

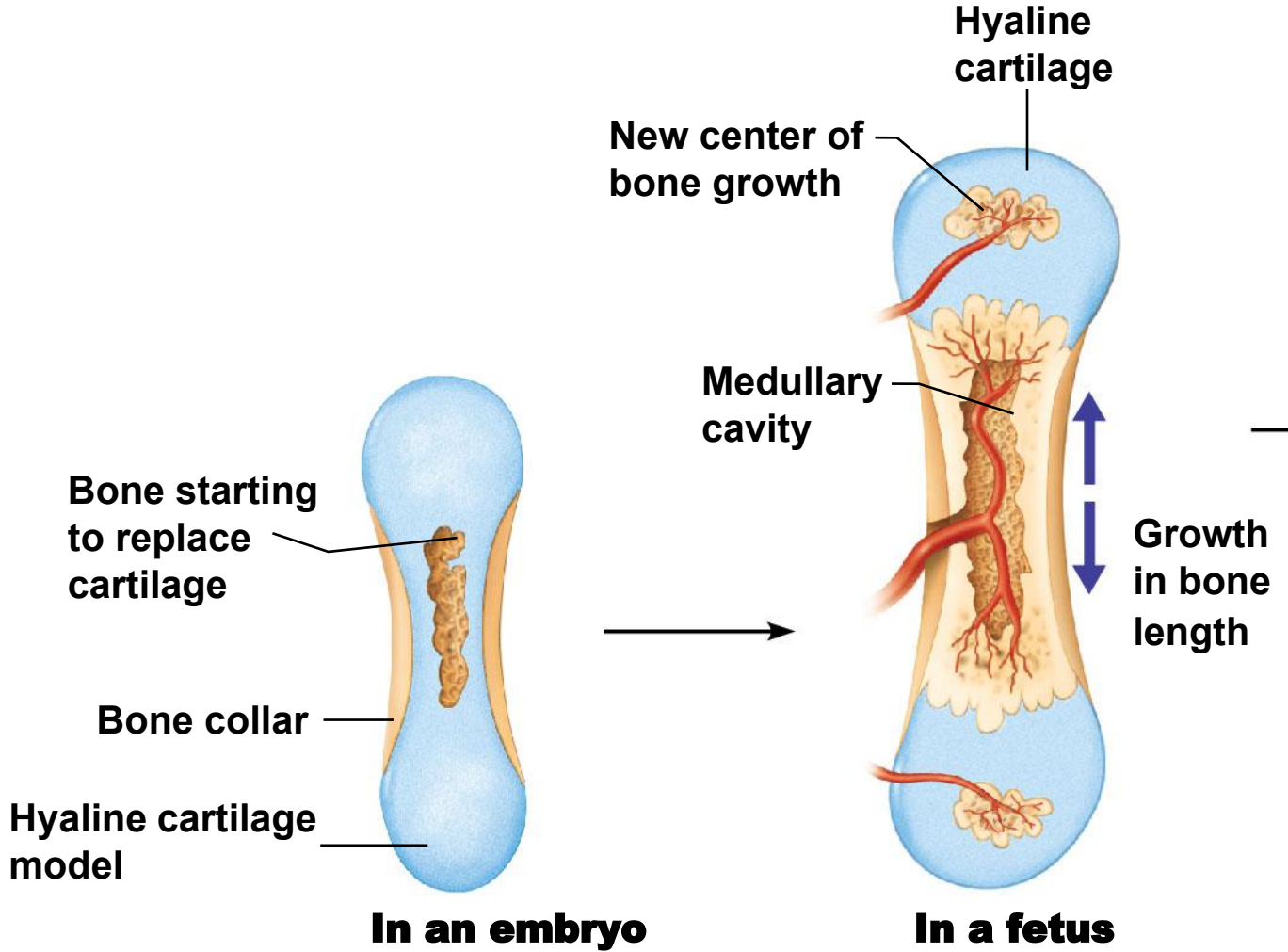
Bone Formation

- The skeleton is formed from two of the strongest connective tissues in the body – **Cartilage and Bone**.
- **Bone formation**, also known as **ossification**, happens in two stages called the **hyaline cartilage model**:
 1. In an embryo:

A bone collar completely covers the hyaline cartilage skeleton by bone forming cells called osteoblasts.
 2. In a fetus:

Hyaline cartilage is then digested away, opening up a medullary cavity within the newly formed bone.

Hyaline Cartilage Model



Bone Lengthwise Growth

- By birth, most hyaline cartilage models have been converted to bone except for two regions in a long bone
 1. Articular cartilages
 2. Epiphyseal plates
- **New cartilage is formed continuously on external face (joint side) of these two cartilages**
- **Old cartilage on the opposite face (medullary cavity side) is broken down and replaced by bony matrix**

Bone Lengthwise Growth

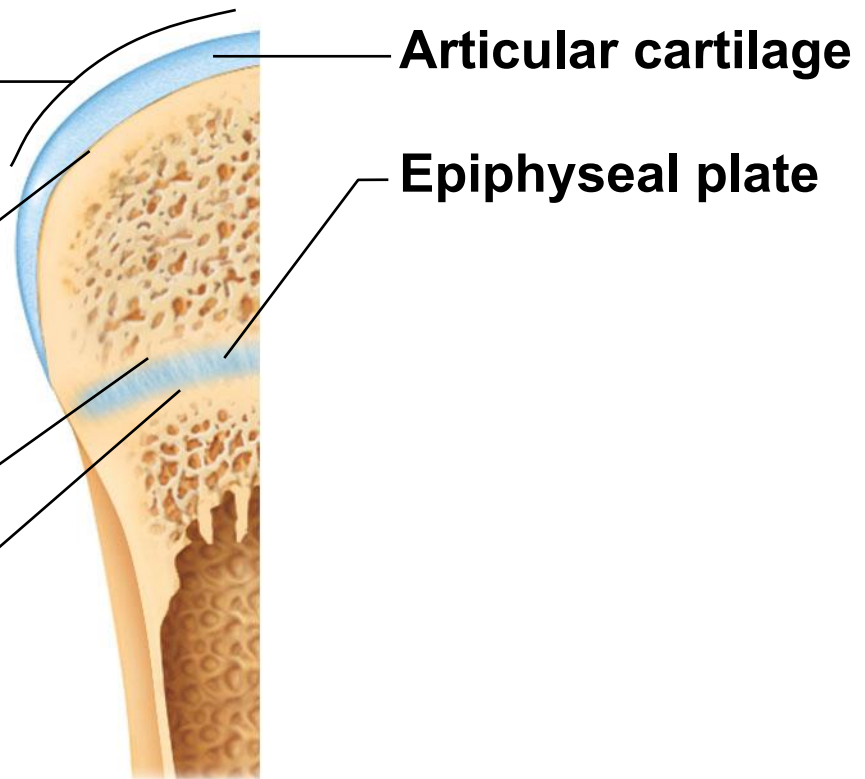
Bone grows in length because:

1 Cartilage grows here.

2 Cartilage is replaced by bone here.

3 Cartilage grows here.

4 Cartilage is replaced by bone here.



Bone Lengthwise Growth

■ Controlled by:

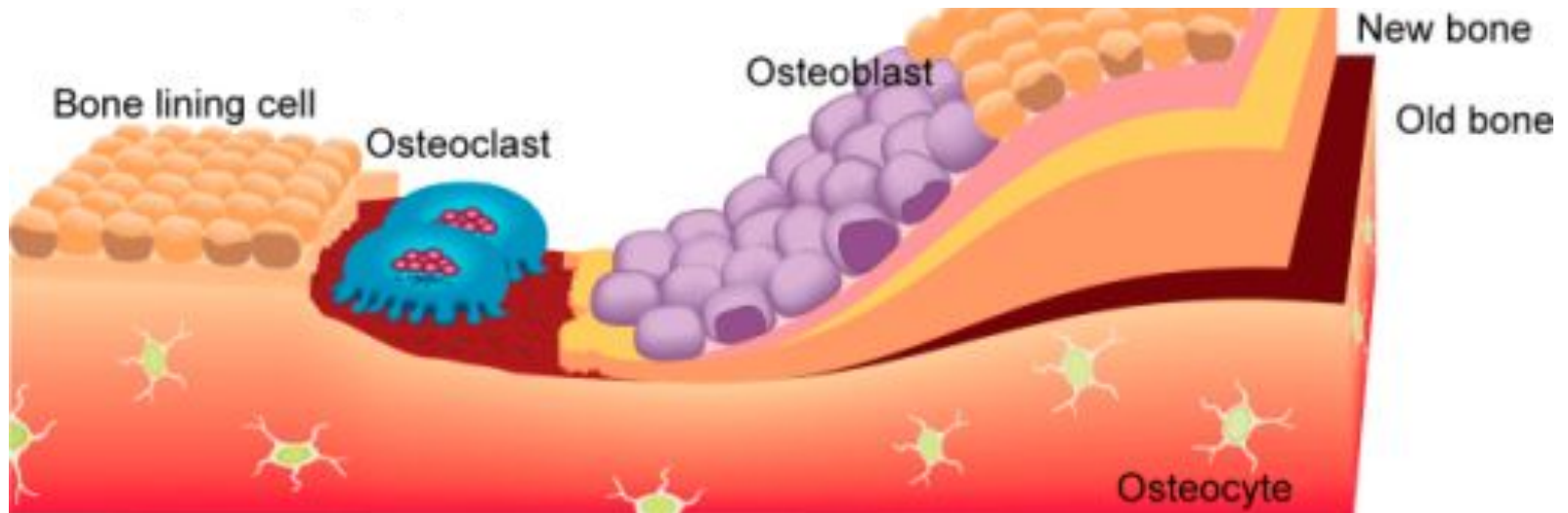
- ✓ **Growth hormones**
- ✓ **Sex hormones during puberty**

■ Duration:

- ✓ **Ends during adolescence**
- ✓ **Epiphyseal plate turns into the epiphyseal line**

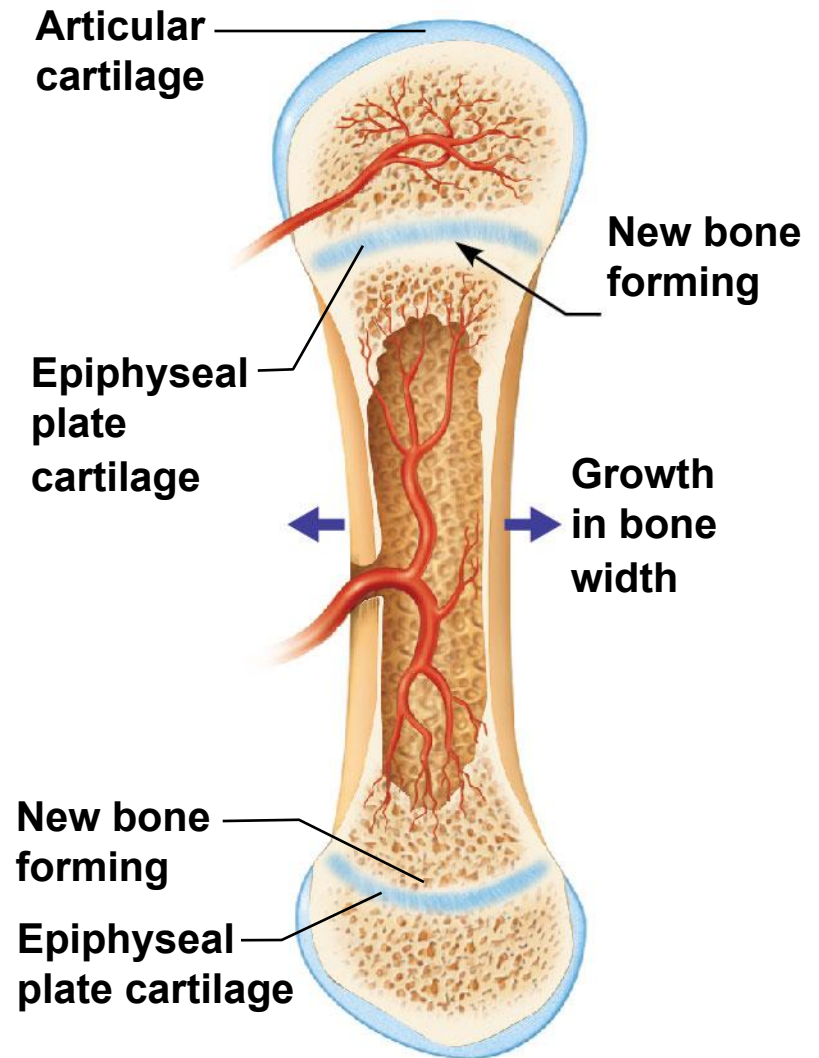
Bone Cells

- Bone growth is an **ongoing active process**.
- Bones cells are constantly **being rebuilt and destroyed by 2 bone cells types**:
 1. **Osteoclasts** break down bone.
 2. **Osteoblasts** form new bone cells.



Bone Appositional Growth

- Bones grow in **width**
- **Osteoblasts in the periosteum add bone matrix to the outside of the diaphysis**
- **Osteoclasts in the endosteum remove bone from the inner surface of the diaphysis**



Bone Appositional Growth

- Controlled by:
 - ✓ **Activity Levels**
 - ✓ **Nutrition**

- Duration:
 - ✓ **Ends at approximately age 25**
 - ✓ **Begins the remodeling phase**

Bone Remodeling

- Bones are remodeled throughout life in response to two factors:
 1. Calcium ion level in the blood determines when bone matrix is to be broken down or formed
 2. Pull of gravity and muscles on the skeleton determines where bone matrix is to be broken down or formed

Bone Remodeling

- Calcium ion regulation (homeostasis)
 - Parathyroid hormone (PTH)
 - ✓ Released when calcium ion levels in blood are low
 - ✓ Activates osteoclasts (bone-destroying cells)
 - ✓ Osteoclasts break down bone and release calcium ions into the blood
 - Calcitonin
 - ✓ Released when calcium ion levels in blood are high
 - ✓ Activates osteoblasts (bone-forming cells)
 - ✓ Osteoblasts take calcium out of the blood and store in the bone matrix

Bone Healing

- **Bones are alive and can repair bone fractures**
- **Bone Healing involves four major events:**
 - 1. Hematoma**
 - ✓ **Blood-filled swelling or bruise is formed**
 - 2. Fibrocartilage callus forms**
 - ✓ **Cartilage matrix, bony matrix, collagen fibers splint the broken bone**
 - 3. Bony callus replaces the fibrocartilage callus**
 - ✓ **Osteoblasts and osteoclasts migrate in**
 - 4. Bone remodeling occurs in response to mechanical stresses**

Bone Healing

