GKTeach

STAGE 1

MSA

Medical Students' Association

Skeleton, Joints, Muscles, Nerve Tissues

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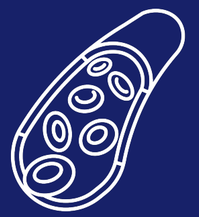
MBBS YEAR 2

24/10/2024



Skeleton

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Bone vs Cartilage

Bone	Cartilage
Low Water Content	High Water Content
Vascular	Avascular
Osteocytes, Osteoclasts, Osteoblasts	Chondrocytes
Ossification (Intramembranous & Endochondral)	Appositional & Interstitial Growth
2 main types: Compact & Spongy Bone	3 main types: Fibrous, Elastic & Hyaline Cartilage

Osteoblast vs Osteoid vs Osteocyte vs Osteoclast

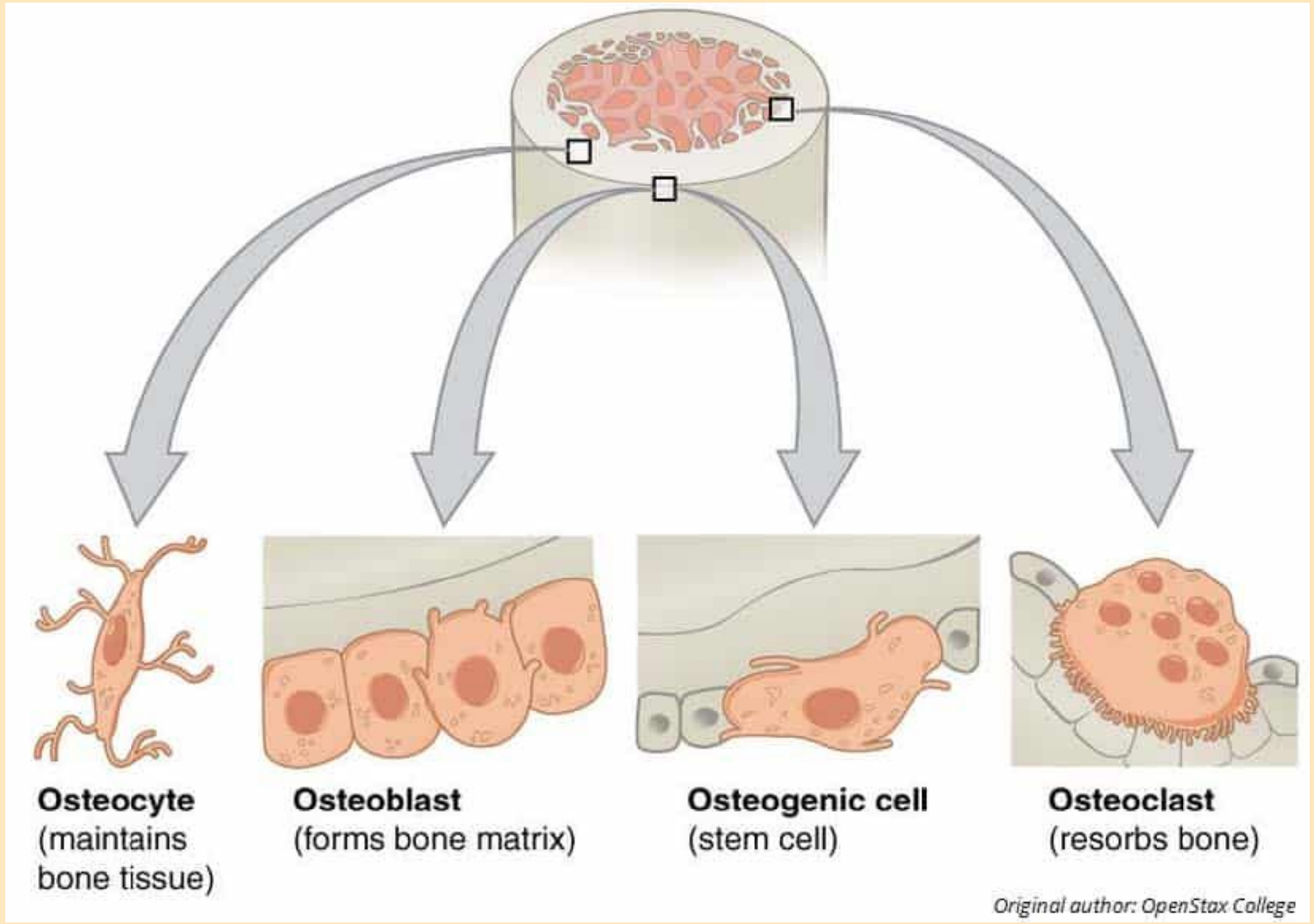
1. -blast ⇒ ‘precursor / immature cell’ (e.g. osteoblast = immature bone cell ⇒ forms new bone tissue)

2. -oid ⇒ ‘resembling’ (e.g. osteoid = bone like ⇒ synthesised by osteoblasts prior to mineralisation)

3. -cyte ⇒ ‘cell’ (e.g. osteocyte = bone cells ⇒ post mineralisation)

4. - clast ⇒ ‘broken’ (e.g. osteoclast => breaks down bone during bone remodelling - different LINEAGE)

Osteoblast vs Osteoid vs Osteocyte vs Osteoclast



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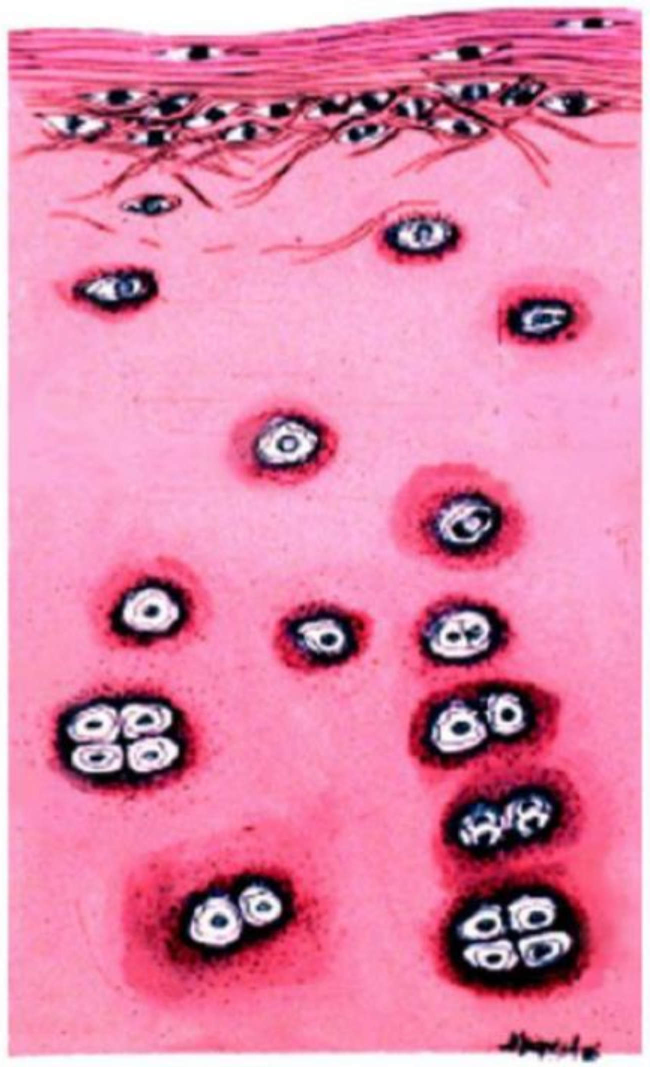
Appositional vs Interstitial Growth

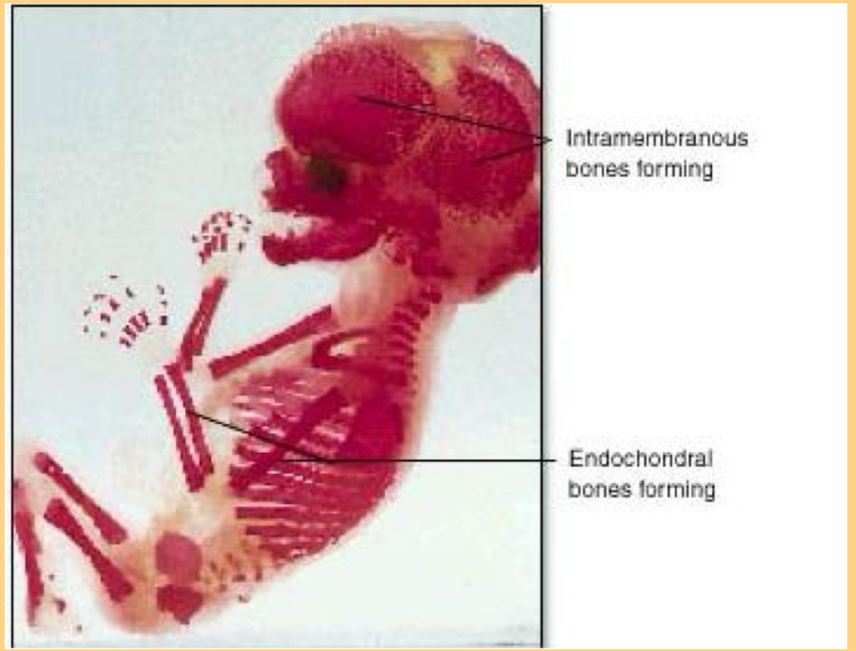
- Appositional growth: chondroblasts in perichondrium differentiate into chondrocytes, start producing matrix, and add to existing cartilage

- Interstitial growth: proliferation and hypertrophy of existing chondrocytes



Ossification = bone making process

1. **Intramembranous** Ossification => bone directly made from embryonic MESENCHYMAL stem cells. (no hyaline cartilage)
2. **Endochondral** Ossification => bone develops by replacing a hyaline cartilage model with bone tissue.



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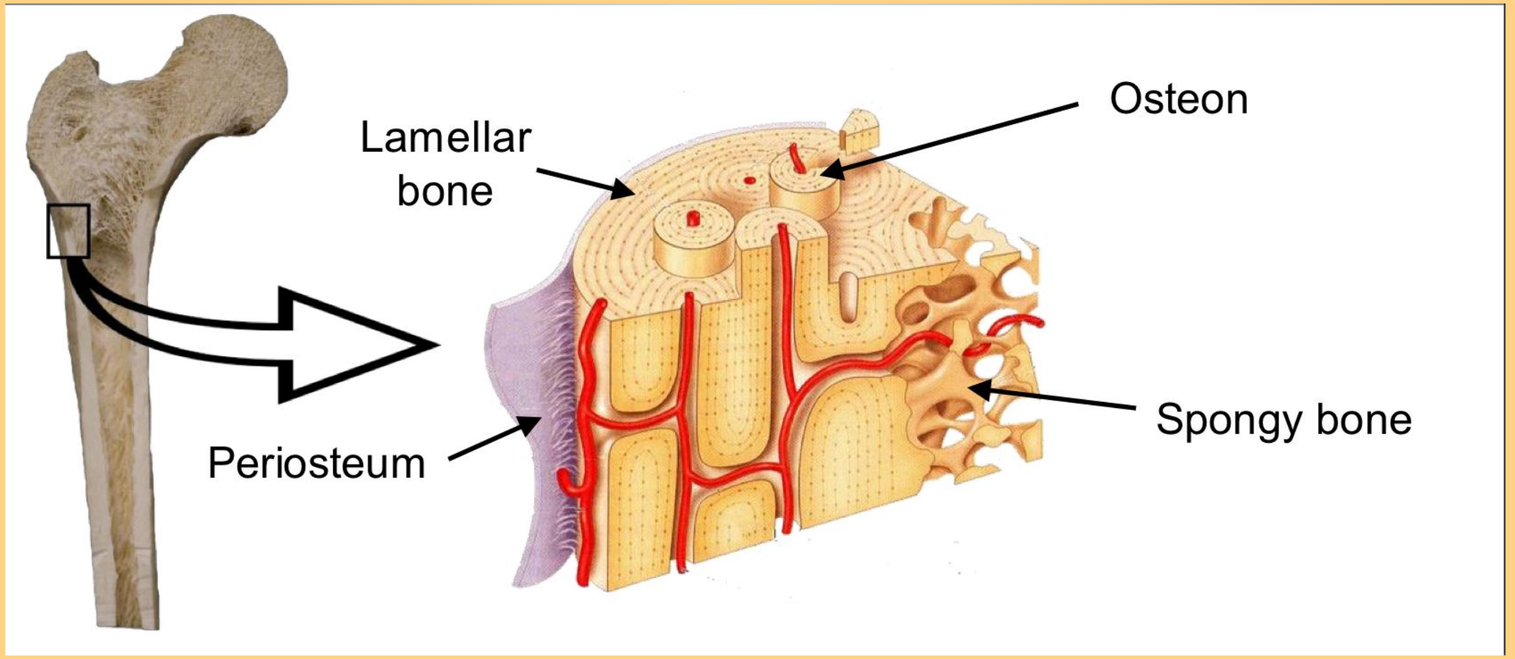
Compact & Spongy Bone

- Compact bone = made of Osteon / Haversian Systems & Lamellar Bone
- Spongy Bone = formed through OSTEOCLASTS (bone resorption)



Three types of Cartilage:

1. **Hyaline** Cartilage = made of Type II collagen fibres e.g. found in end point of long bones in joints
2. **Elastic** Cartilage = made of Type II collagen fibres + elastic fibres e.g. cartilage in ear
3. **Fibrocartilage** = made of Type I & II collagen fibres + dense fibre bundles e.g. intervertebral discs

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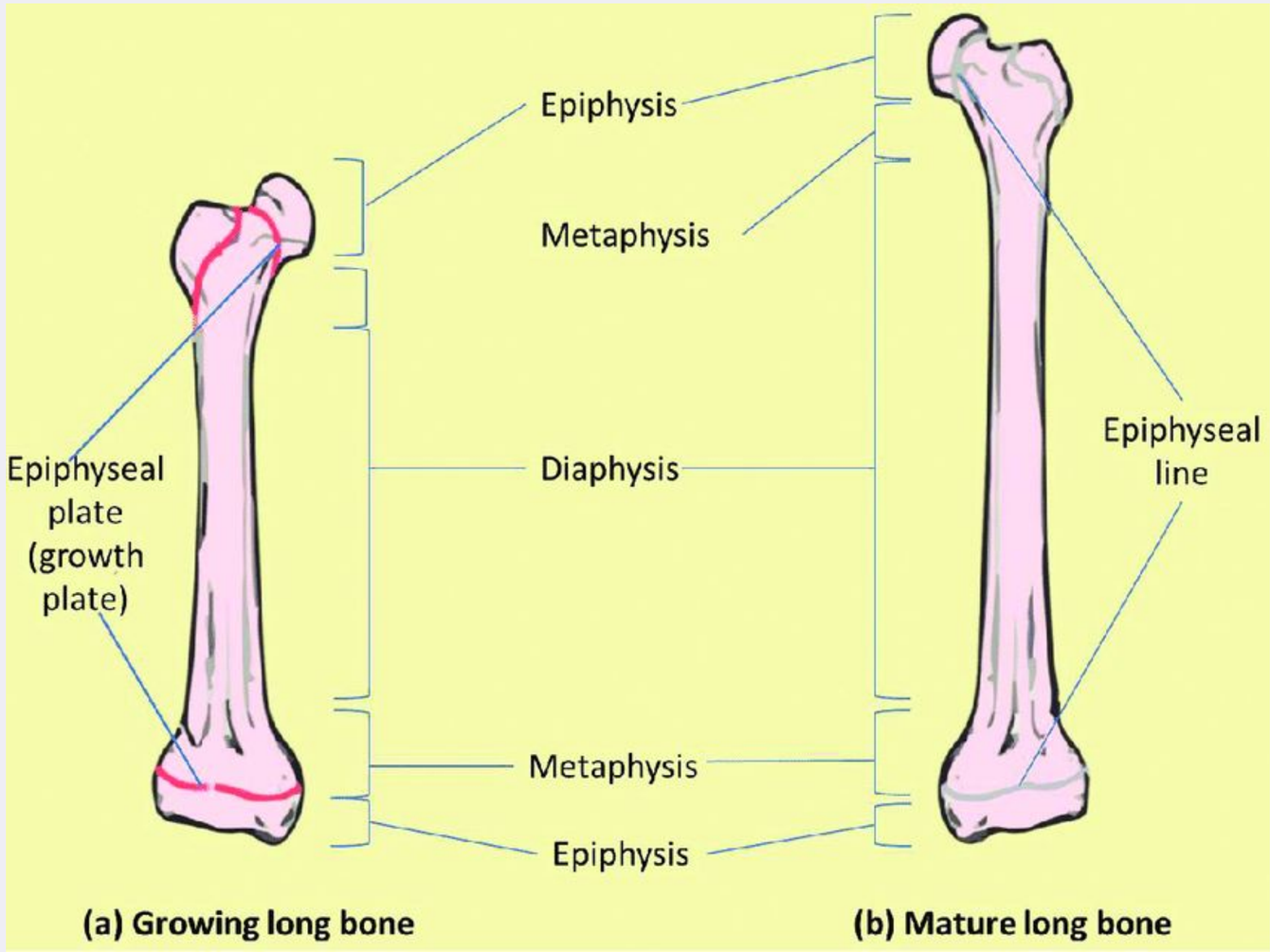
Long Bones & Growth Plates



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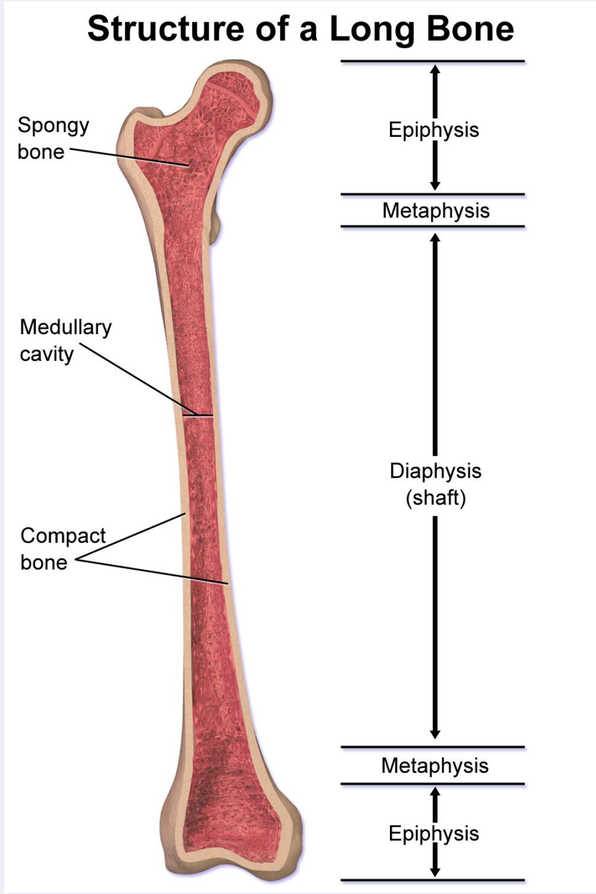
Long Bones & Growth Plates

- -physis = growth plate
- epi- = above
- meta- = after
- dia- = through / across



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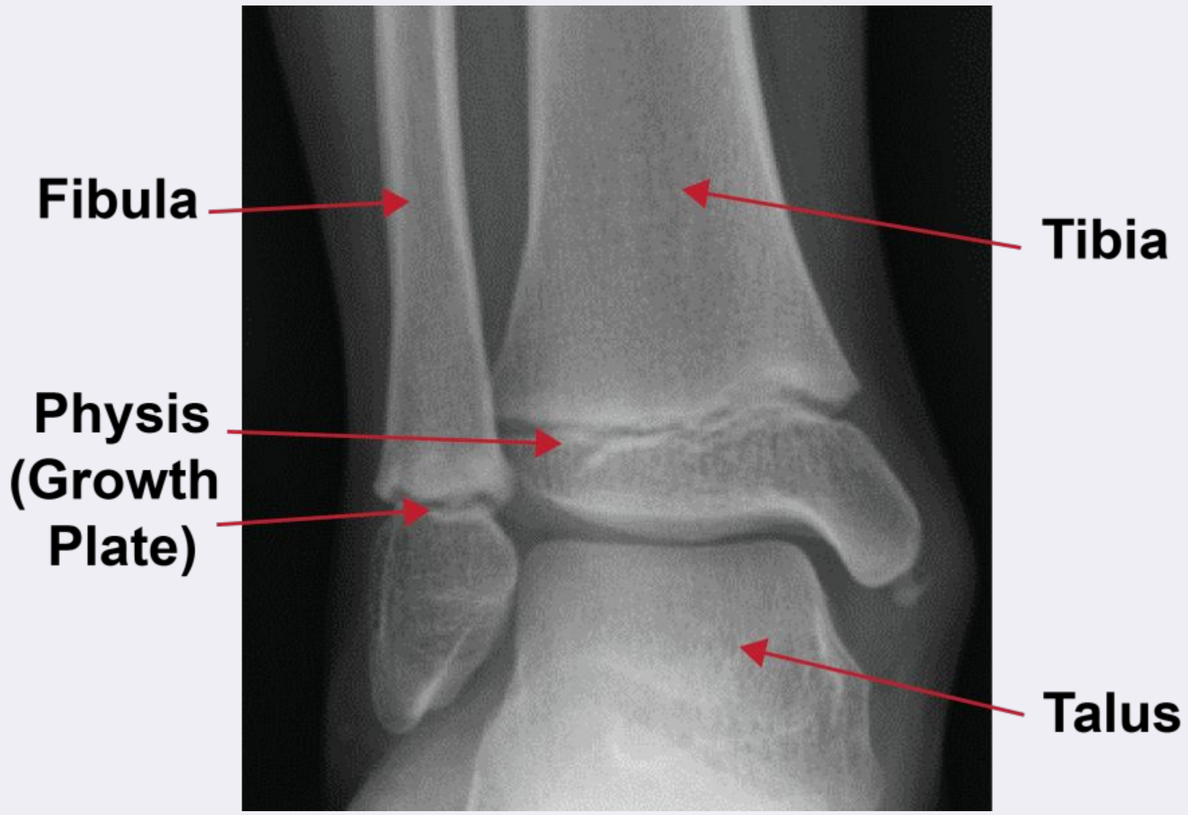
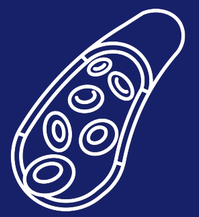
Long Bones & Growth Plates





Joints

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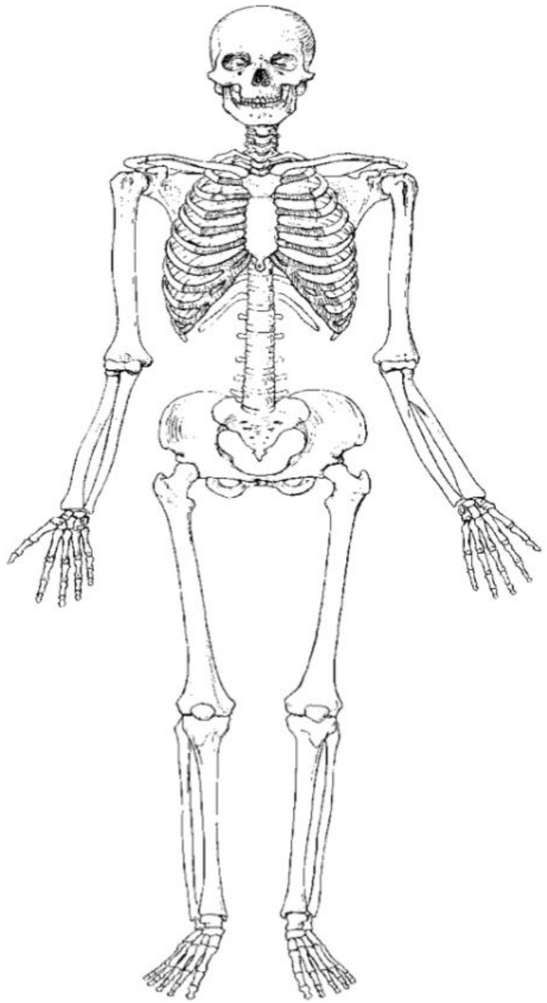
What are Joints?

1) Definition: a place of union between two or more bones.
2) Articulations = joints = arthroses (sing. = arthrosis)
3) Joints exist to either allow movement OR to allow growth (or both).
4) Two ways to classify joints:
   a) By structure
   b) By movement



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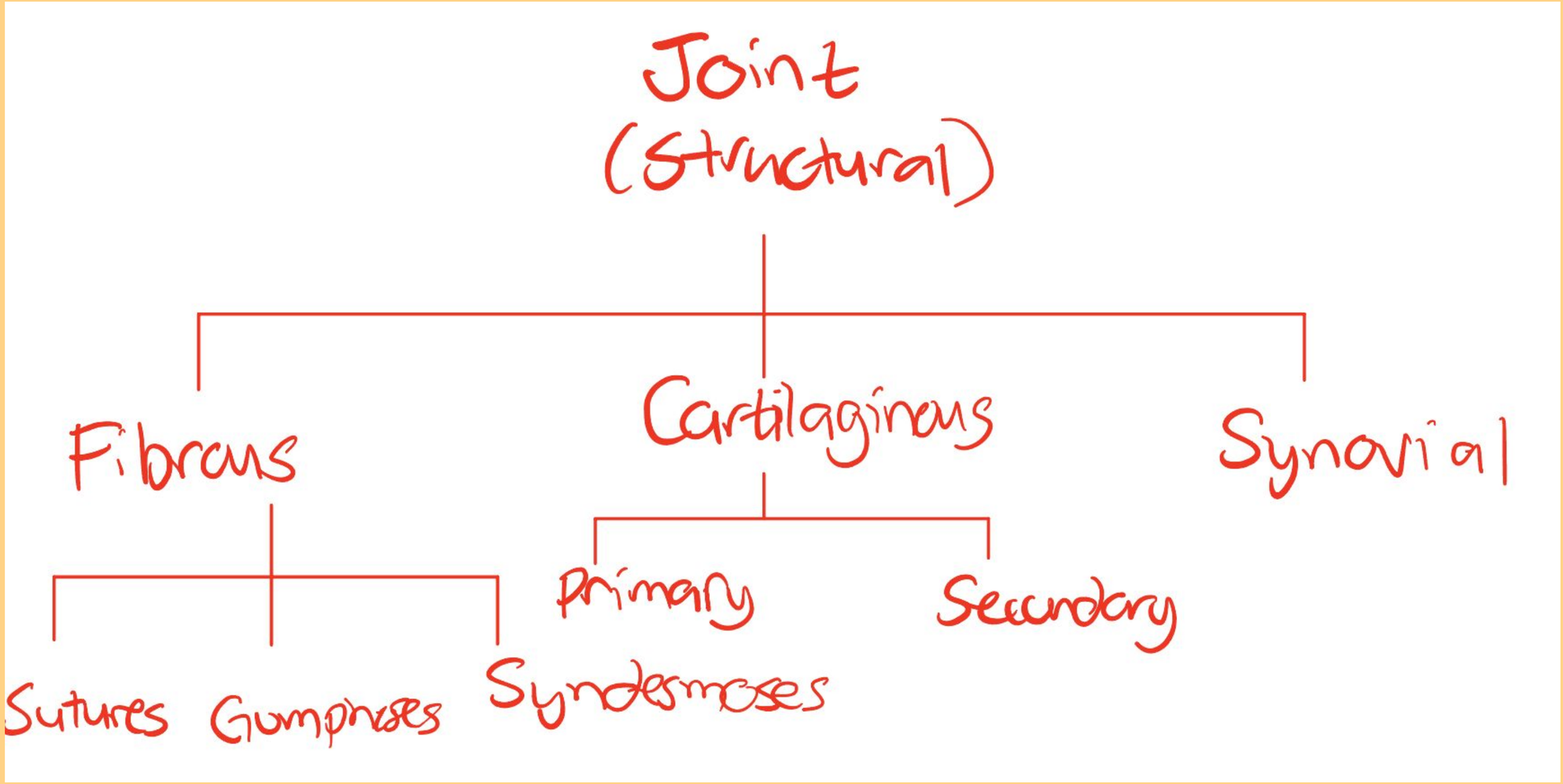
Joints classified by STRUCTURE:



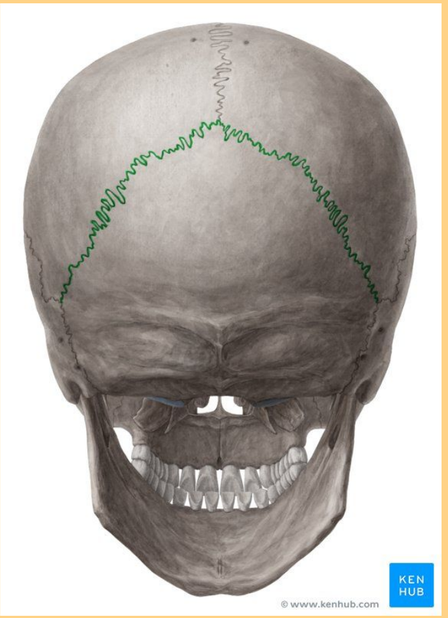
Fibrous Joints

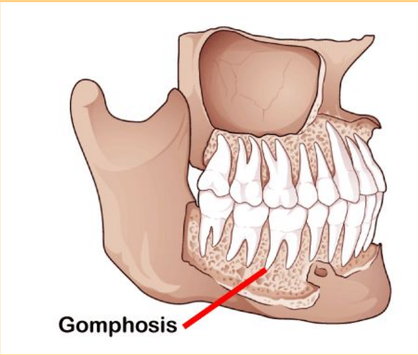
- Fibrous Tissue connects bones
- Synarthrosis (lacks movement)
- Three main types:

a. Sutures

b. Syndesmosis

c. Gomphoses





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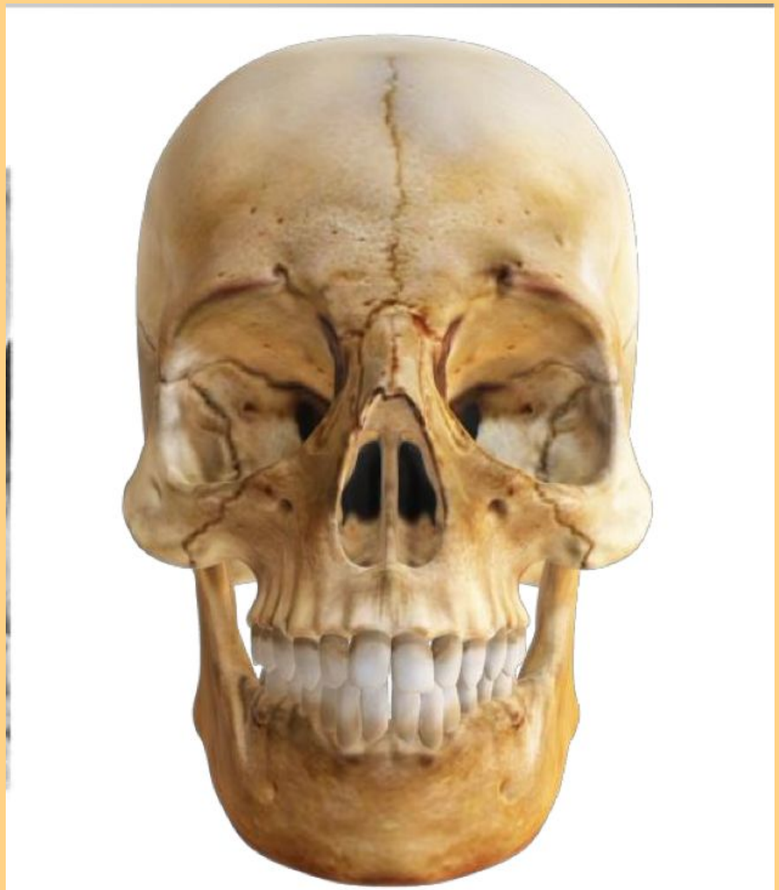
Sutures

Serrated

Squamous



Planar

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Syndesmosis

- A type of FIBROUS joint where two bones held together by **interosseous ligaments.**
- **e.g. inferior tibiofibular joint**

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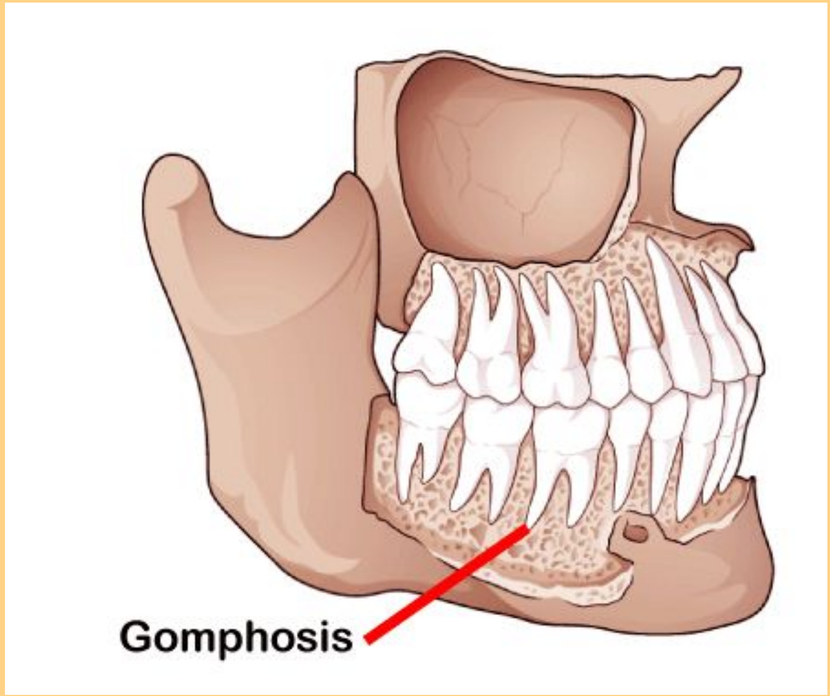
Gomphoses

- A type of FIBROUS joint where a peg (tooth) fits into the socket (on alveolar bone)



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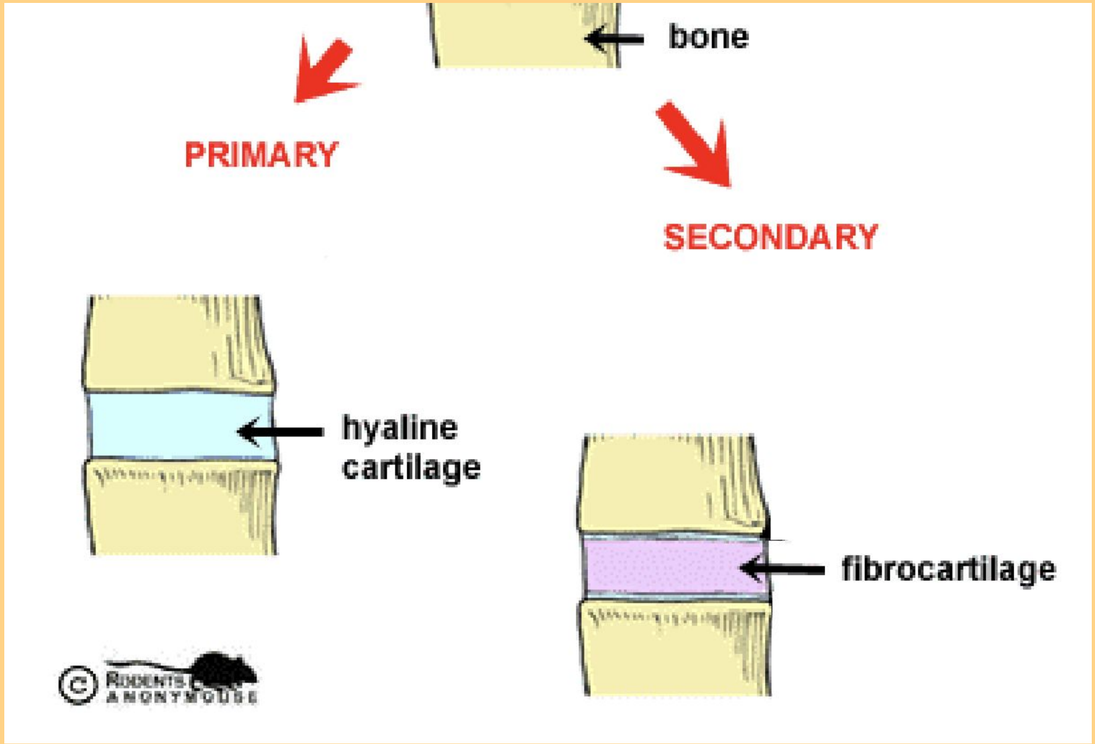
Cartilaginous Joints

- Joints held together by CARTILAGE
- Two main types:

a. Primary (Synchondrosis)

b. Secondary (Symphysis)



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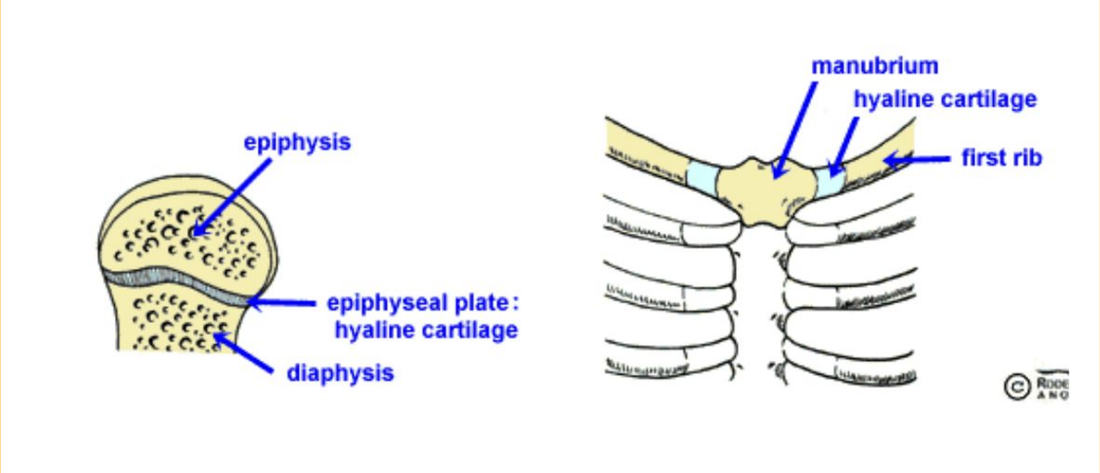
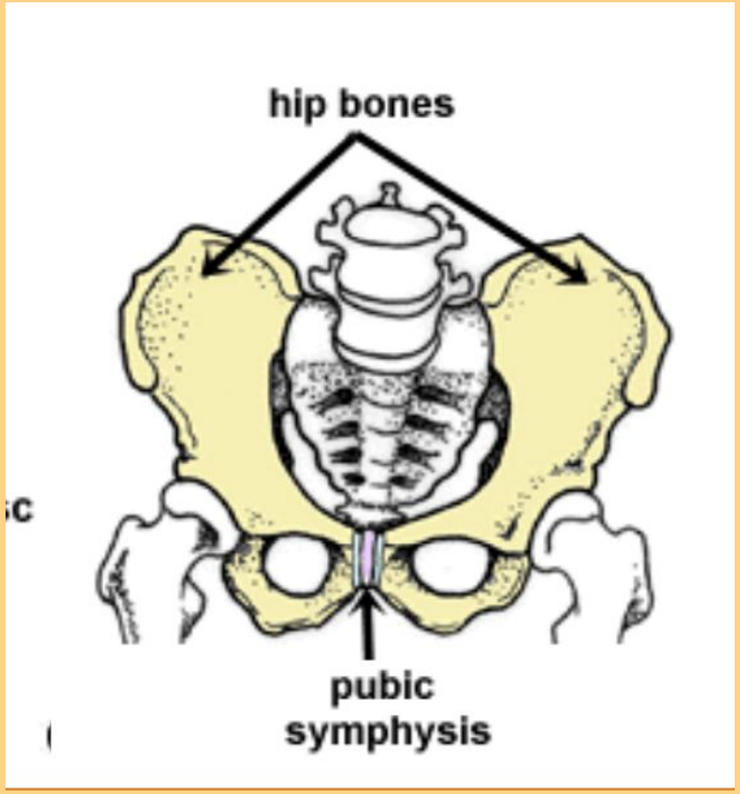
Primary Cartilaginous Joints

- KEY FEATURE: bones separated by HYALINE cartilage
- Synarthrosis (lacks movement)



Secondary Cartilaginous Joint

- KEY FEATURE: bones separated by HYALINE cartilage sandwiched with FIBROCARTILAGE
- Synarthrosis (slight movement)



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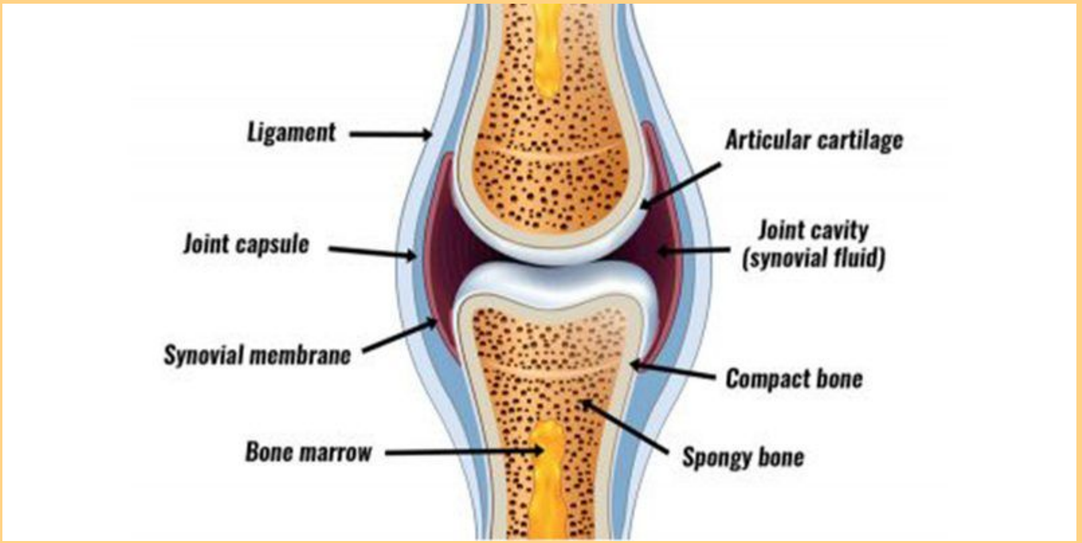
Synovial Joints

- Joints containing synovial fluid in the joint cavity found in between bones
- Diarthrosis (free movement)



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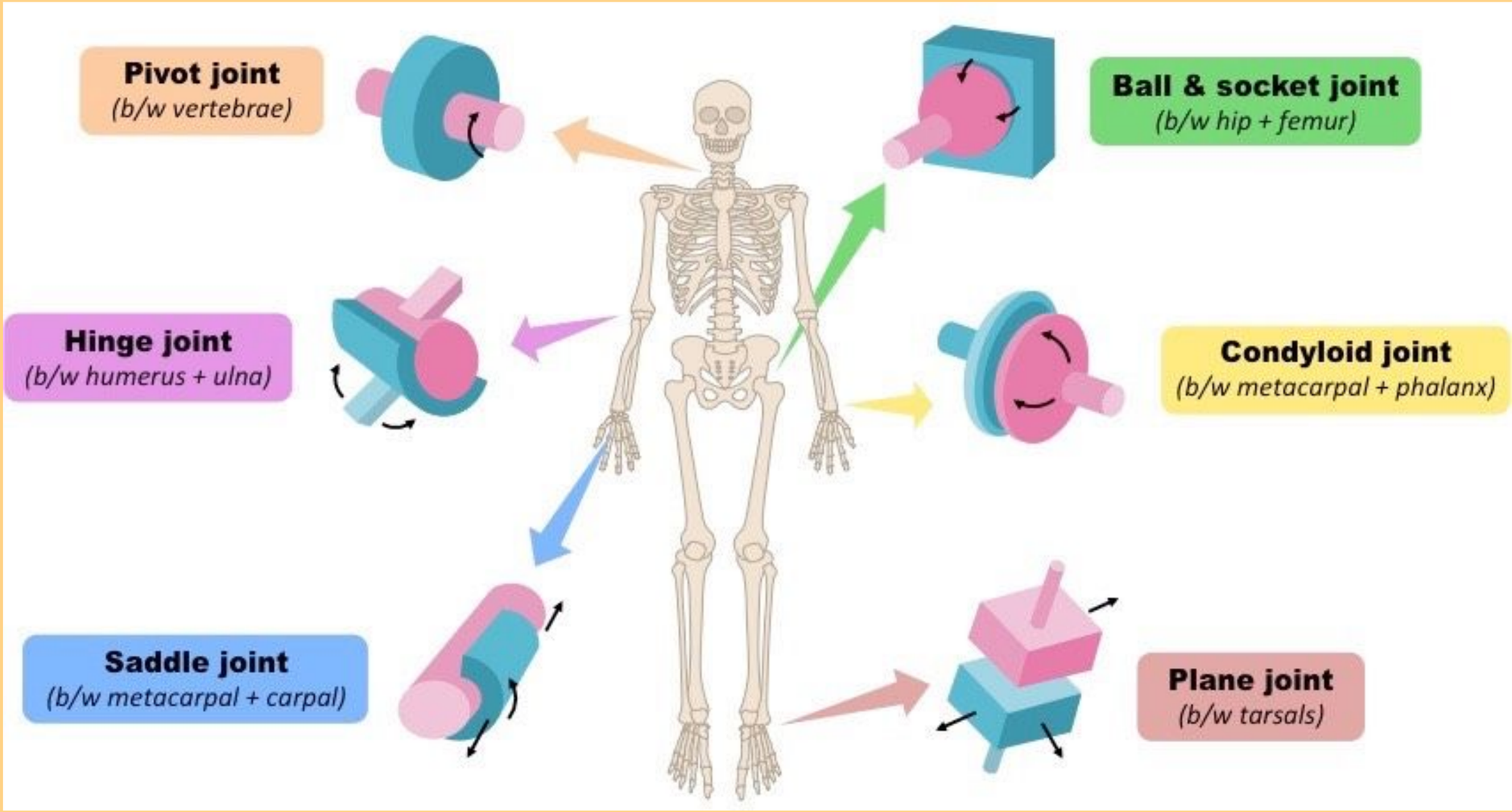
Types of Synovial Joints:



Types of Synovial Joints MNEMONIC:

Prince = planar (uni-axial)

Harry = hinge (uni-axial)

Pulled = pivot (uni-axial)

Charles' = condyloid (bi-axial)

Saddle = saddle (bi-axial)

Bag = ball and socket (multi-axial)

and he fell off and hurt his joints

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Joints in the ARM MNEMONIC

Harry - Hinge (elbow)

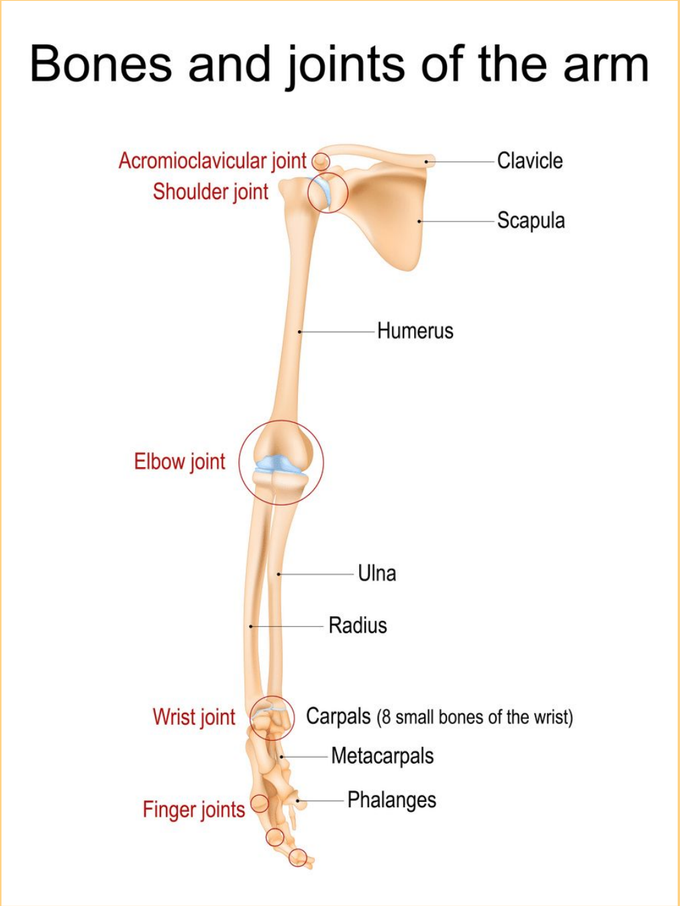
Can’t - condyloid (wrist)

Come - condyloid (MCP)

Home - hinge (IP)

MCP = Metacarpophalangeal Joint

IP = Interphalangeal Joint



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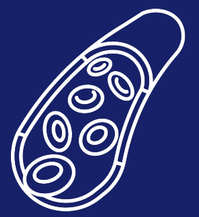
Muscles

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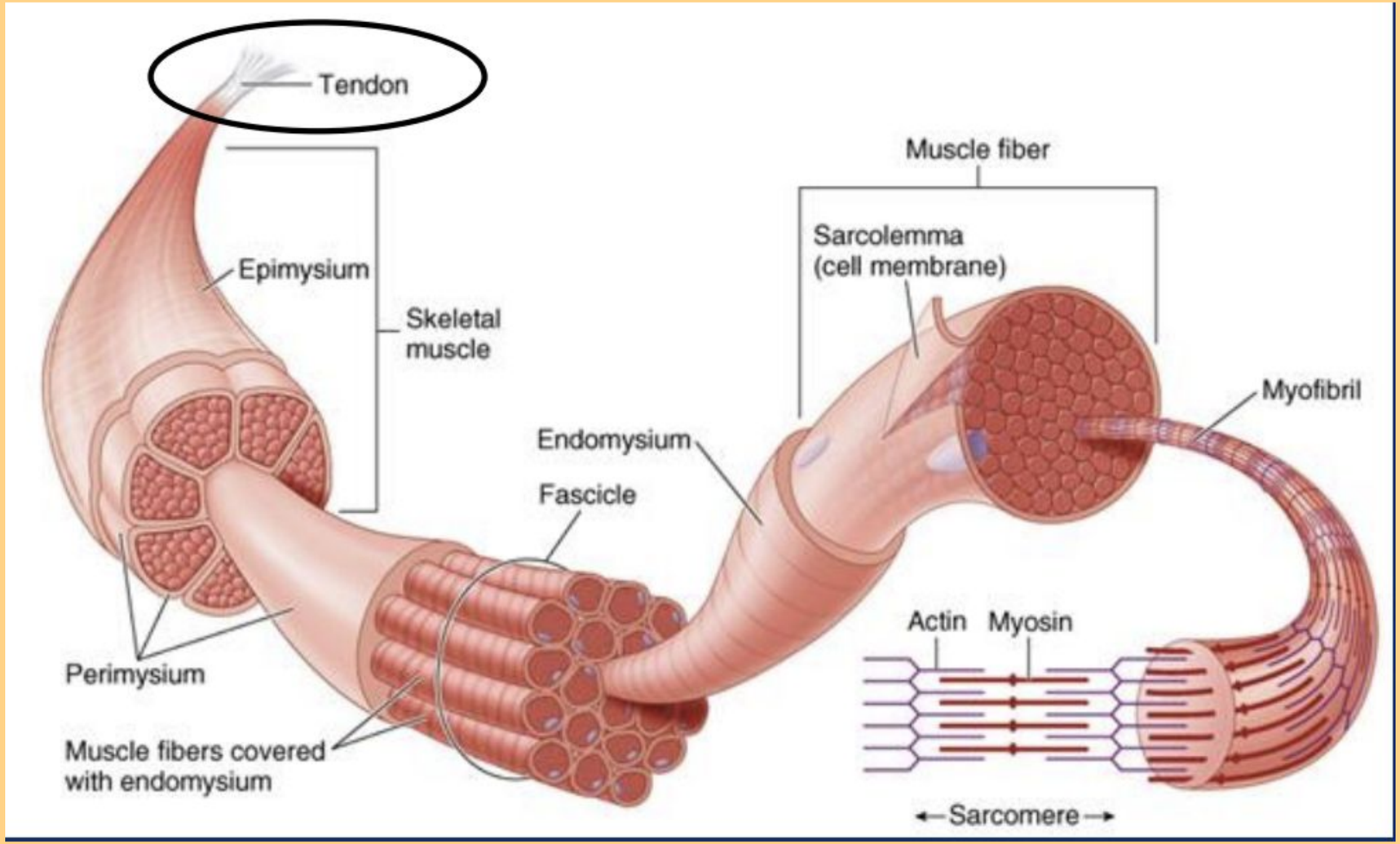
Microarchitecture of Skeletal Muscles



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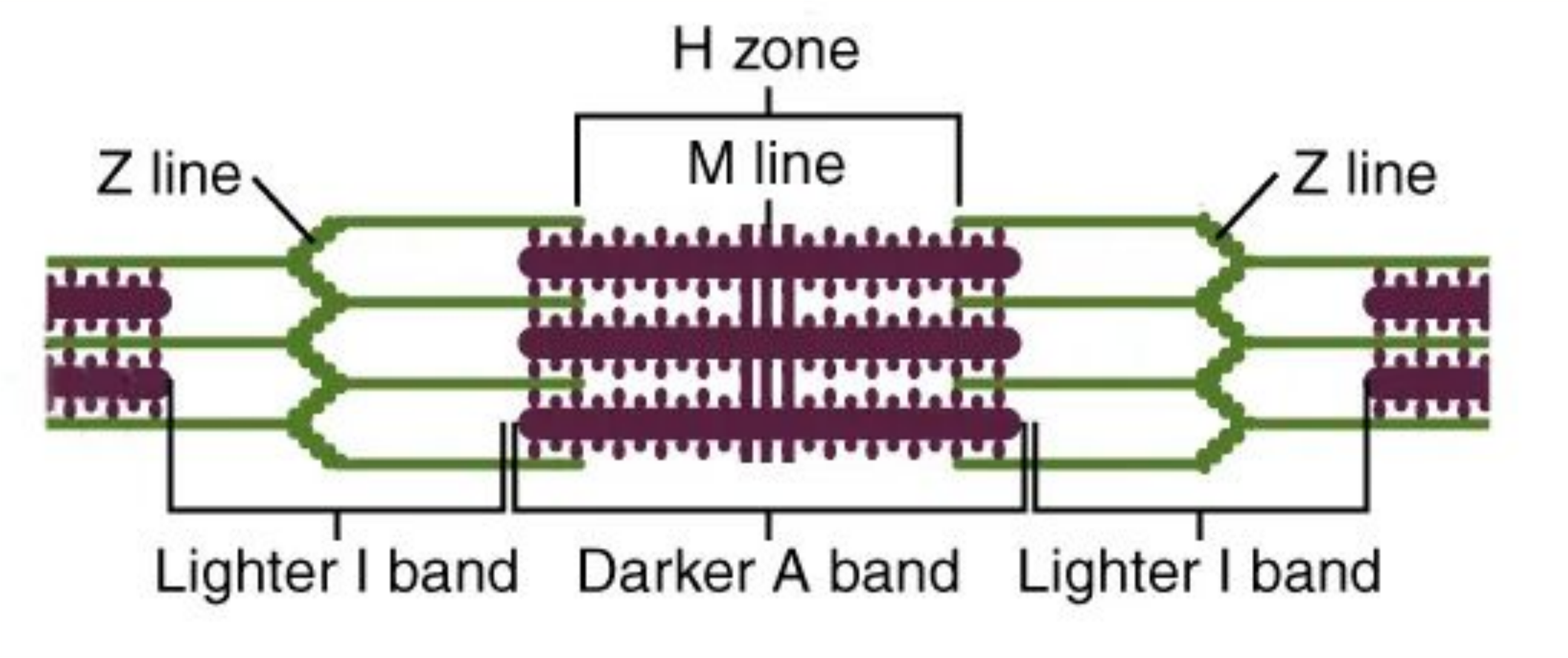
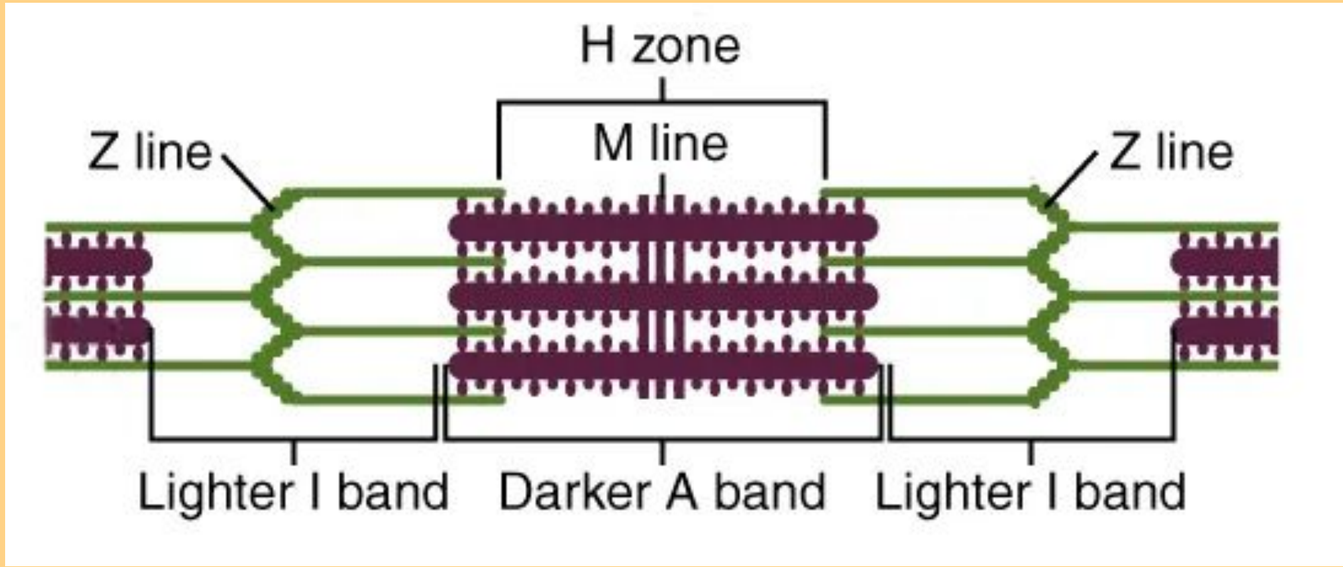
Sarcomeres = functional units found in myofibrils



Sarcomeres = functional units found in myofibrils

- **Z line** – where the actin filaments are anchored.
- **M line** – where the myosin filaments are anchored.
- **I band** – contains only actin filaments.
- **A band** – the length of a myosin filament, may contain overlapping actin filaments.
- **H zone** – contains only myosin filaments.

A useful acronym is **MHAZI** – the M line is inside the H zone which is inside the A band, whilst the Z line is inside the I band.



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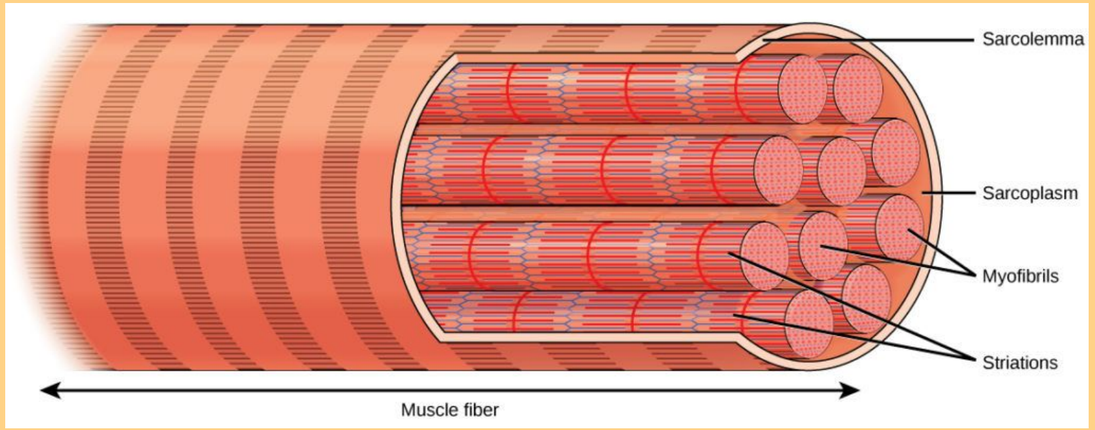
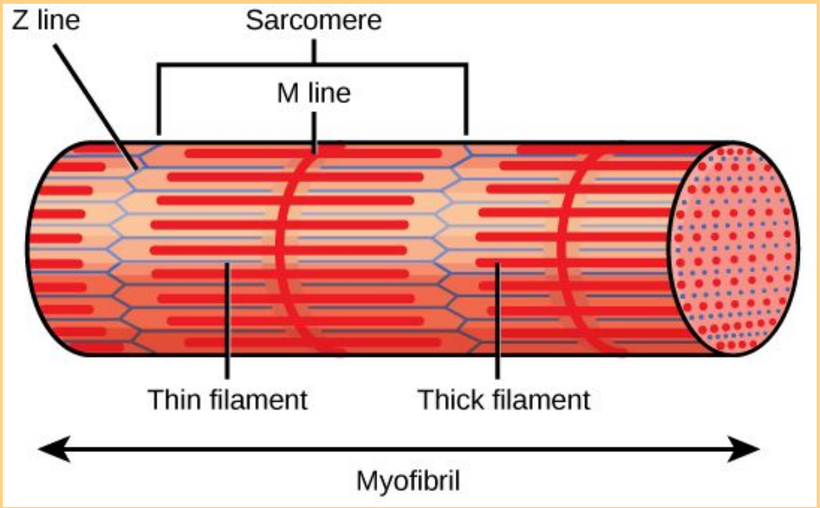
Myofibrils

- Found WITHIN a muscle fibre containing repeating units of sarcomeres responsible for muscle contraction.





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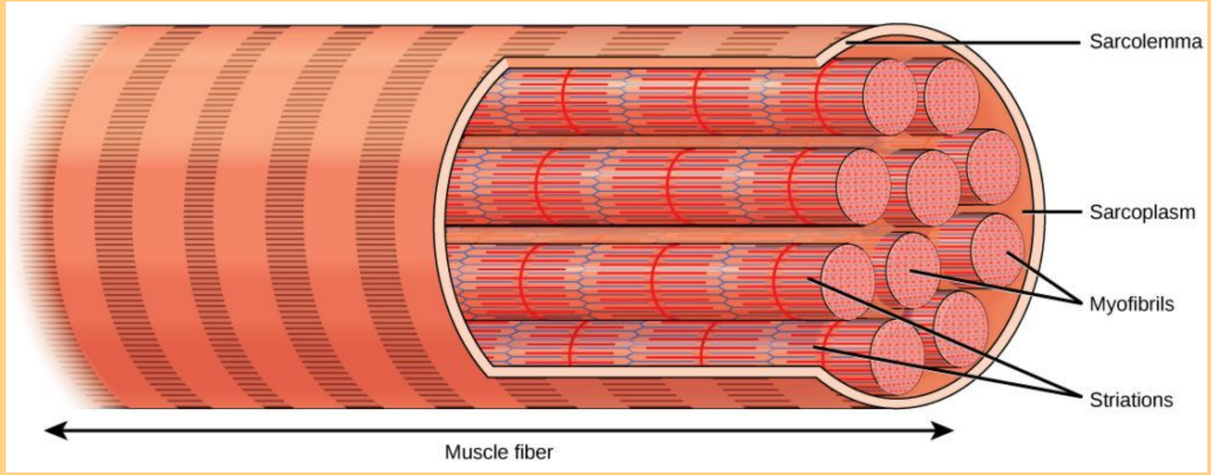
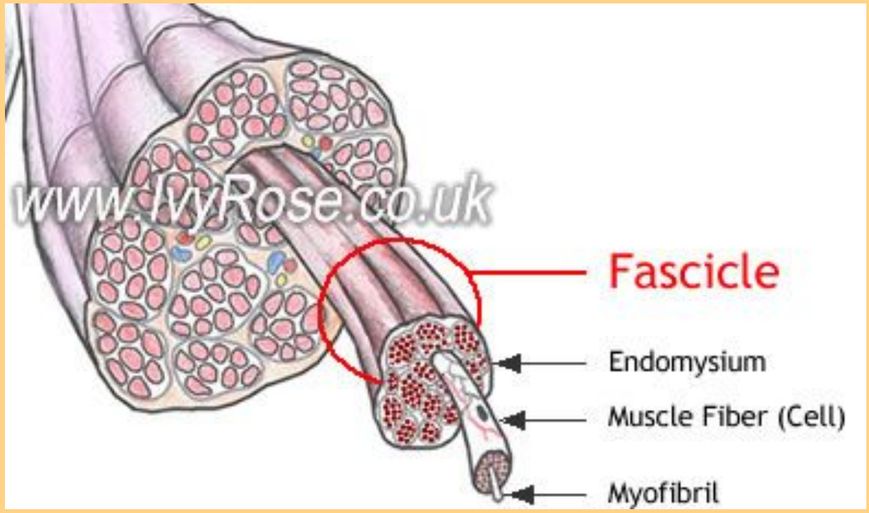
Muscle Fibres

- Found WITHIN a fascicle covered in sarcolemma (cell membrane) and endomysium (endo = within / inside) containing repeating units of myofibrils.





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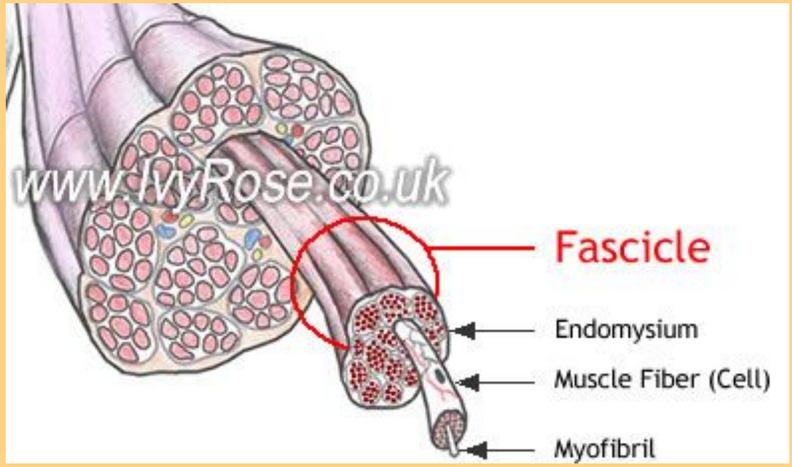
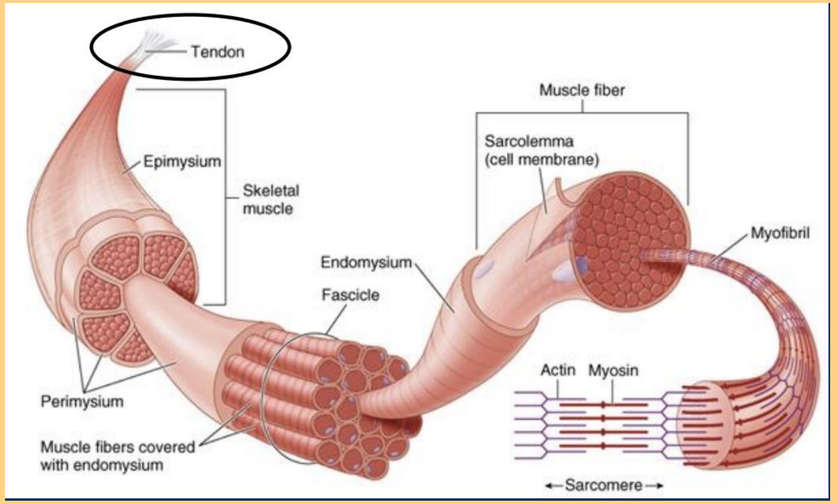
Fascicles

- Found WITHIN Skeletal Muscles covered in perimysium (peri = surrounding / around) containing a cluster of muscle fibres.





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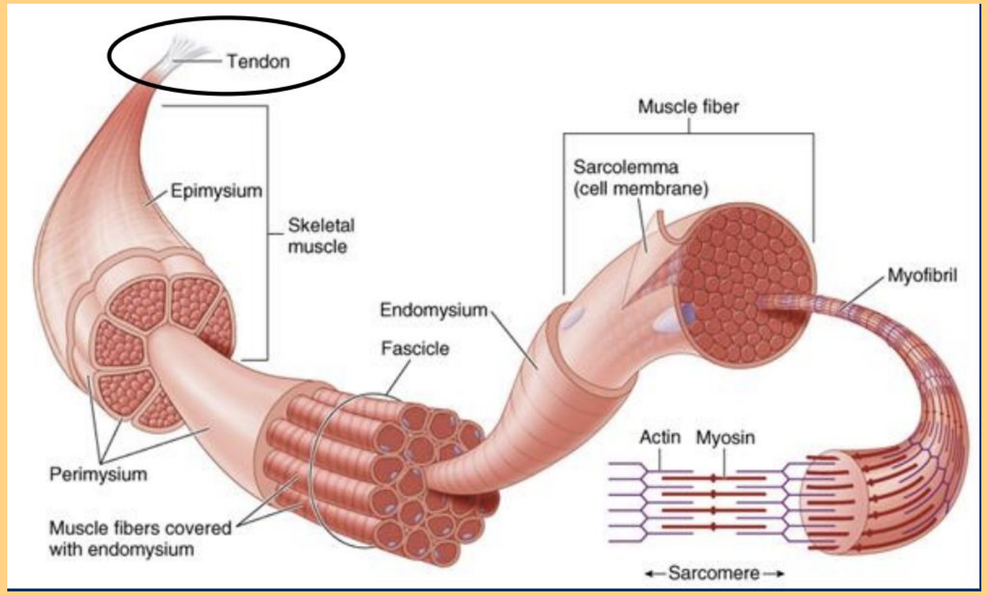
Microarchitecture of Skeletal Muscles

SKELETAL MUSCLES (e.g. biceps brachii) are covered in **EPIMYSIUM**, (EPI = above) made of a cluster of **FASCICLES** where each cluster is covered in **PERIMYSIUM**. Each **FASCICLE** is made of a cluster of **MUSCLE FIBRES**, where each MF is covered in **ENDOMYSIUM** & **SARCOLEMMA**. Each MF is made of **MYOFIBRILS** that contain units of **SARCOMERES**.



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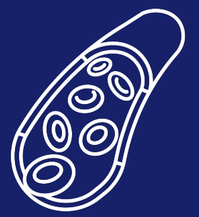
Nerve Tissues

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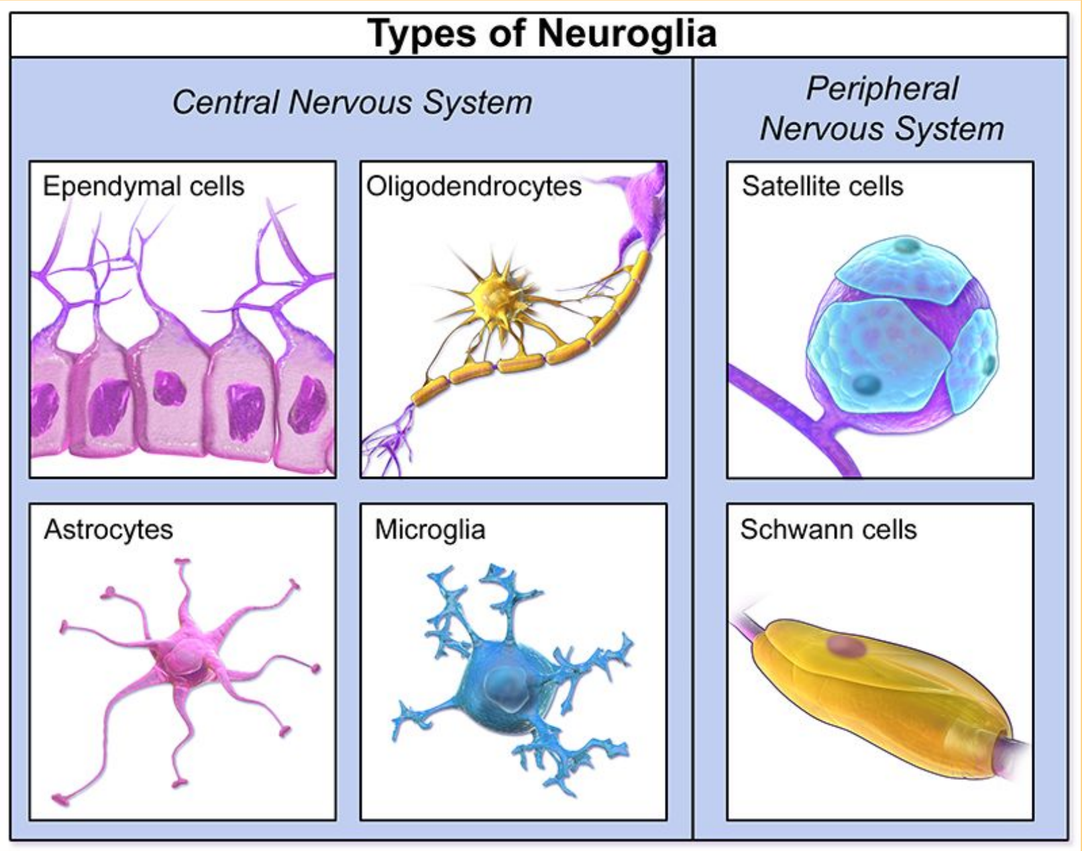
What are Glial Cells?

they are cells of the nervous system that serves a homeostatic role (e.g., structural and nutritional support, insulation of neurons, phagocytosis of pathogens).



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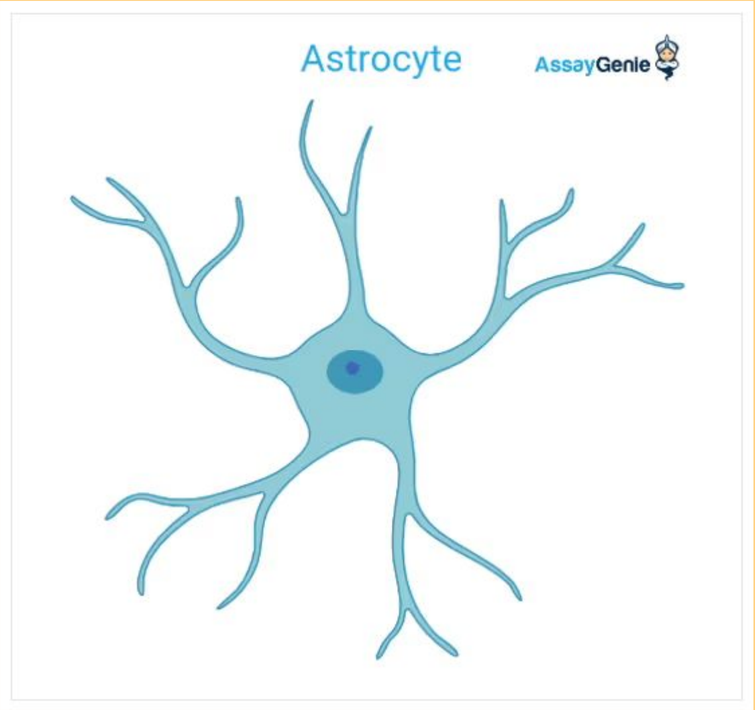
CNS: Astrocytes

maintains BBB in brain (foot processes wrapped around capillaries in brain) - found in NBSS in GBE



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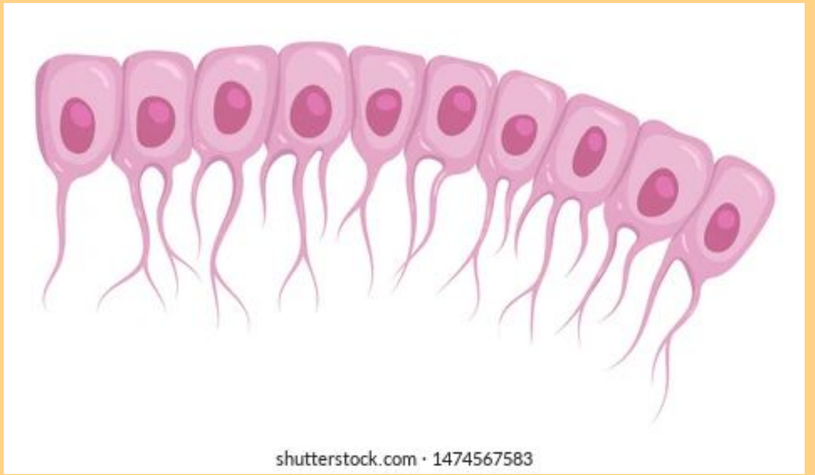
CNS: Ependymal Cells

these cells line central canal of spinal cord and ventricles of brain responsible for producing, maintaining and monitoring CSF



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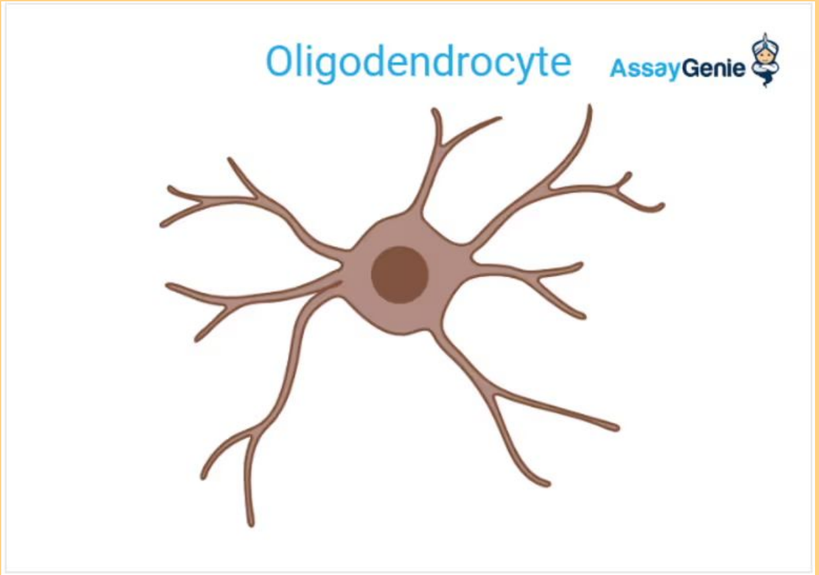
CNS: Oligodendrocytes

these cells are found in the CNS that produce and maintain the myelin sheath that surround the CNS axons.



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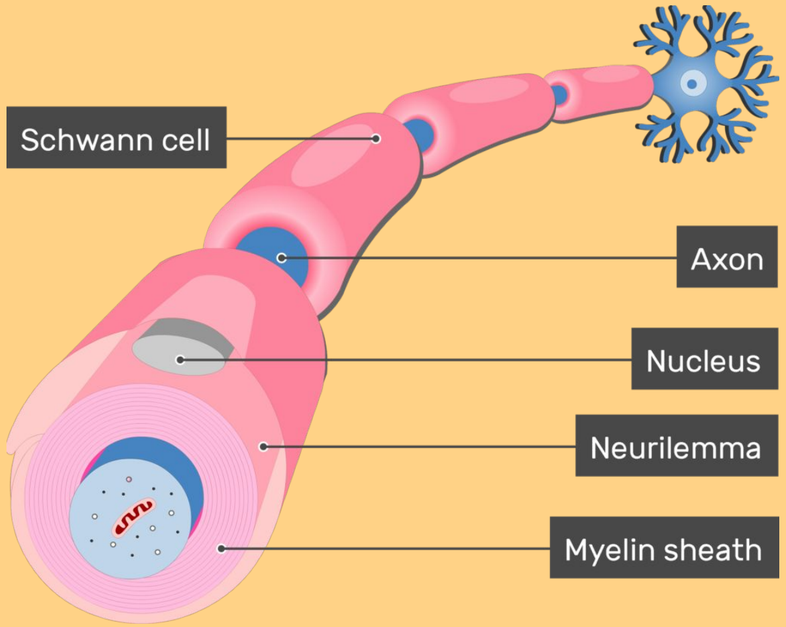
CNS: Microglia

resident glial cells that serve as the primary immune defence of the CNS. consists of specialised macrophages.

PNS: Schwann Cells

these cells are found in the peripheral nervous system which produce and maintain the myelin sheath that surround the peripheral axons.



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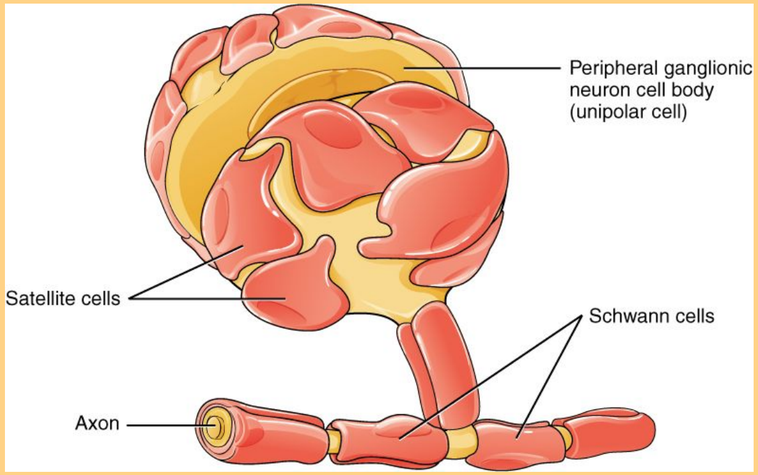
PNS: Satellite Cells

RESIDENT muscle stem cells found on the surface of muscle fibres



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SBA

Long bones grow by adding bone tissue:

A) between epiphysis and articular cartilage

B) within the epiphysis

C) between the epiphysis and the diaphysis

D) in the centre portion of the diaphysis

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SBA

Long bones grow by adding bone tissue:

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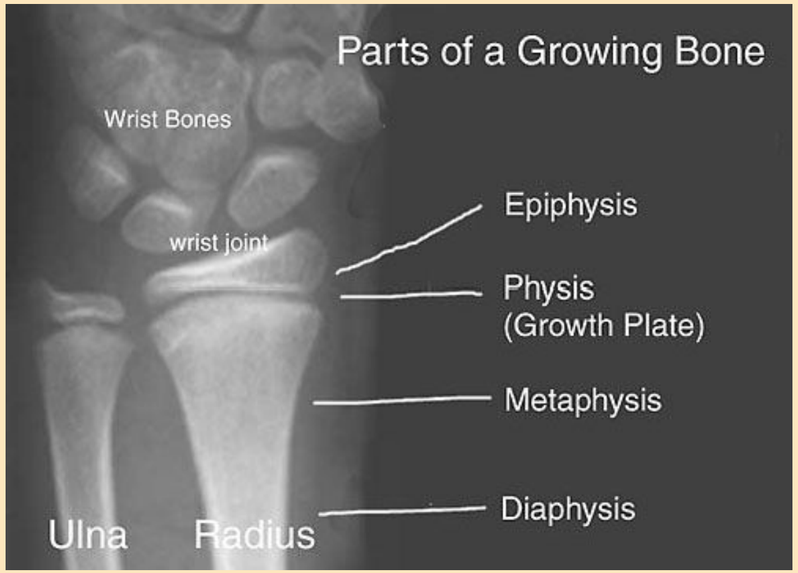
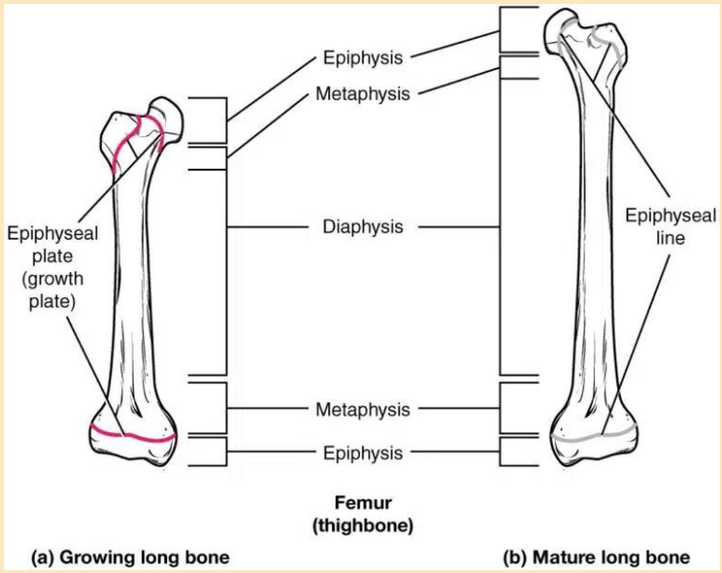
SBA Answer Explanation

Long bones grow by adding bone tissue between the epiphysis and the diaphysis





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SBA

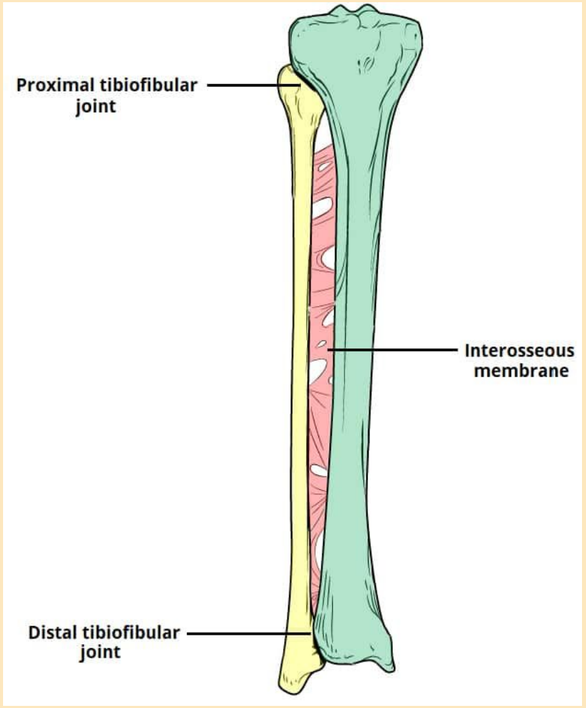
Inferior tibiofibular joint is classified as a:

A) Synchondrosis

B) Synarthrosis

C) Symphysis

D) Syndesmosis



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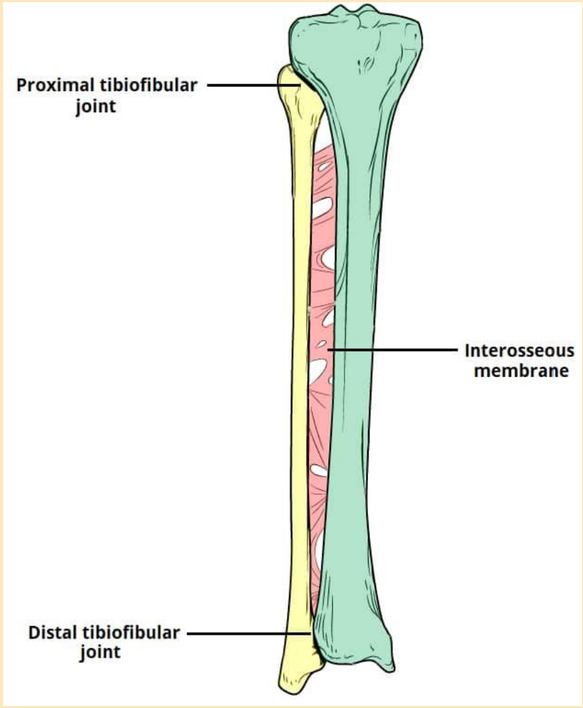

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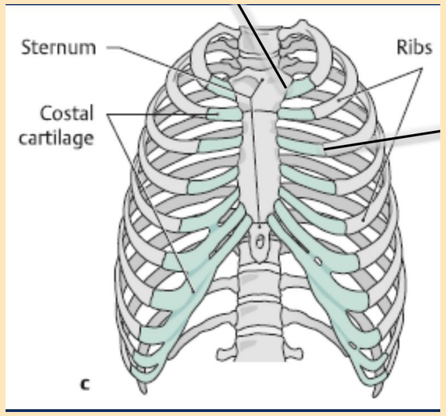
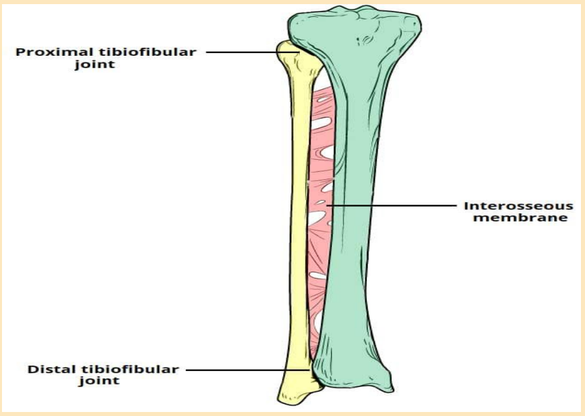
SBA Answer Explanation



Synchondrosis / Primary Cartilaginous Joint

Symphysis / Secondary Cartilaginous Joint



Syndesmosis (a type of fibrous joint

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SBA

Which of the following surrounds each fascicle found in skeletal muscles?

A) Endomysium

B) Perimysium

C) Epimysium

D) Sarcolemma

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SBA

Which of the following surrounds each fascicle found in skeletal muscles?

A) Endomysium

B) Perimysium

C) Epimysium

D) Sarcolemma

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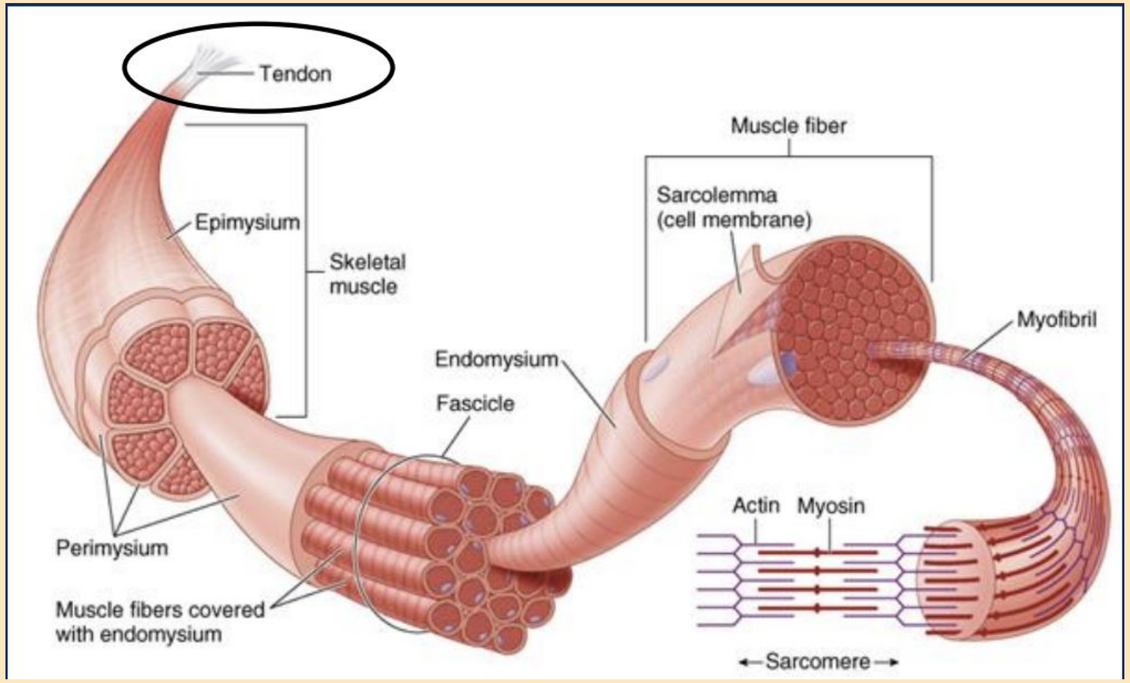
SBA Answer Explanation

Perimysium surrounds each fascicle found in muscles.



SBA

Which glial cell produces myelin sheath for CNS axons?

A) Astrocytes

B) Microglia

C) Oligodendrocytes

D) Schwann Cells

E) Ependymal Cells

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SBA

Which glial cell produces myelin sheath for CNS axons?

A) Astrocytes

B) Microglia

C) Oligodendrocytes

D) Schwann Cells

E) Ependymal Cells

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SBA Answer Explanation

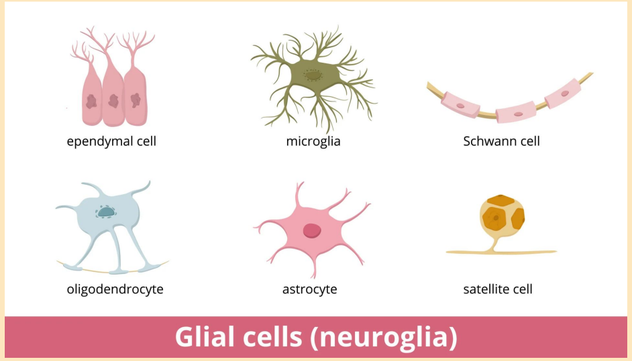
Oligodendrocytes - myelin sheath for CNS axons

Schwann Cells - myelin sheath for PNS axons

Astrocytes - maintain BBB

Ependymal cells - produce and circulate CSF

Microglia - immune cells of CNS



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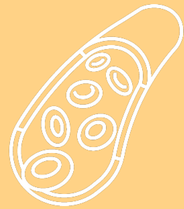

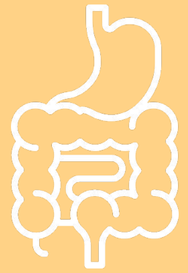

Learning Medicine is ALMOST like learning another language, if you don't understand a word, try to break it down as it usually tells you what it means.

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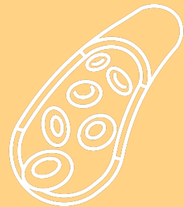

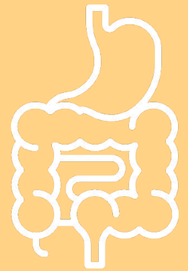

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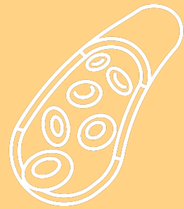

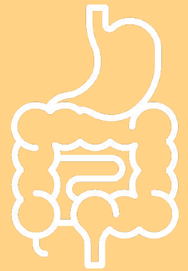

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