



كلية المستقبل الجامعة  
قسم الفيزياء الطبية  
المرحلة الثالثة

# Medical Physics

## Lecture Three

### What is Bone Made of ?

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# What is Bone Made of ?

## The Bone :

Bone is living tissue that makes up the body's skeleton, A bone is a rigid organ that constitutes part of the skeleton in most. Bones protect the various other organs of the body.

Bones provide support for our bodies and help form our shape. Although they're very light, bones are strong enough to support our entire weight.

Bones come in a variety of shapes and sizes and have a complex internal and external structure. They are lightweight yet strong and hard, and serve multiple functions :

- **Produce red and white blood cells.**
- **Movement and enable mobility .**
- **Provide structure and support for the body .**



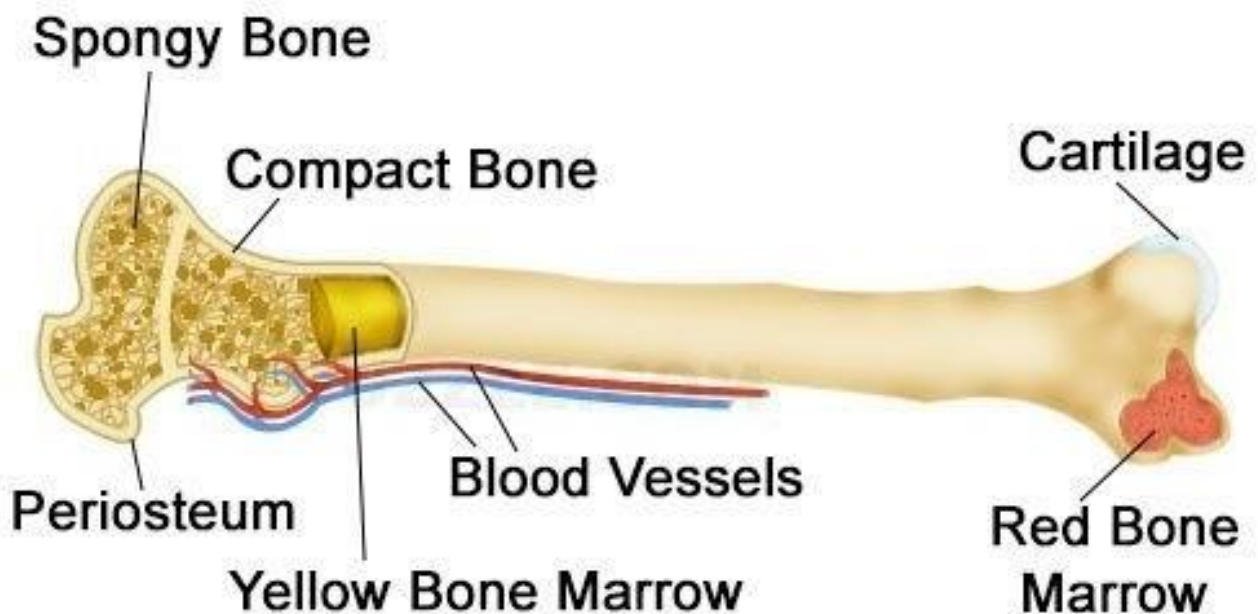
## What is Bone Made of ?

Bones are made up of a framework of :

- 1- A protein called collagen .
- 2- A mineral called calcium phosphate that makes the framework hard and strong.
- 3- the spaces in spongy bone are full of blood vessels and soft tissue called bone marrow .
- 4- the marrow in spongy bone is red .

Bones store calcium and release some into the bloodstream when it's needed by other parts of the body.

The amounts of some vitamins and minerals that you eat, especially vitamin D and calcium, directly affect how much calcium is stored in the bones .



## The Metabolic Functions of Bone :

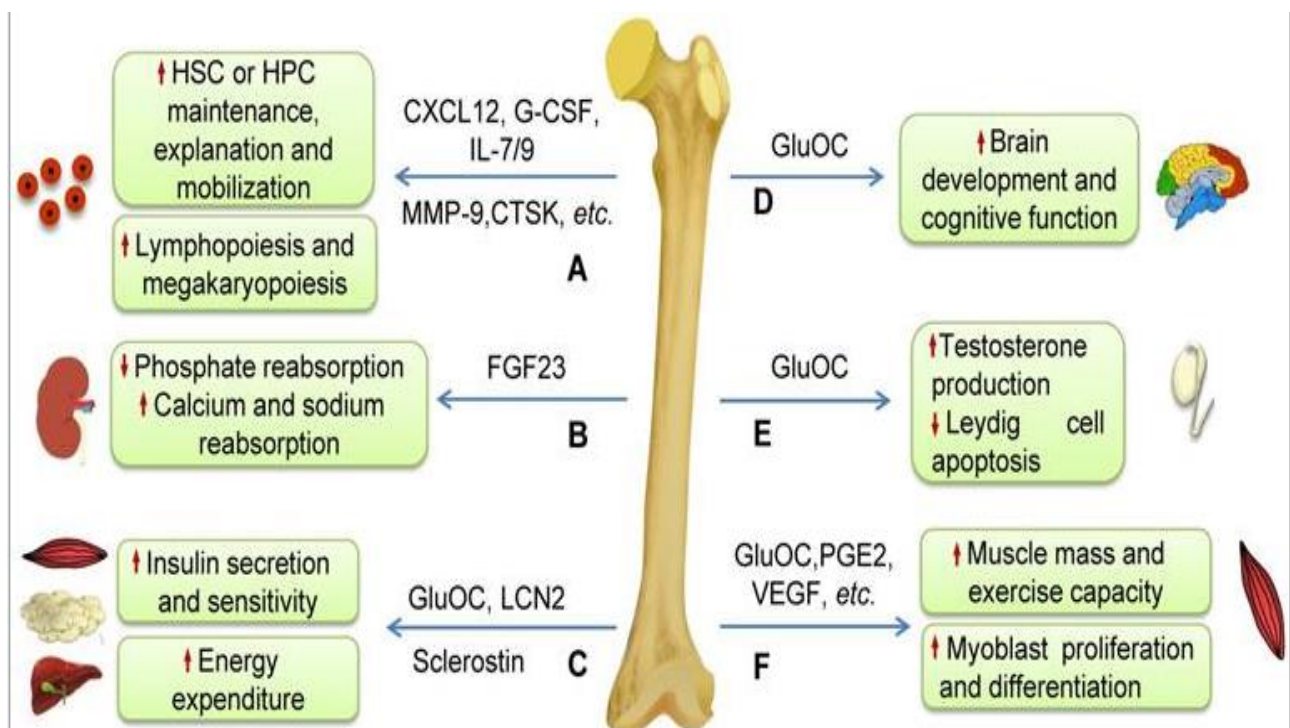
**1- Storage :** Bones act as a reserve for minerals, particularly calcium and phosphorous. Bone marrow adipose tissue can also store fatty acids .

**2- Calcium Balance:** Bones can raise or reduce calcium in the blood by forming bone, or breaking it down in a process called resorption.

**3- PH Balance :** bones can release or absorb alkaline salts, helping blood to stay at the right pH level .

**4- Detoxification :** Bones can absorb Trusted Source heavy metals such as lead, mercury, and arsenic from the blood .

**5- Endocrine function :** Bones produce the precursors to various hormones, including those involved in growth, insulin production, and brain development. They release hormones that act on the kidneys and influence blood sugar regulation and fat deposition



## Types of Bone :

1- Long bones: These are mostly compacted bones with little marrow and include most of the bones in the limbs. They tend to support weight and help movement.

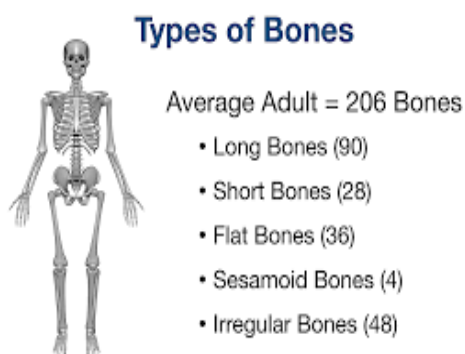
2- Short bones: include bones of the wrist and ankle.

3- Flat bones .

4- Sesamoid bones .

5- Irregular bones: These bones do not fit into the first four categories and have an unusual shape. They include the bones of the spine and pelvis.

They often protect organs or tissues .



## Osteoporosis :

is a bone disease that involves a reduction in bone mineral density. This increases the risk of fractures. It most commonly occurs in females. However, it can affect males too Osteoporosis occurs either when removal or resorption of bone happens .

Causes of osteoporosis :

- **Low calcium levels**
- **Vitamin D deficiency**

## Lubrication of Bone Joints :

### Joint Lubrication :

The natural lubricant of the joints is called hyaluronic acid (HA) .

This lubricant in concentrated form can be injected into a joint to increase lubrication .

The body uses hyaluronic acid to cushion, hydrate, lubricate, and heal your body. It's in your connective tissue, skin, bones, joint fluid (synovial fluid), cartilage, and the eye's vitreous body.

### Hyaluronic Acid (HA) :

is the key molecule responsible for skin moisture and has the ability to retain water. This essential molecule contributes to joints' stability and friction-free mechanics.



Joints contain synovial fluid with hyaluronic acid, creating a smooth layer. This layer greatly reduces the friction in the joint and helps absorb shocks to prevent joint wear .

In the core of the intervertebral discs, a gel made of hyaluronic acid serves as a shock absorber and protects against impact and pressure .