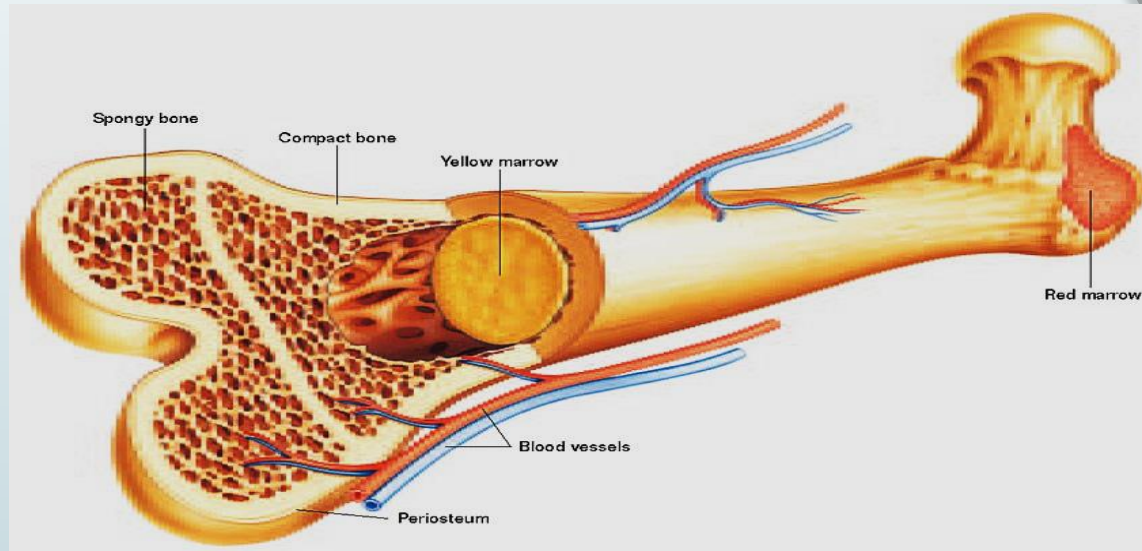


# BONE MARROW



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# Bone marrow

Bone marrow is a spongy organ that fills the center of various bones of your body. It is where **stem cells** produce red and white blood cells and platelets. Without bone marrow, you couldn't move oxygen through your body or fight infections, and blood wouldn't clot.

## **It is composed of :**

Hematopoietic cells.

Marrow adipose tissue.

Supportive stromal cells.

In adult humans, bone marrow is primarily located in the axial bones **ribs, vertebrae, sternum, and bones of the pelvis**. Bone marrow comprises approximately **5%** of total body mass in healthy adult humans.

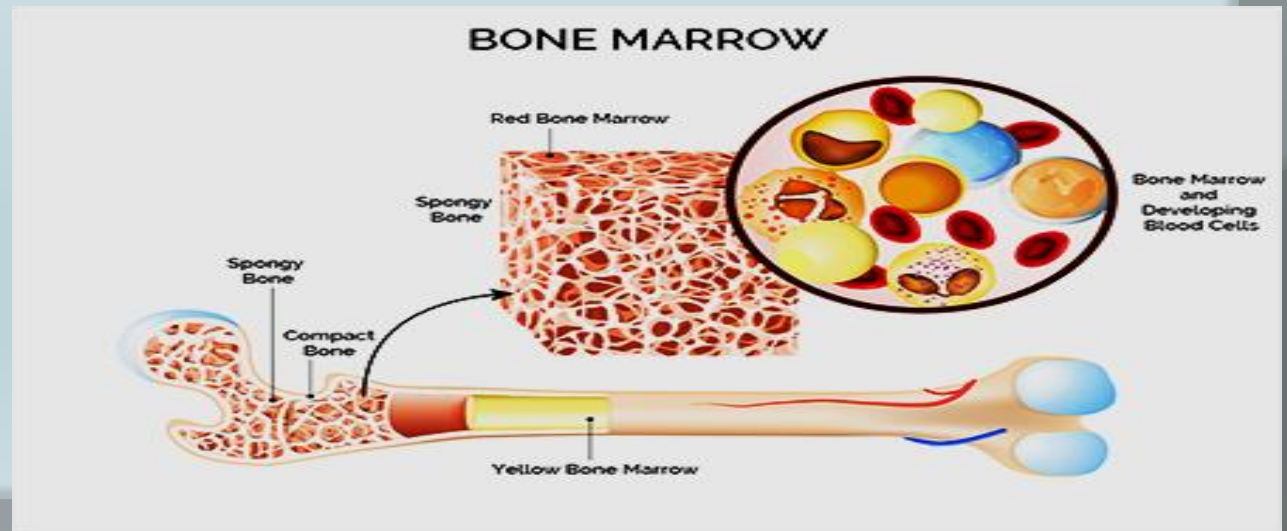
# Structure

In humans, marrow is characterized as "**red**" or "**yellow**" marrow, respectively depending on the prevalence of hematopoietic cells vs fat cells.

A newborn baby's bones exclusively contain haematopoietically active "**red**" marrow, and there is a progressive conversion towards "**yellow**" marrow with age.

**Yellow** bone marrow stores fat and nutrients for **red** bone marrow to use and to maintain body functions.

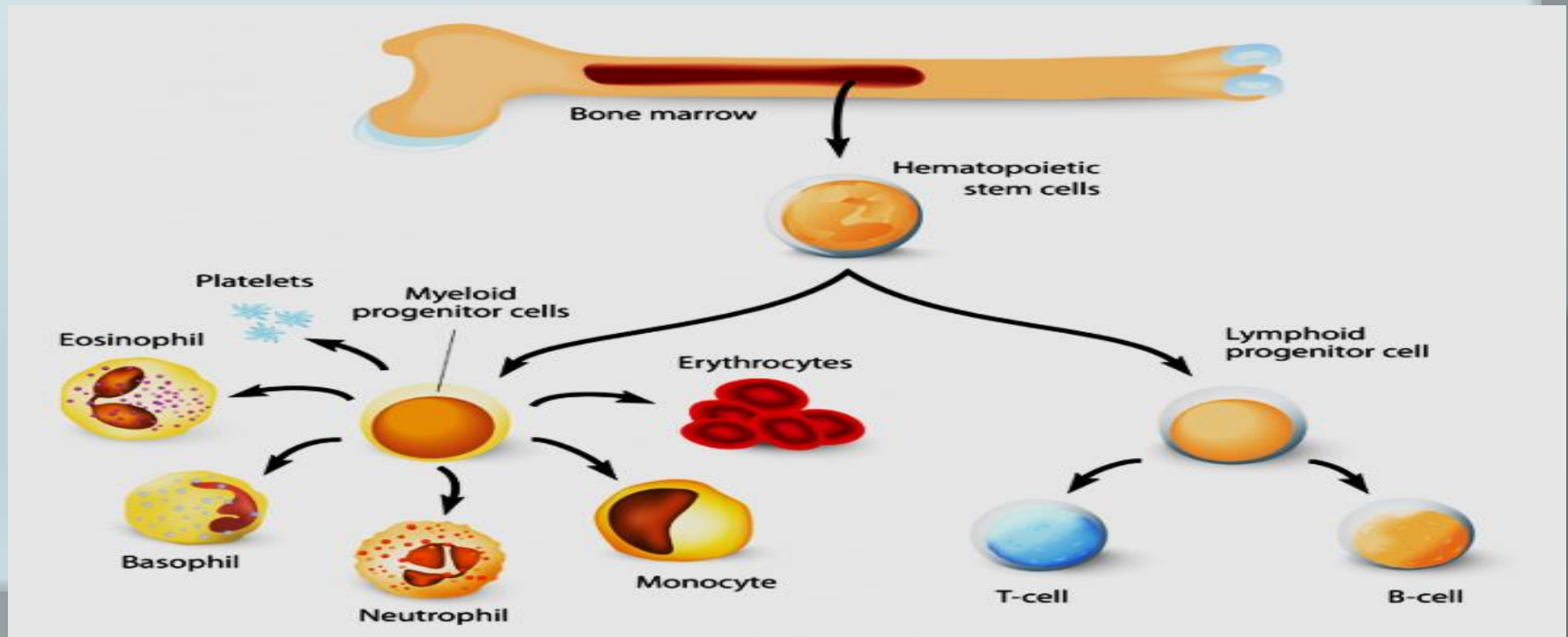
In conditions of chronic hypoxia, the body can convert **yellow** marrow back to **red** marrow to increase blood cell production.

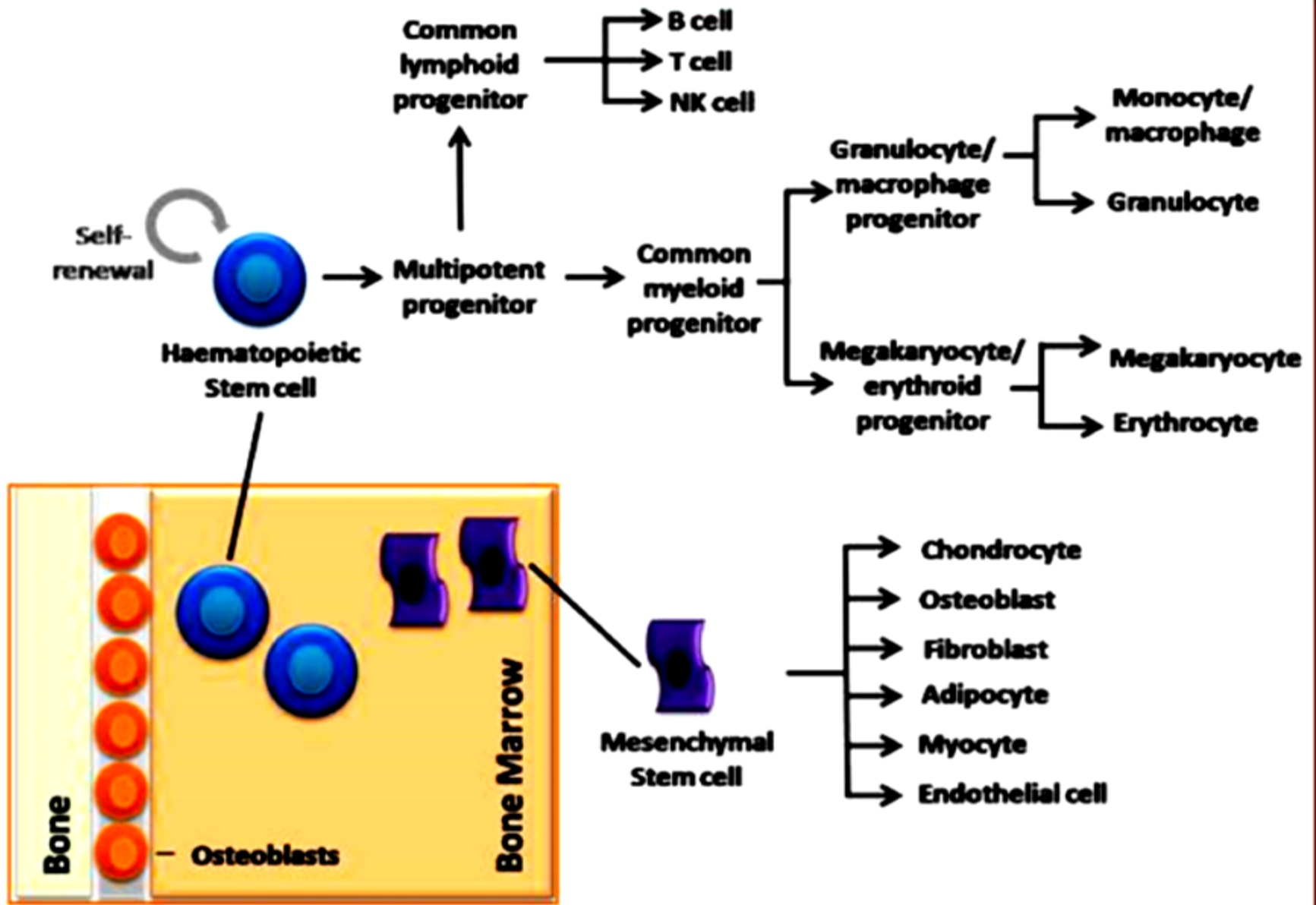


# Hematopoietic components

At the cellular level, the main functional component of bone marrow includes the **progenitor cells** which are destined to mature into **blood and lymphoid cells**.

Marrow contains **hematopoietic stem cells** which give rise to the three classes of blood cells that are found in circulation: white blood cells (**leukocytes**), red blood cells (**erythrocytes**), and platelets (**thrombocytes**).





Cellular constitution of the red bone marrow parenchyma

# Stroma

- ❖ Stromal cells may be indirectly involved in hematopoiesis, providing suitable-environment that influences the function and differentiation of hematopoietic cells.

For example : they generate **colony stimulating factors**, which have a significant effect on hematopoiesis.

- ❖ Cell types that constitute the **bone marrow stroma** include:

**Fibroblasts** (reticular connective tissue), **Adipocytes** (fat cells), **Osteoblasts** (synthesize bone), **Osteoclasts** (resorb bone), **Endothelial cells**, which form the sinusoids.

## Function

### Mesenchymal stem cells

The bone marrow stroma contains mesenchymal stem cells (**MSCs**), also known as marrow stromal cells. These are **multi-potent stem cells** that can differentiate into a variety of cell types. MSCs have been shown to differentiate, **in vitro** or **in vivo**, into **osteoblasts, chondrocytes, myocytes, marrow adipocytes** and **beta-pancreatic islets cells**.

## **Bone marrow barrier**

The **blood vessels** of the bone marrow constitute a barrier, inhibiting immature blood cells from leaving the marrow. Only **mature blood cells** contain the membrane proteins, such as aquaporin and glycophorin, that are required to attach to and pass the blood vessel endothelium.

## **Lymphatic role**

The **red bone marrow** is a key element of the lymphatic system, being one of the primary lymphoid organs that generate lymphocytes from immature hematopoietic progenitor cells. The bone marrow and thymus constitute the primary lymphoid tissues involved in the production and maturation of lymphocytes.

# Clinical significance

## Disease

The normal bone marrow architecture can be damaged or displaced by **aplastic anemia**, **malignancies** such as multiple myeloma, or **infections** which leading to a decrease in the production of blood cells and blood platelets.

The bone marrow can also be affected by various forms of **leukemia**, which **attacks** its **hematologic progenitor cells**. Furthermore, exposure to **radiation** or **chemotherapy** will kill many of the rapidly dividing cells of the bone marrow and will therefore result in a depressed immune system.

## Application of stem cells in therapeutics

**Bone marrow derived stem cells** have a wide array of application in regenerative medicine.



Thank You