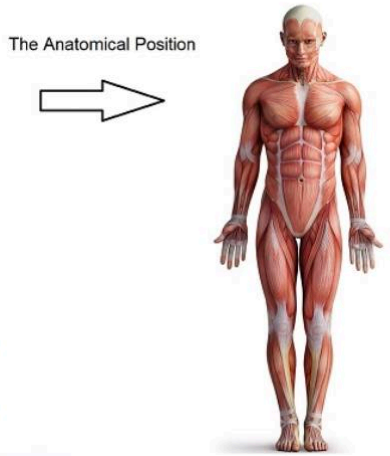
BONES, JOINTS & GENERAL ANATOMY

ANATOMICAL POSITION & ANATOMICAL PLANES

Anatomical Position

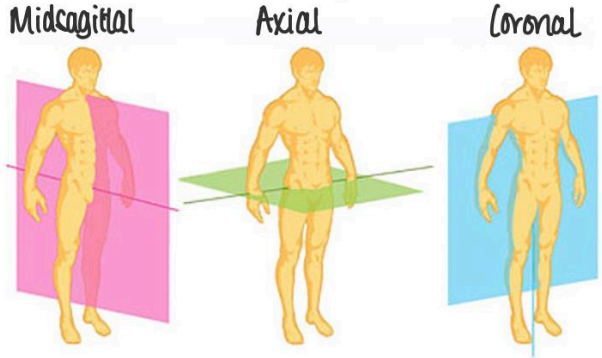
- Standing upright
- Face looking forward
- Upper limbs by sides, palms facing forward
- Lower limbs close together, toes pointing forward



Anatomical planes

- Sagittal: divides the body into a right and left portion by a vertical plane
  - ↳ Median/midsagittal plane: through the centre, divides the body into equal left and right halves
- Coronal plane: divides the body into a front and back by a vertical plane
- Axial/Transverse/Horizontal plane: horizontal plane dividing the body into a top and bottom portion - viewed from feet upwards

Right hand side is represented on the left of the image



DIRECTIONAL TERMINOLOGY

Term	Etymology	Definition*
Right		Toward the body's right side
Left		Toward the body's left side
Inferior	Lower	Below
Superior	Higher	Above
Anterior	To go before	Toward the front of the body
Posterior	*Posterus,* following	Toward the back of the body
Dorsal	*Dorsum,* back	Toward the back (synonymous with *posterior*)
Ventral	*Venter,* belly	Toward the belly (synonymous with *anterior*)
Proximal	*Proximus,* nearest	Closer to a point of attachment
Distal	*di* + *sto,* to be distant	Farther from a point of attachment
Lateral	*Latus,* side	Away from the midline of the body
Medial	*Medialis,* middle	Toward the middle or midline of the body
Superficial	*Superficialis,* surface	Toward or on the surface
Deep	*Deop,* deep	Away from the surface, internal

*All directional terms refer to a human in the anatomical position.

MOVEMENTS

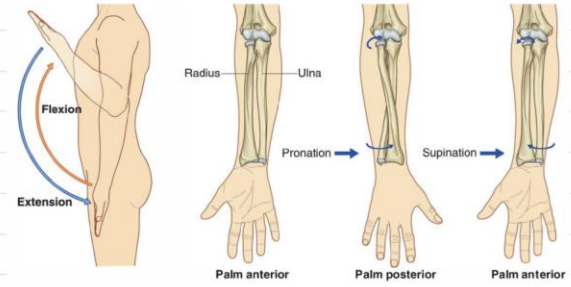
Movements

Shoulder

- Flexion: bringing your arm straight up in front of you
- Extension: bringing your arm behind you
- Abduction: taking the arm away from the midline
- Adduction: taking the arm toward the midline
- Lateral rotation: turning the arm at the shoulder joint, away from the midline (demonstrated with forearm perpendicular to arm)
- Medial rotation: bringing something towards the midline
- Circumduction: flexion → abduction → extension → adduction

Elbow and forearm

- Flexion: bringing the forearm up towards the arm
- Extension: straightening the arm out



- Pronation: palm facing back or facing downwards after pronation
- Supination: moving palm to face upwards

Wrist

- Flexion: bringing the palm up towards the forearm
- Extension: extending the hand out
- Abduction: moving the hand away from the body at the little finger (radial deviation)
- Adduction: moving the hand towards the body from the little finger (ulna deviation)

You can also circumduct your wrist: flexion, abduction, extension, and adduction

Digits

- Flexing: bending
- Extending: straightening up
- Abduction: moving of digits away from midline of the hand
- Adduction: moving of digits towards midline of the hand
- Opposition: bringing the pad of the thumb in opposition with the other digits ie. touching the other fingertips

Hip

- Flexion: bringing leg forward
- Extension: bringing leg backward
- Abduction: bringing leg out to the side
- Adduction: bringing the leg in

Also medial rotation, lateral rotation and circumduction

MOVEMENTS P2

Knee and foot

- Flexion: bending at the knee
- Extension: standing - straight leg position
- Dorsiflexion: dorsal of the foot is brought up to the shin
- Plantarflexion: plantar (sole) of the foot is brought downwards
- Inversion: moving sole of the foot inwards towards the median plane
- Eversion: moving sole of the foot outwards

Jaw - temporomandibular joint

- Elevation of mandible: lifting the jaw up
- Depression of mandible: lowering the jaw
- Protraction of mandible: bringing the jaw forwards
- Retraction of mandible: bringing the jaw backwards

Different movements can be used to indicate nerve function

DIFFERENT TYPES (LAMELLAR) OF BONE

COMPACT BONE

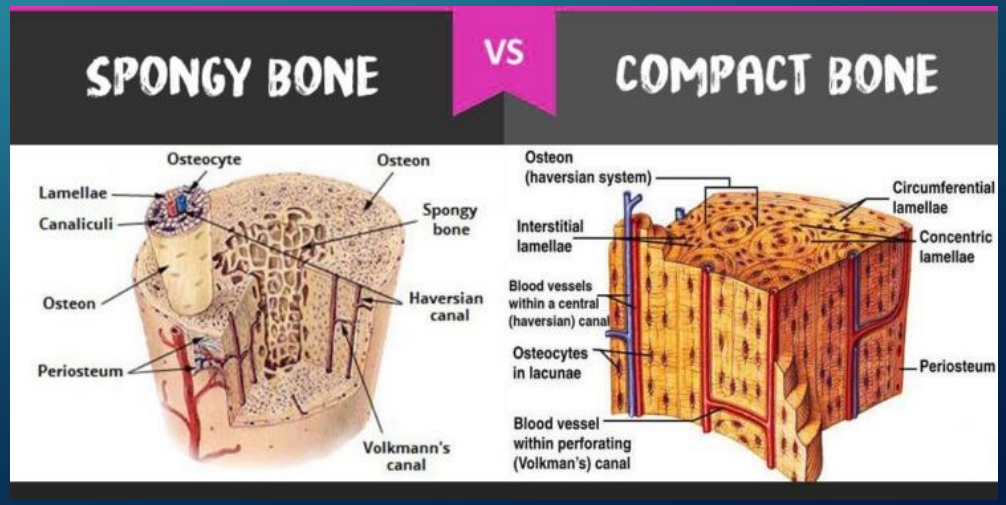
Bone is made from collagen type 2 that becomes calcified and mineralised. Osteons are distinct concentric rings that form in the compact bone, they surround the osteonic (haversian) canal.

- Strong in one direction only due to the arrangement of collagen fibres
- Not good at taking load in different directions

SPONGY/TRABECULAR/CANCELLOUS BONE

Collagen fibres are arranged in struts that are then cross-linked to provide strength

- You can load it in all different directions
- Cannot take as much load as compact bones
- Mainly found in joints

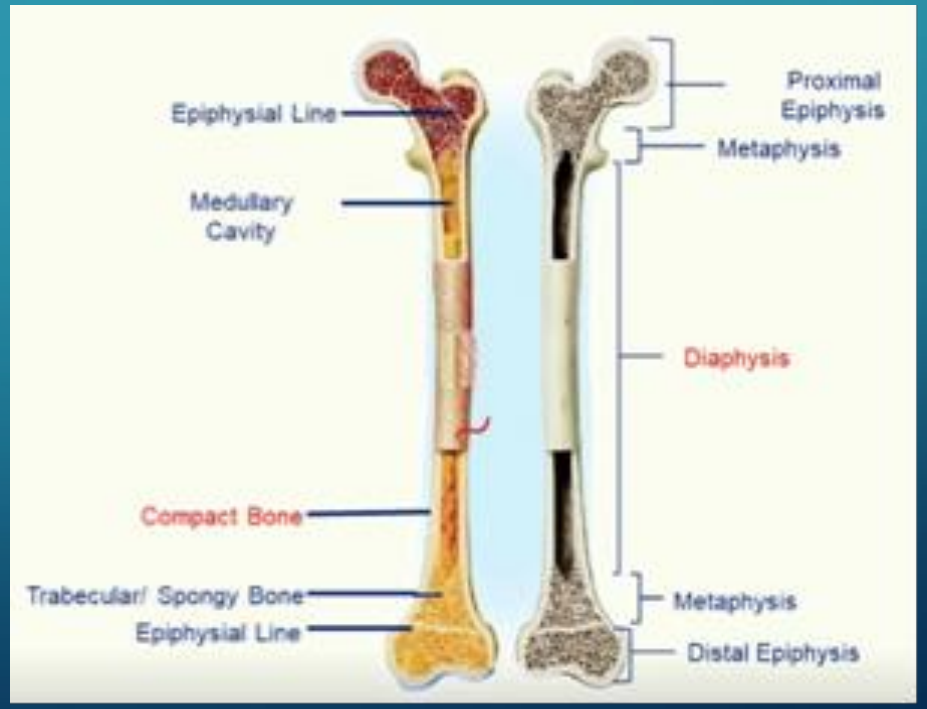


LONG BONES

Long bones – bones that are longer than they are wide

•The middle part is the diaphysis and is made of compact bone and surrounds the medullary cavity

•The ends are known as the epiphyses (there is a proximal and distal epiphysis) and they are connected to the diaphysis by the proximal and distal metaphysis

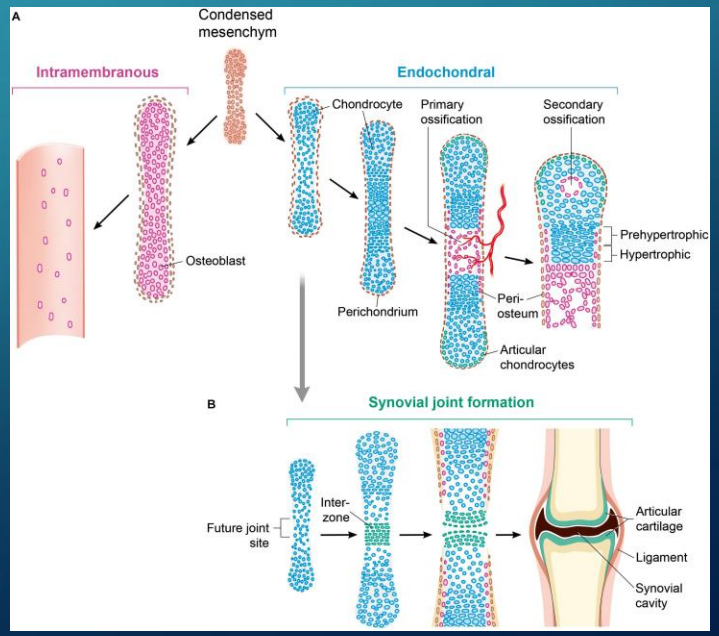


OSSIFICATION

Ossification is the formation of bone, bone forms by replacing other tissue.

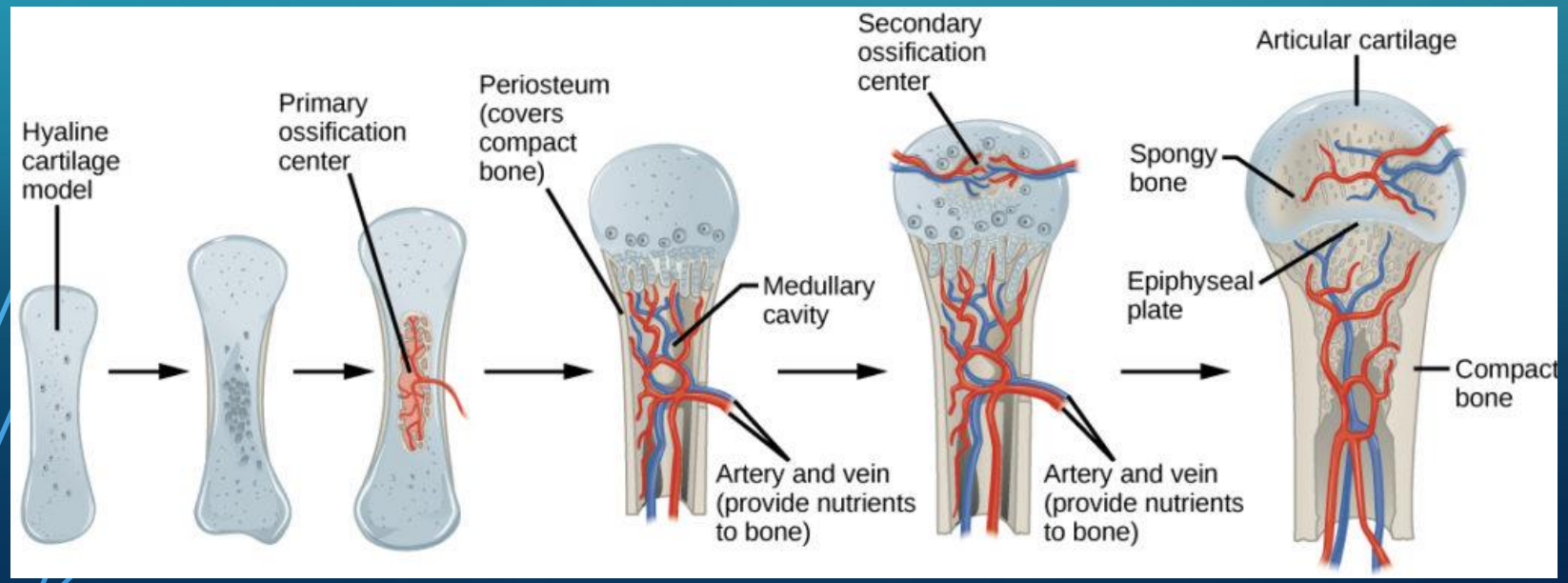
- Endochondral ossification: (chondo = cartilage) so in endochondral ossification bone replaces an existing cartilage model.
- Intramembranous ossification: where bone develops from what is known as mesenchyme which is fibrous connective tissue

99% of ossification is endochondral, intramembranous is the skull and clavicle only.



ENDOCHONDRAL OSSIFICATION

- Cells of condensation differentiate into chondrocytes and start to proliferate
- Hypertrophic chondrocyte differentiation
- Perichondral cells differentiate in osteoblasts, forming bone collar. Hypertrophic chondrocyte apoptosis favours matrix mineralization and blood vessel invasion
- Osteoblasts accompany vascular invasion, forming the primary ossification centre
- Chondrocytes continue to proliferate, lengthening the bone
- The secondary ossification centre forms through vascular invasion

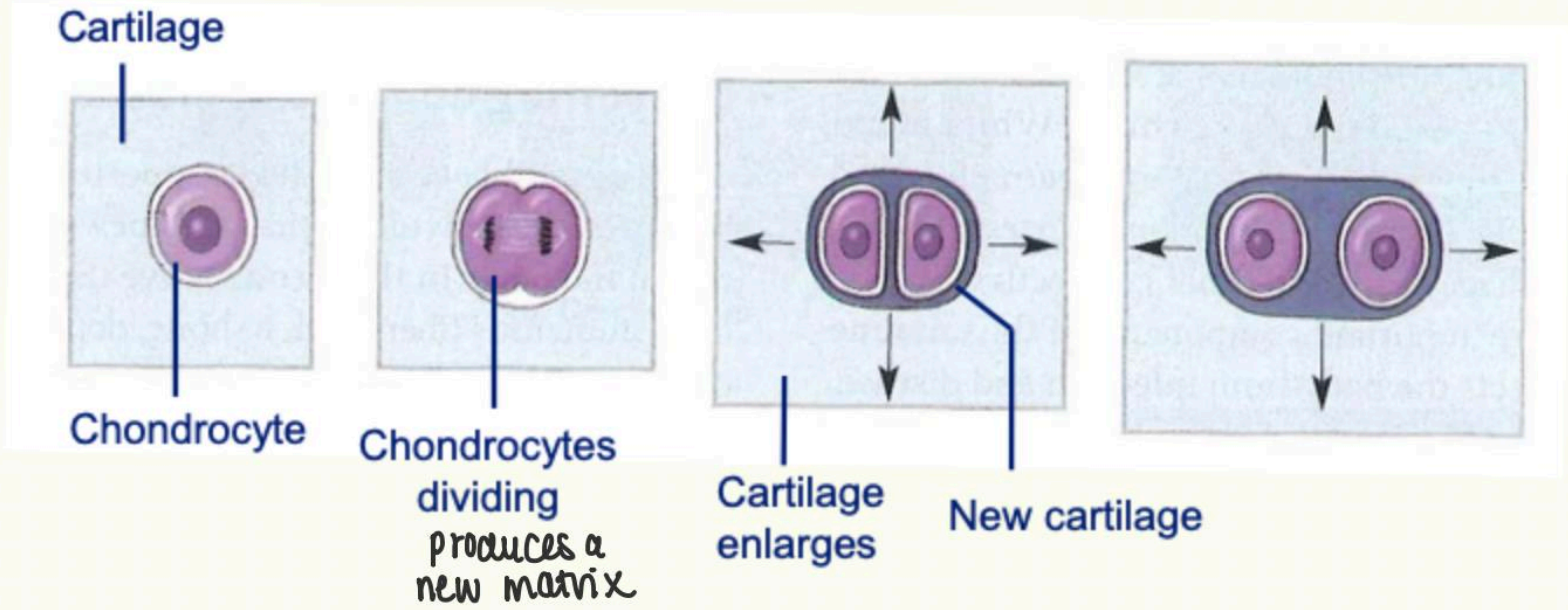


Chondrocytes: cartilage cells
Osteoblasts: bone making cells
Osteoclasts: bone resorbing cells

Bone formation is a balance of osteoblasts making bones and osteoclasts resorbing it

APPOSITIONAL VS INTERSTITIAL GROWTH

- Cartilage grow by two means – Interstitial and Appositional
  - Interstitial – Growth from within (the epiphyseal growth plate)



- Appositional Growth – New layers of cartilage are added to the surface
  - Via the perichondrium

CLASSIFICATION OF JOINTS

Functional classification of joints

- Synarthrosis: fixed joint
- Amphiarthrosis: slightly moveable joint
- Diarthrosis: freely moveable

Structural classification is based on the interleaving tissue

- Fibrous: fibrous tissue between the two joints
- Cartilaginous: primary is where there is hyaline cartilage between two bones, and secondary cartilaginous is where there is a layer of hyaline at the ends of the bones and the intervening tissue is fibrocartilage
- Synovial: has no tissue in between, it is a joint cavity containing synovial fluid

Fibrous joints

- Suture: sagittal suture, coronal suture, lambdoid suture – fibrous tissue ensure no movement ensure bones do not move and slide in the skull
- Syndesmosis: inferior tibiofibular joint is the only example (by ankle)
- Gomphosis: tooth in bony socket

CARTILAGINOUS JOINTS

Primary cartilaginous joints

- Between diaphysis and epiphysis of bones
- In the skull, between the sphenoid and the occipital bones on the base of the skull
- Between the 1st rib and the sternum

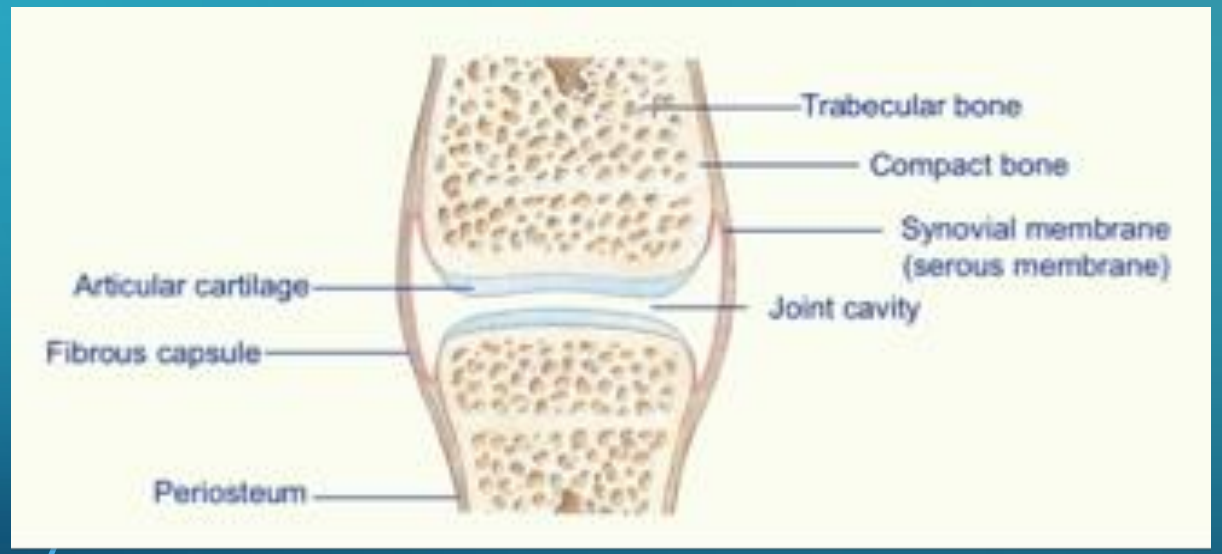
Secondary cartilaginous joints

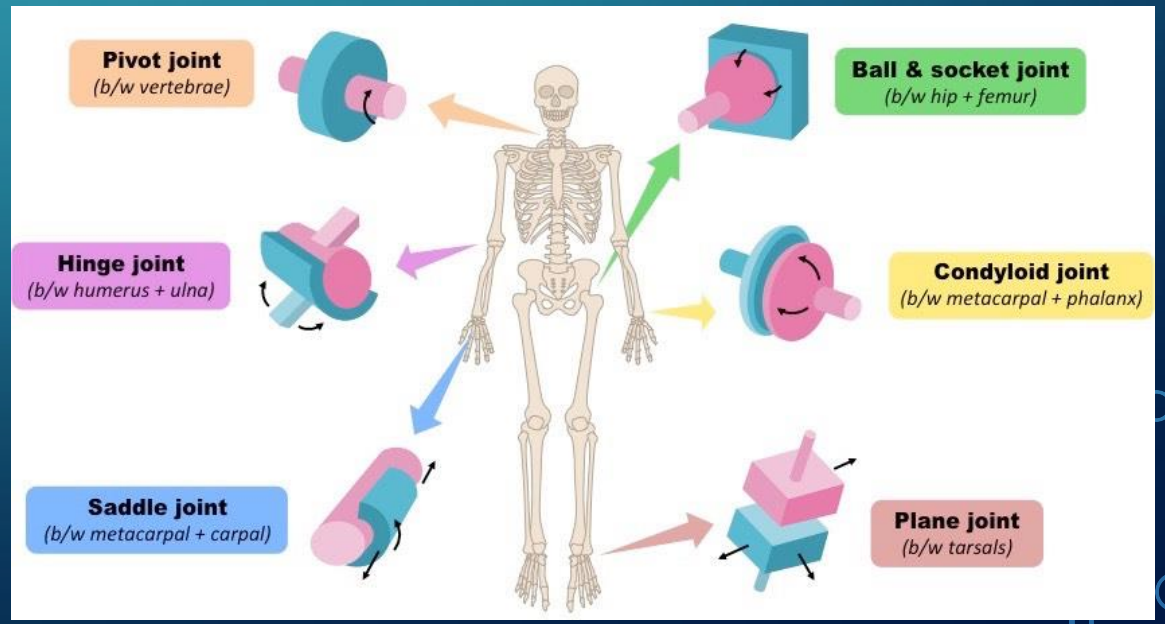
- These are in areas where bone is too stiff and rigid so cartilage is needed
- The intervertebral joints between the bodies of the vertebrae
- The manubriosternal joint between the body and manubrium of the sternum
- The pubic symphysis between the pubic parts of the hip bone

SYNOVIAL JOINTS

Synovial joints allow a lot of movement

Synovial membrane secretes serous membrane which coats the articular cartilage, preventing friction





WHAT CELL TYPE MAKES BONE?

1. Erythrocyte
2. Osteocyte
3. Osteoblast
4. Osteoclast

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WHAT IS THE ELBOW JOINT CLASSED AS?

1. Gliding
2. Ball and socket
3. Hinge
4. Pivot

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WHAT PLANE CUTS YOU DOWN THE MIDDLE INTO LEFT AND RIGHT SIDES?

1. Coronal
2. Sagittal
3. Axial

WHAT PLANE CUTS YOU DOWN THE MIDDLE INTO LEFT AND RIGHT SIDES?

1. Coronal
2. **Sagittal**
3. Axial

THANKS FOR LISTENING !