of sutures

- Frontal & parietal bones joins at the **Coronal suture**.
- The parietal bones articulate with each other at **Sagittal suture**.
- The parietal bones articulate with occipital bone at the **Lambdoid sutures**.
- The parietal bones articulate with temporal bones at **Squamous suture**.





Slightly Movable or Cartilaginous Joints



- These joints are formed by a pad of fibrocartilage, a tough material that act as a shock absorber.
- No synovial cavity.
- Such arrangement often permit slight movement.
- E.g.: 1) Joints between **Vertebrae**.
- 2) Symphysis pubis- joints between **pubic bones**.
- 3) **Tibia with fibula**

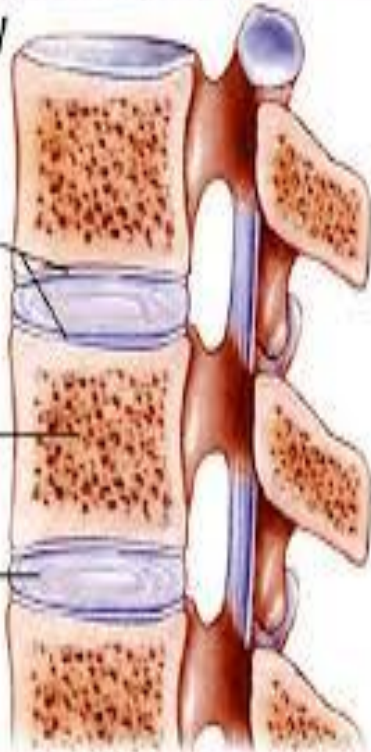
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Joints—Slightly Movable

Articular cartilage

Body of vertebra

Intervertebral disk

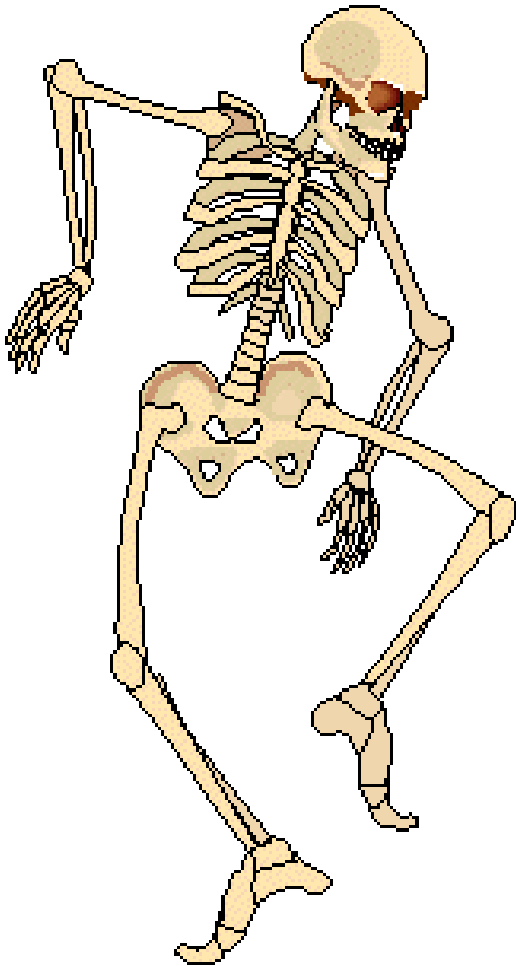


Sacroiliac Joints



Symphysis Pubis Joint

Freely Movable or Synovial Joints



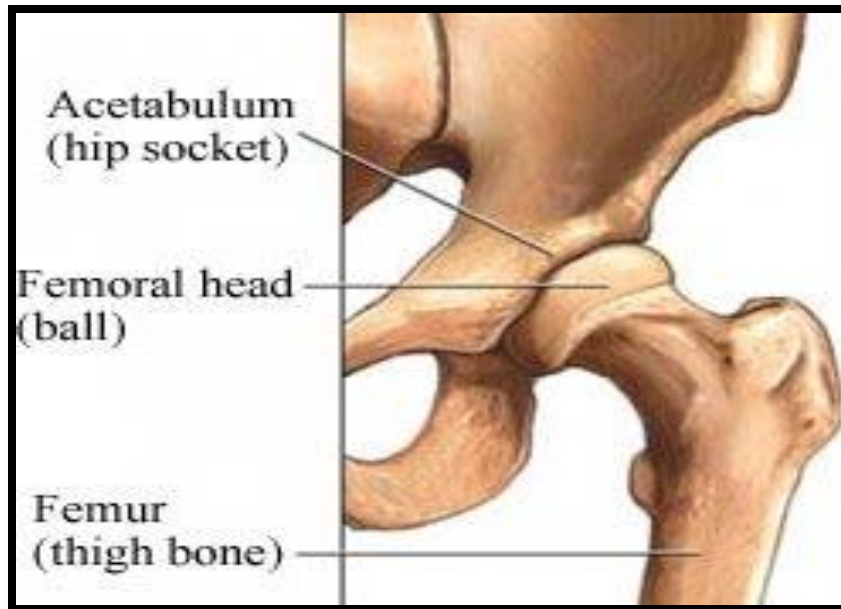
- Synovial joints are characterized by the presence of space between the articulating bones.
- The ends of bone are lubricated with a small amount of fluid (Synovial fluid).
- Synovial joints permit a range of movements.

TYPES OF SYNOVIAL JOINTS

1. Ball and Socket joint e.g. **Shoulder joint, Hip joint**
2. Hinge joint e.g. **Elbow joint, Knee joint, Ankle joint**
3. Gliding joint e.g. Joint between **carpals**, joint between **tarsals, sternoclavicular joint.**
4. Pivot joint e.g. Joint between **atlas** and **axis, Radioulnar joints.**
5. Condylloid joint (the double hinge joint) e.g. **Wrist joint**, temporomandibular, **metacarpophalangeal joint (joint bet metacarpal & phalanges)** and metatarsophalangeal joints (Joint bet metatarsal & phalanges).
6. Saddle joint e.g. Joint between **trapezium** & first **metacarpal bone.**

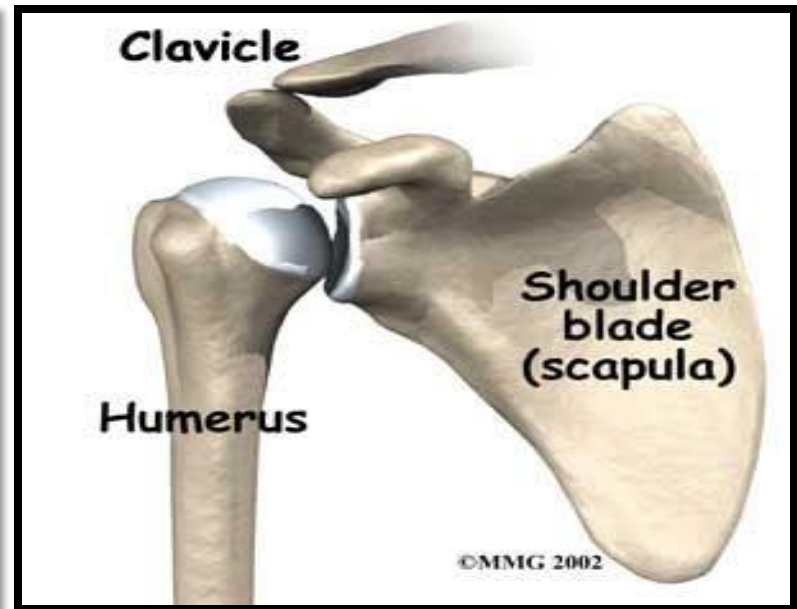
1. Ball and Socket joint

- The head of one bone is ball shaped and articulate with cup shaped socket of another.



Hip joint

Between Head of femur bone and acetabulum cavity of hip bone

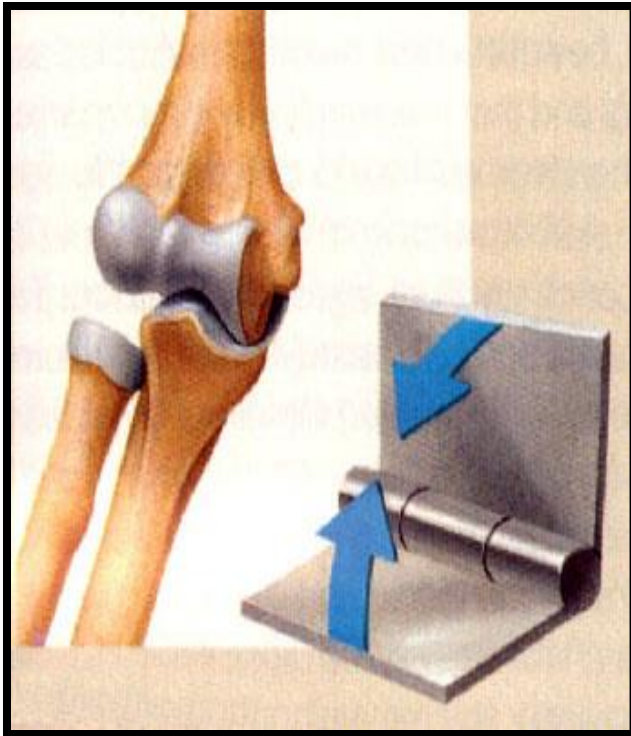


Shoulder joint

Between head of humerus and glenoid cavity of scapula

2. Hinge joint

The articulating ends of the bones form an arrangement like a hinge on door.



Elbow joint
Humerus, radius and
ulna



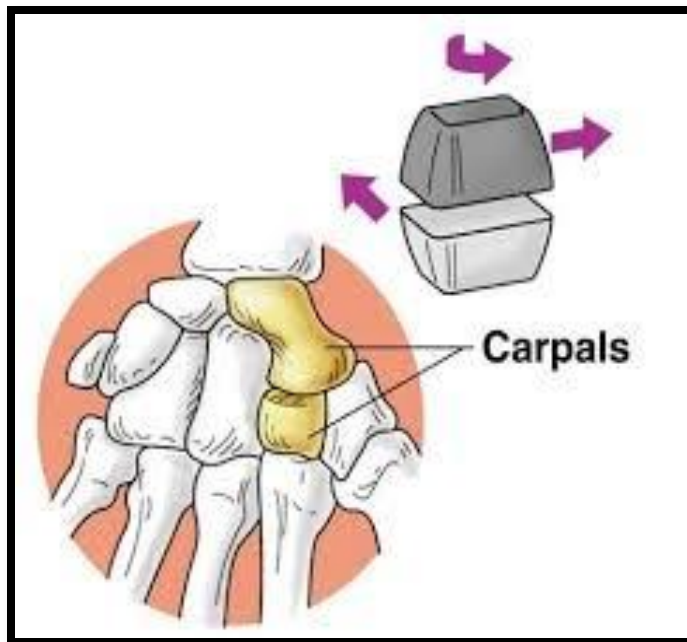
Knee joint
Femur, Tibia,
Fibula, Patella



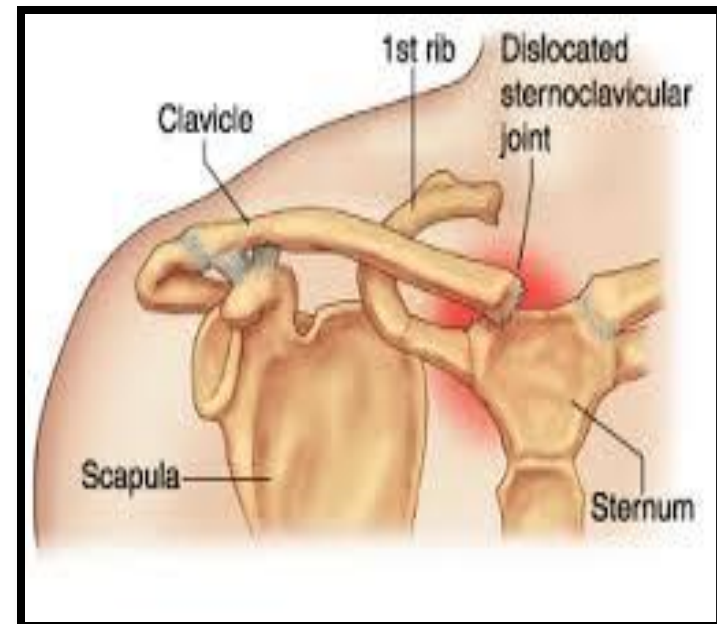
Ankle joint
tibia, fibula, Talus
bone

3. Gliding joint

- The articulating surfaces are flat or very slightly curved and glide over one another (move back-and-forth and from side to side).
- Least movable of all the synovial joints.



Joint between carpals

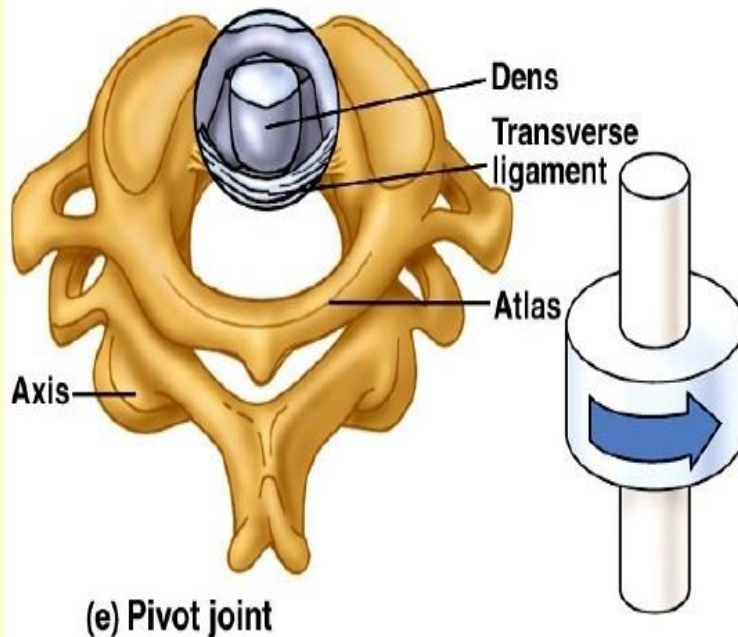


Sternoclavicular joint

4. Pivot joint

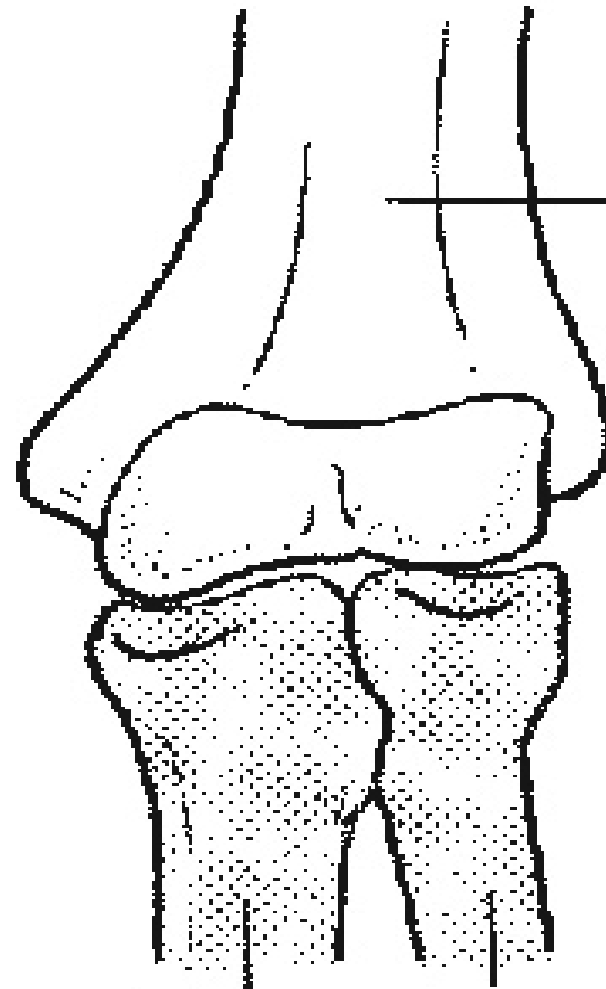
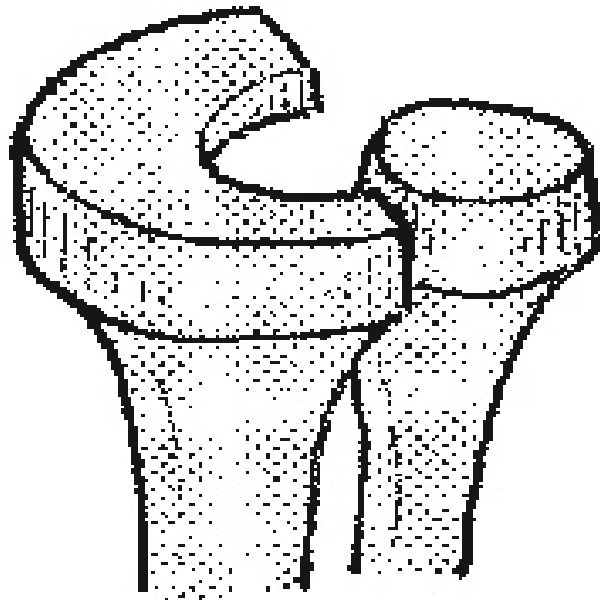
- ❖ The rounded or pointed surface of one bone articulates with a ring formed partly by another bone and partly by a ligament.
- ❖ These joints allow a bone or a limb to rotate.

- **Pivot joint:** rotation around a central axis
- **Ex:** atlas/axis joint



Joint between atlas and axis

Pivot joint



Humerus

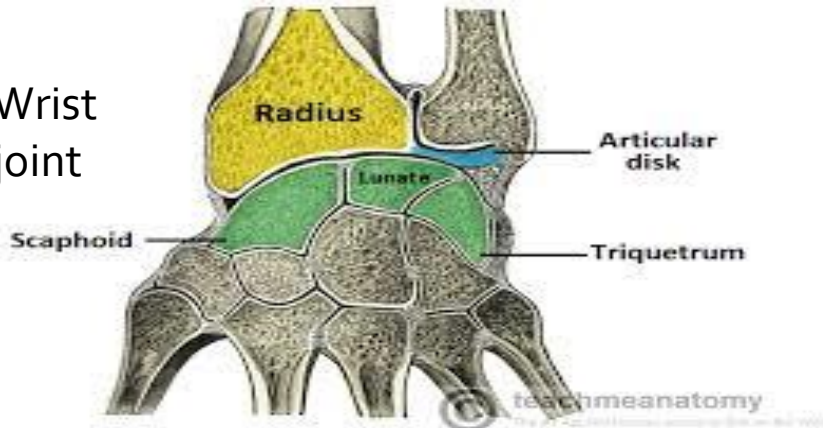
Ulna

Radius

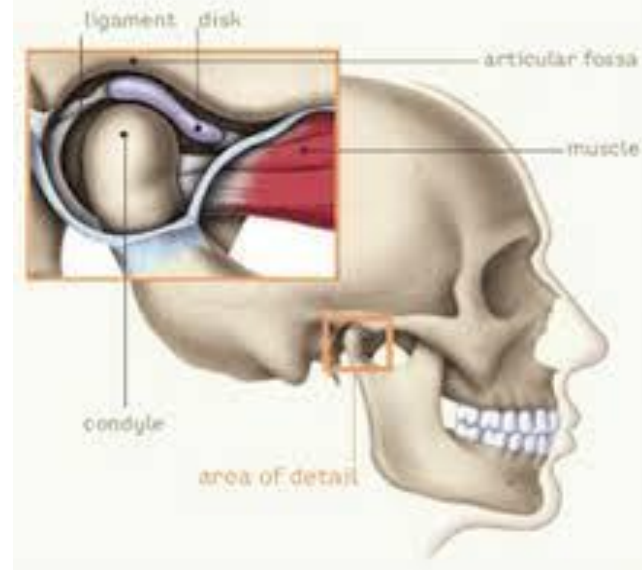
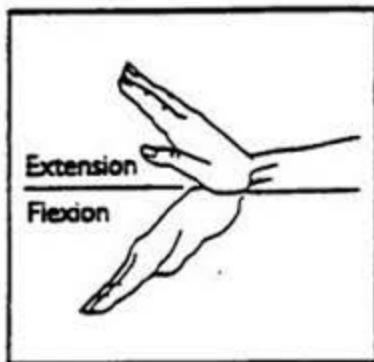
5. Condylod or Ellipsoidal or Double Hinge joint

The convex oval shaped projection of one bone fits into oval shaped depression of another bone.

Wrist joint



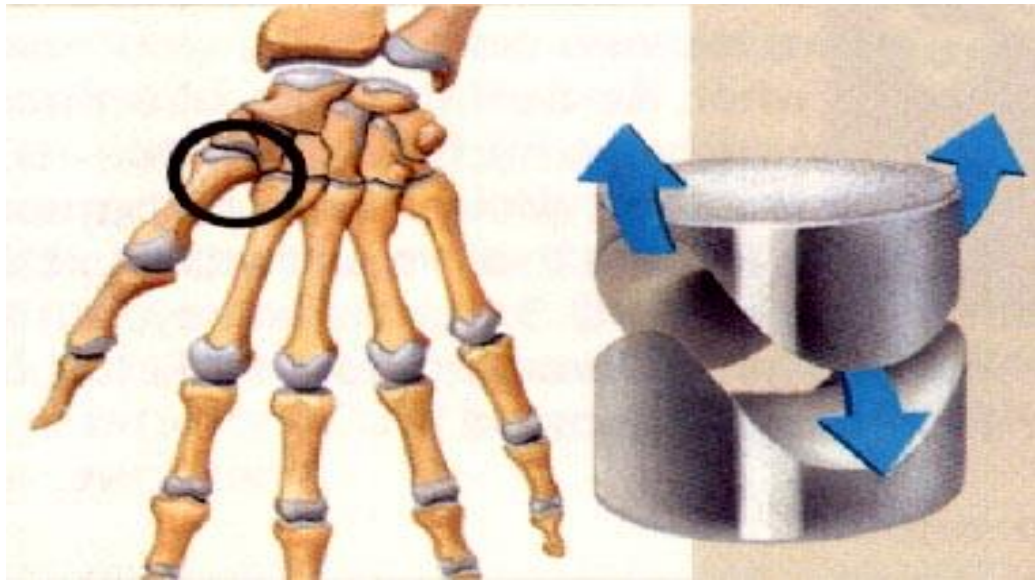
Extension/Flexion



Temporomandibular joint

6. Saddle joint

- The articular surface of one bone is saddle shaped, and the articulating surface of other bone fits into the “saddle” as a sitting rider would sit.



Joint between trapezium & first metacarpal bone

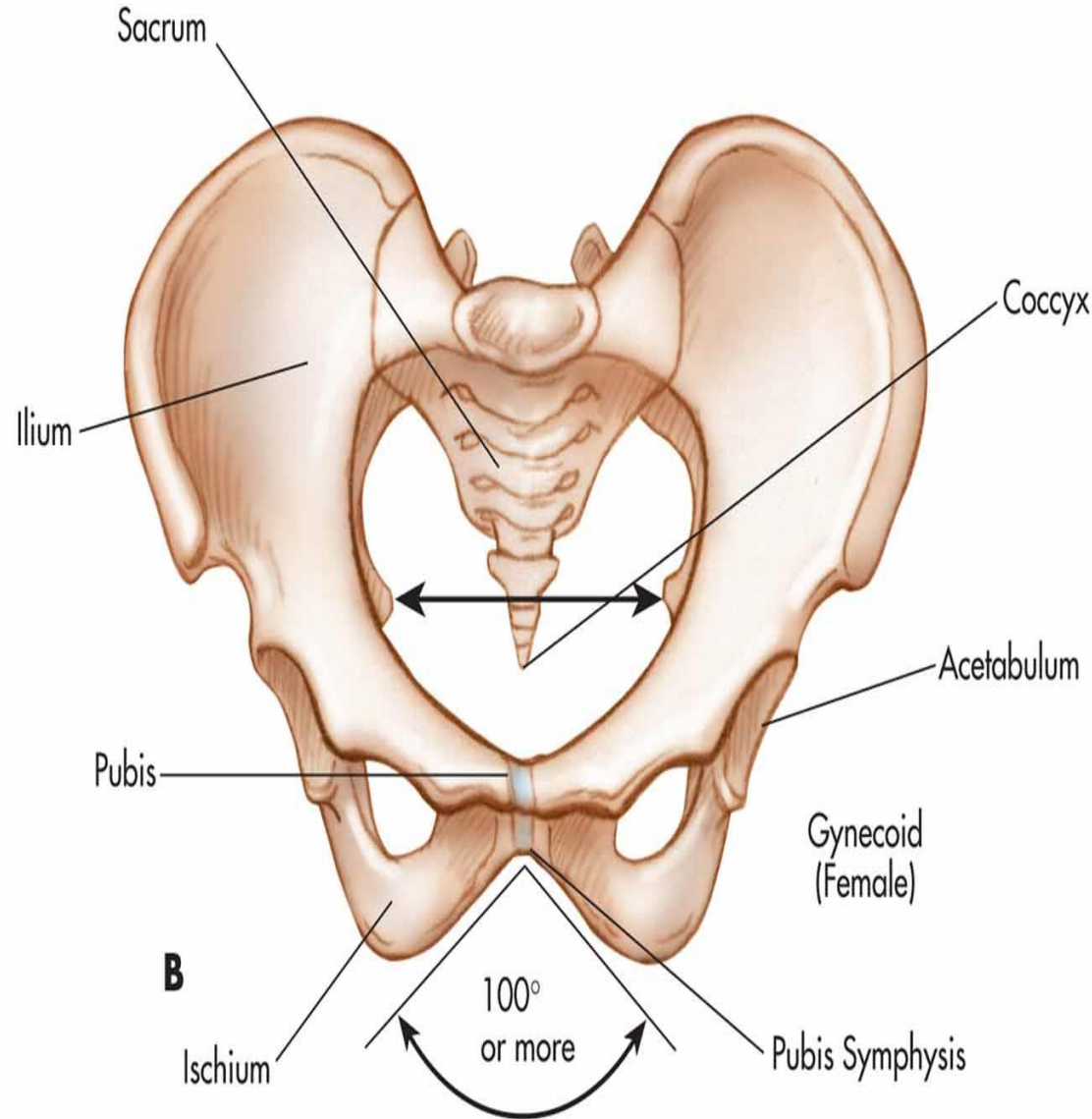
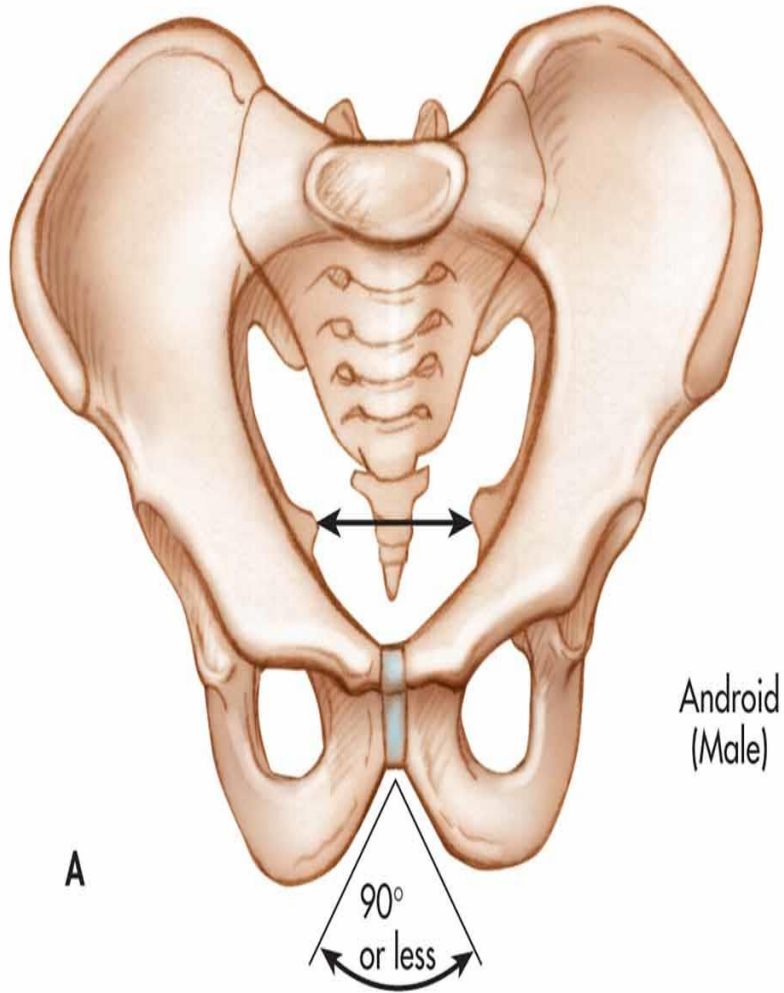
Male & Female pelvis

Differentiate between male and female pelvis. (3.5 marks)

	Female	Male
Bones	Lighter and thin	Heavier and thick
cavity	Shallow and oval	Deep and funnel shape
sacrum	More concave anteriorly, making true pelvis broader	Less concave, making the true pelvis narrower at the outlet
Pubic-Arch	The angle made at the symphysis pubis is wider.	The angle of the pubic arch is narrower

Male Pelvis

Female Pelvis



Classify bones according to their shapes and size

1. **Long bones:** These consist of an elongated shaft with two extremities.

- The shaft consists of a cylindrical compact bone and extremities are formed by a thin outer shell of compact tissue with an interior network of spongy or cancellous bone containing red bone marrow.
e.g. femur, tibia, fibula.

2. **Short bones:** These are roughly box like bones having no shaft but consist of smaller masses of spongy bones covered by a thin layer of compact bone.

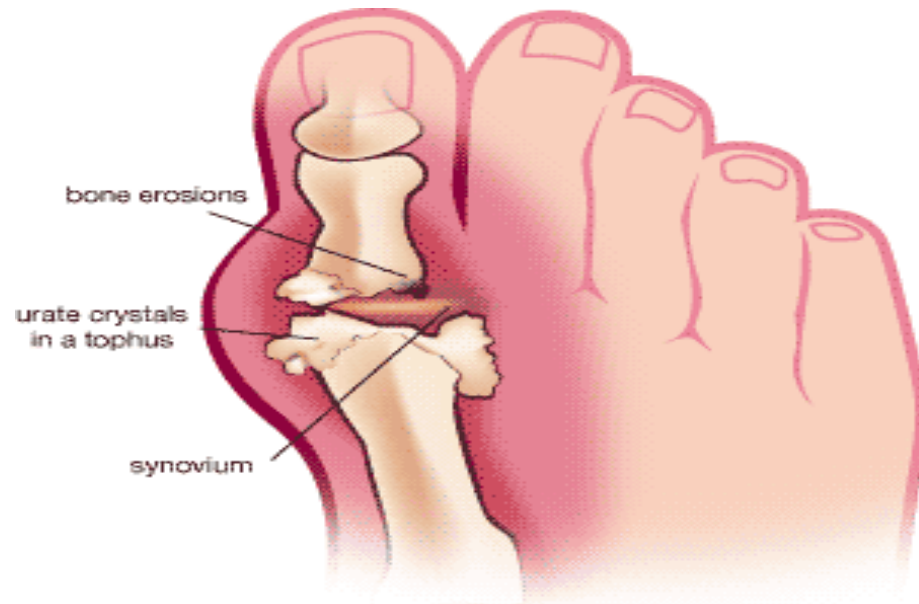
- e.g. Wrist, Carpal and tarsal bones.

3. Flat bones: In this type, a thin layer of cancellous bone is sandwiched in between two layers of compact bones.

- e.g. sternum, Scapula, bones of the skull.
- Irregular bones: These bones cannot place in any of the above categories and their shape is not fixed.
- e.g. vertebrae and most bones of face.
- Sesamoid bones: These are small bones which are developed in the tendons around certain joints.
- e.g. patella bone.

Joints disorders

- **Gout:** It is condition caused by the deposition of sodium urate crystals in joints and tendons that provokes an acute inflammatory response.



Osteoarthritis

- It is condition caused by degeneration of articular cartilage that results in pain and restrictive movements of joints.

Evolution of Osteoarthritis

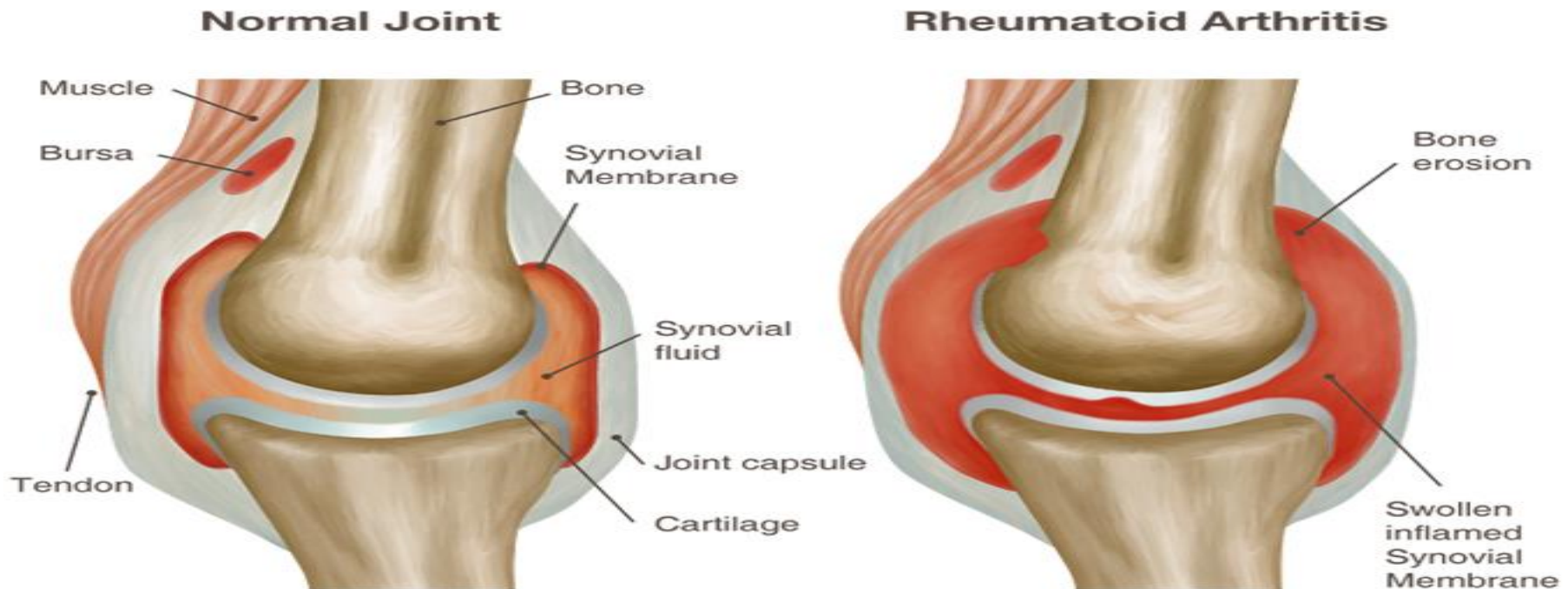


1. Bone
2. Cartilage
3. Thinning of cartilage

4. Cartilage remnants
5. Destruction of cartilage

Rheumatoid arthritis

- This is chronic progressive inflammatory autoimmune disease which affects synovial joints and causes pain.





THANK YOU