

# **Chapter 5 Cartilage and bone**

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# I . Cartilage

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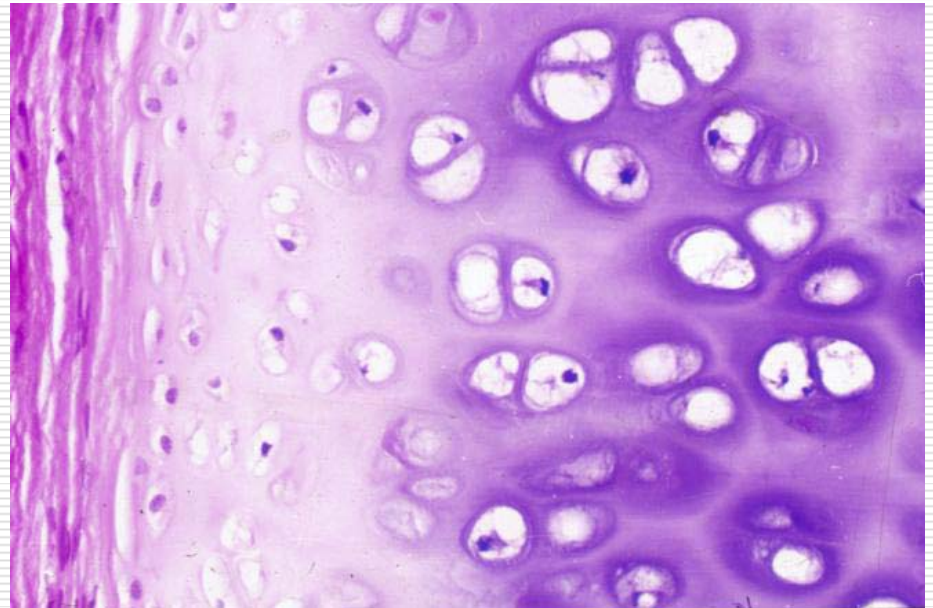
**Cartilage tissue**

**Chondrocyte**

**Cartilage matrix**

**Perichondrium**

- 1. Hyaline cartilage**
  - 2. Elastic cartilage**
  - 3. Fibrous cartilage**
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# 1. Hyaline cartilage

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(1) chondrocyte

Isogenous group

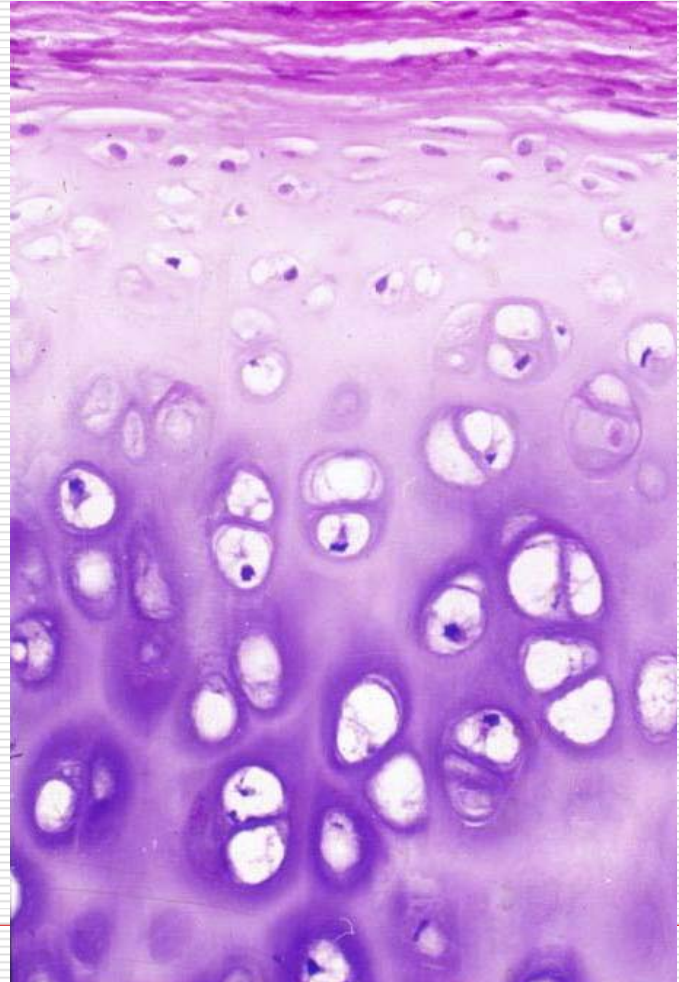
(2) Cartilage matrix

cartilage lacuna

cartilage capsule

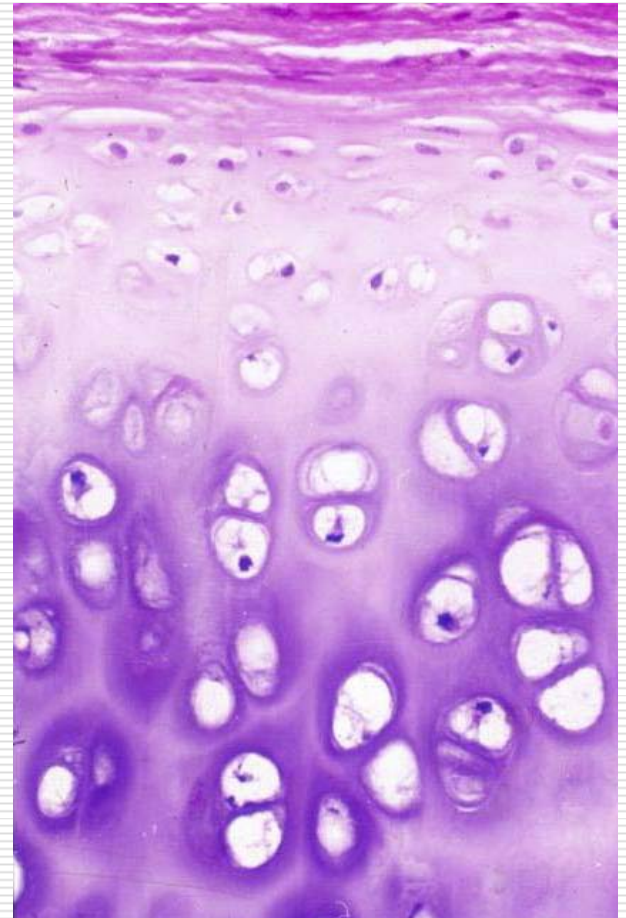
(3) fiber

collagenous fibril



# Perichondrium

- The outer zone:  
more fibers, less cells
- The inner zone:  
less fibers,  
more osteogenic cells  
and blood vessels

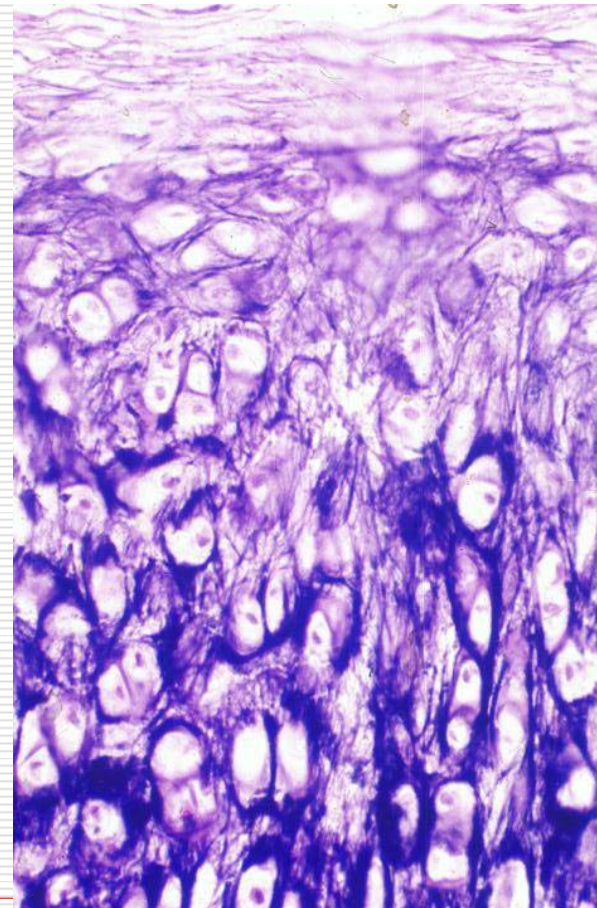


## 2. Elastic cartilage

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**elastic fibers**

**more elasticity**

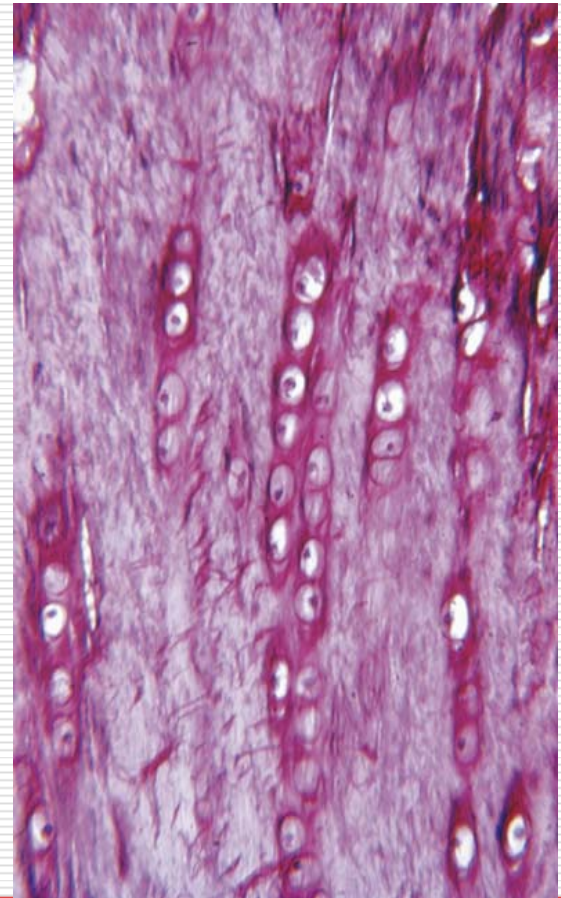


# 3. Fibrous cartilage

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large number of  
collagenous fibers

Chondrocytes  
arranged in rows



# **Development of cartilage**

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**Origin: mesenchyme**

**Generation of cartilage:**

**Osteogenic cell → chondroblast → chondrocyte**

**→ secretory of ground substance and fiber**

**(1) Interstitial growth**

**(2) appositional growth**

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# II .Bone

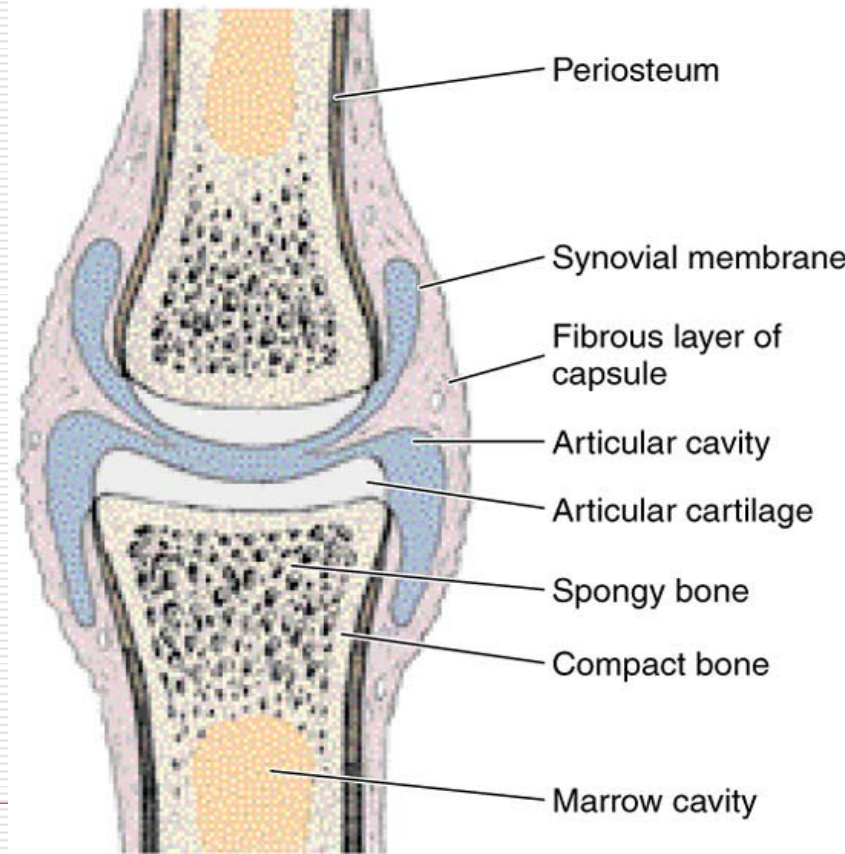
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**Bone: osseous tissue**

**Periosteum**

**Endosteum**

**bone marrow**





# 1. Osseous tissue

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cells

bone matrix

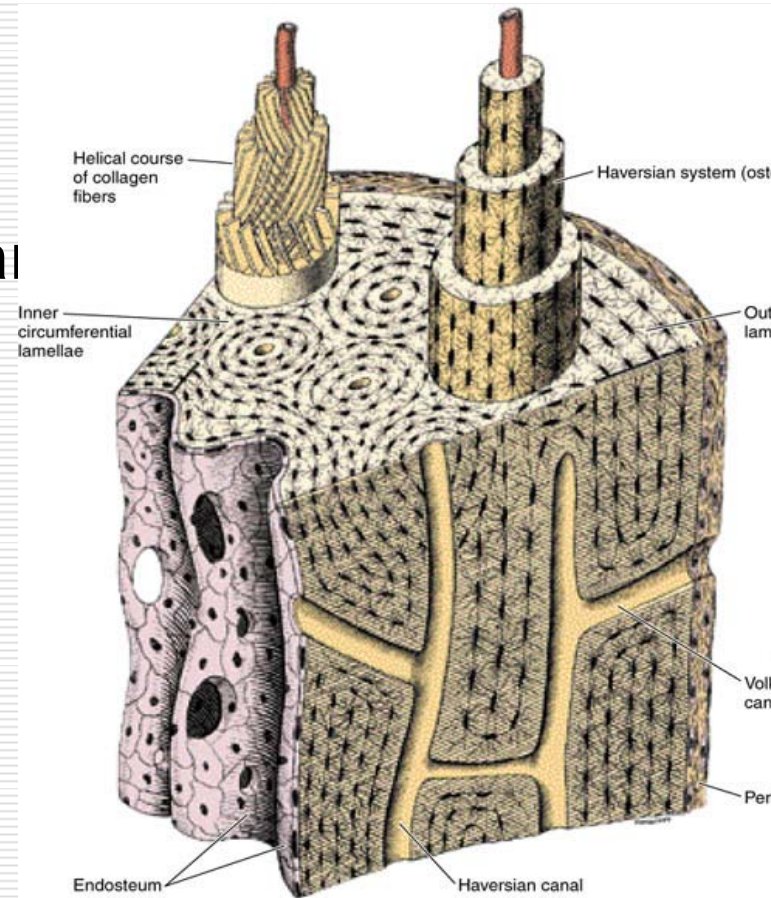
calcified intercellular substance

Bone lamella

Bone lacuna

Bone canaliculus

perforating canal  
(blood vessels)



# 1.1 Bone matrix

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( 1 ) Organic matter:

collagen fiber: I type collagen

ground substance:

glycosaminoglycan

glycoprotein

( 2 ) Inorganic component:

hydroxyapatite crystals

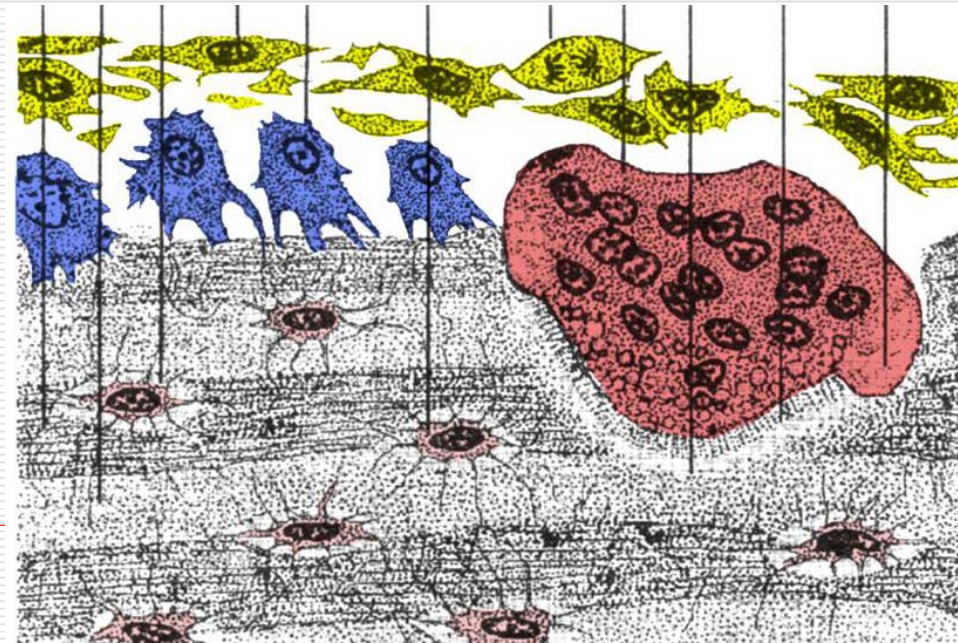


# 1.2 The cells of bone tissue

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## (1) Osteoprogenitor cell (osteogenic cell)

osteogenic cell  $\longrightarrow$  osteoblasts  
 $\searrow$   
chondroblast



## (2) Osteoblast

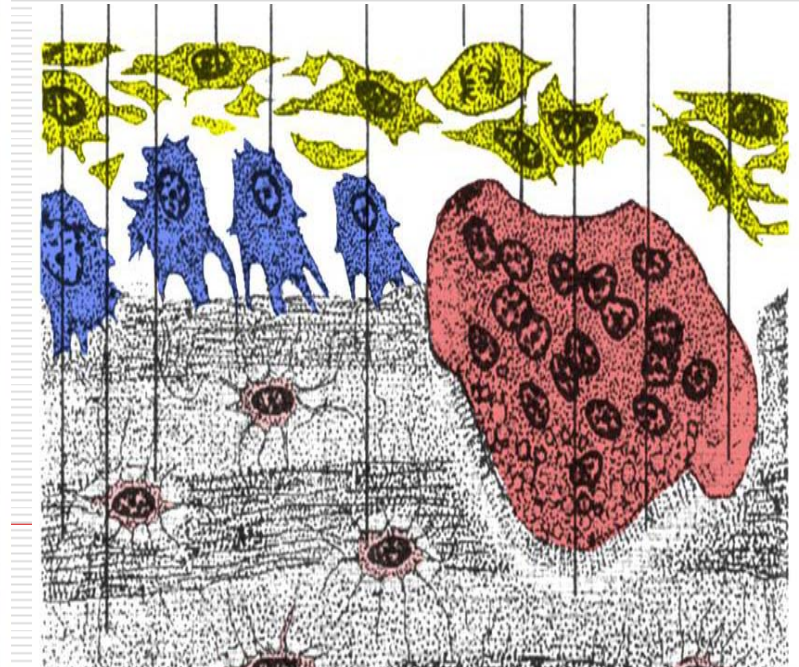
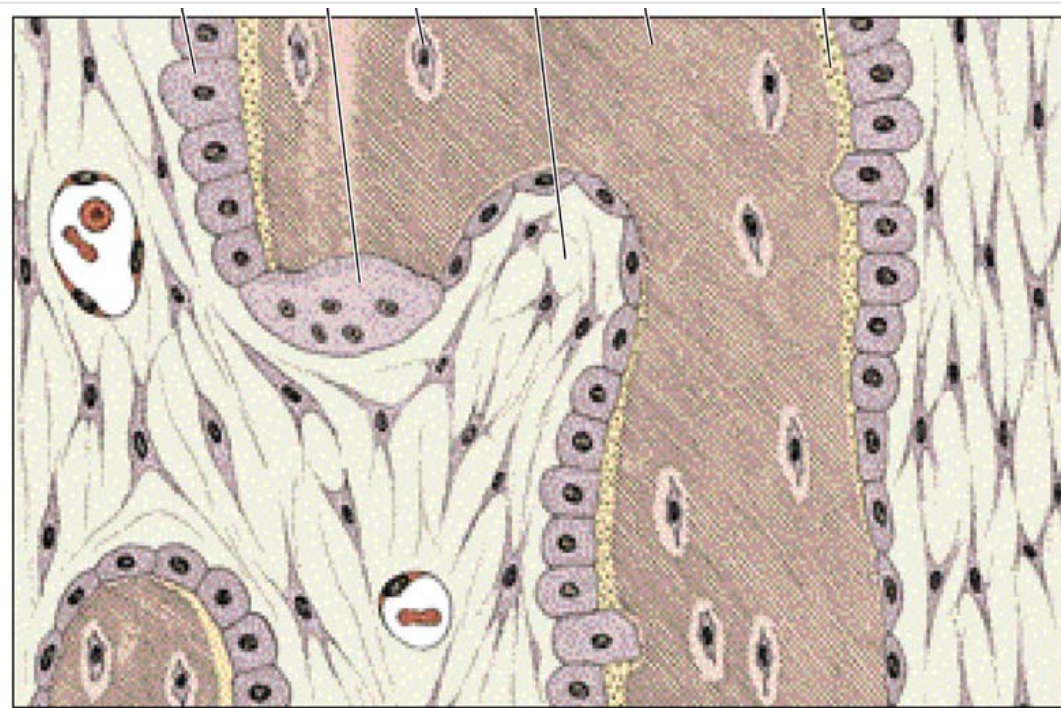
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LM:

EM: RER , free ribosome and Golgi complex  
matrix vesicle

Origin: osteogenic cell

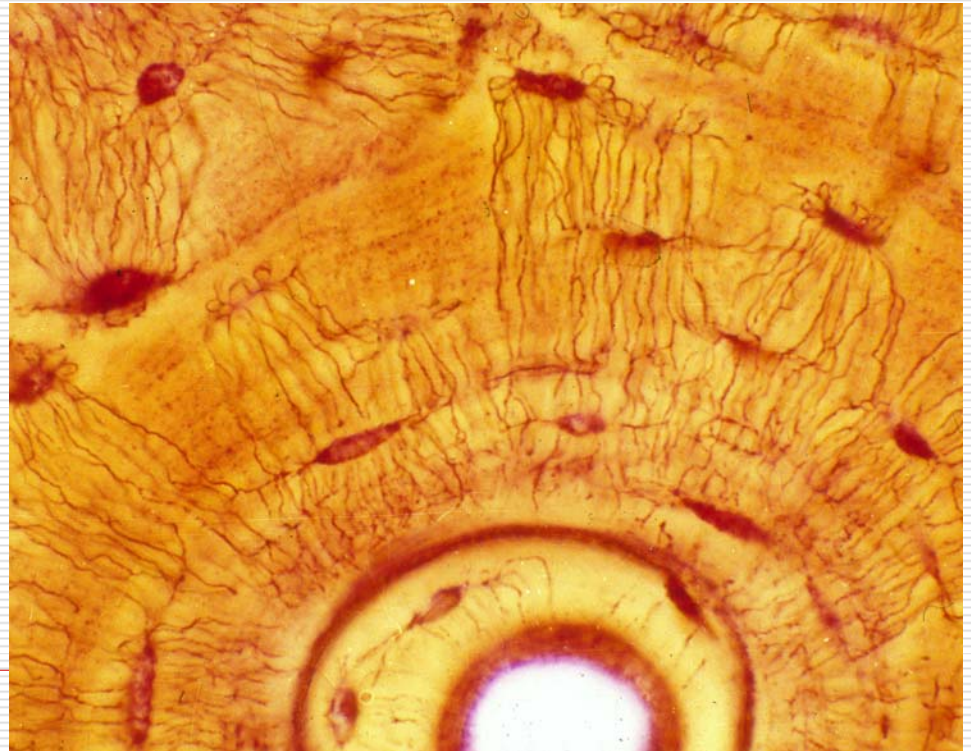
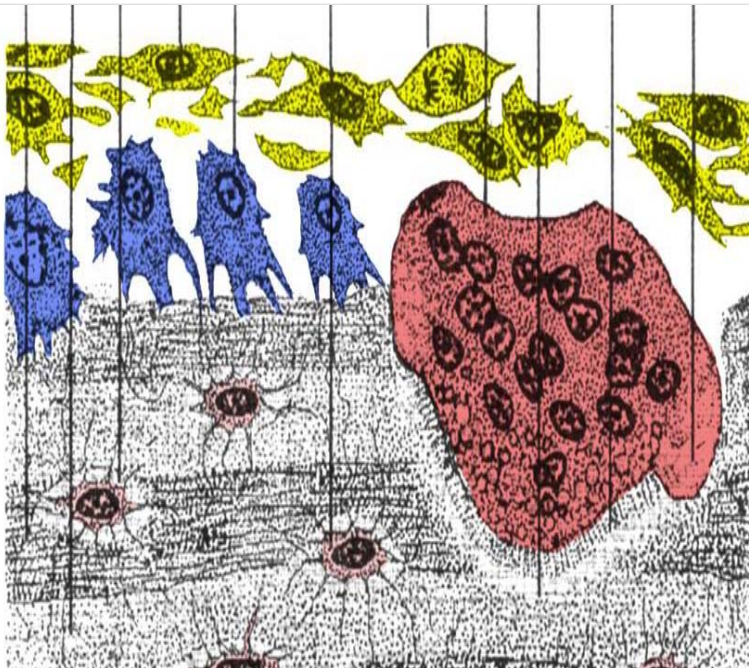
Function: osteoid



# (3) Osteocyte

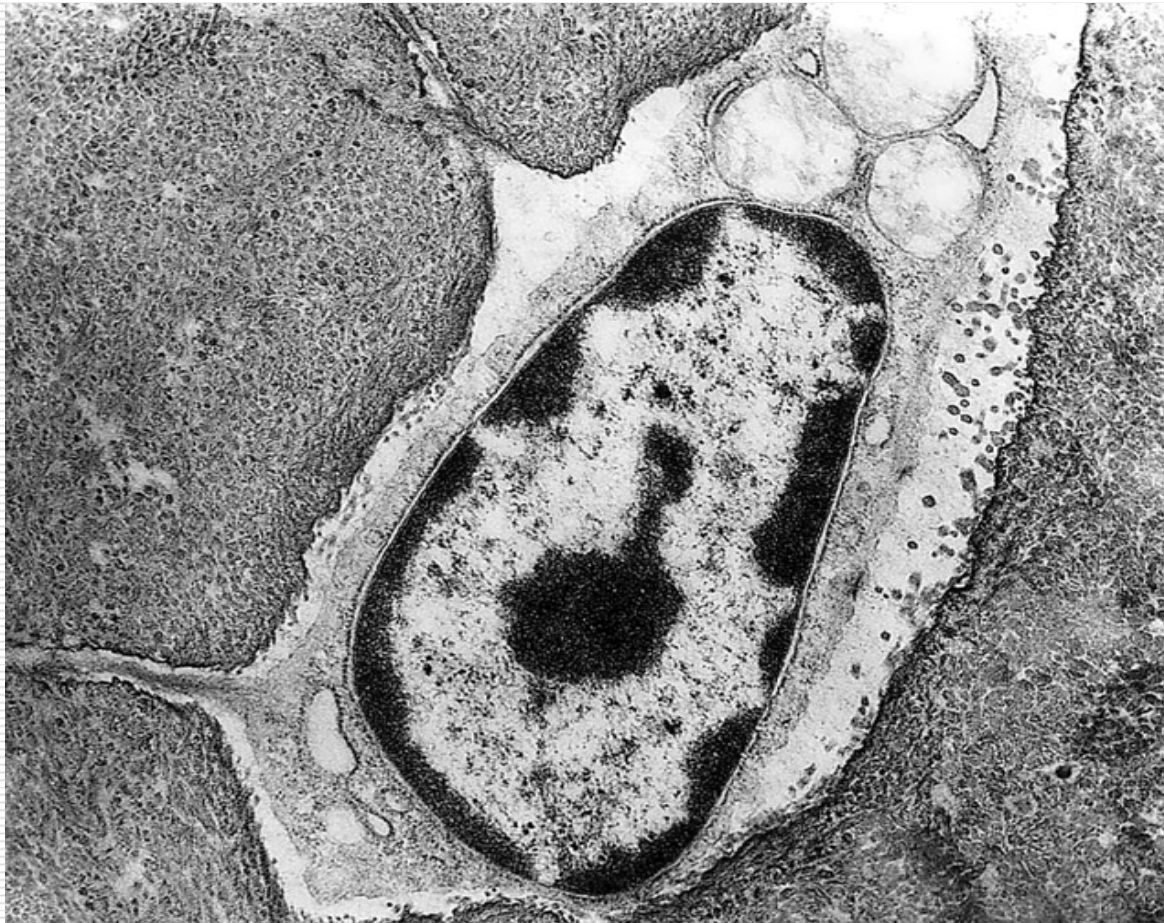
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**LM: smaller ovoid shape, fine processes of cell, basophilic cytoplasm**



# Osteocyte (TEM)

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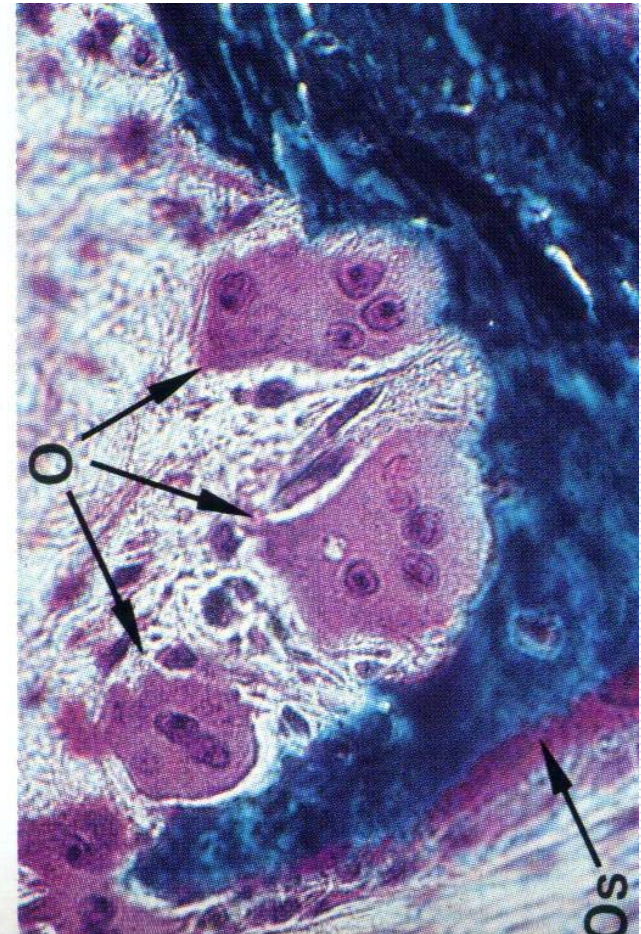
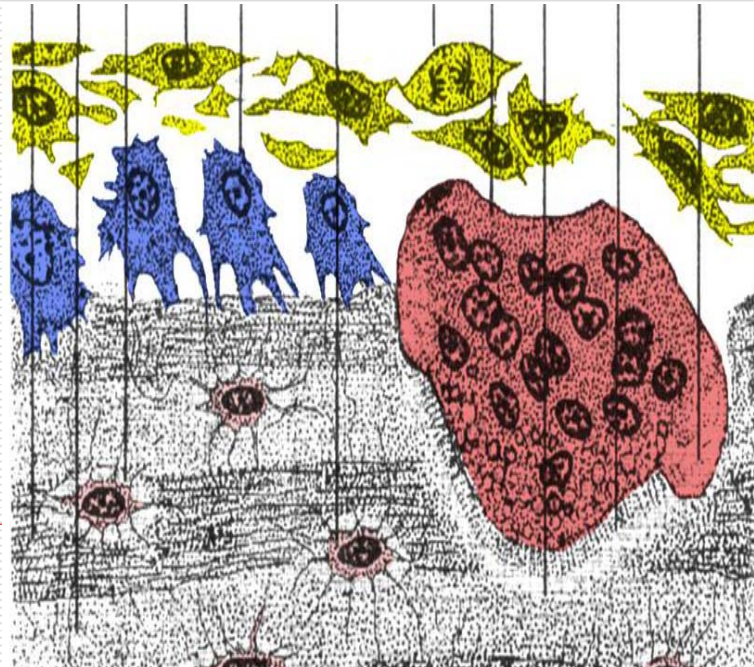


# ( 4 ) Osteoclast

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**LM: very large, many nuclei, acidophilic cytoplasm**

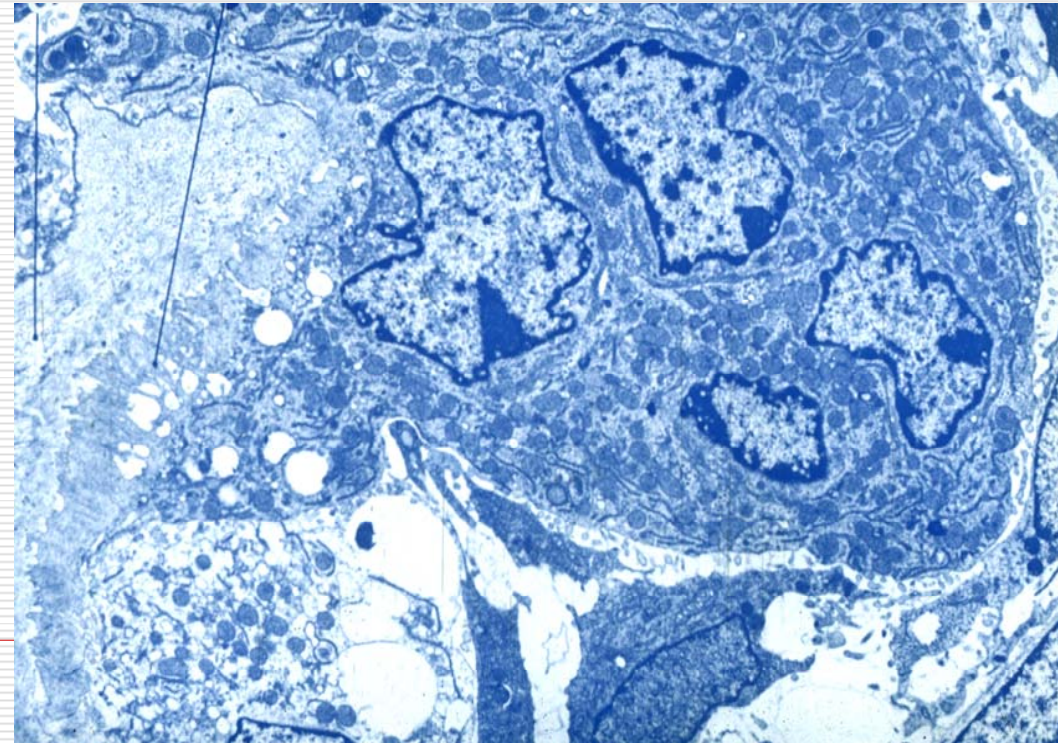
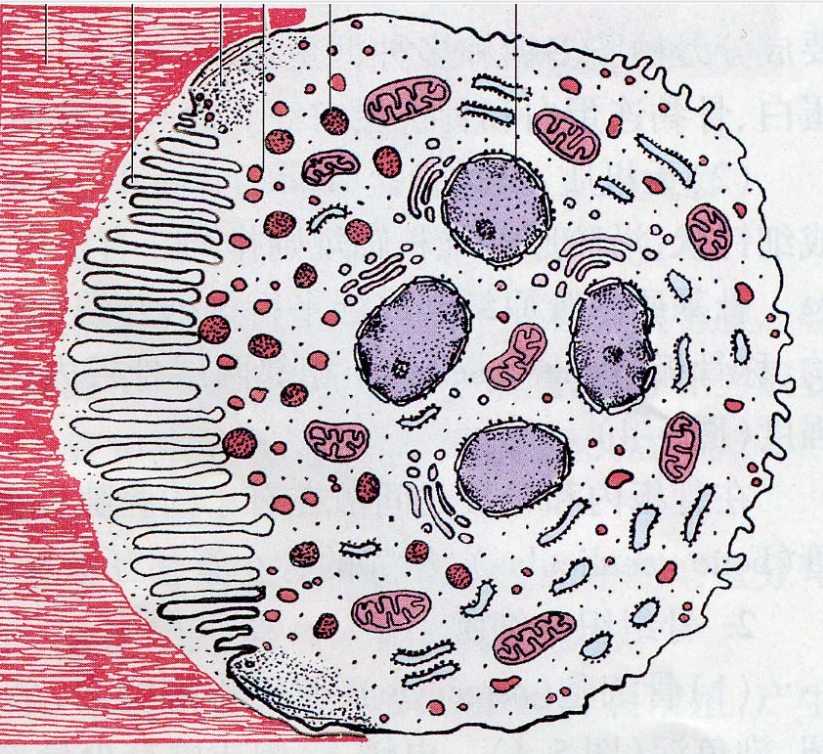
**origin: monocyte**



## ( 4 ) Osteoclast (TEM)

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**EM: ruffled border, numerous lysosomes, RER, Golgi complex and mitochondria**



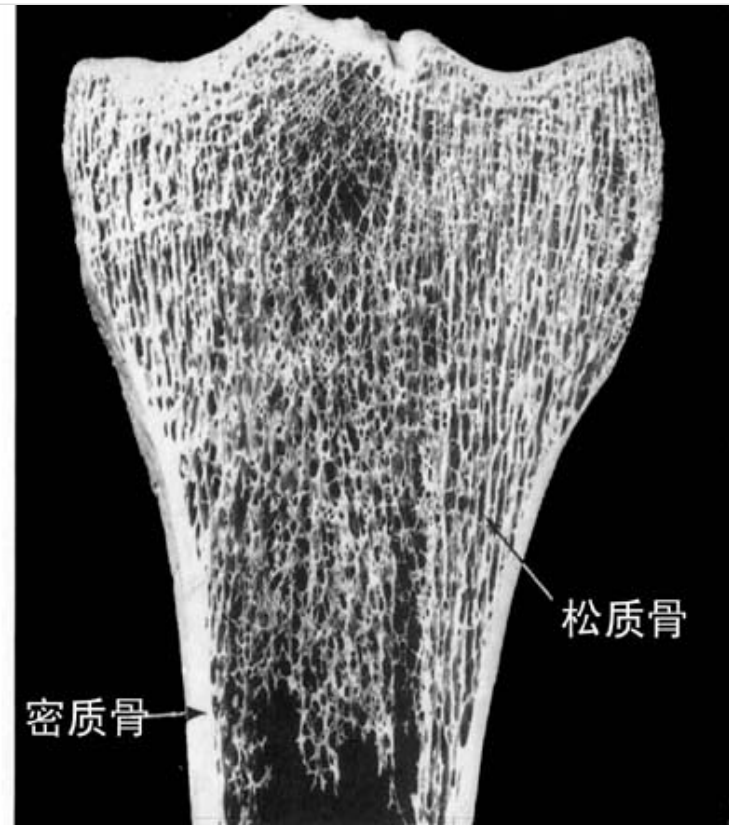


## 2. The structure of long bone

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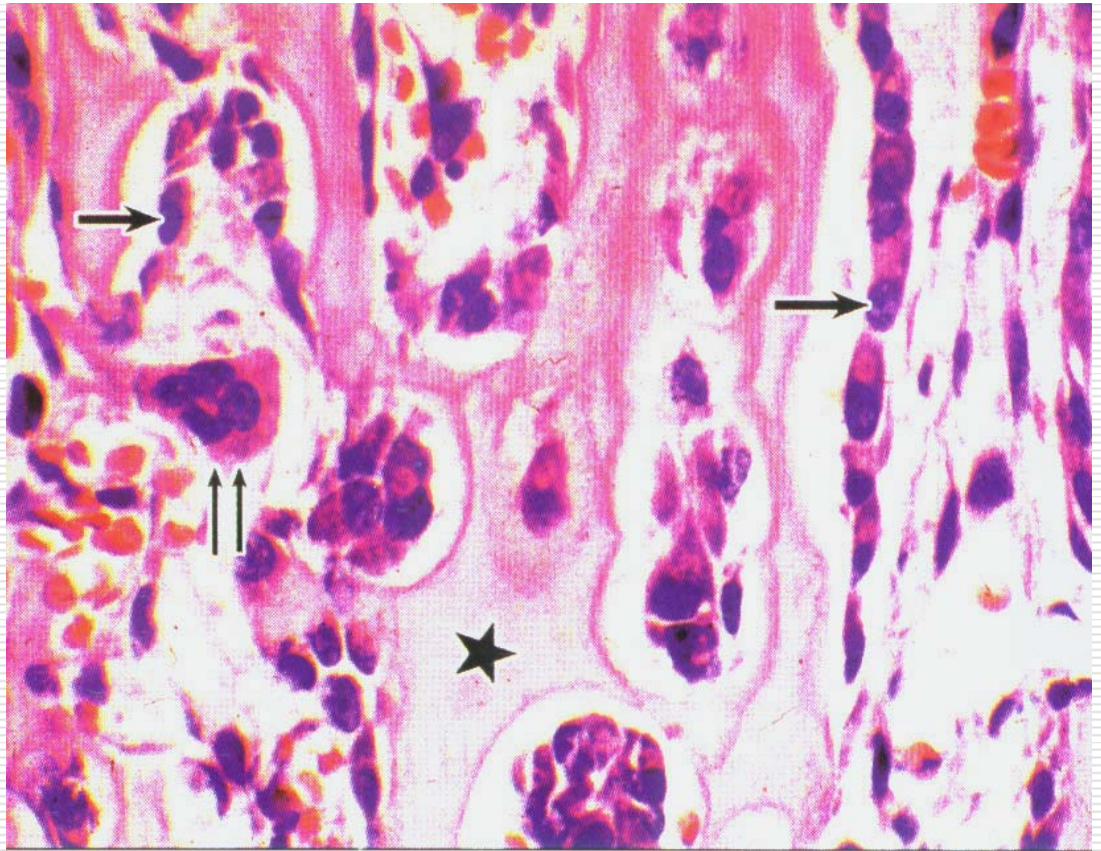
compact bone, spongy bone

periosteum and endosteum



# 2.1 Spongy bone

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# 2.2 Compact bone

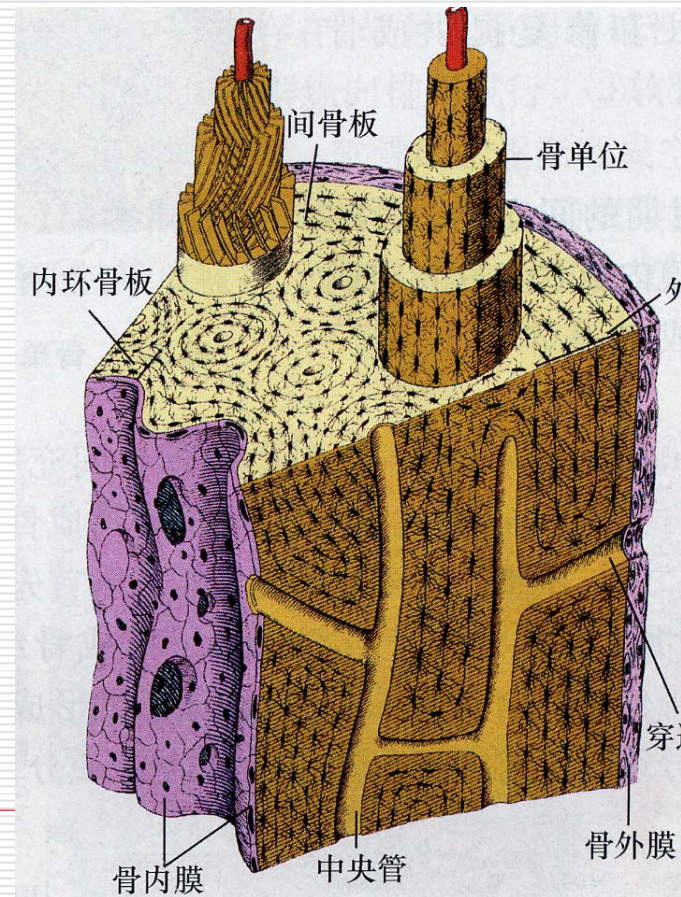
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## (1) Circumferential lamellae

Outer

Inner

Perforating canal



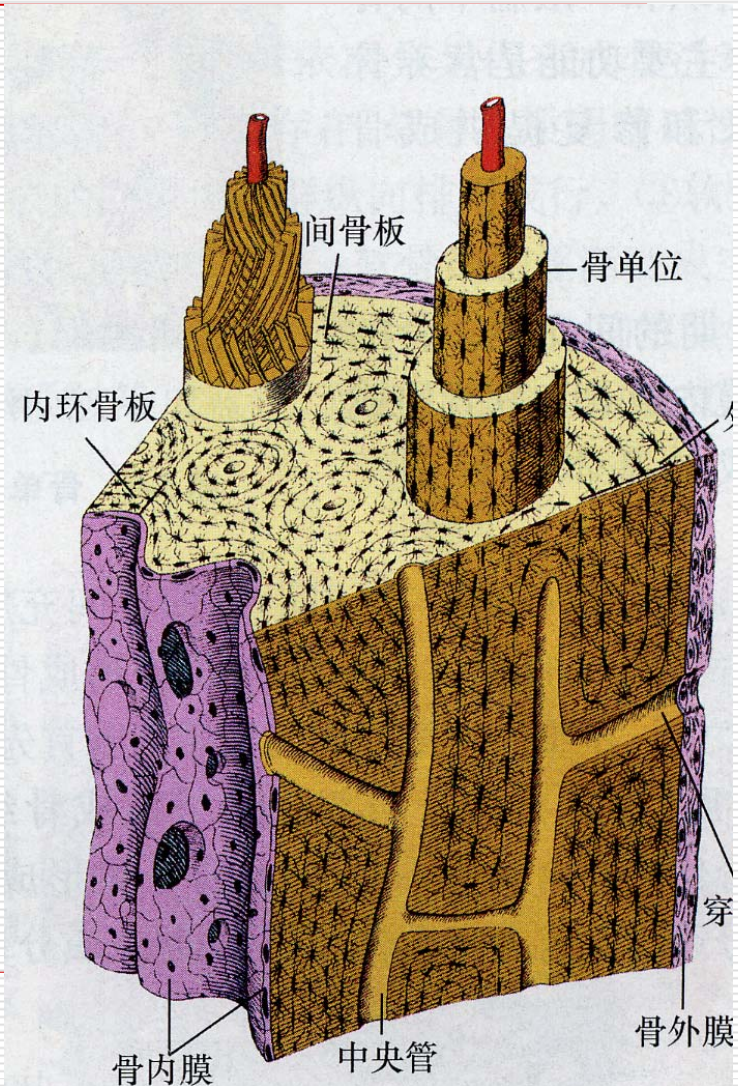
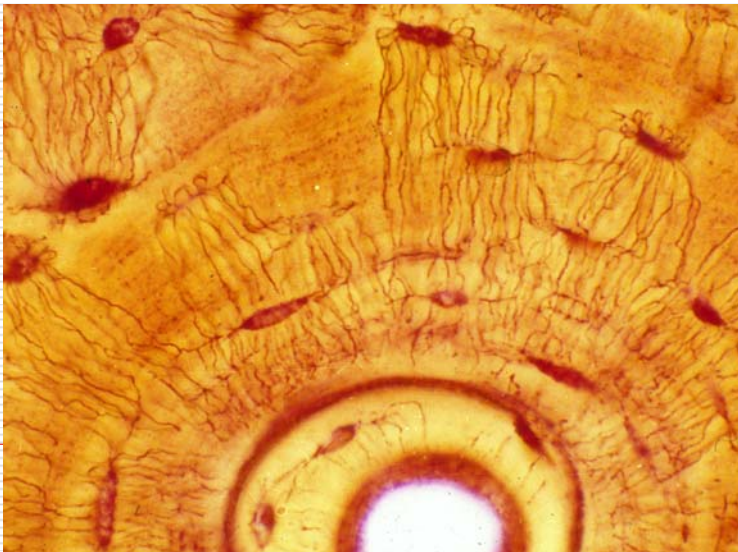
## (2) Osteon (Haversian system)

Central canal

Haversian lamella

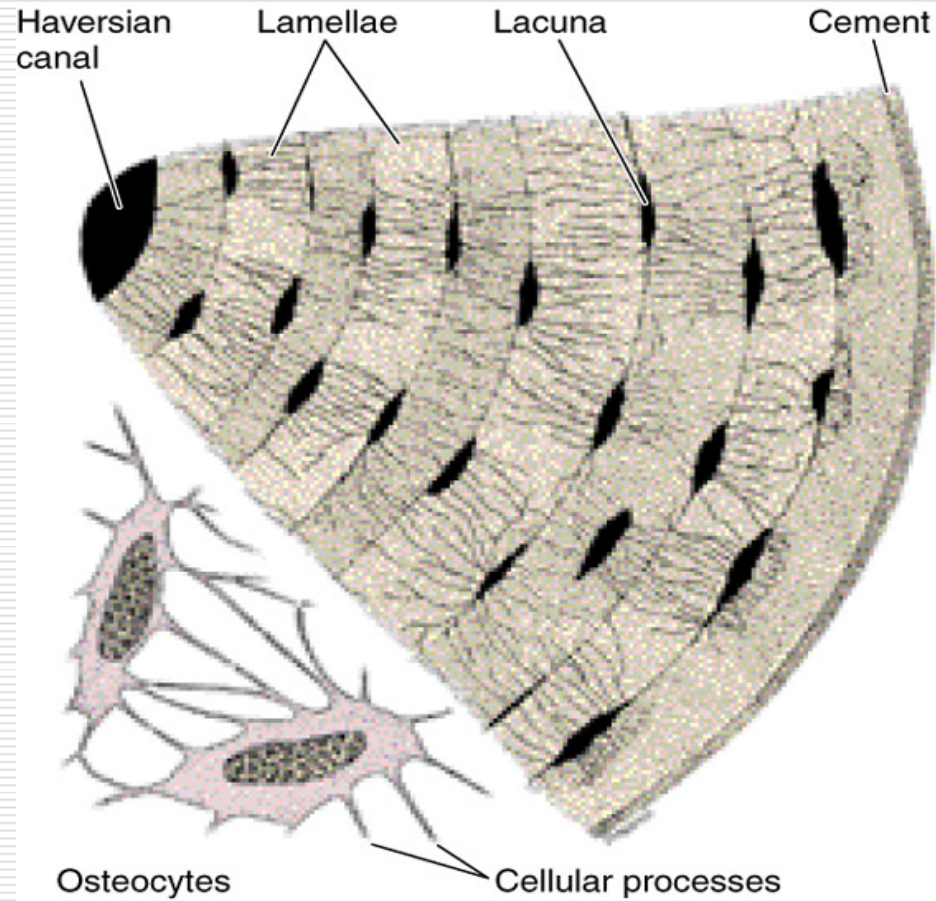
Bone canaliculus

Bone lacuna



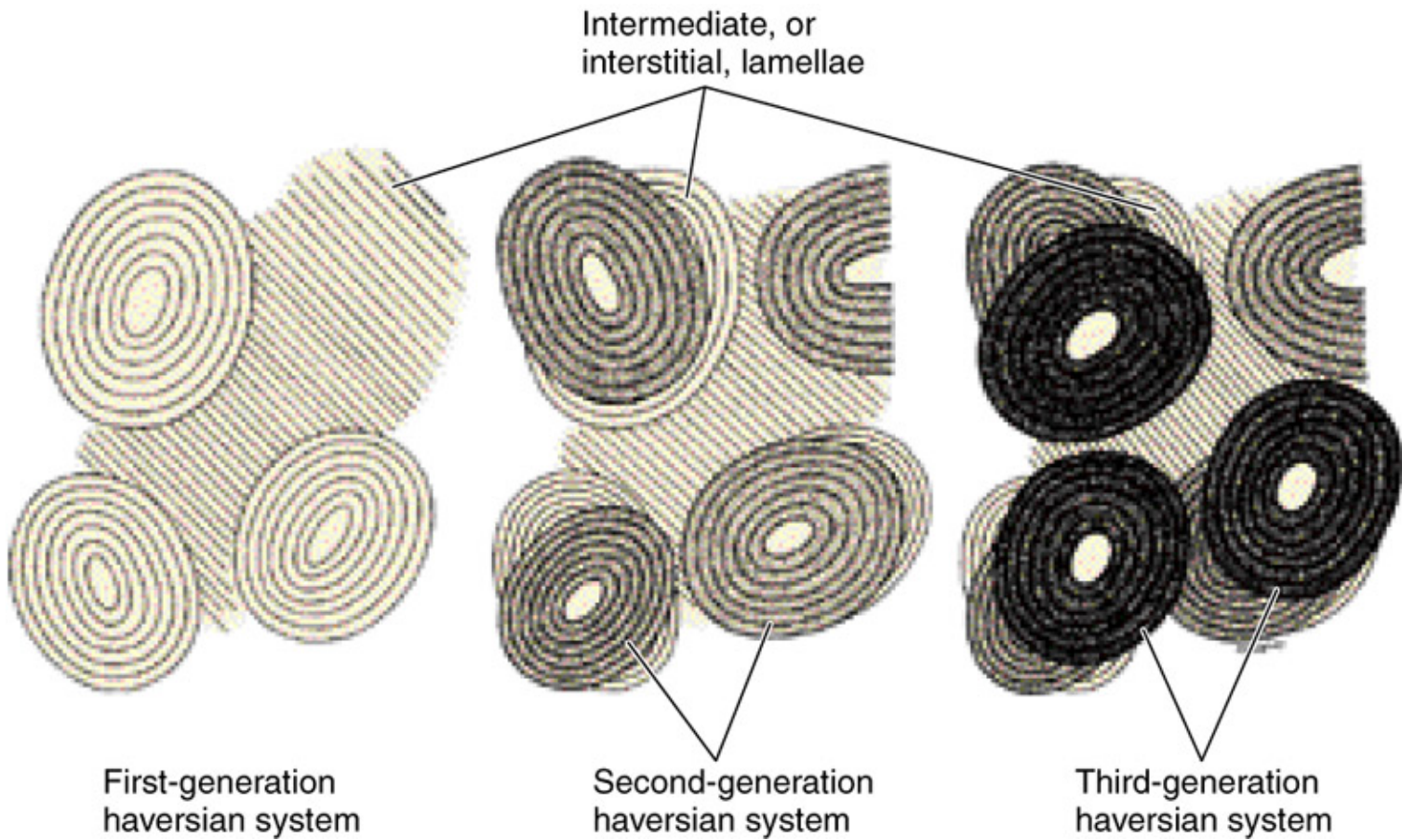
## (2) Osteon(model)

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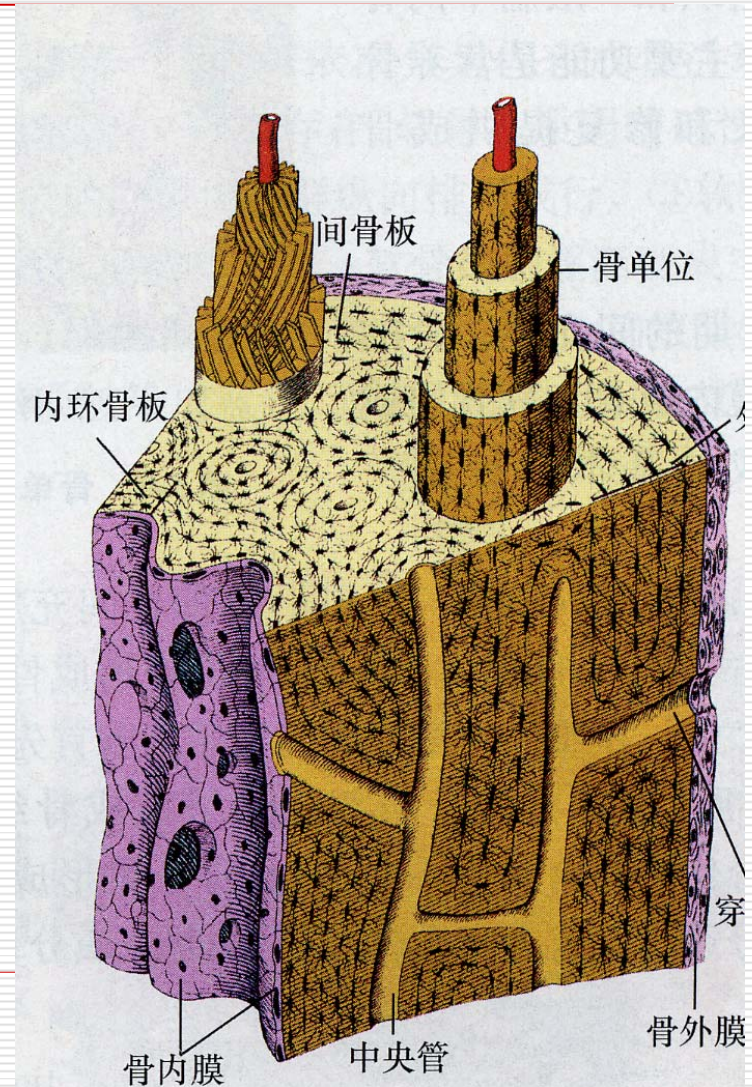
# (3) Interstitial lamella

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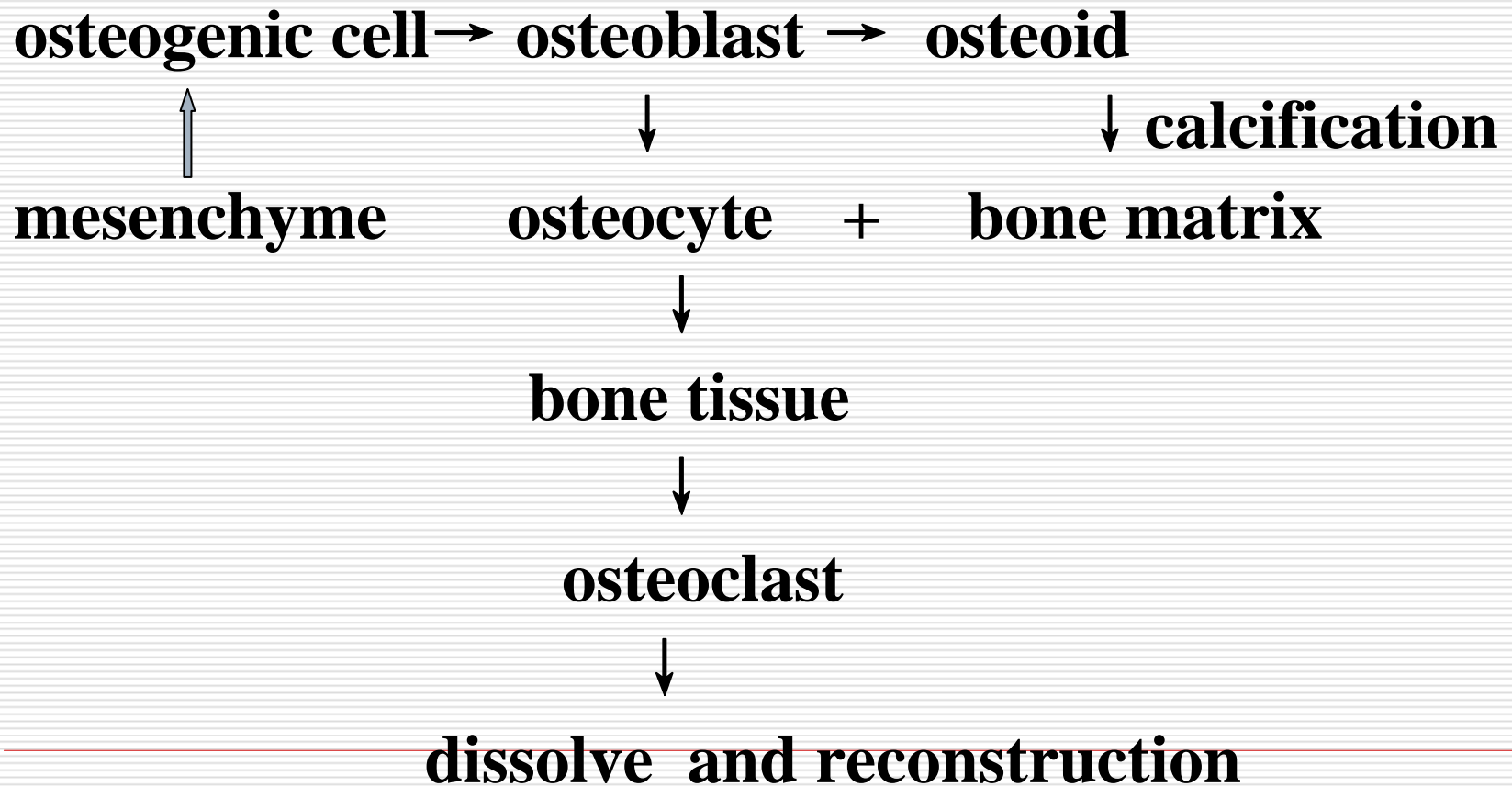
## 2.3 Periosteum and endosteum

**Periosteum:**  
**outer layer:**  
    **perforating fiber**  
**Inner layer:**  
    **osteogenic cells**  
    **osteoblast**  
**Endosteum:**



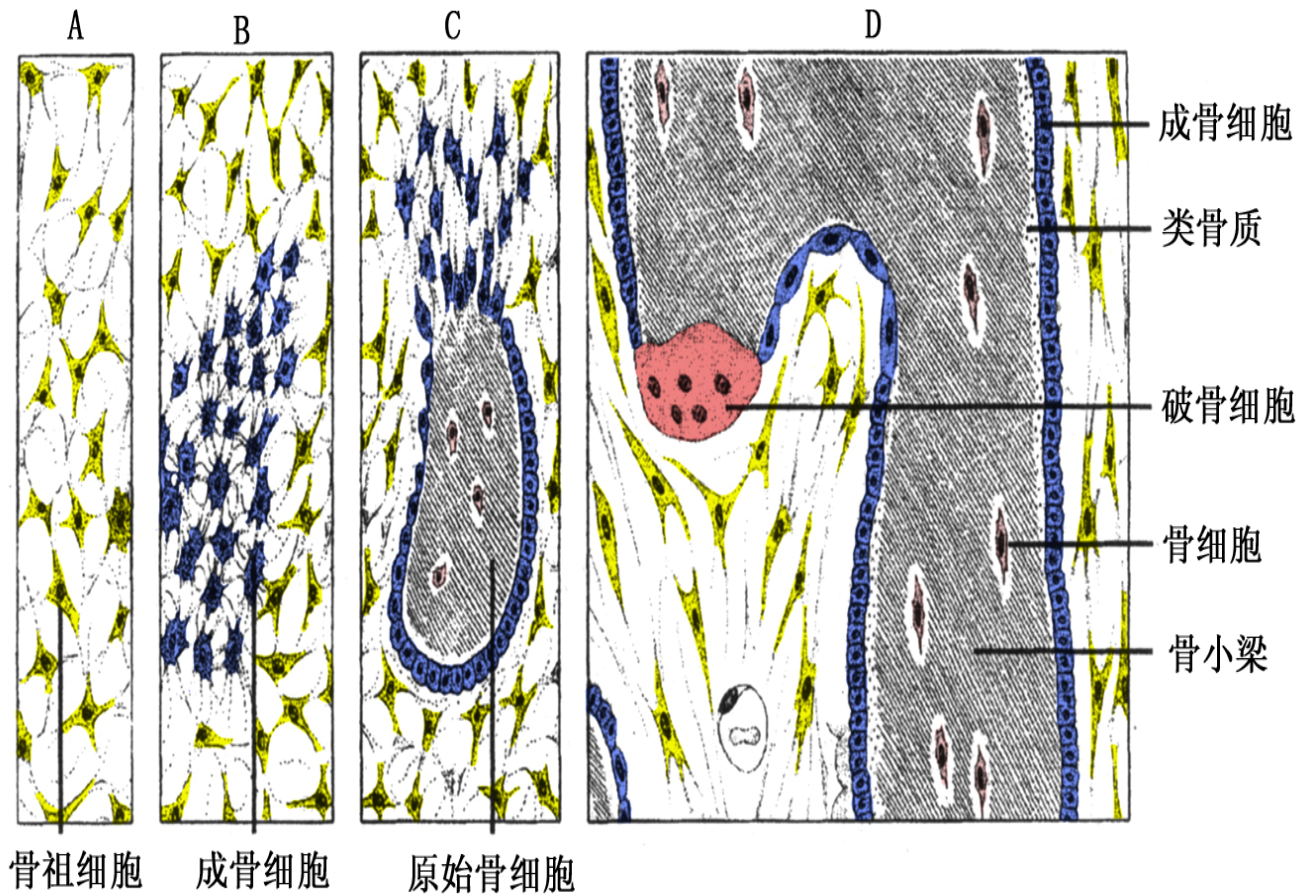
# III. Osteogenesis, Growth And Regeneration

## 1. Development of bone tissue





## 2. Intramembranous ossification



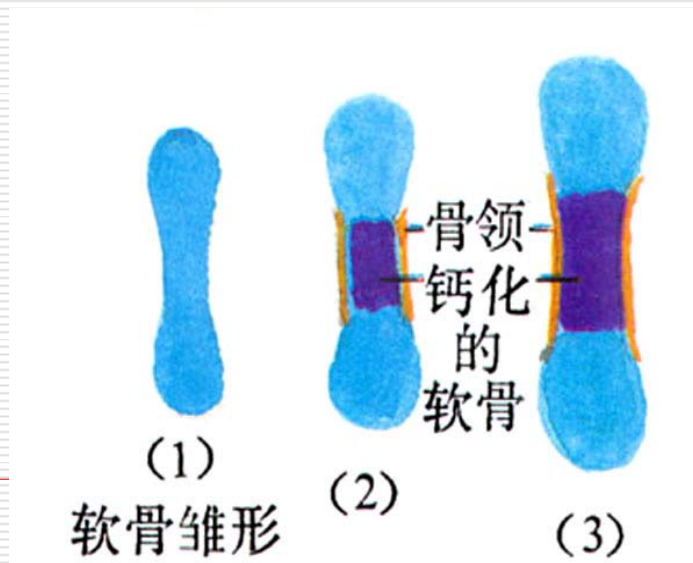
# 3. Enchondral bone formation

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## 3.1 Formation of cartilage model

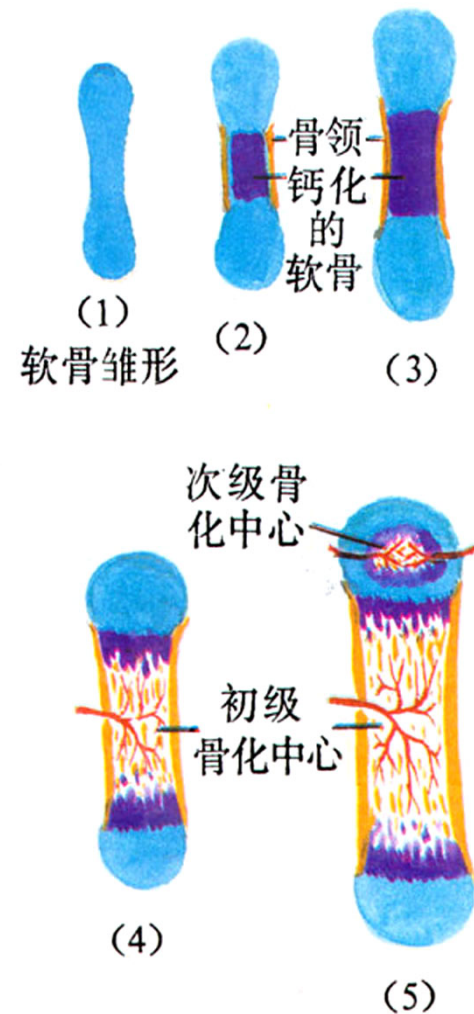
## 3.2 Perichondral ossification

### Formation of bone collar

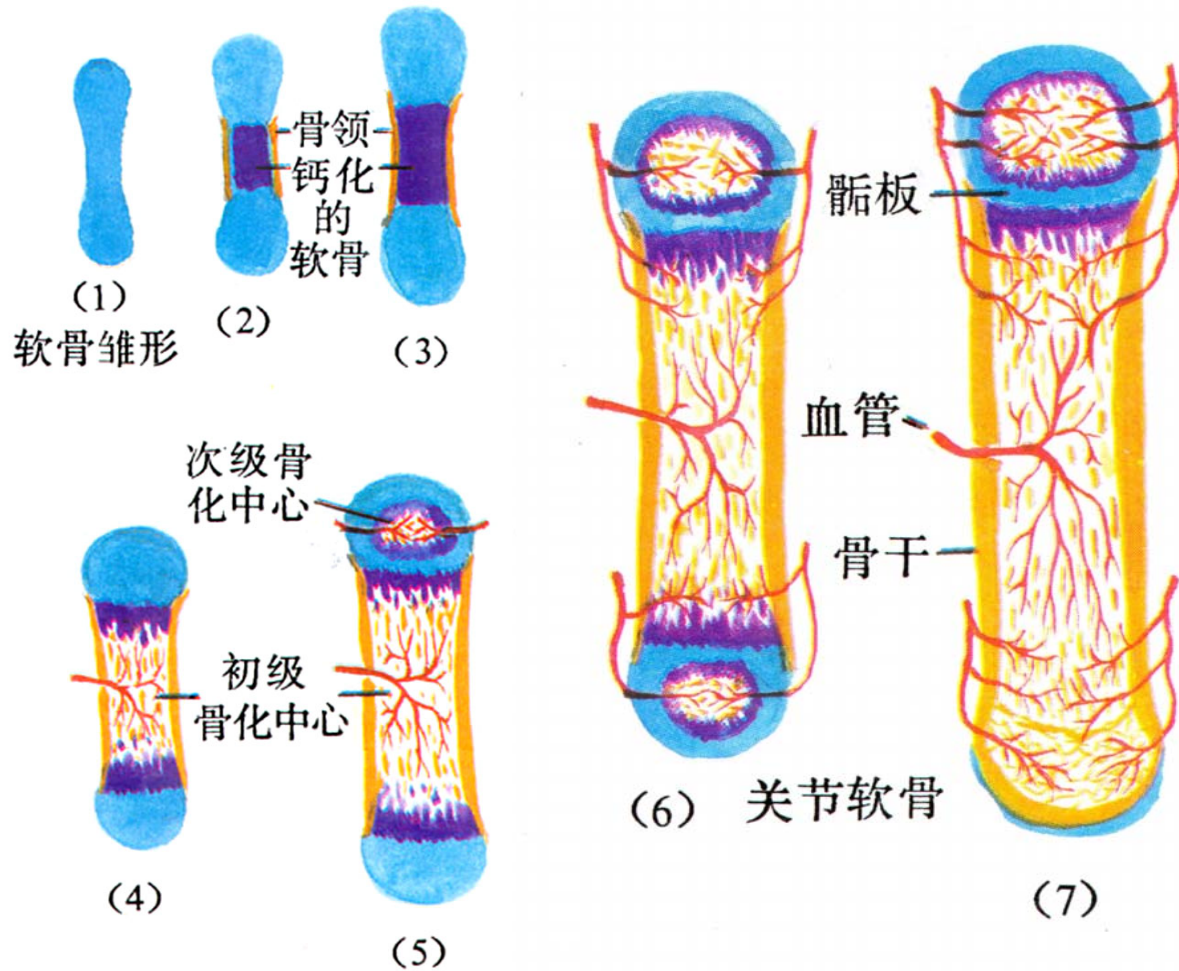


# 3.3 Intrachondral ossification

- (1) primary ossification center
- (2) formation of cavity of bone marrow
- growth of bone (thick and long)



# (3) secondary ossification center



# Growth of bone

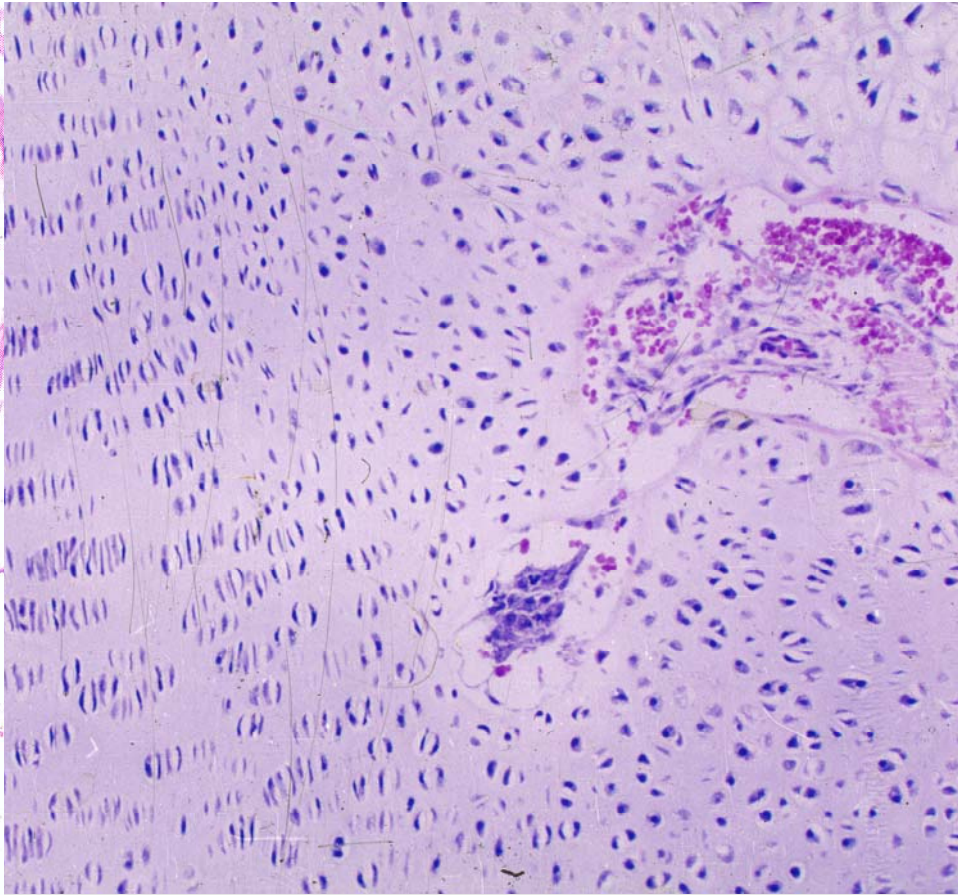
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- ① zone of reserve cartilage
- ② zone of proliferating cartilage
- ③ zone of calcifying cartilage
- ④ zone of ossification



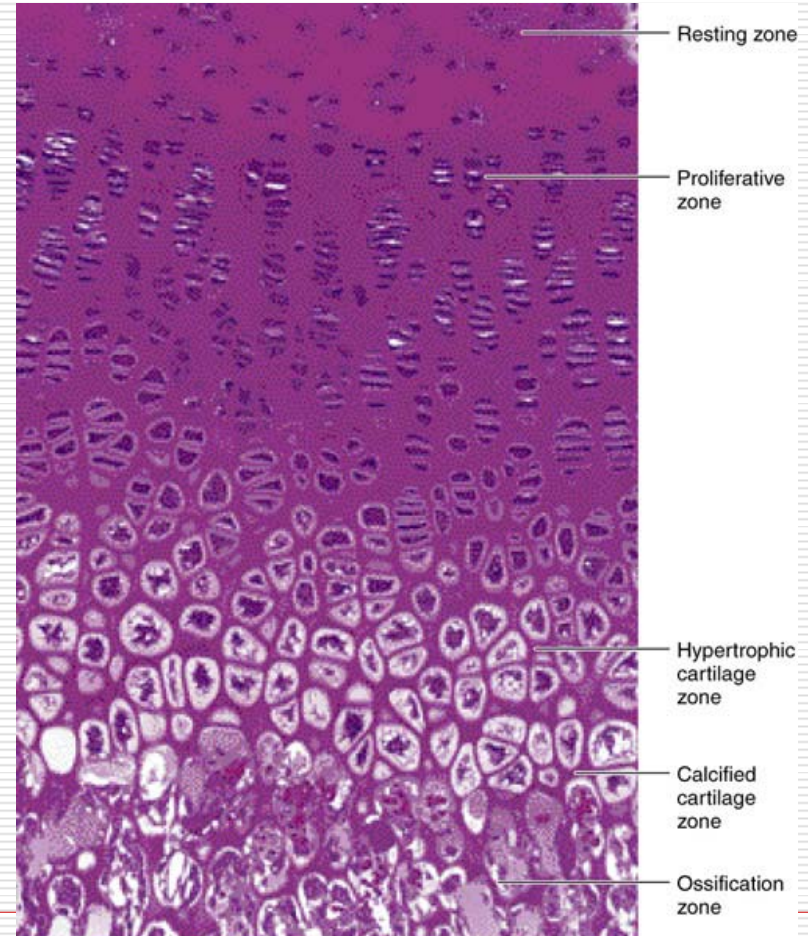
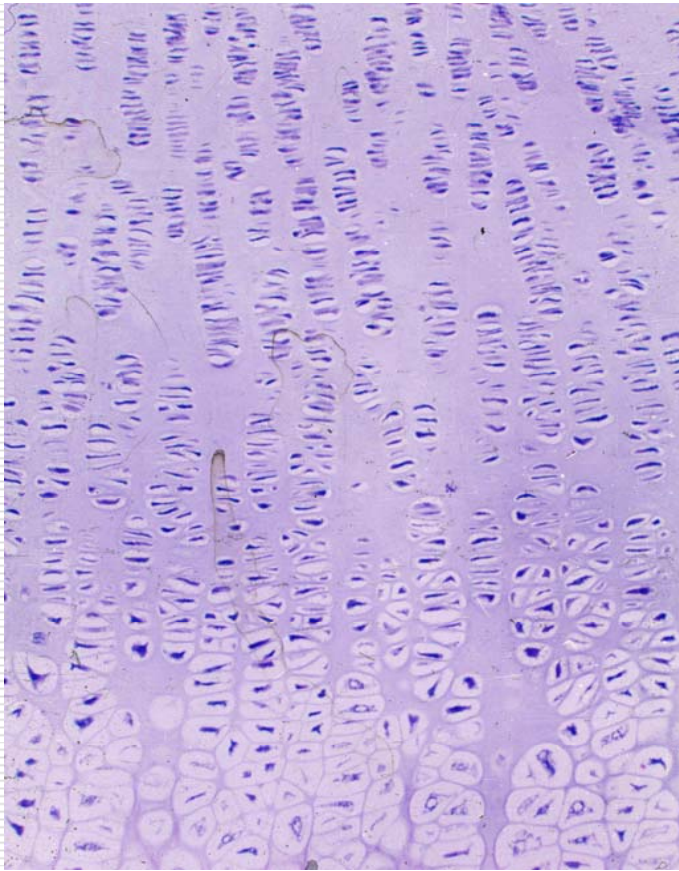
# ① zone of reserve cartilage

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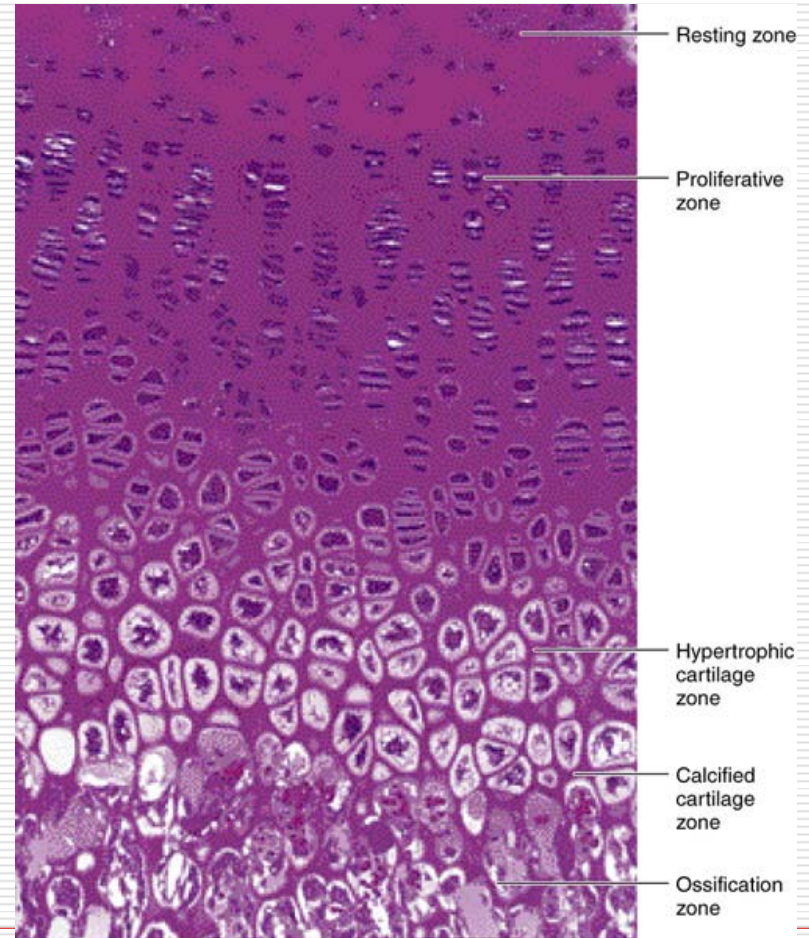
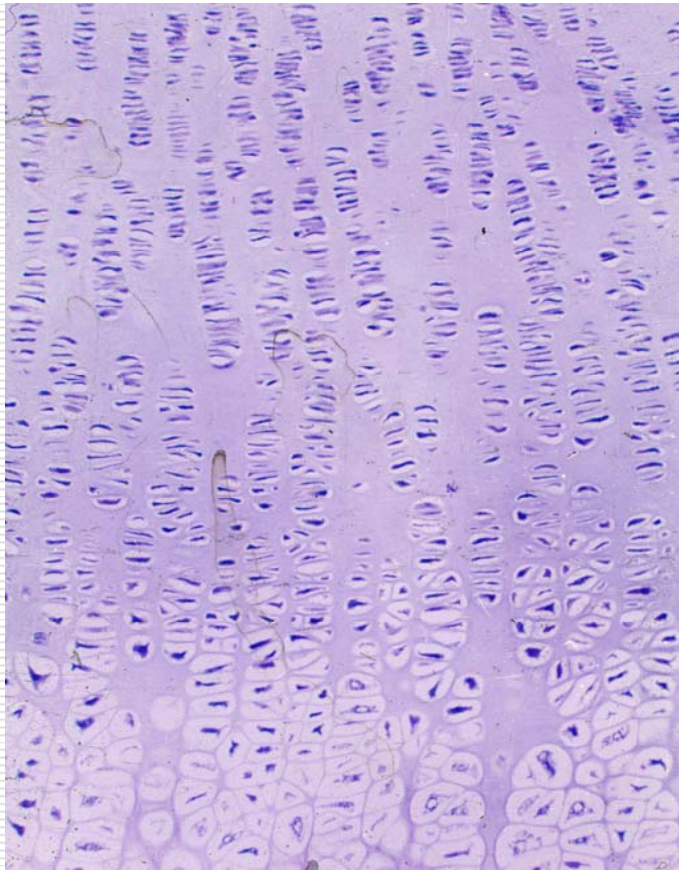


# ② zone of proliferating cartilage

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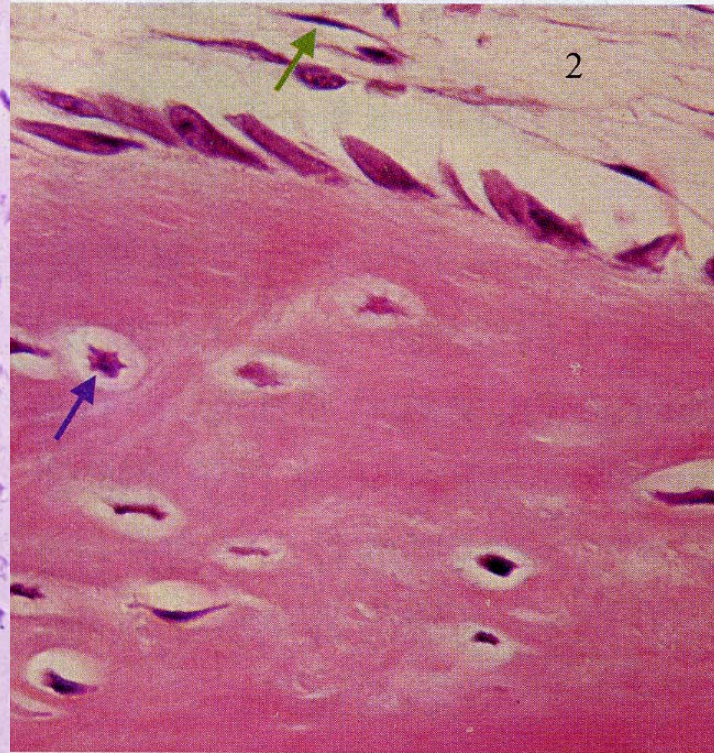
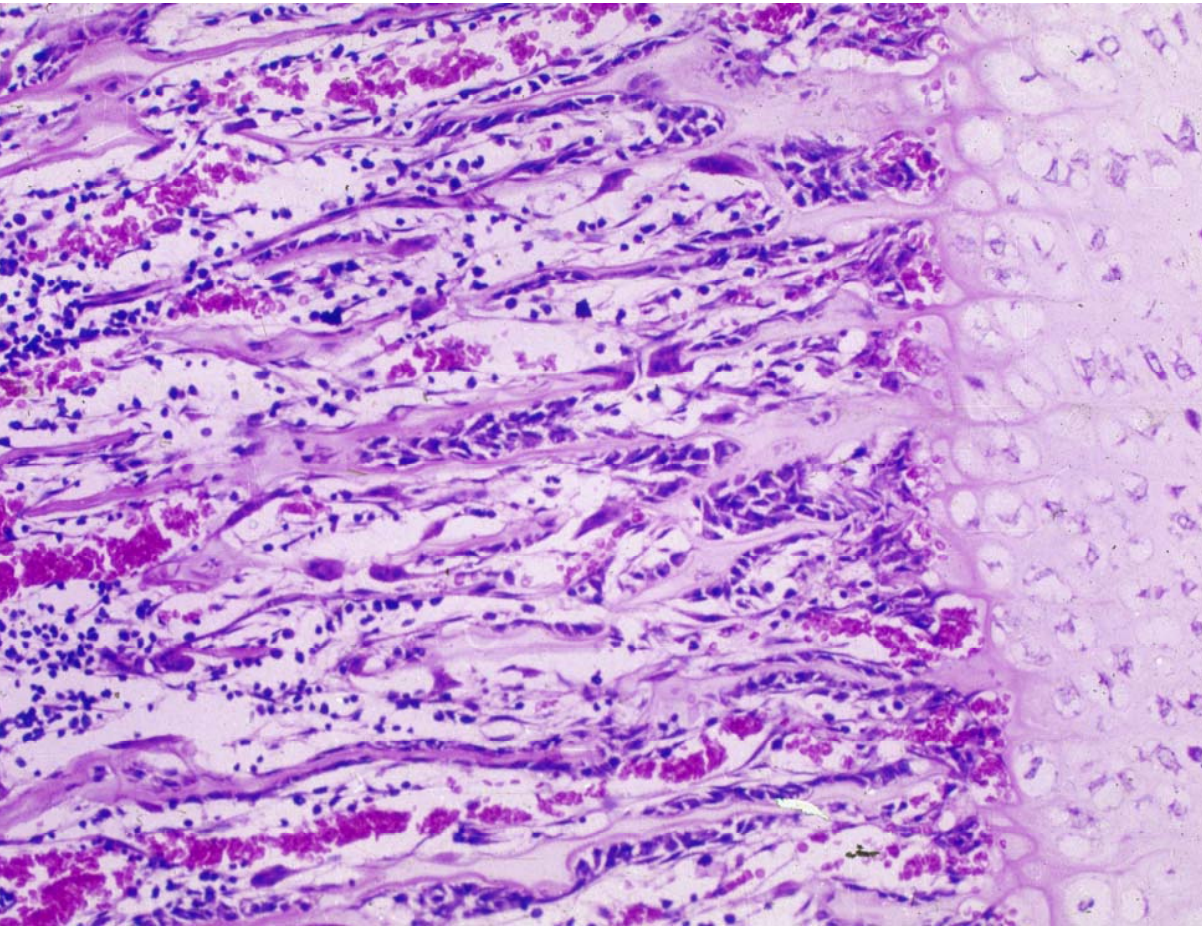
# ③ zone of calcifying cartilage



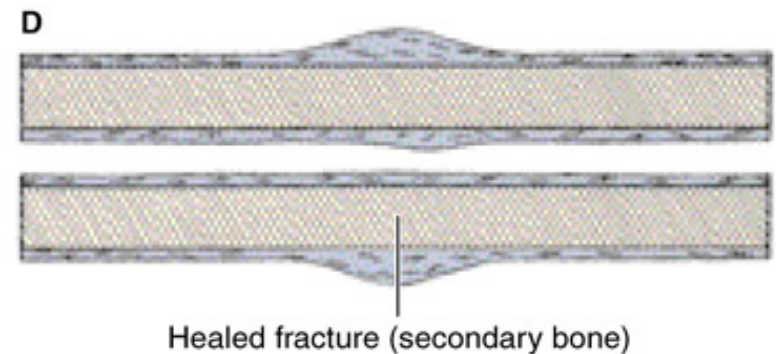
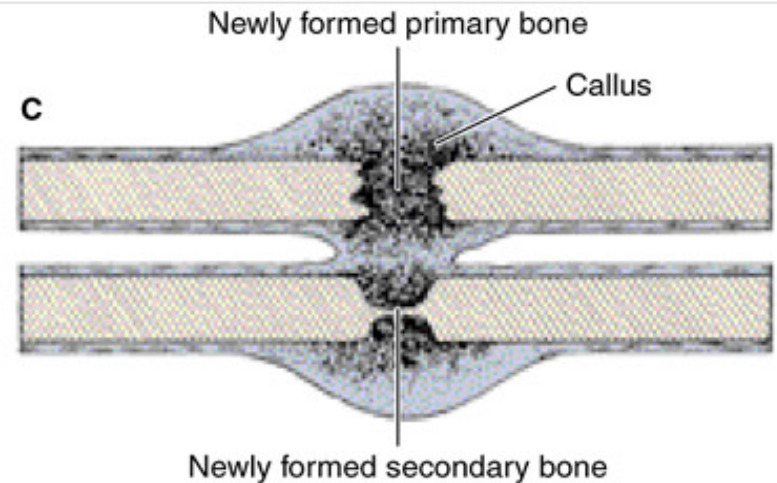
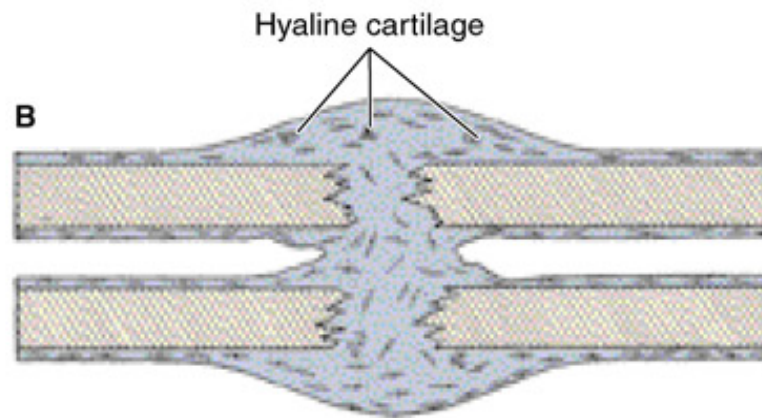
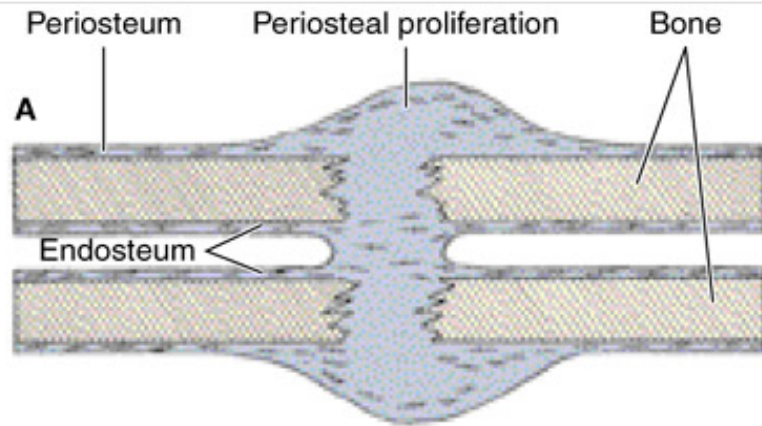


# ④ zone of ossification

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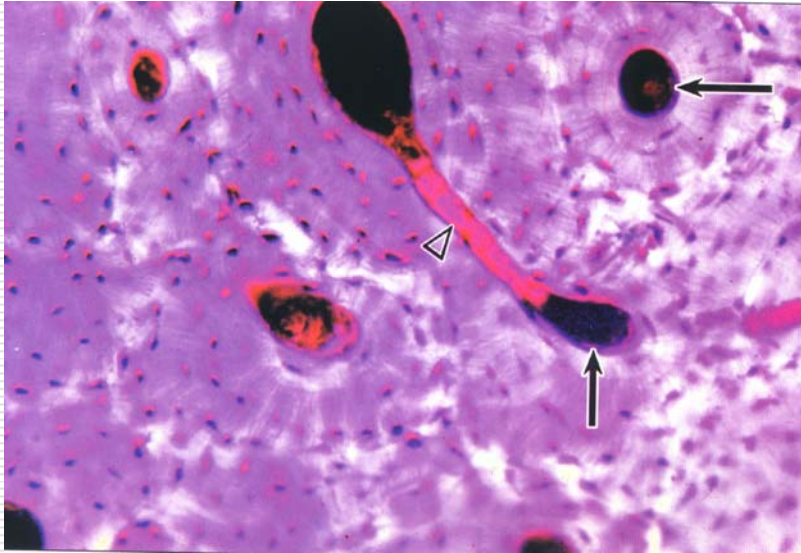


# Regeneration of bone and the healing of bone fracture

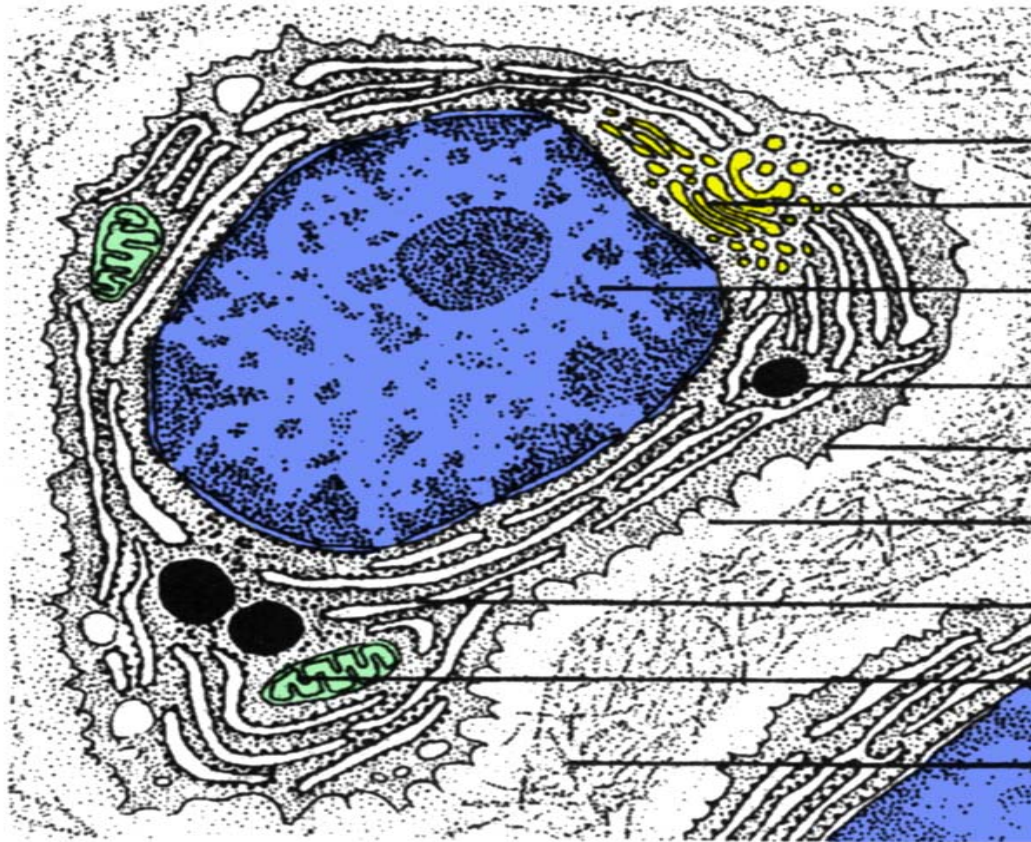


# Perforating canal (LM)

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# Chondrocyte



- 糖原
- 高尔基复合体
- 细胞核
- 脂滴
- 细胞膜
- 软骨囊
- 粗面内质网
- 线粒体
- 胶原原纤维



# Osteoblast (TEM)

