



Physiology of Skeletal System Joints

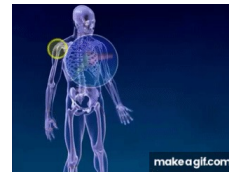
By
Assist. Prof. Dr Dler Gallaly

PhD in Medical Physiology

Dept. of Physiotherapy
Faculty of Applied Sciences
Tishk International University
Kurdistan Region, Erbil, Iraq.
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Mob.#: (+964) 750 461 87 58

Email: dler.qader@tiu.edu.iq



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Contents:

- Joints and Homeostasis.
- Structural and functional classifications of joints.
- Structure and functions of the 3 types of fibrous joints.
- Structure and functions of the 3 types of cartilaginous joints.
- The structure of synovial joints.
- The structure and function of bursae and tendon sheaths.



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Objectives:

After studying this lecture, you will be able to:

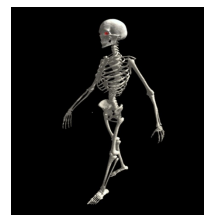
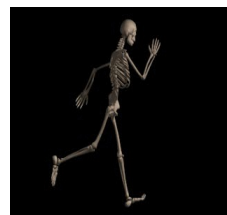
1. Describe structural and functional classifications of joints.
2. Know structure and functions of the 3 types of fibrous joints.
3. Describe structure and functions of the types of cartilaginous joints.
4. Describe the structure of synovial joints.
5. Discuss the structure and function of bursae and tendon sheaths.



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Joints and Homeostasis:

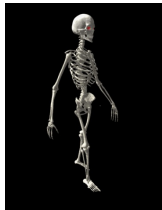
- The joints of the skeletal system contribute to homeostasis by **holding bones together** in ways that allow for **movement** and **flexibility**.



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Introduction:

- A joint (**articulation**) is a point of contact between **two bones**, between **bone and cartilage**, or between **bone and teeth**.
- The scientific study of joints is termed **arthrology**.
- The study of motion of the human body is called **kinesiology**



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Introduction:

Joints are classified:

- **Structurally:** based on their anatomical characteristics.
- **Functionally:** based on the type of movement they permit.



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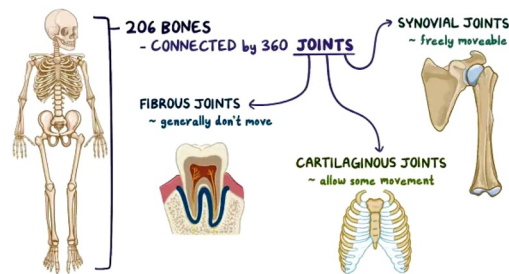
Structural classification of joints:

■ Anatomically subclassified based on two criteria:

1. The **presence or absence of a space** between the articulating bones, a **synovial cavity**.
2. The **type of connective tissue** that binds the bones together.

Structurally, joints are classified as one of the following types:

- Fibrous joints
- Cartilaginous joints
- Synovial joints



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Fibrous joints:

- Fibrous joints **lack a synovial cavity**
- The articulating bones are held very closely together by dense irregular connective tissue (**rich in collagen fibers**).
- Fibrous joints permit **little or no movement**.
- There are 3 types of **fibrous joints**:
 - ✓ Sutures,
 - ✓ Syndesmoses,
 - ✓ Interosseous membranes

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Fibrous joints: Sutures

- Composed of a thin layer of dense irregular connective tissue.
- Formed as the numerous bones of the skull come in contact during development.
- Occur only between bones of the skull.

Example: the coronal suture between the parietal and frontal bones.

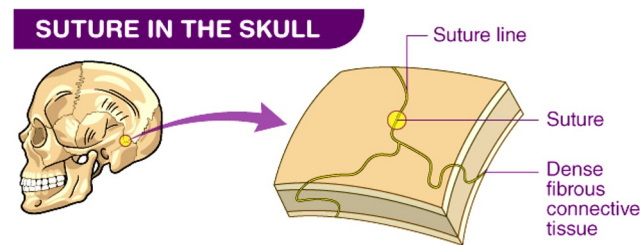
- The irregular, interlocking edges of sutures give them added strength and decrease their chance of fracturing.



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Fibrous joints: Sutures

- The Sutures are **immovable** or **slightly movable**.
- In older individuals: sutures are **immovable** (**synarthroses**).
- In infants and children: **slightly movable** (**amphiarthroses**).
- Sutures play important roles in **shock absorption in the skull**



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Fibrous joints: Sutures

- Some sutures, although present during growth of the skull, are replaced by bone in the adult (**synostosis**) or bony joint.

- **Synostosis:**

- ✓ is a complete fusion of two separate bones into one.
- ✓ is classified as a **synarthrosis** because it is **immovable**.

Example:

the frontal bone grows in halves that join together across a suture line.

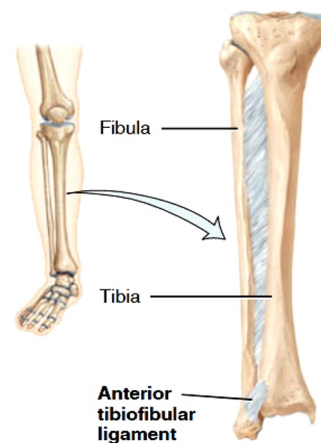
- **Obscure:** suture completely fused by age 6.
- **Frontal (metopic)** suture: if it is persisted beyond age 6.



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Fibrous joints: Syndesmoses:

- In which there is a **greater distance between the articulating surfaces** and **more dense irregular connective tissue than in a suture**.
- The dense irregular connective tissue is typically arranged as a bundle (ligament), allowing the joint to permit limited movement (**amphiarthrosis**).
- Example: **distal tibiofibular joint**

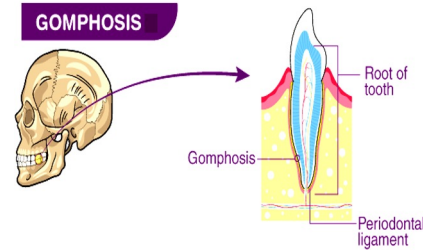


Syndesmosis between tibia and fibula at distal tibiofibular joint

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Fibrous joints: Syndesmoses:

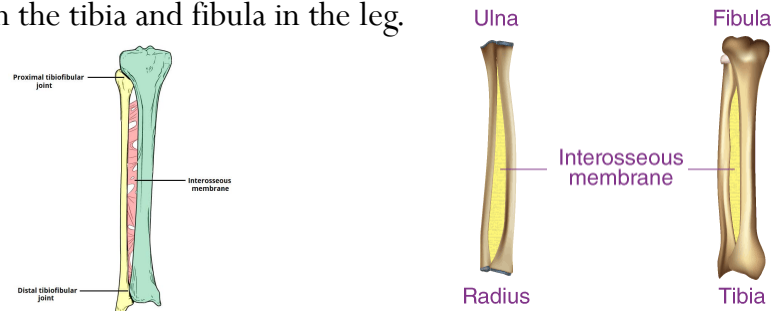
- Another example of a syndesmosis is called a **gomphosis** (bolt or nail) or **dentoalveolar joint**.
- The only examples of **gomphoses** in the human body are the articulations between the roots of the teeth and their sockets (dental alveoli) in the alveolar processes in the maxillae and mandible.
- A healthy gomphosis permits minute shock-absorbing movements (**amphiarthrosis**).



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Fibrous joints: Interosseous membrane:

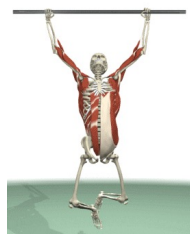
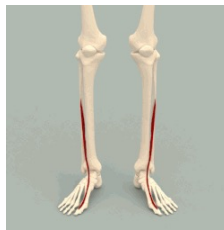
- Interosseous membrane is a substantial sheet of dense irregular connective tissue that binds neighboring long bones and permits slight movement (**amphiarthrosis**).
- **There are two principal interosseous membrane joints in the human body:**
 - between the radius and ulna in the forearm.
 - between the tibia and fibula in the leg.



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Functions of interosseous membrane joints:

- They help hold adjacent long bones together.
- play an important role in defining the range of motion between the neighboring bones.
- provide an increased attachment surface for muscles that produce movements of the digits of the hand and foot.



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Cartilaginous joint:

- Cartilaginous joint lacks a synovial cavity and allows little or no movement.
- At a cartilaginous joint the bones are held together by cartilage (either hyaline cartilage or fibrocartilage).
- **There are three types of cartilaginous joints:**
 - ✓ **Synchondroses,**
 - ✓ **Symphyses,**
 - ✓ **Epiphyseal cartilages.**

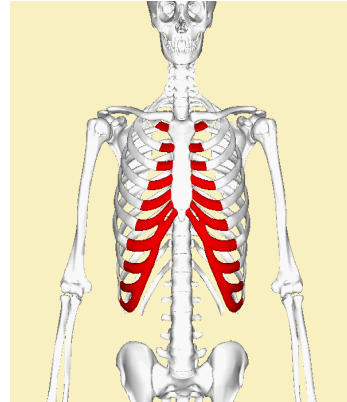
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Cartilaginous joint: Synchondroses:

- In synchondrosis (a cartilaginous joint) the connecting material is **hyaline cartilage**.
- slightly movable (**amphiarthrosis**) to immovable (**synarthrosis**)

One example of a synchondrosis is:

- ✓ the joint between the first rib and the manubrium of the sternum.



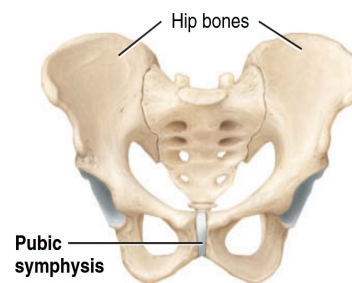
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Cartilaginous joint: Symphyses:

- A symphysis is a cartilaginous joint in which the ends of the articulating bones are covered with hyaline cartilage, but a broad, flat disc of fibrocartilage connects the bones.
- A symphysis is a slightly movable joint (amphiarthrosis).
- All symphyses occur in the midline of the body.

Example:

The pubic symphysis between the anterior surfaces of the hip bones.

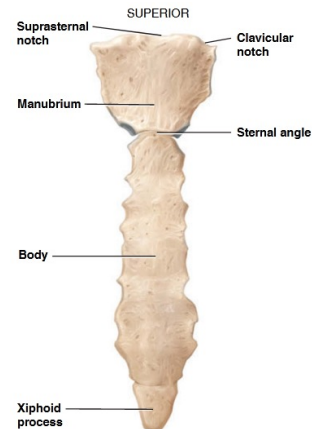
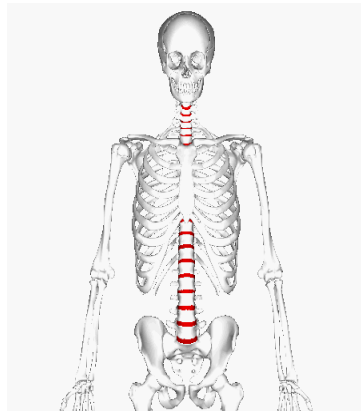


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Cartilaginous joint: Symphyses:

Other examples:

- The manubrium and body of the sternum.
- The intervertebral joints between the bodies of vertebrae.



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Cartilaginous joint: Epiphyseal cartilages:

- They are actually hyaline cartilage growth centers during endochondral bone formation, not joints associated with movements.

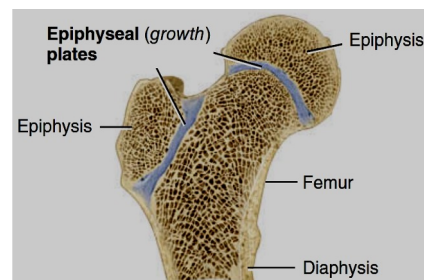
Example:

- Epiphyseal cartilage is the epiphyseal (growth) plate that connects the epiphysis and diaphysis of a growing bone.

Functionally:

Epiphyseal cartilage is an immovable joint (**synarthrosis**).

When bone elongation ceases, bone replaces the hyaline cartilage, and becomes a **synostosis**, a bony joint.



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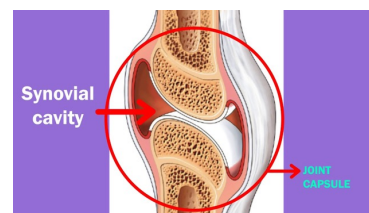
Synovial joints: Structure of Synovial joints:

- The distinguishing feature of a synovial joint is the presence of a space (**synovial cavity** or **joint cavity**) between the articulating bones.
- Because the synovial cavity allows considerable movement at a joint, all synovial joints are classified functionally as freely movable (**diarthroses**).
- **Articular cartilage:**
 - ✓ a layer of hyaline cartilage, covers the bones at a synovial joint.
 - ✓ reduces friction between bones in the joint during movement.
 - ✓ helps to absorb shock.

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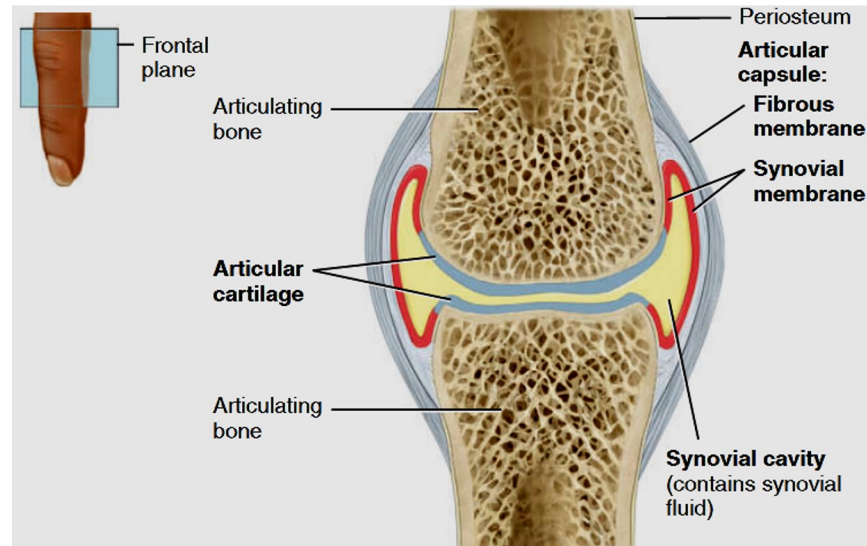
Synovial joints: Structure of Synovial joints:

- **Articular capsule or joint capsule:**
 - ✓ **composed of two layers:**
 - **an outer fibrous membrane**
 - permits considerable movement at a joint,
 - helps prevent the bones from dislocating.
 - **an inner synovial membrane**
 - composed of areolar connective tissue with elastic fibers.
 - secretes **synovial fluid**
 - ✓ surrounds a synovial joint
 - ✓ encloses the synovial cavity,
 - ✓ unites the articulating bones.



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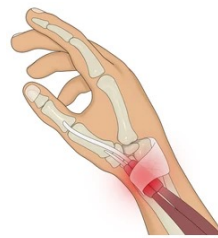
Structure of Synovial joints:



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Bursae and Tendon Sheaths:

- Bursae are saclike structures.
- filled with a small amount of fluid (similar to synovial fluid).
- alleviate friction in some joints (the shoulder and knee joints).
- Can be located between the **skin and bones**, **tendons and bones**, **muscles and bones**, or **ligaments and bones**.
- The fluid-filled bursal sacs cushion the movement of these body parts against one another.
- **Tendon sheaths:**
 - ✓ Also known as **synovial sheaths**.
 - ✓ They are tubelike bursae **reduce friction at joints**.



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Questions and Comments:



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