

## Musculoskeletal System: Bones, joints and Muscles

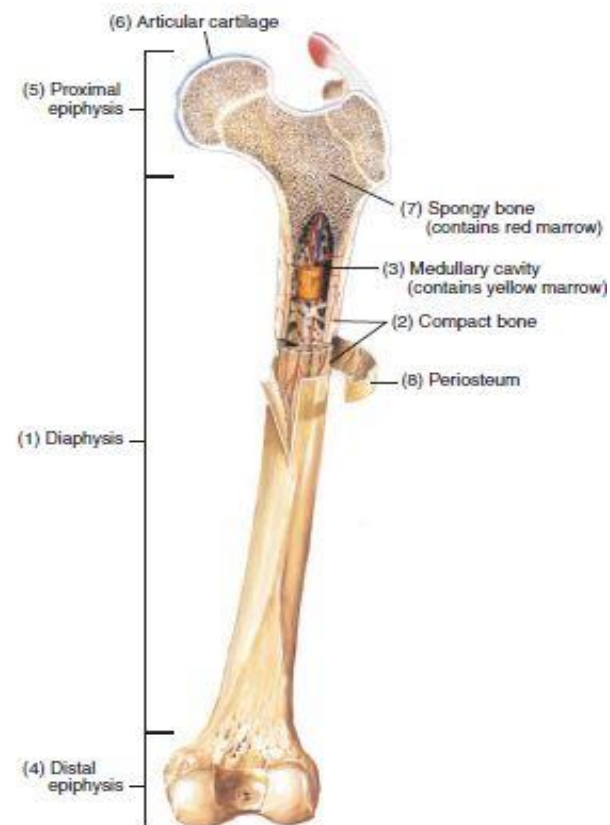
The musculoskeletal system includes **muscles, bones, joints**, and related structures, such as the **tendons** and **connective tissue**

**Bones:** are providing the framework of the body, protect internal organs, store calcium and other minerals, and produce blood cells within bone marrow (**hematopoiesis**).

**Bone types:** There are **four principal** types of bone:

1. **Short bones:** are **cube-shaped**. Examples: **ankles, wrists, and toes**.
2. **Irregular bones:** include the bones their **complex shapes**. Examples: **vertebrae**
3. **Flat bones:** They provide broad surfaces for **muscular attachment**. Examples: the **skull, shoulder blades, and sternum**.
4. **Long bones:** are found in the **extremities of the body**. Example: **humerus, femur, and fingers**.

**Fig 1: Longitudinal structure of a long bone.**



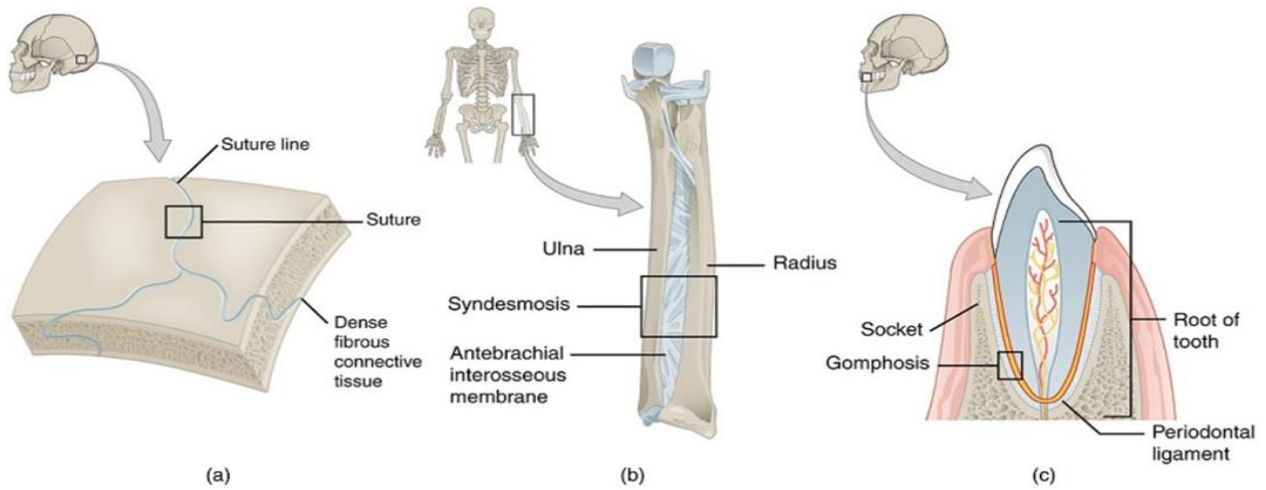
**Joints:** are any place where **adjacent bones** or **bone and cartilage** come together (**articulate with each other**) to form a **connection**. Also called an **articulation**,

### A. Joints Structural Classification:

1. **Fibrous Joints:** the adjacent bones are **directly connected** to each other by **fibrous connective tissue**, and thus the bones **do not have a joint cavity** between them.

There are **three types** of fibrous joints:

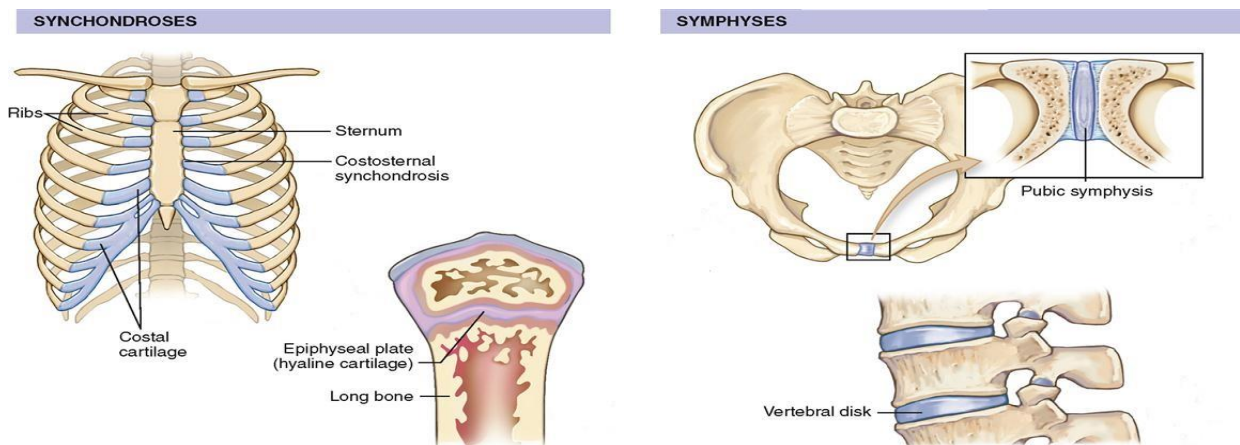
- **Suture:** all the bones of **the skull**.
- **Syndesmosis:** In the **forearm (radius and ulna)**.
- **Gomphosis:** Is **the root of a tooth** into its bony socket within the maxillary bone (**upper jaw**) or mandible bone (**lower jaw**) of the skull.



**Fig2: Fibrous Joint types**

**2. Cartilaginous joint:** The adjacent bones are united by **cartilage**. These types of joints **do not have joint cavity** and the bones are joined together by either **hyaline cartilage** or **fibrocartilage**.

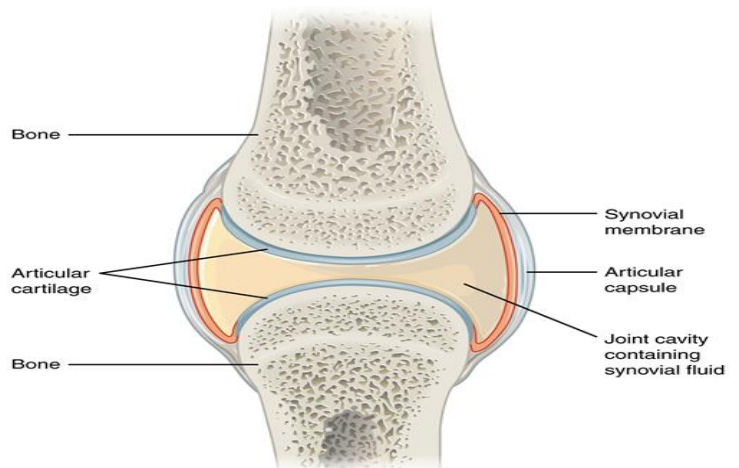
For example: the **costal cartilage** of the **thoracic cage**, the **Pubic Symphysis** of the **pelvic girdle** and **Intervertebral disc** of the **vertebrae**.



**Fig3: Cartilaginous joint types**

**3. Synovial joint:** The bones are **not directly connected**, but contact with each other within a **joint cavity** that is filled with a **lubricating fluid**. Synovial joints are the **most common joints of the body**.

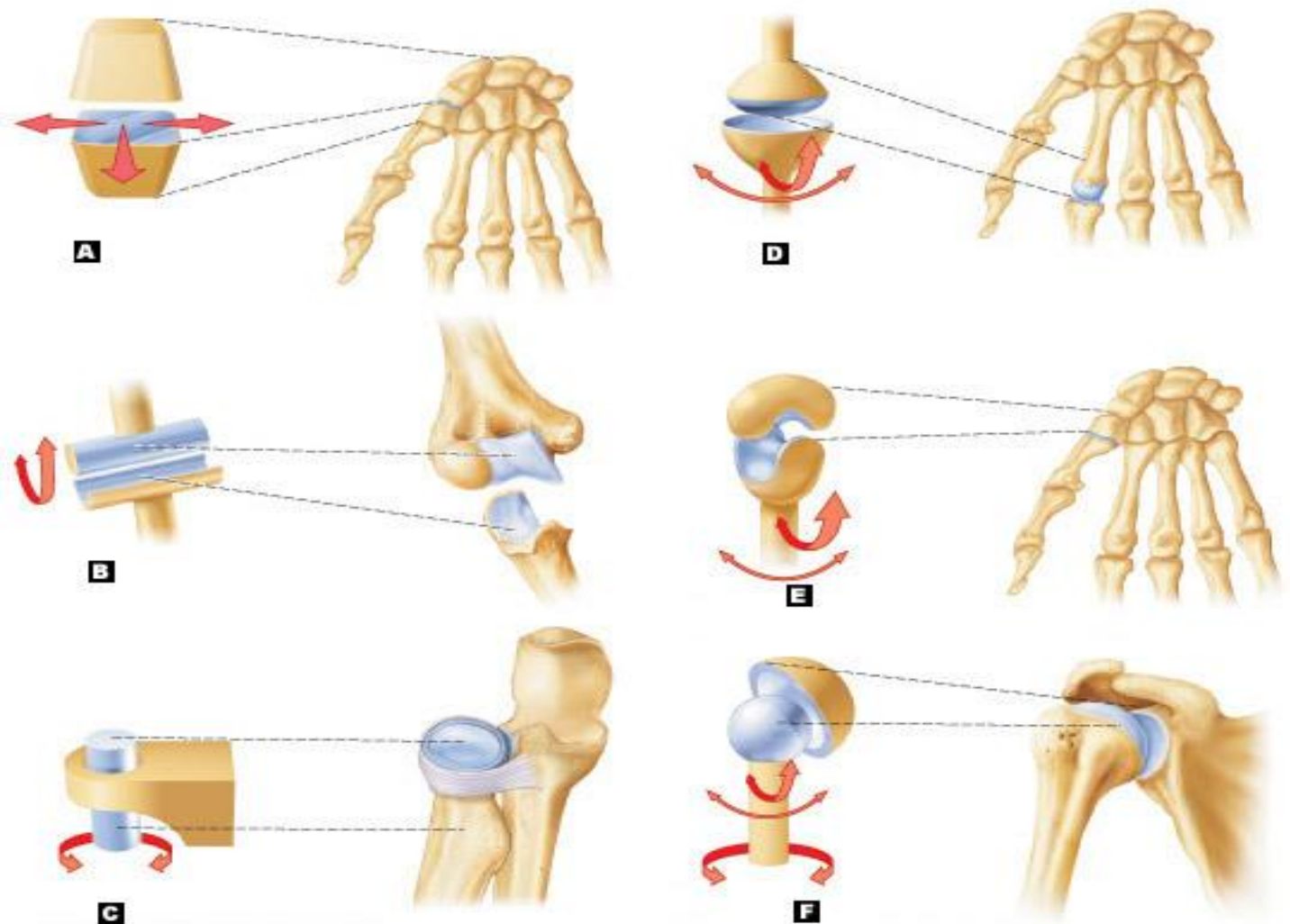
**Fig4: Synovial joint**



## **B. Joints Functional Classification:**

The functional classification of joints is determined by **the amount of mobility** found between the adjacent bones.

1. **Immobile joint:** is **immobile** or **nearly immobile** joint for example: **Sutures**
2. **Slightly moveable joint:** is a joint that has **limited mobility** for example: **Intervertebral disc** and **Pubic symphysis**.
3. **Freely moveable joint:** is providing the majority of **body movements** for example: **Synovial joints** and most joints are found in the **appendicular skeleton**. These joints are divided into **three categories**,
  - A **uniaxial joint:** allows for a motion in a **single plane** for example: **Elbow joint**
  - A **biaxial joint** allows for motions within **two planes** for example: **Hand joint**.
  - A **multiaxial joint** (polyaxial or triaxial joint) allows for the **several directions** of movement for example: **shoulder and hip joints**.



**Fig5: Freely moveable joint**

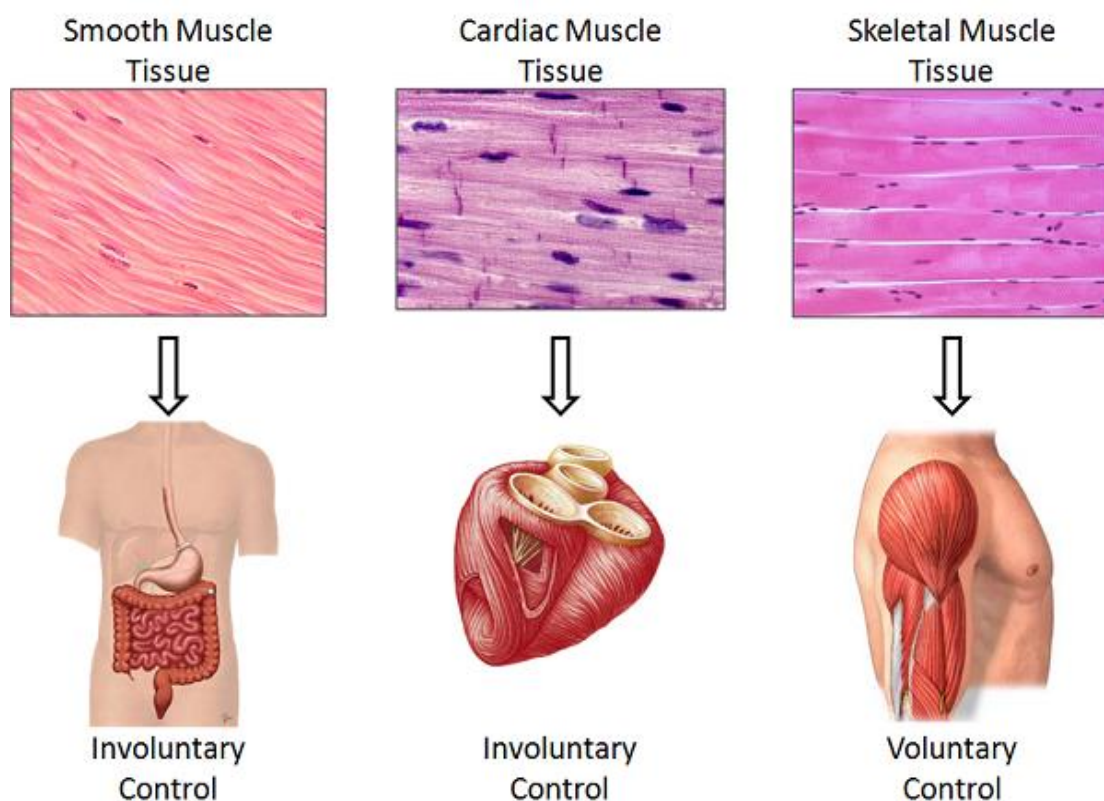
**Muscles:** are composed of **contractile cells or fibers** that provide movement of an organ or body part. Muscles contribute to produce **body heat** and a protective **covering for internal organs**.

There are **three types** of muscle tissue in the body:

A. **Skeletal muscles:** also called **voluntary** or **striated muscles**, are muscles whose action is under voluntary control.

B. **Cardiac muscle:** is found only in the heart and makes up most of the **wall heart**.it is striated, tubular and branched but it produces **involuntary** contractions.

C. **Smooth muscles:** also called **involuntary** or **visceral muscles**. They are found principally in the **internal or visceral organs, walls of arteries and respiratory passages, and digestive, urinary and reproductive ducts**.



**Fig 6: Muscles Type**

**Muscles and Body Movements:** Muscles are attached to at least two points **Origin and Insertion**

**Origin** – attachment to a moveable bone.

**Insertion** – attachment to an immovable bone.