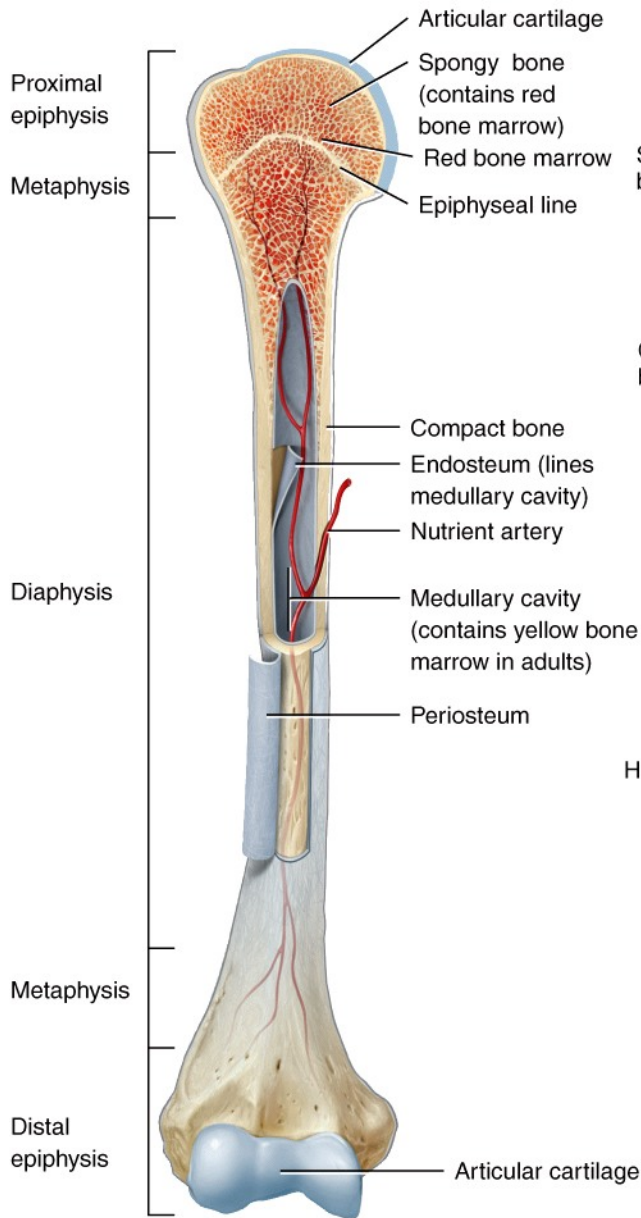
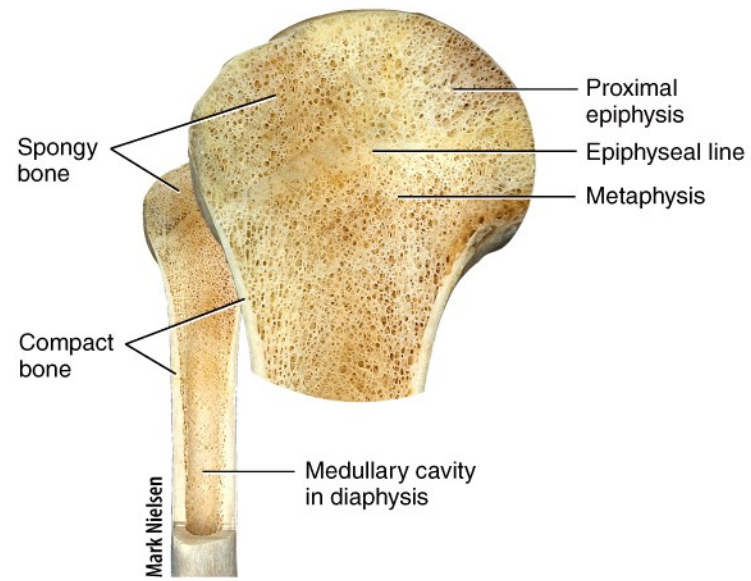


C6

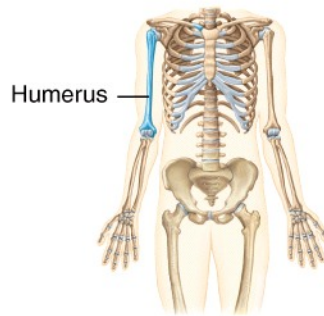
# Images of Bone Tissue

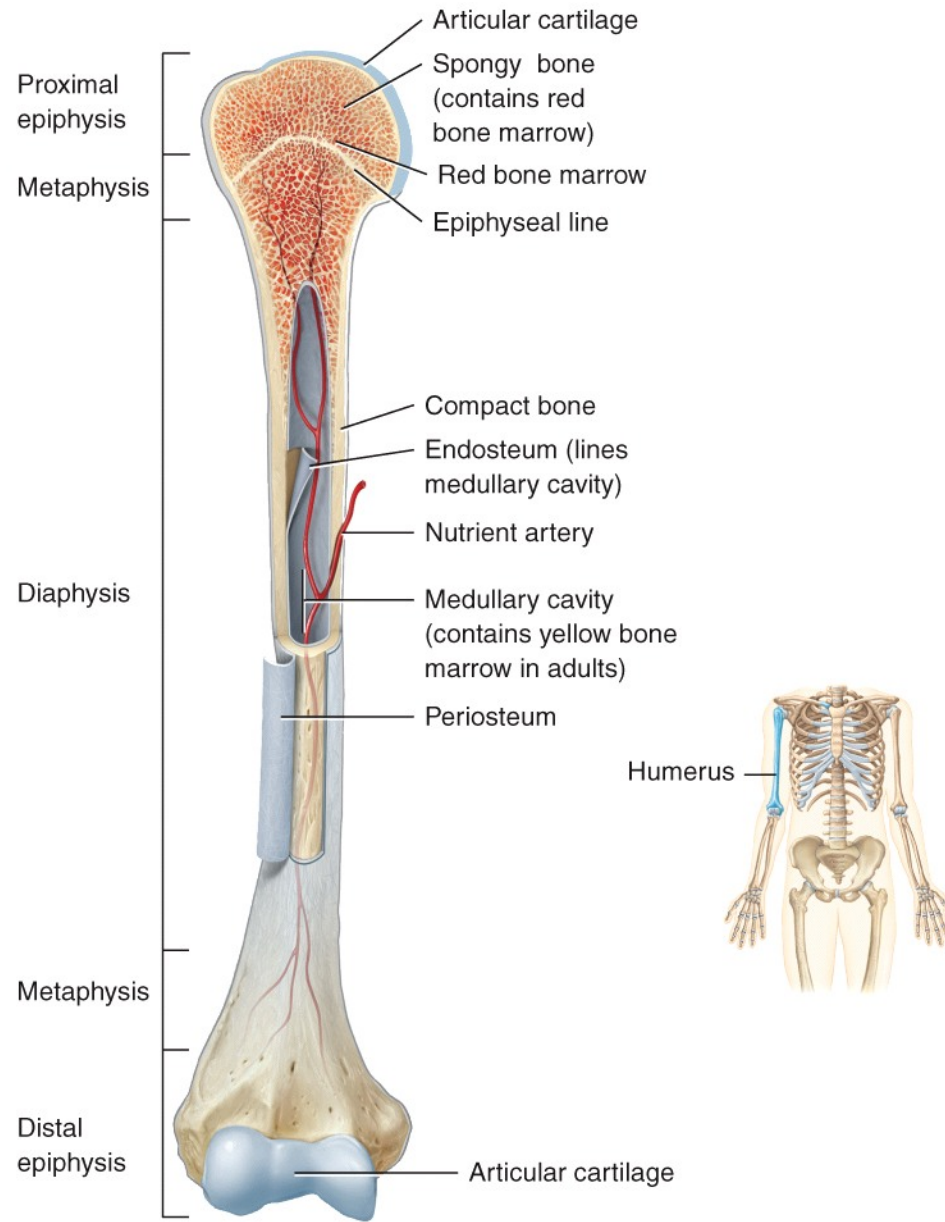


(a) Partially sectioned humerus (arm bone)

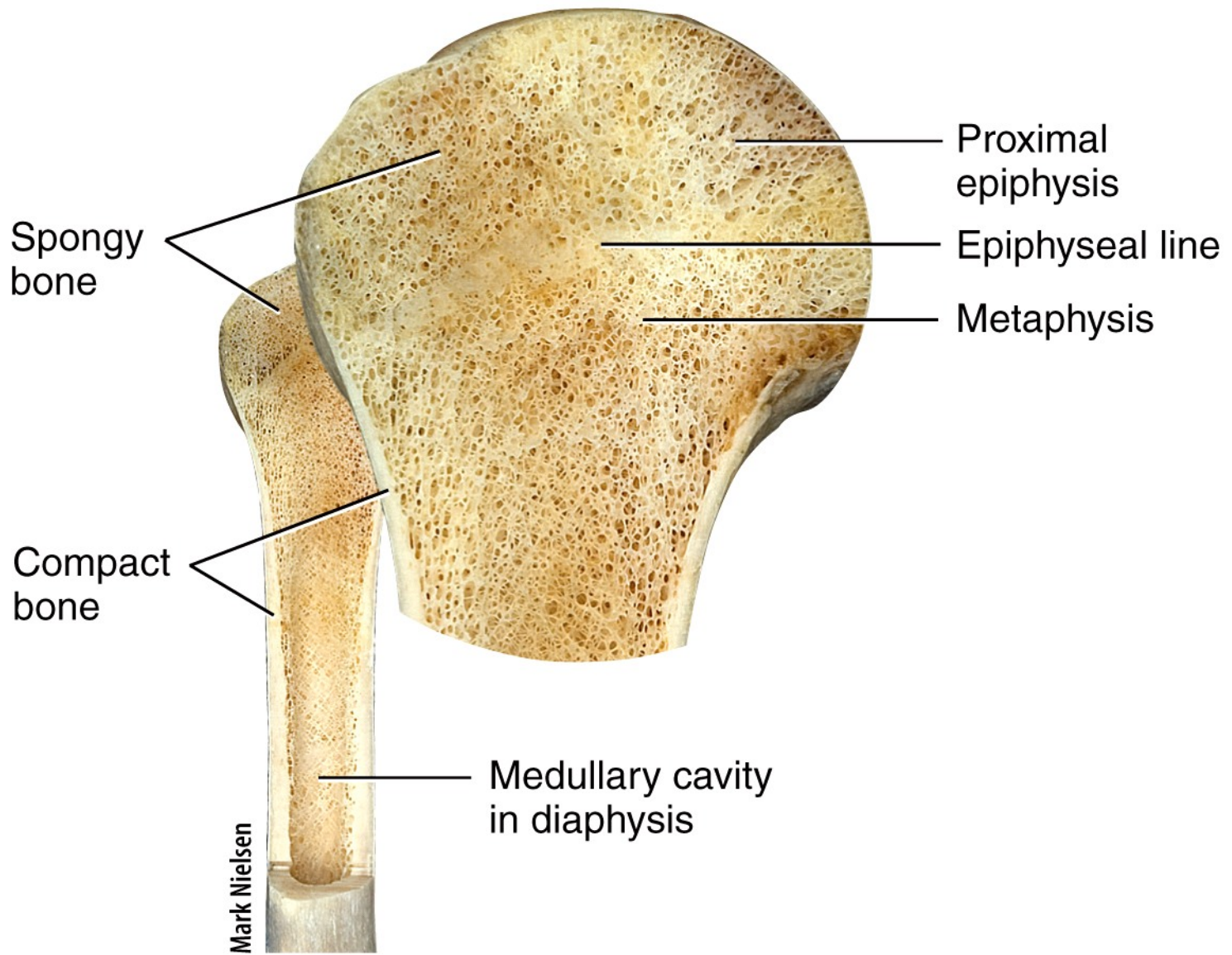


(b) Partially sectioned humerus





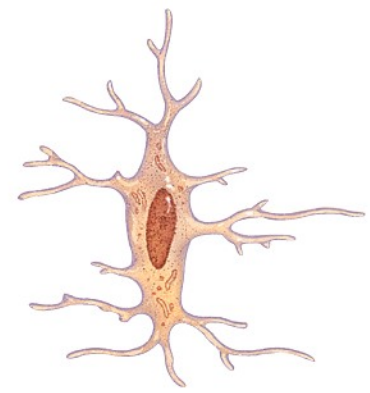
(a) Partially sectioned humerus (arm bone)



(b) Partially sectioned humerus



From bone cell lineage



From white blood cell lineage



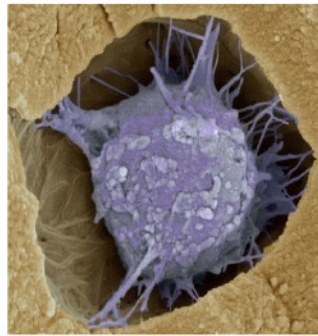
Ruffled border

**OSTEOPROGENITOR CELL**  
(develops into an osteoblast)

**OSTEOBLAST**  
(forms bone extracellular matrix)

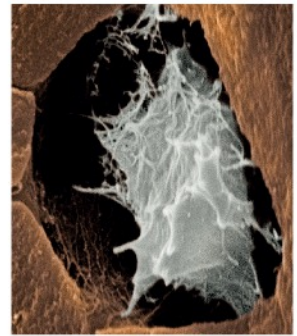
**OSTEOCYTE**  
(maintains bone tissue)

**OSTEOCLAST**  
(functions in resorption, the breakdown of bone extracellular matrix)



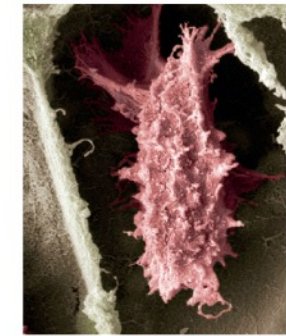
Steve Gschmeissner/Science Photo Library/Photo Researchers, Inc.

**SEM** x8000



SPU/Science Source/Photo Researchers, Inc.

**SEM** x4000



Steve Gschmeissner/Science Source/Photo Researchers, Inc.

**SEM** x2700



**OSTEOPROGENITOR CELL**  
(develops into an osteoblast)



From bone cell lineage



**OSTEOBLAST**  
(forms bone extracellular matrix)



**OSTEOCYTE**  
(maintains bone tissue)

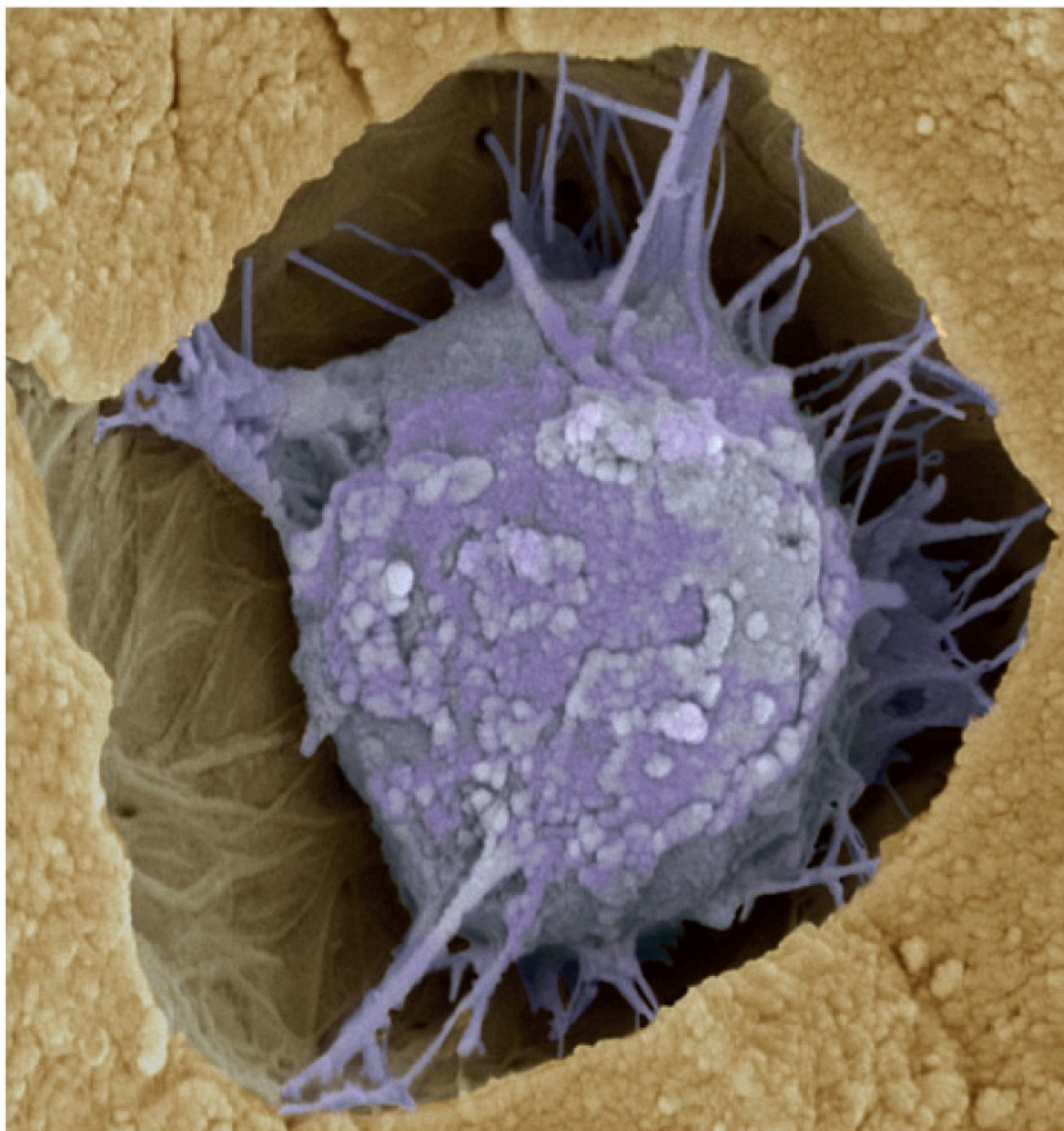


From white blood cell lineage



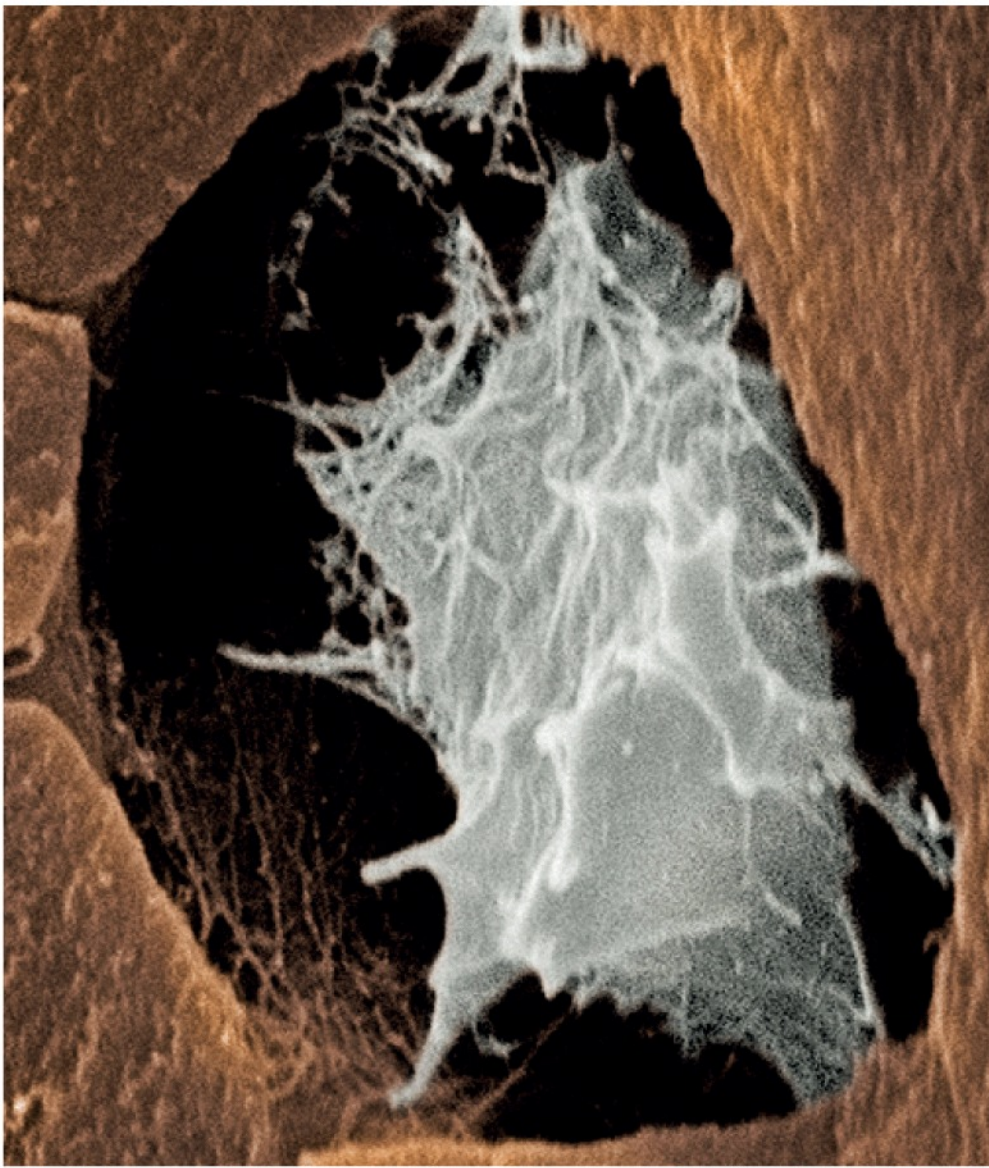
Ruffled border

**OSTEOCLAST**  
(functions in resorption, the breakdown of bone extracellular matrix)



Steve Gschmeissner/Science Photo Library/Photo Researchers, Inc.

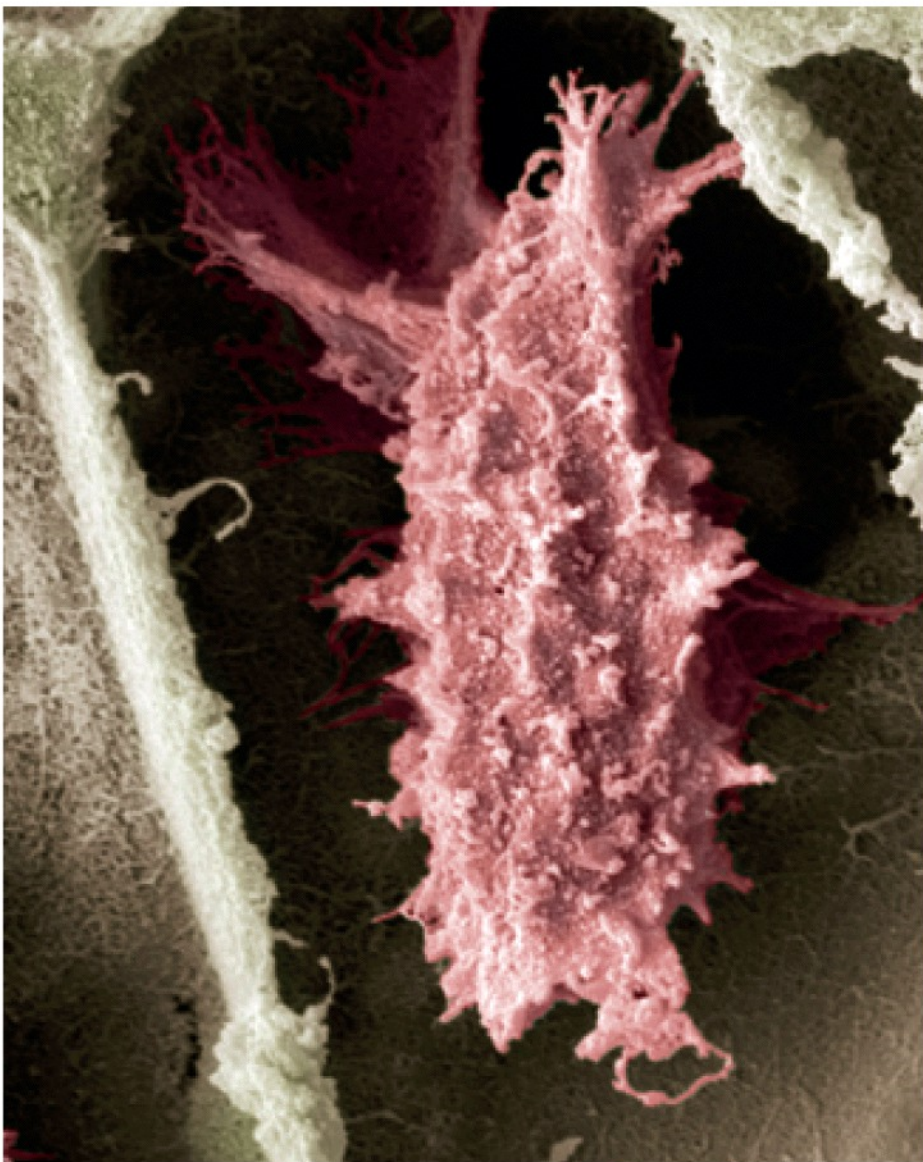
**SEM** x8000



**SEM** x4000

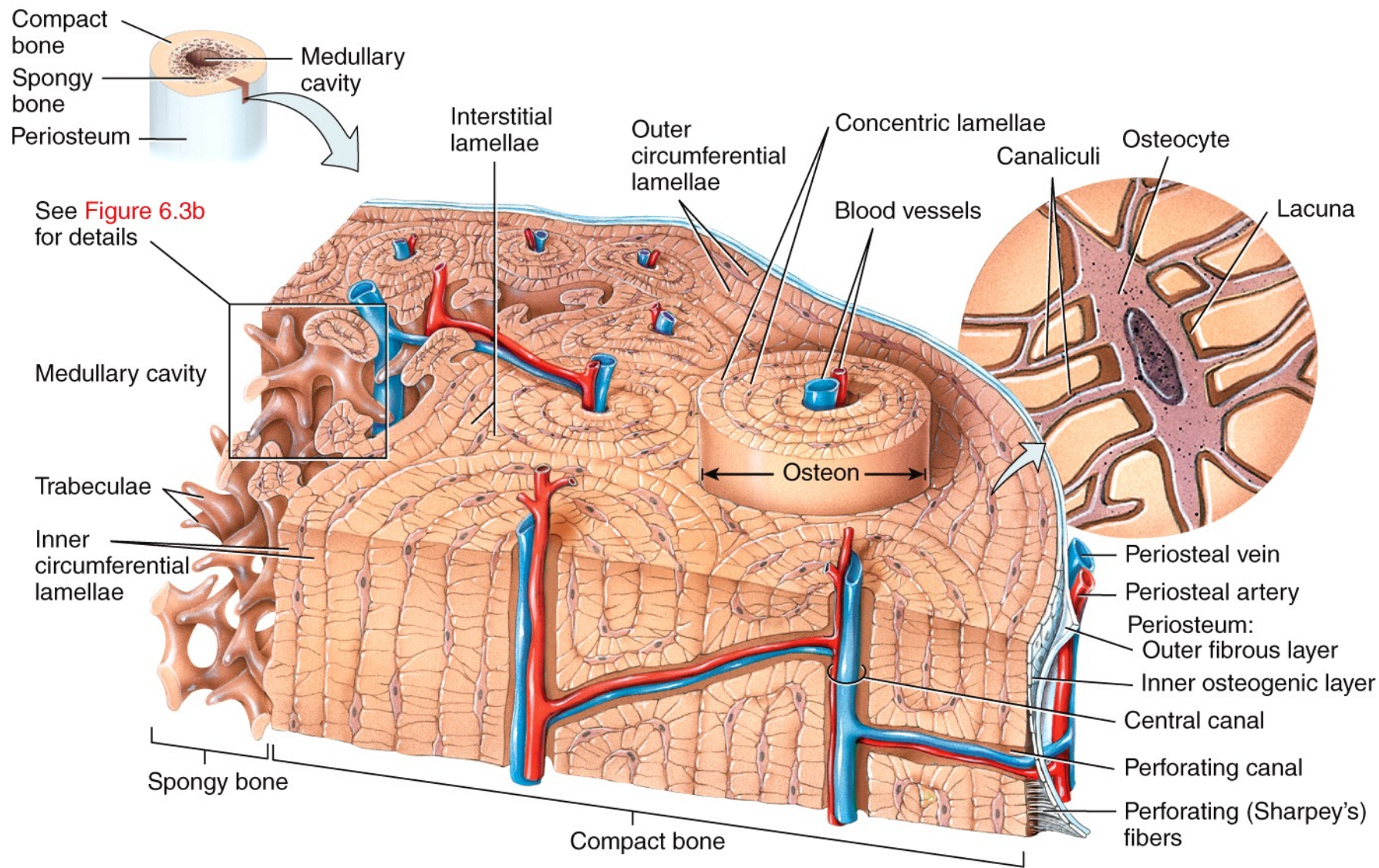
SPL/Science Source/Photo Researchers, Inc.



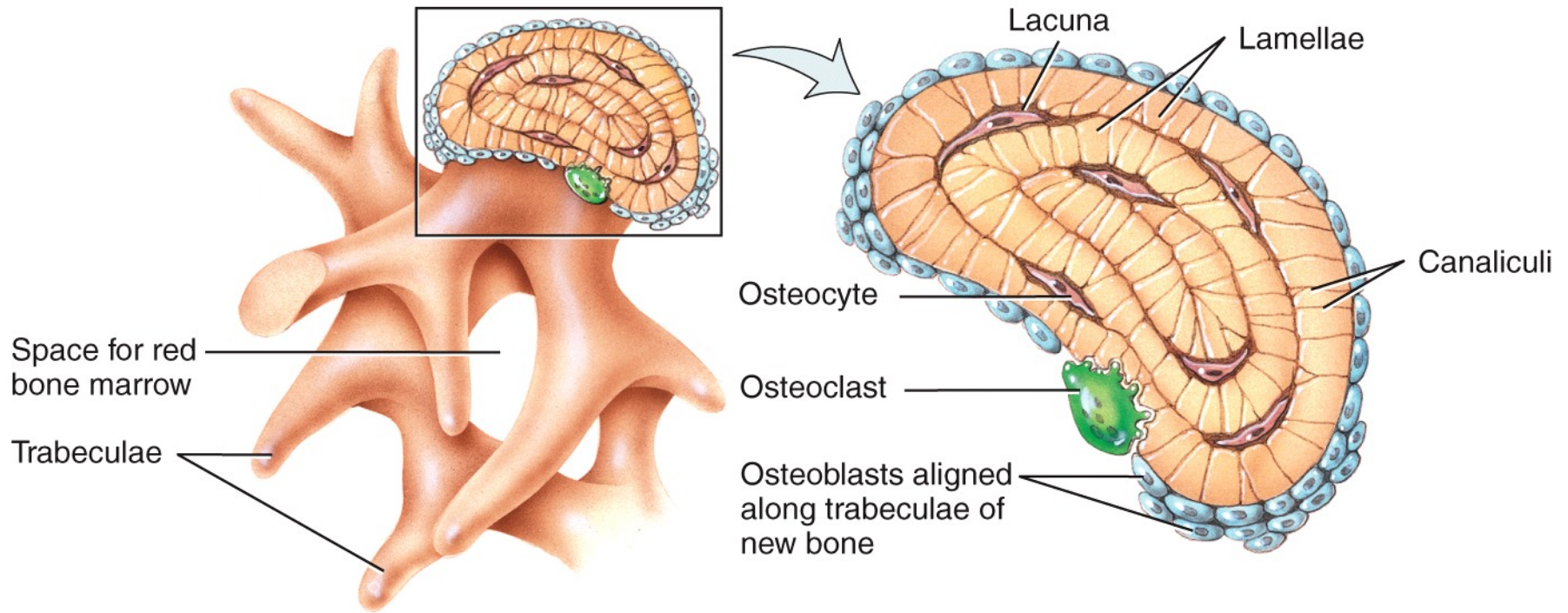


**SEM** x2700

Steve Gschmeisner/Science Source/Photo Researchers, Inc.

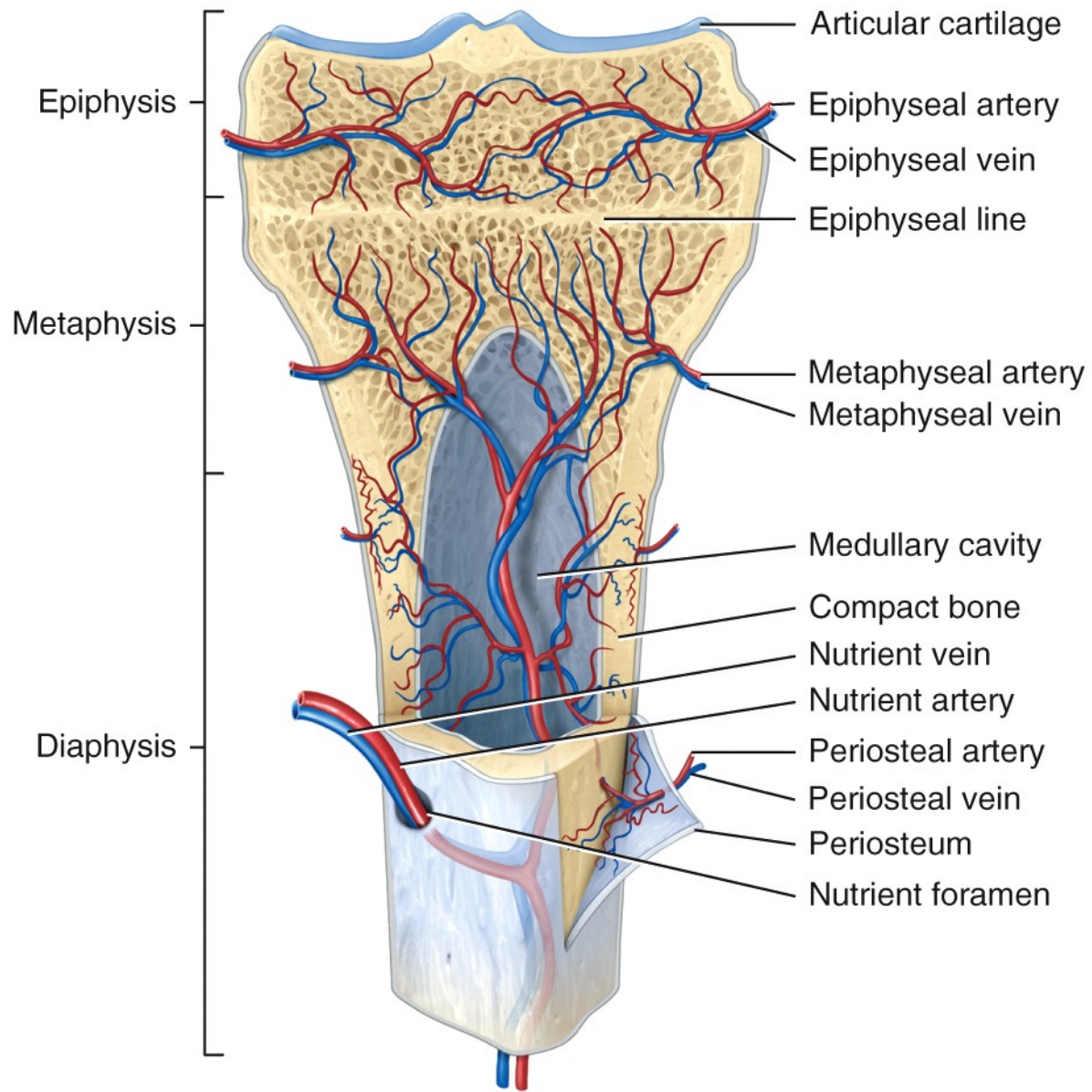


(a) Osteons (haversian systems) in compact bone and trabeculae in spongy bone

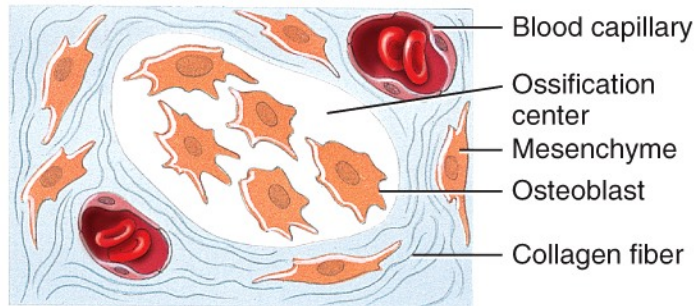
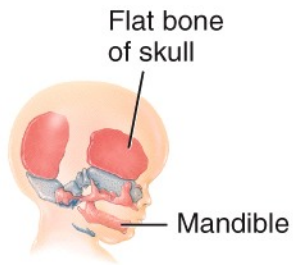


(b) Enlarged aspect of spongy bone trabeculae

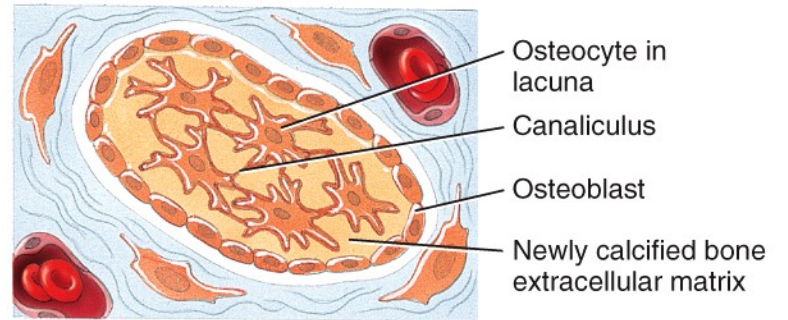
(c) Details of a section of a trabecula



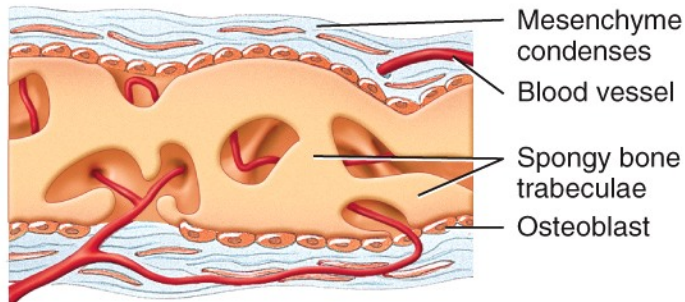
Partially sectioned tibia (shin bone)



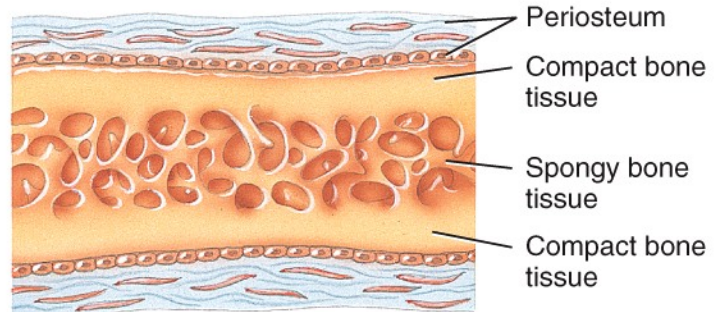
**1** Development of ossification center: osteoblasts secrete organic extracellular matrix.



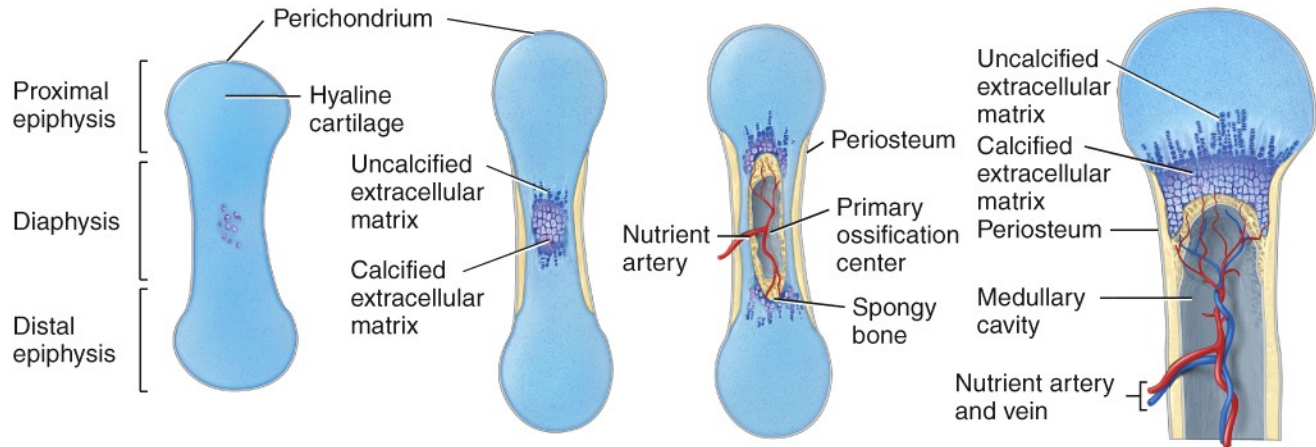
**2** Calcification: calcium and other mineral salts are deposited and extracellular matrix calcifies (hardens).



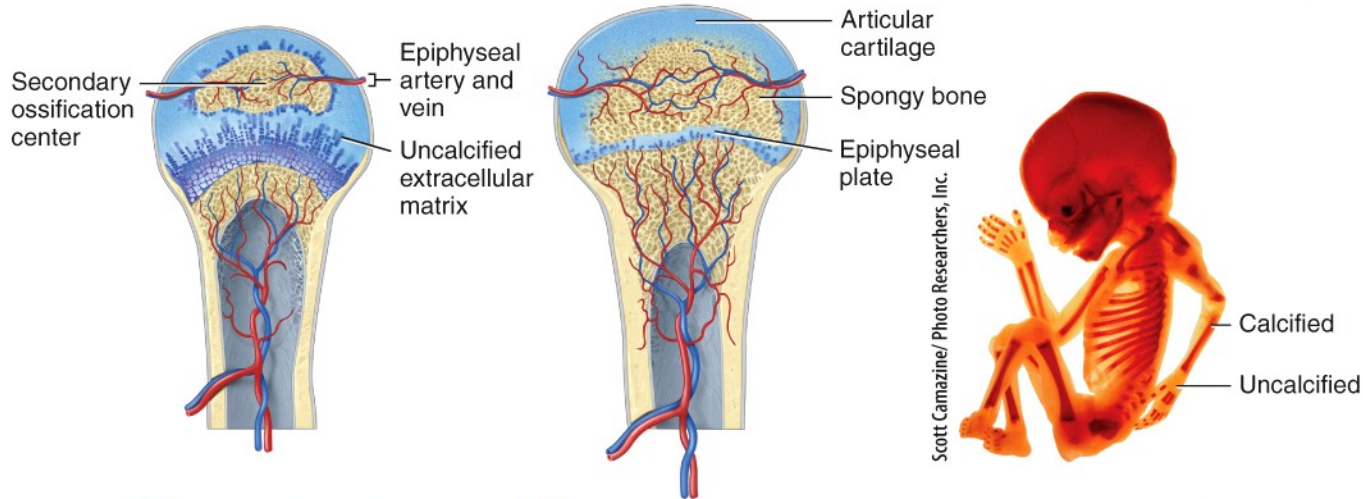
**3** Formation of trabeculae: extracellular matrix develops into trabeculae that fuse to form spongy bone.



**4** Development of the periosteum: mesenchyme at the periphery of the bone develops into the periosteum.

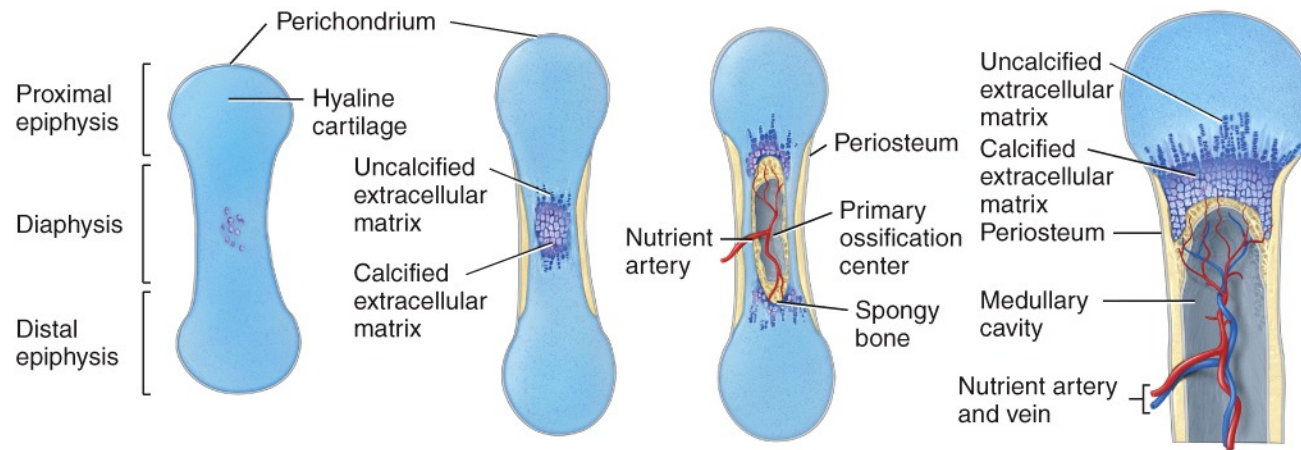


- 1 Development of cartilage model: mesenchymal cells develop into chondroblasts, which form the cartilage model.
- 2 Growth of cartilage model: growth occurs by cell division of chondrocytes.
- 3 Development of primary ossification center: in this region of the diaphysis, bone tissue has replaced most of the cartilage.
- 4 Development of the medullary (marrow) cavity: bone breakdown by osteoclasts forms the medullary cavity.

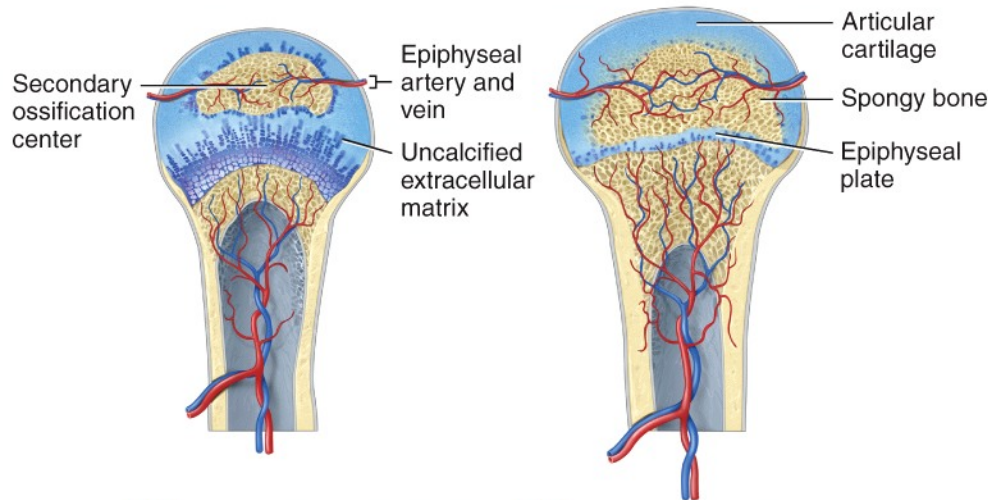


- 5 Development of secondary ossification centers: these occur in the epiphyses of the bone.
  - 6 Formation of articular cartilage and epiphyseal plate: both structures consist of hyaline cartilage.
- (b) Twelve-week fetus. The red areas represent bones that are forming (calcified). Clear areas represent cartilage (uncalcified).

(a) Sequence of events

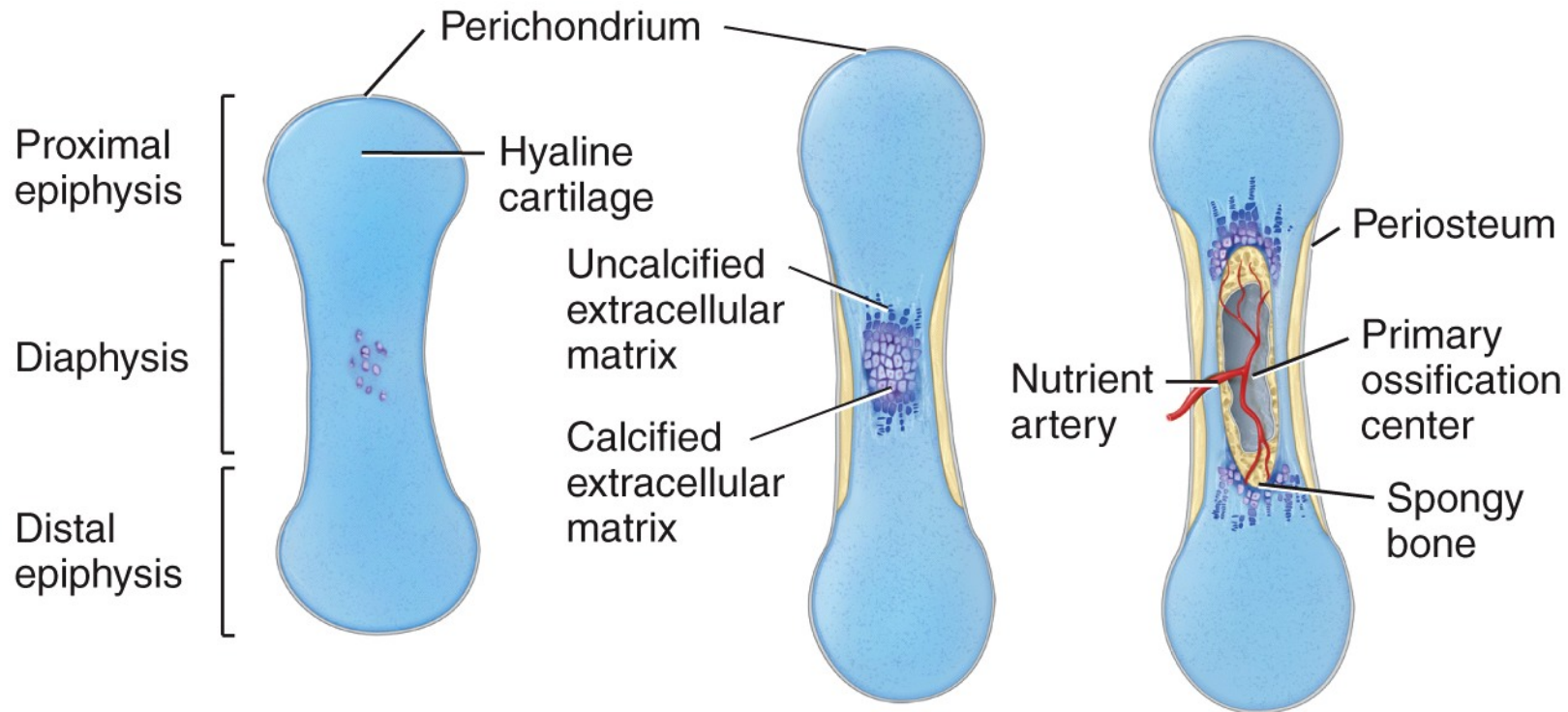


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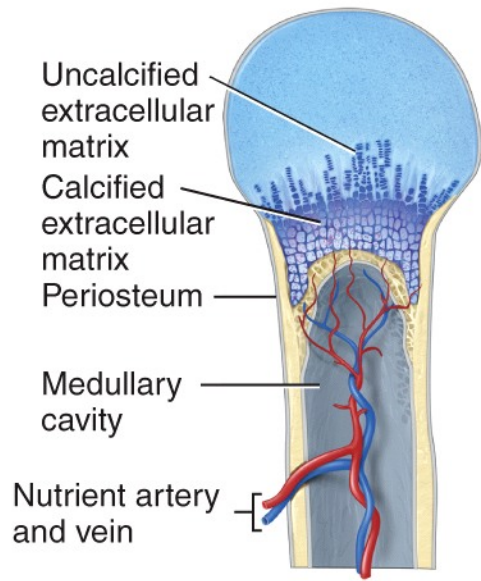
(a) Sequence of events



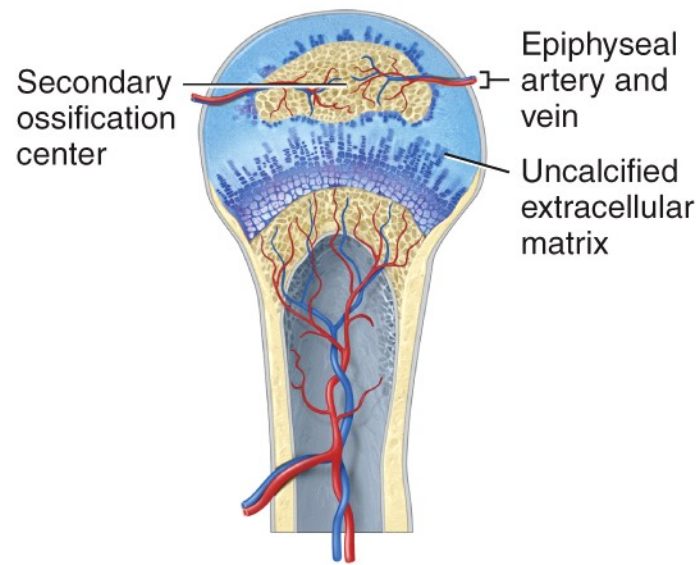
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- 2 Growth of cartilage model: growth occurs by cell division of chondrocytes.
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(a) Sequence of events

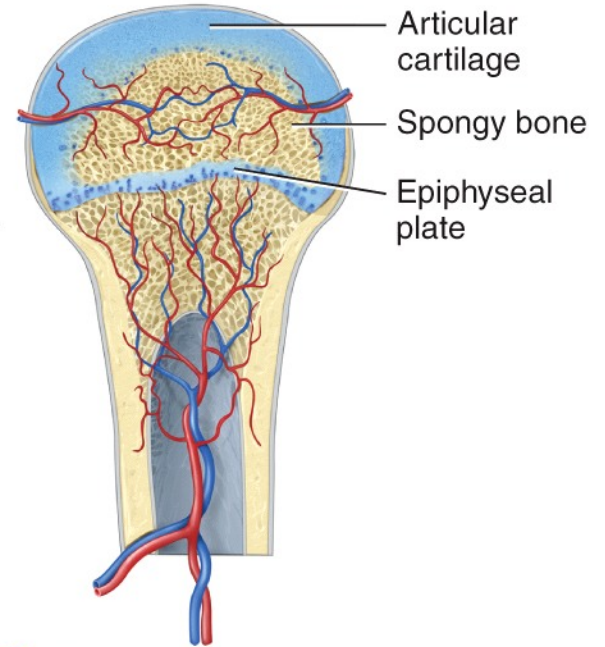




- 4 Development of the medullary (marrow) cavity: bone breakdown by osteoclasts forms the medullary cavity.



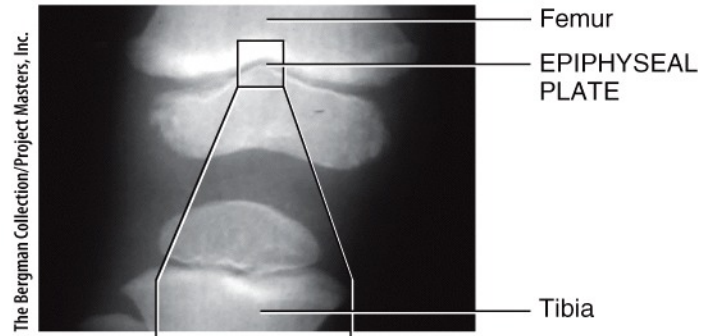
- 5 Development of secondary ossification centers: these occur in the epiphyses of the bone.



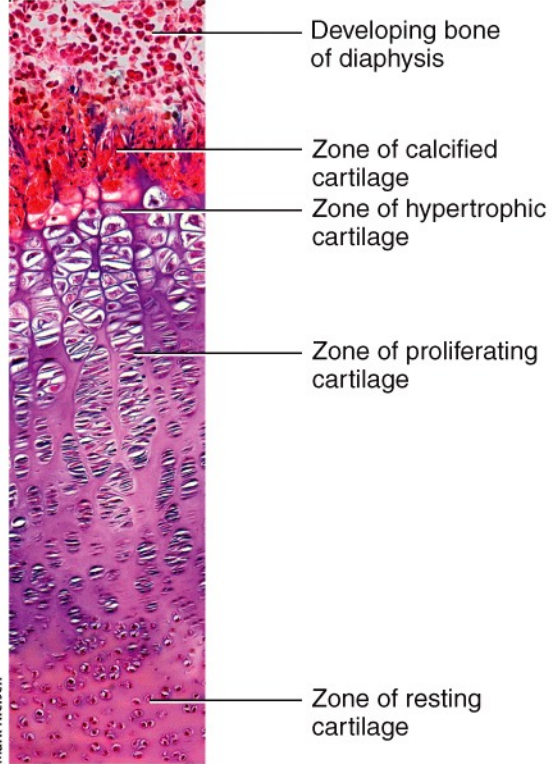
- 6 Formation of articular cartilage and epiphyseal plate: both structures consist of hyaline cartilage.

(a) Sequence of events

(a) Radiograph showing the epiphyseal plate of the femur of a 3-year-old



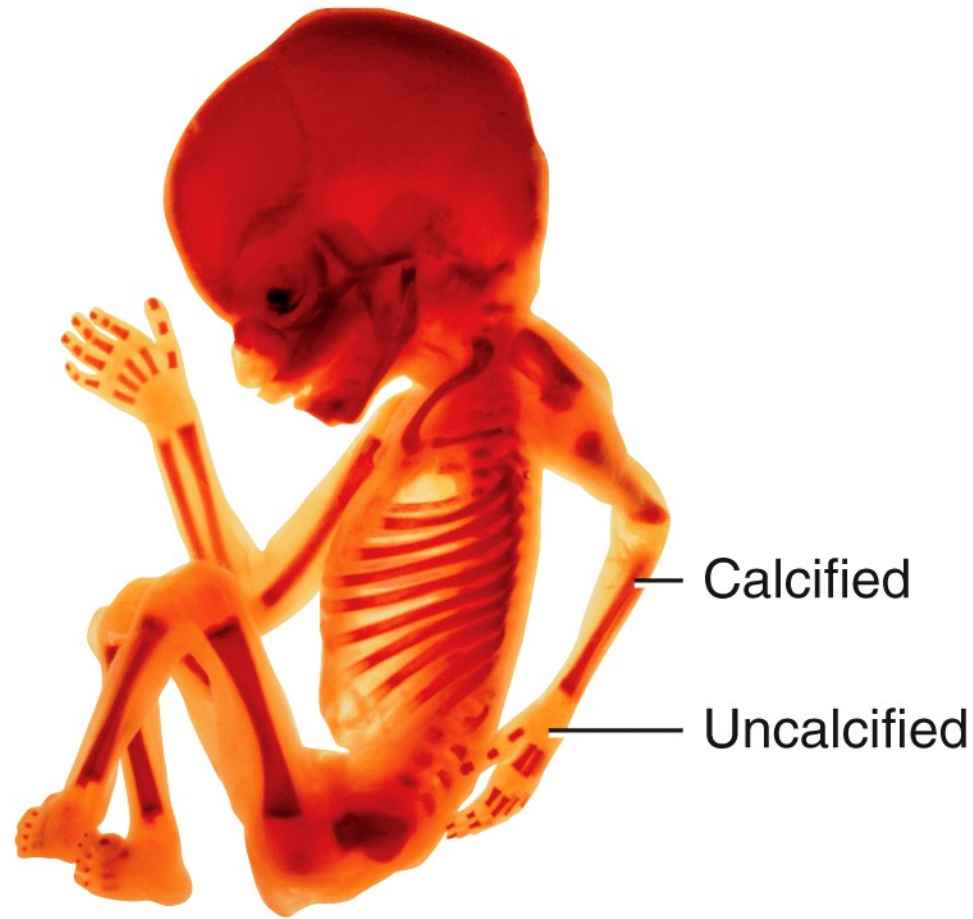
Diaphyseal side



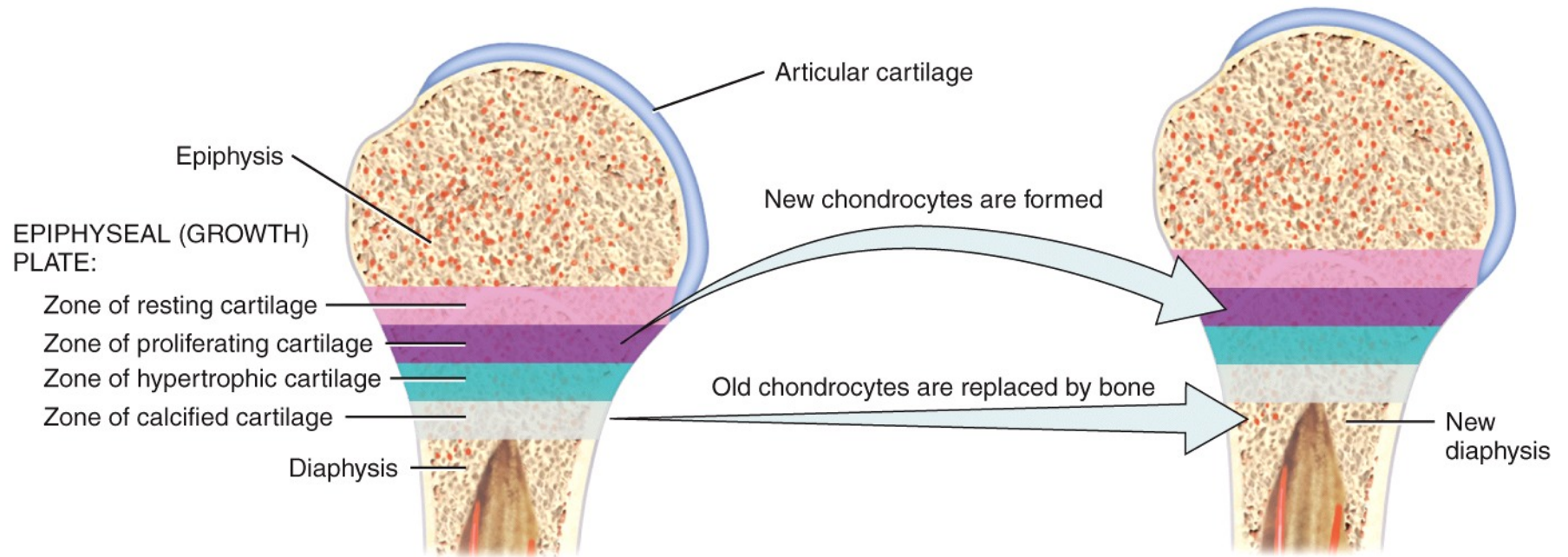
Epiphyseal side LM 400x

(b) Histology of the epiphyseal plate

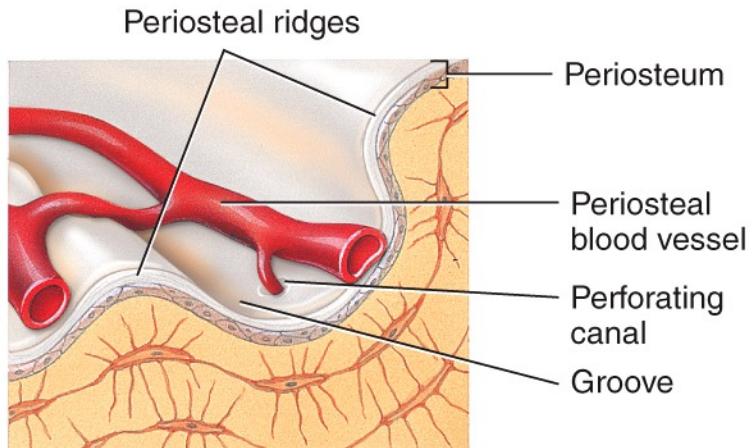
Scott Camazine/Photo Researchers, Inc.



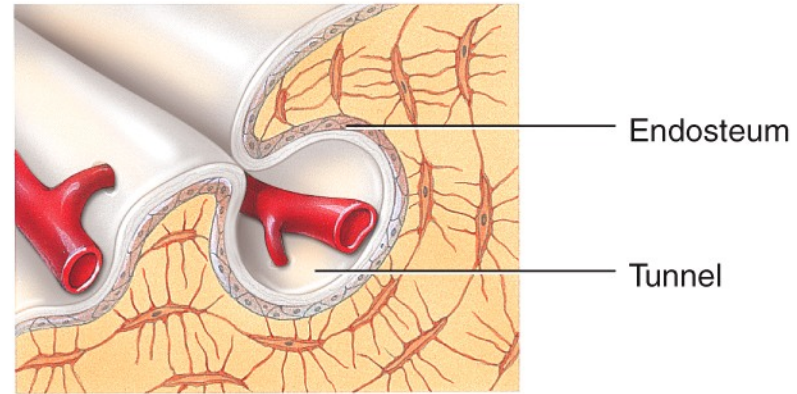
(b) Twelve-week fetus. The red areas represent bones that are forming (calcified). Clear areas represent cartilage (uncalcified).



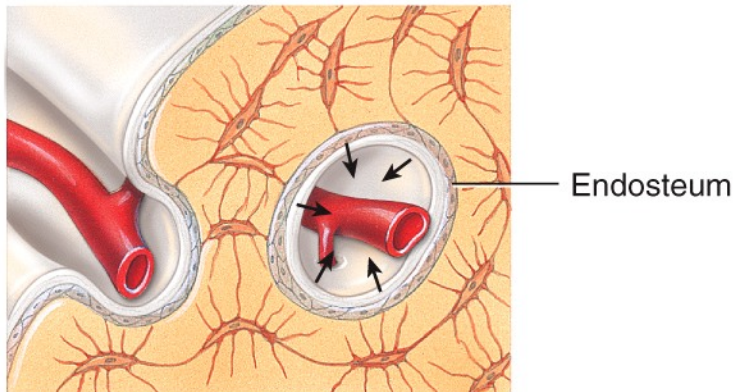
(c) Lengthwise growth of bone at epiphyseal plate



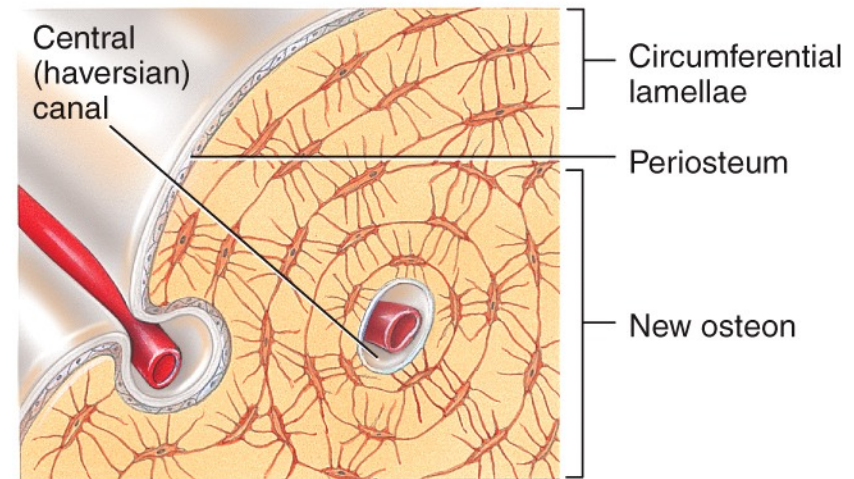
- 1 Ridges in periosteum create groove for periosteal blood vessel.



- 2 Periosteal ridges fuse, forming an endosteum-lined tunnel.

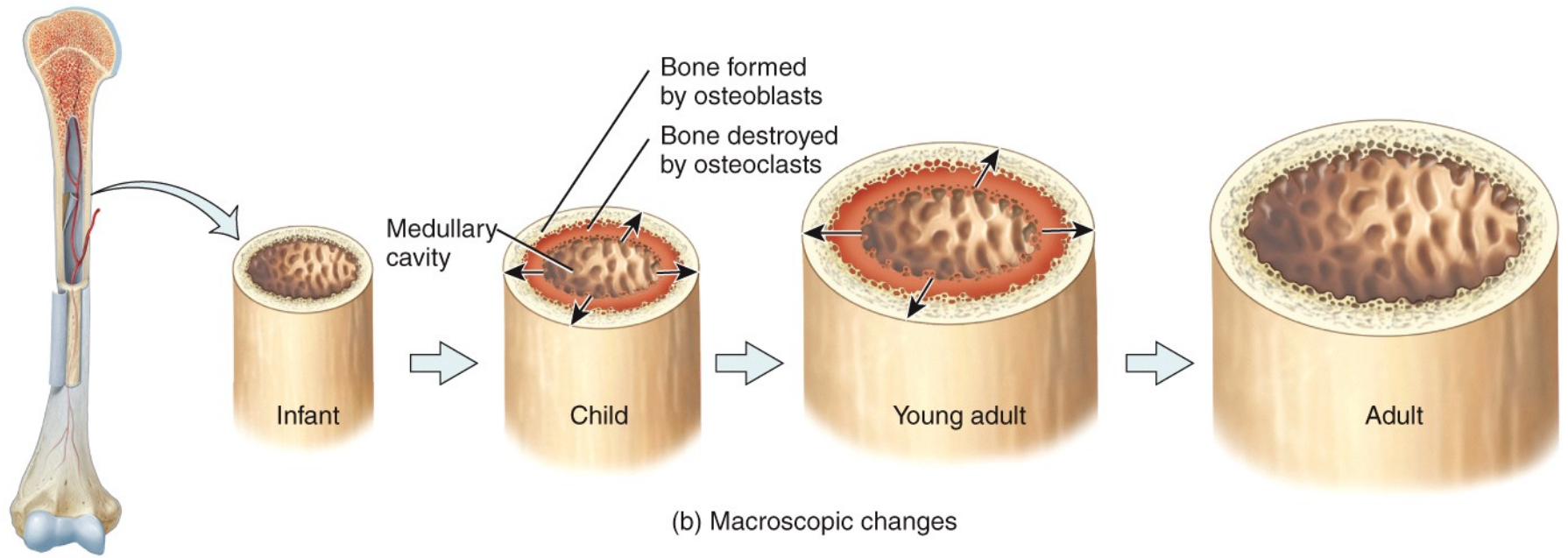


- 3 Osteoblasts in endosteum build new concentric lamellae inward toward center of tunnel, forming a new osteon.

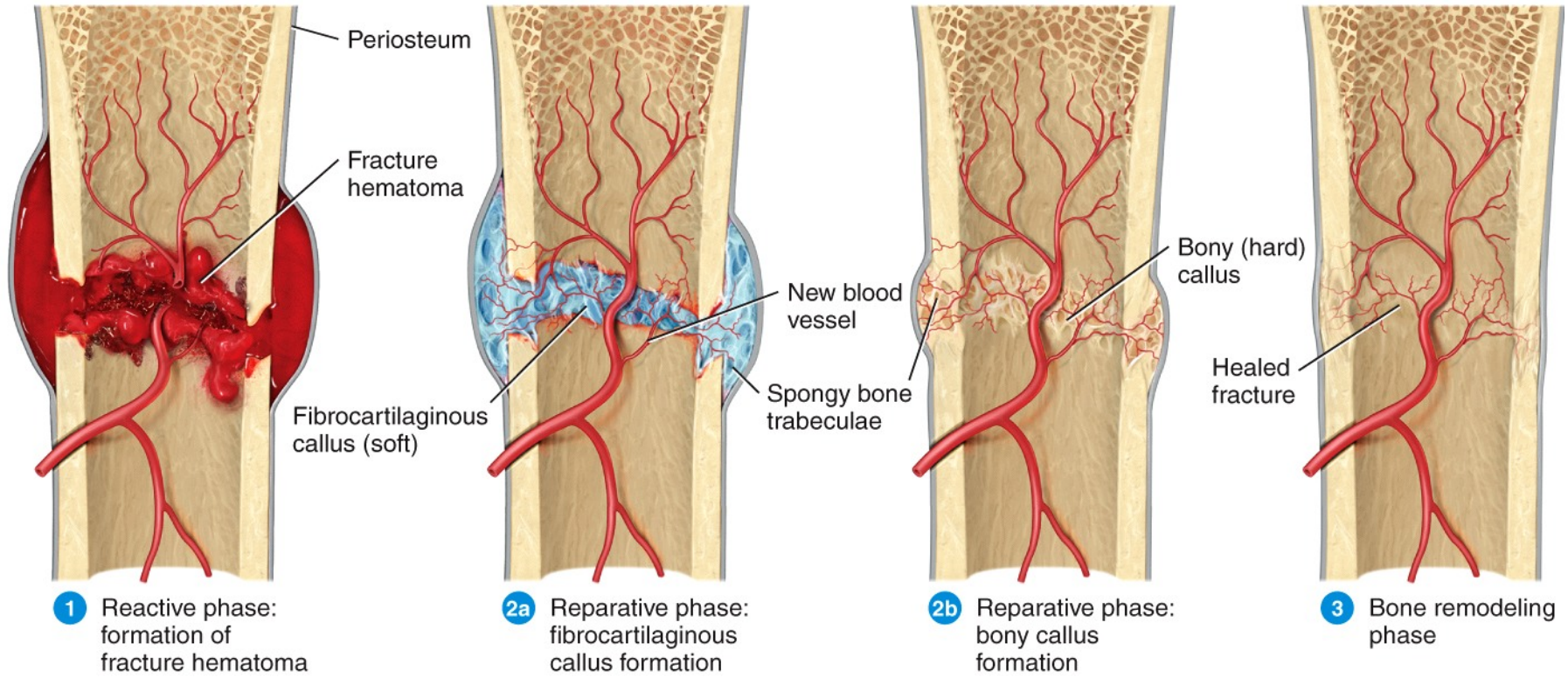


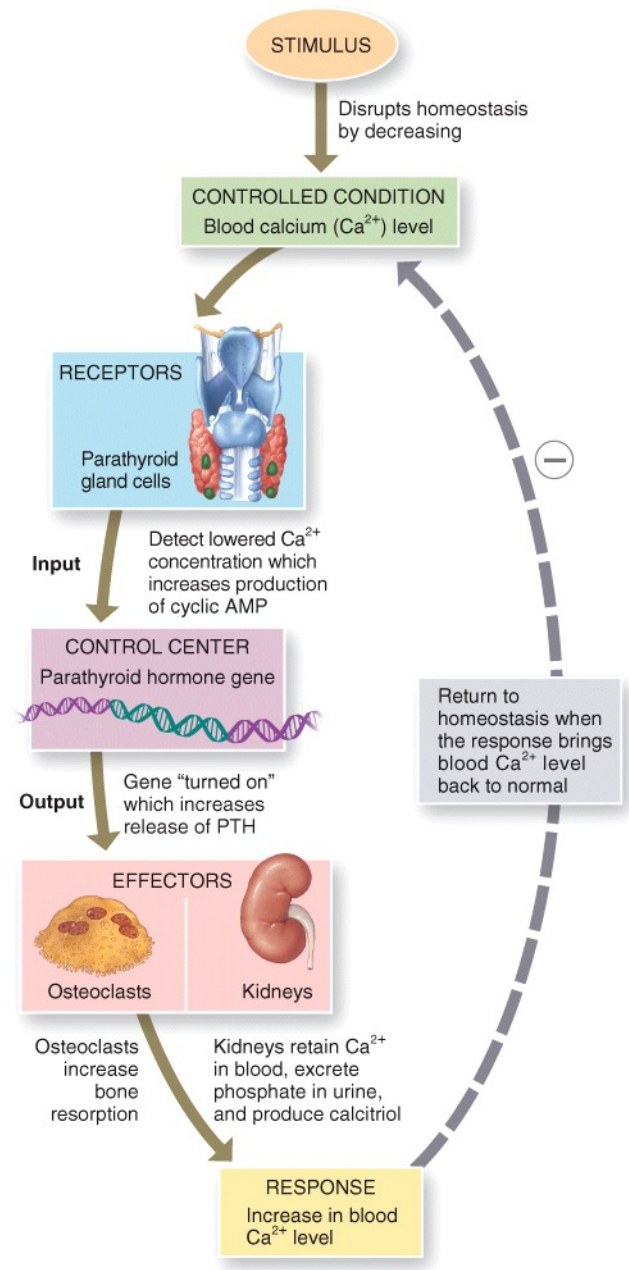
- 4 Bone grows outward as osteoblasts in periosteum build new circumferential lamellae. Osteon formation repeats as new periosteal ridges fold over blood vessels.

(a) Microscopic details



(b) Macroscopic changes



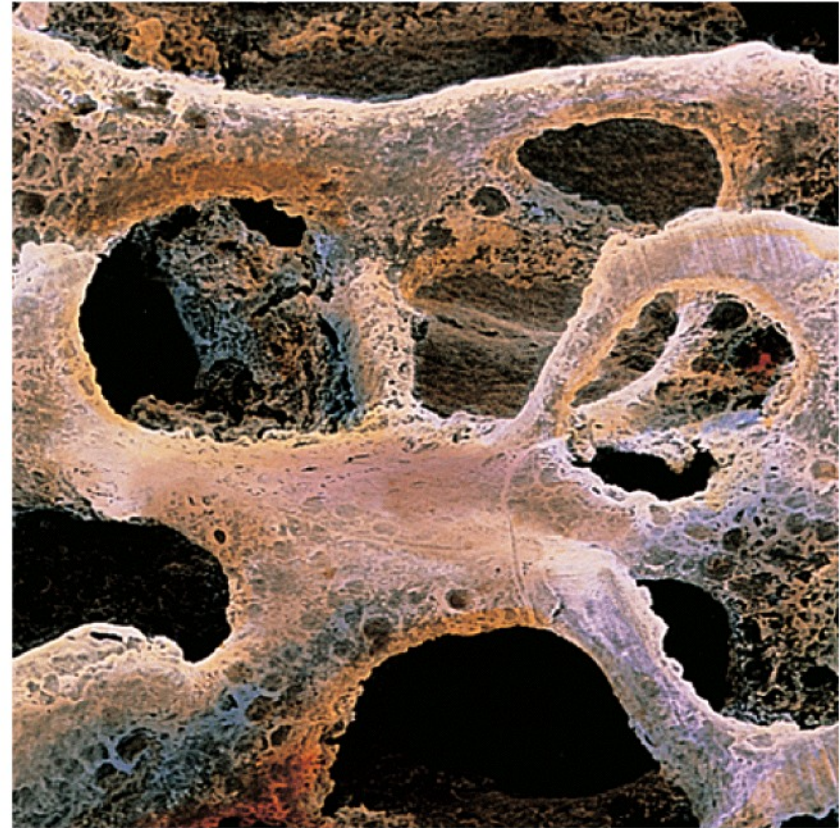






**SEM** 30x

(a) Normal bone



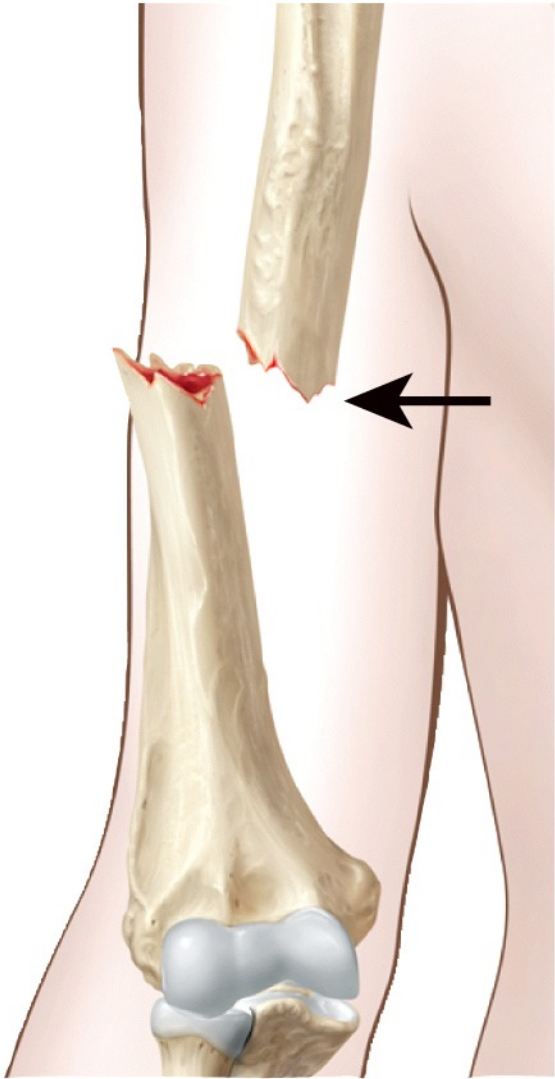
**SEM** 30x

(b) Osteoporotic bone

P. Motta/Photo Researchers, Inc.



Larry Mulvehill/Science Source/Photo Researchers



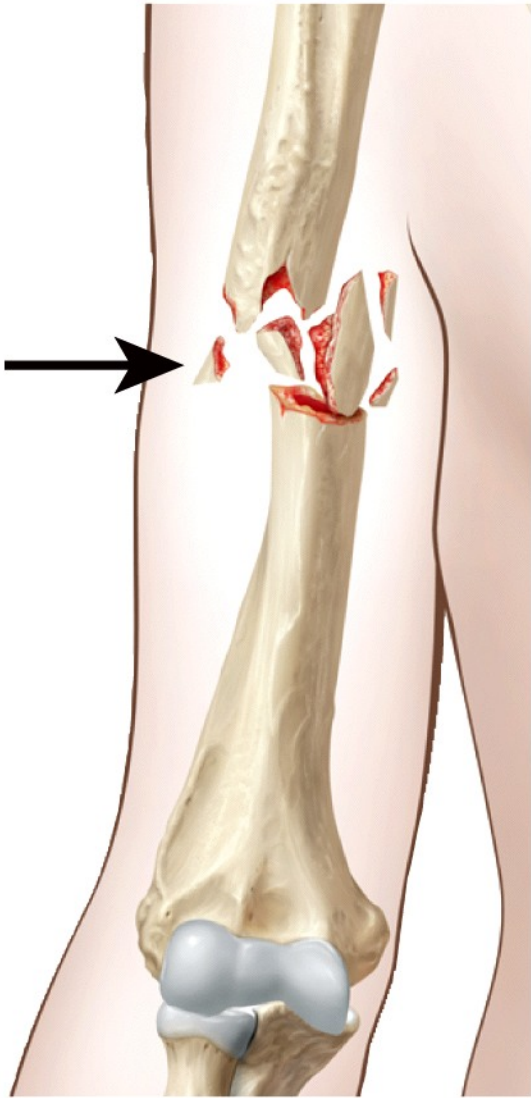
Humerus

Radius

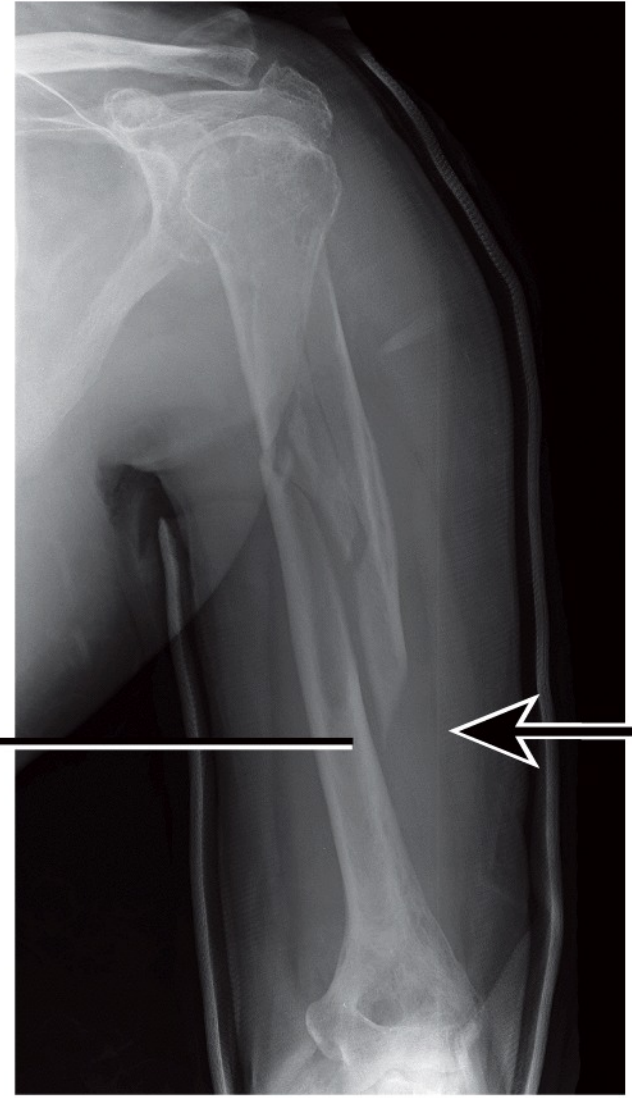
Ulna



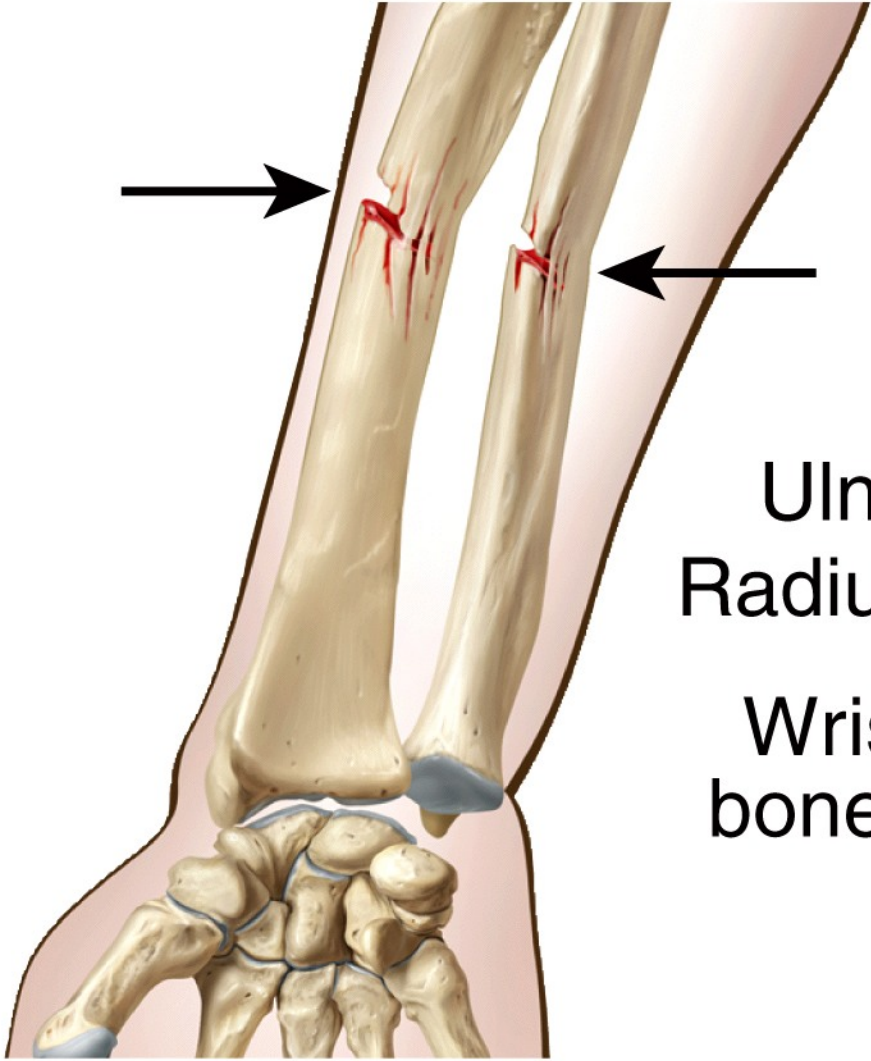
Courtesy Dr. Brent Layton



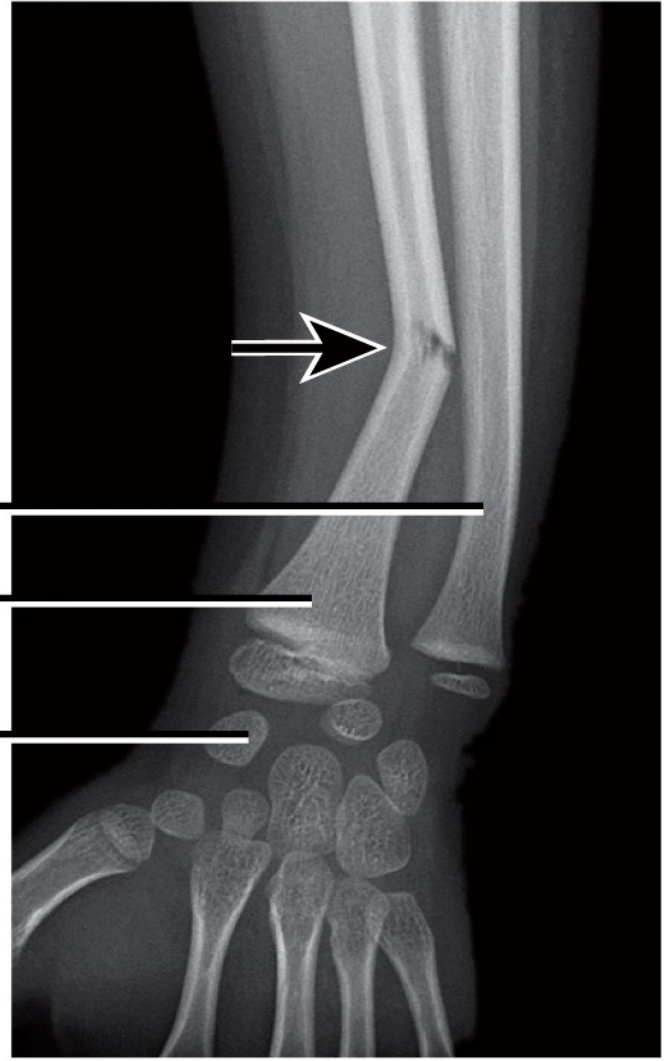
Humerus



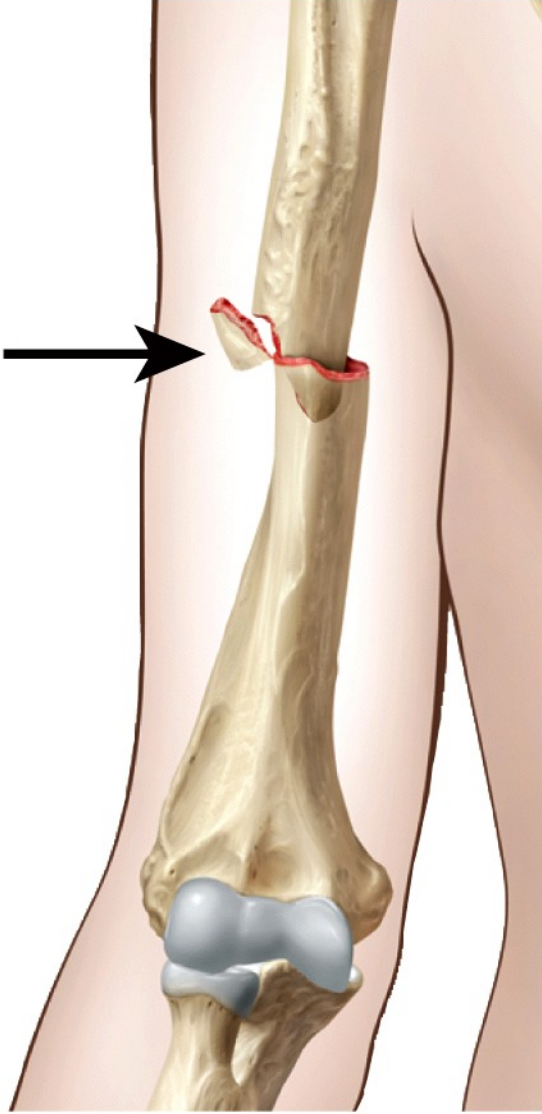
Courtesy Per Amundson, M.D.



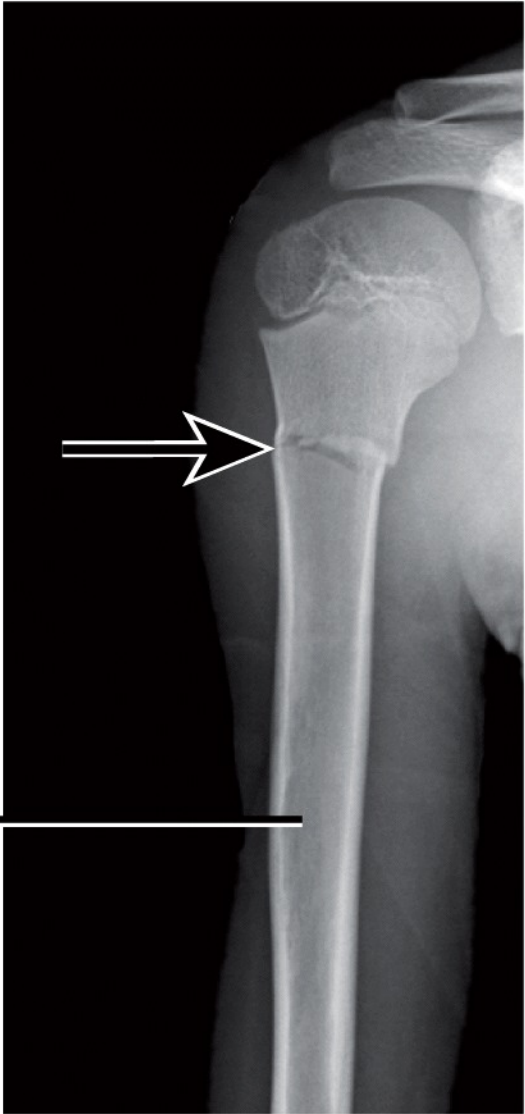
Ulna  
Radius  
Wrist  
bones



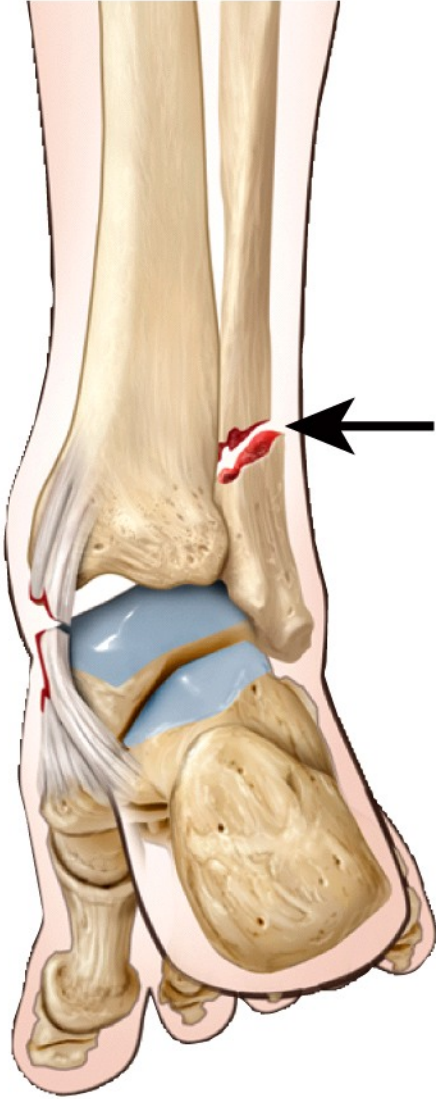
Courtesy Dr. Brent Layton



Humerus



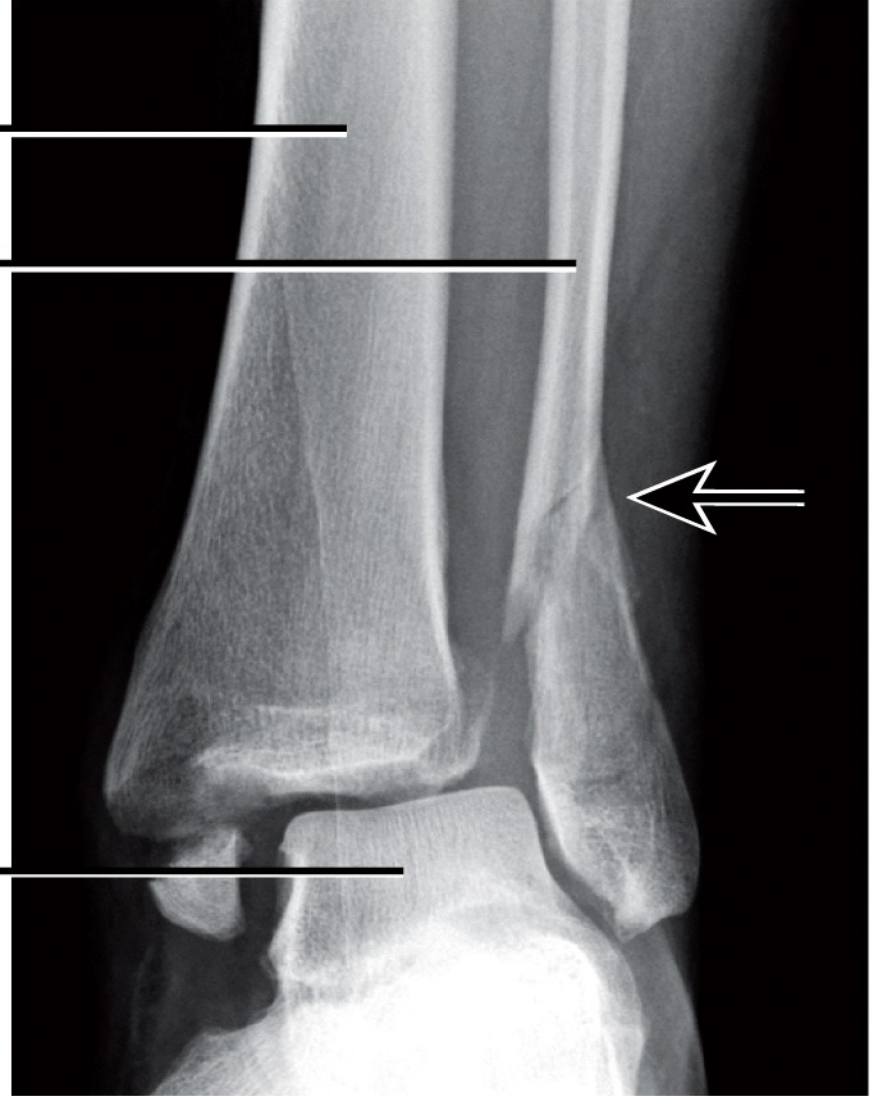
Courtesy Dr. Brent Layton



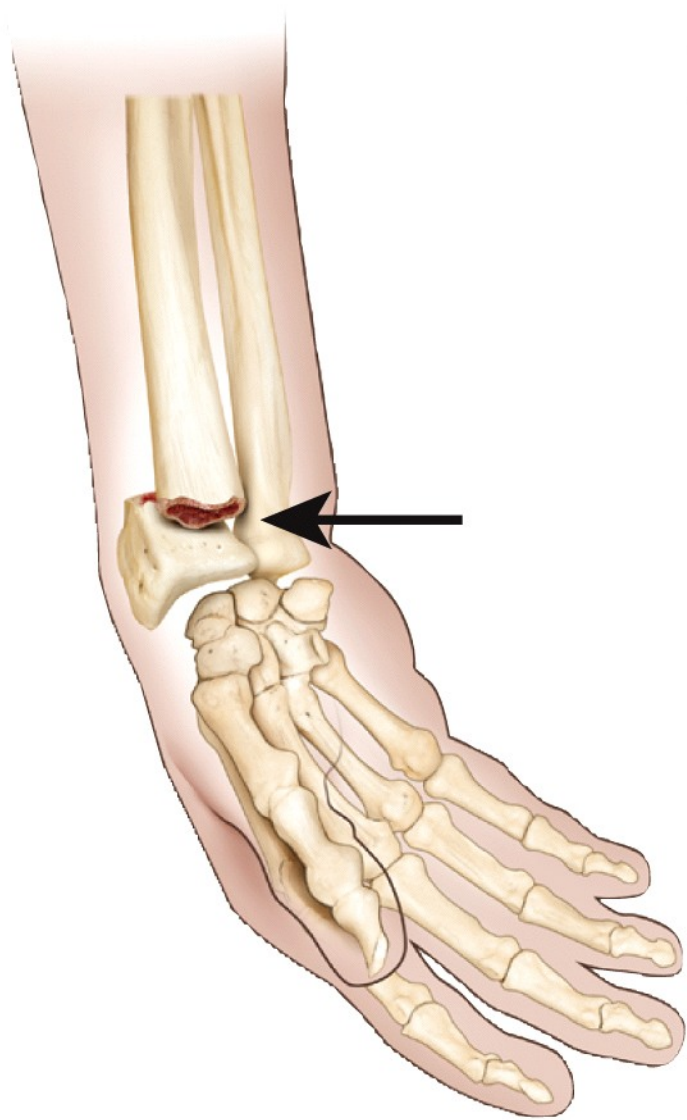
Tibia

Fibula

Ankle  
bones



Courtesy Dr. Brent Layton



Radius

Ulna

Wrist  
bones

