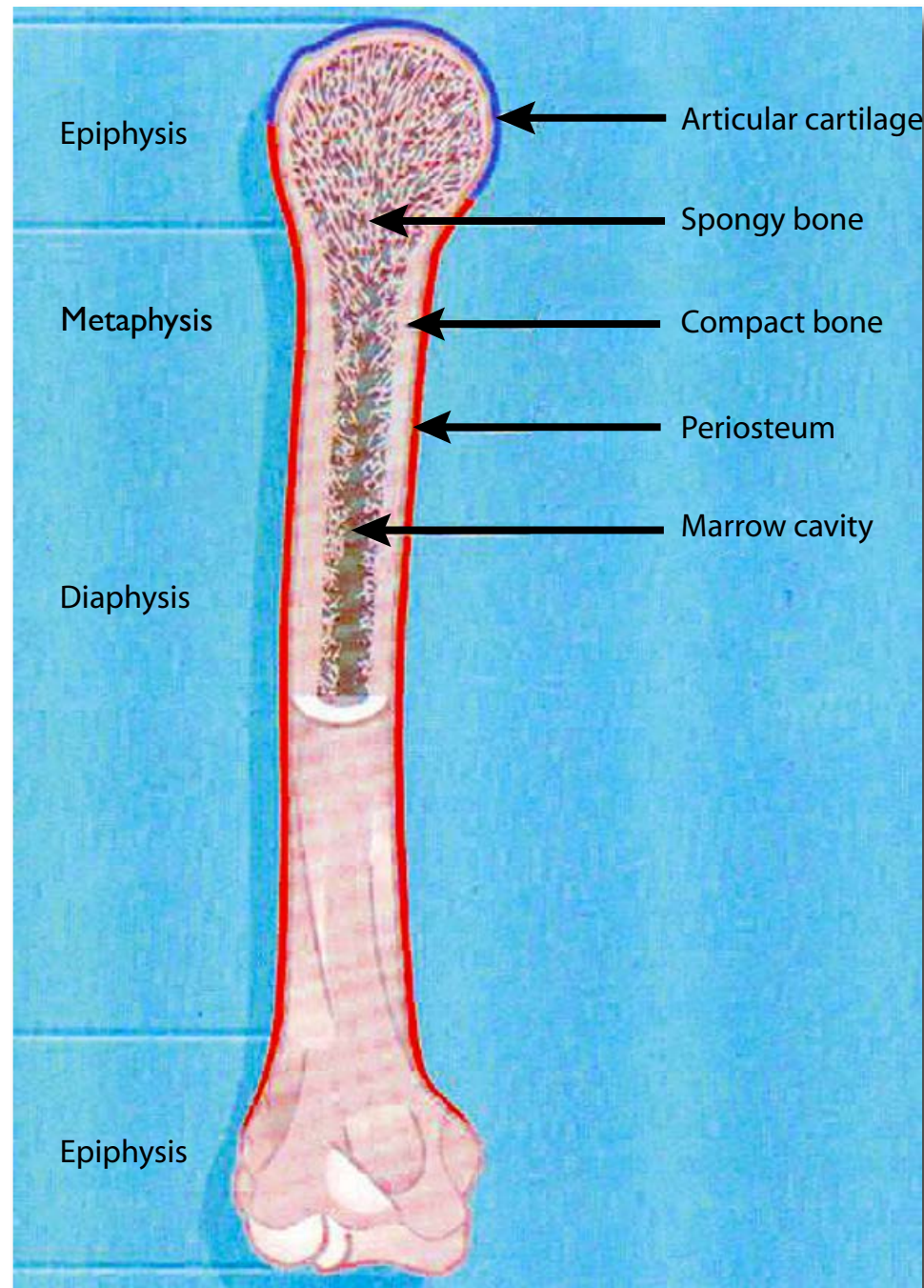


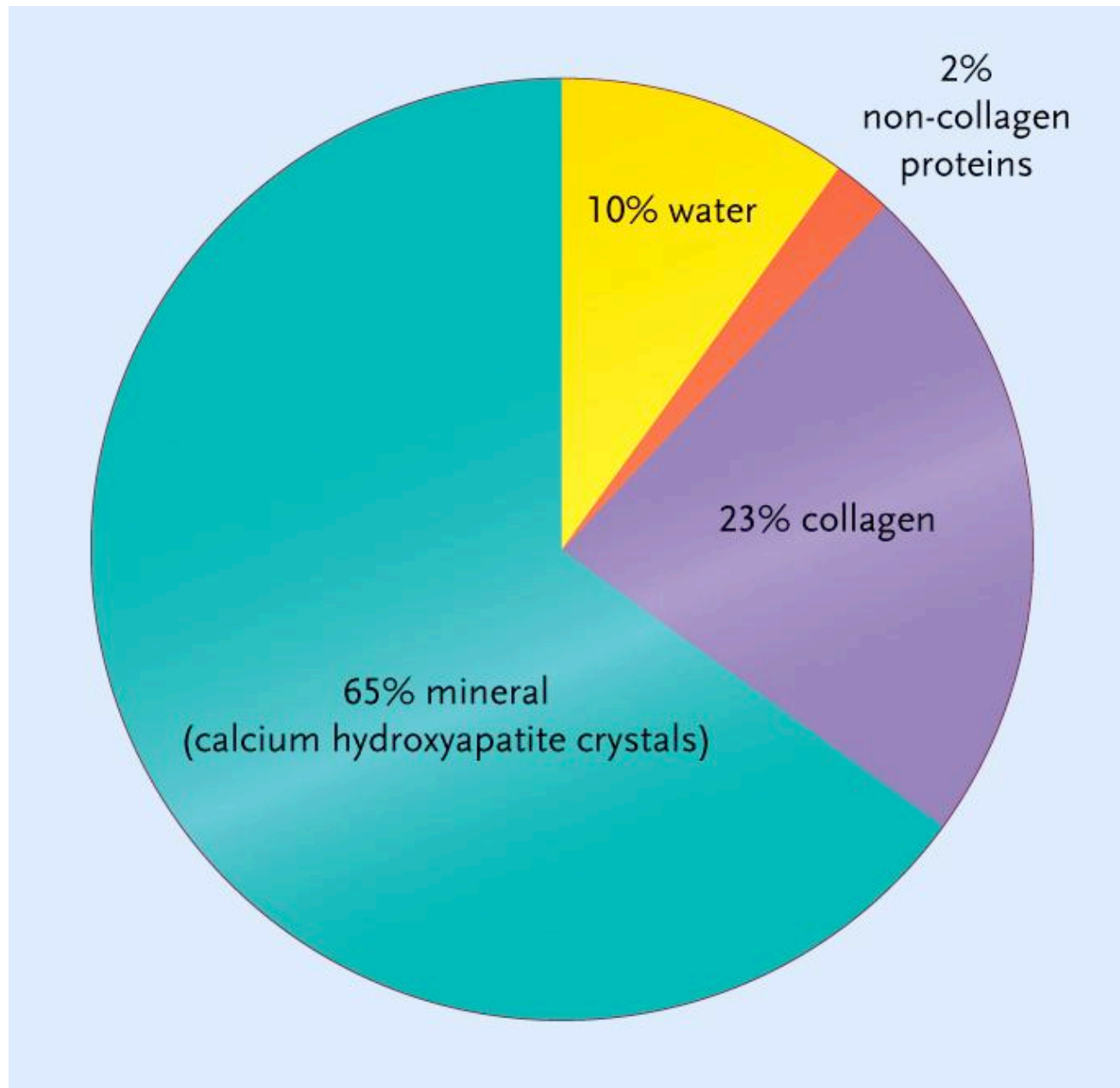
# Bone and Joint Diseases

Henry Sánchez, M.D.

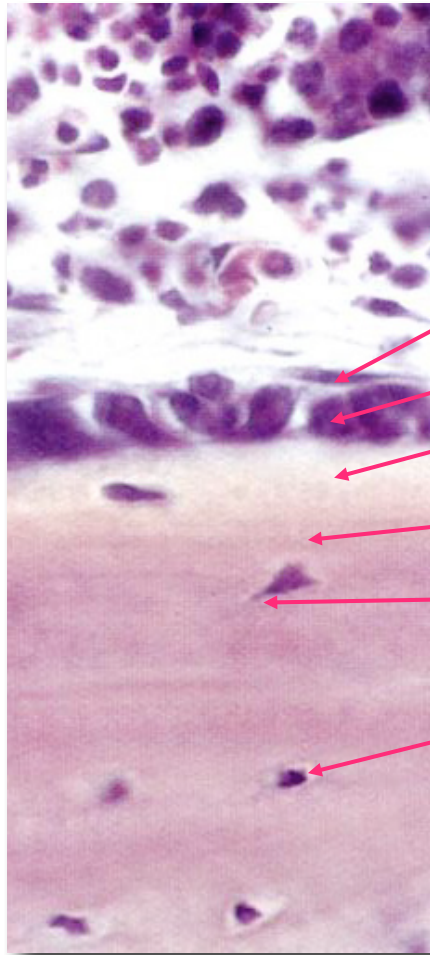
# Skeletal Tissues: Cartilage and Bone



# Bone Composition



# Bone Cells



Osteoprogenitor cell

Osteoblast

Uncalcified bone matrix

Calcified bone matrix

Cell process in canaliculus

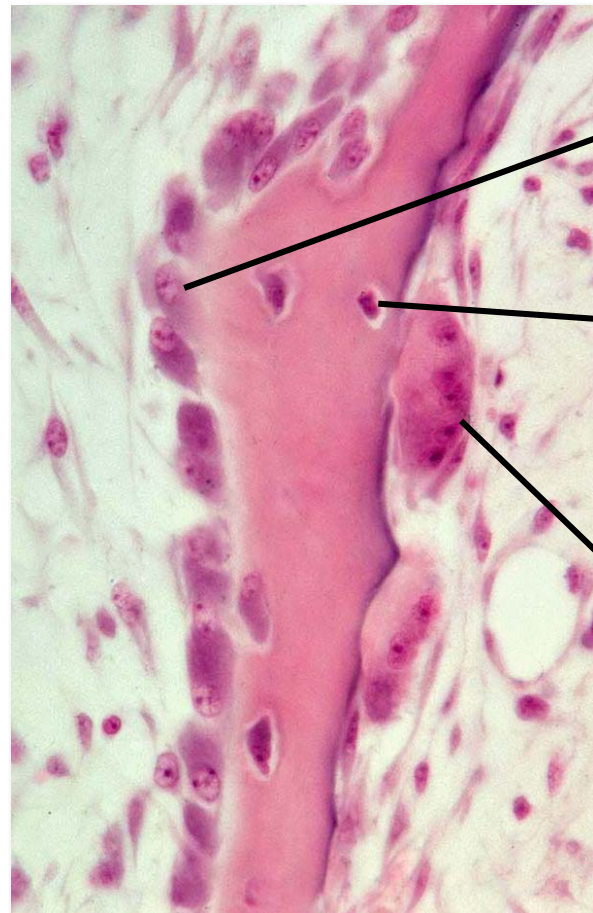
Osteocyte



10 μm



# Bone Cells

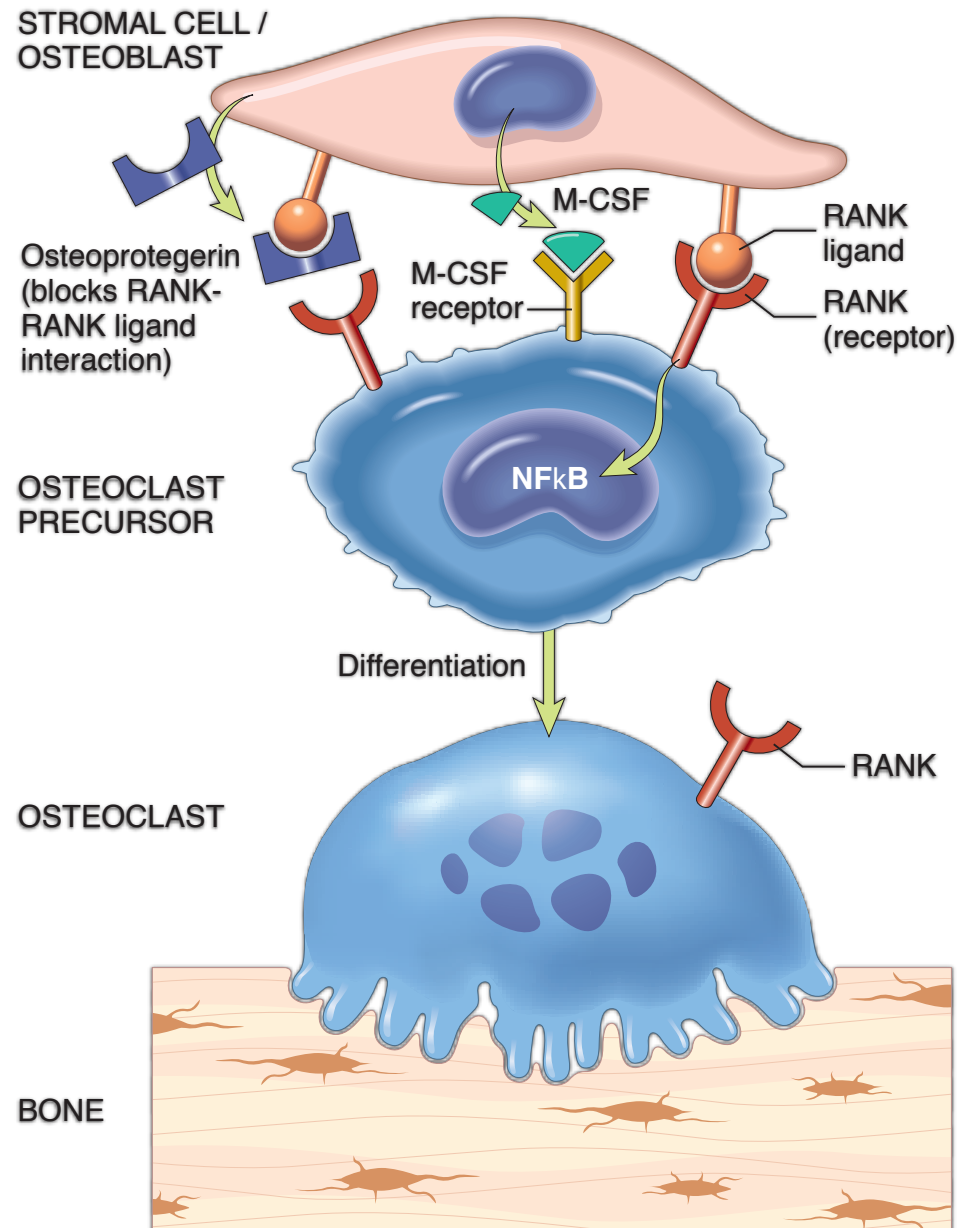


Osteoblast

Osteocyte

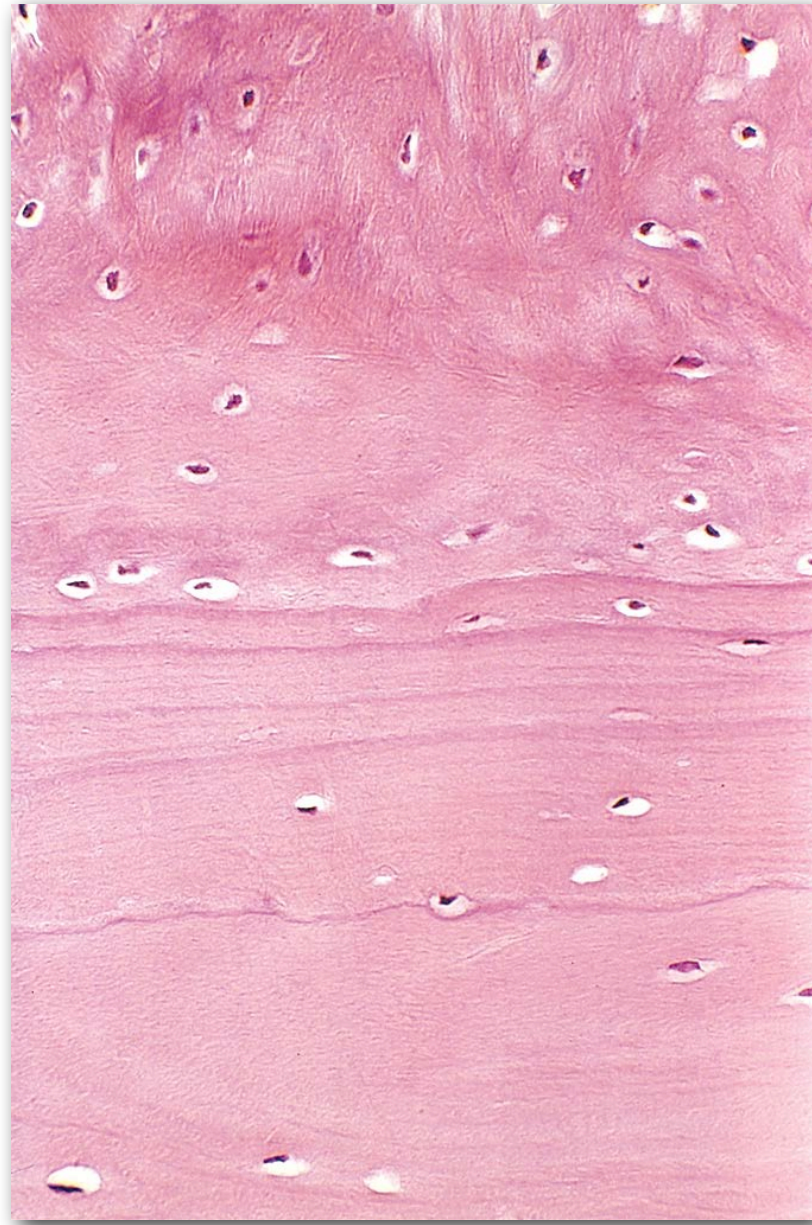
Osteoclast

# Bone Cell Interaction



Woven (immature) —  
bone

Lamellar (mature) —  
bone





# Spongy Bone (Trabecular Bone)

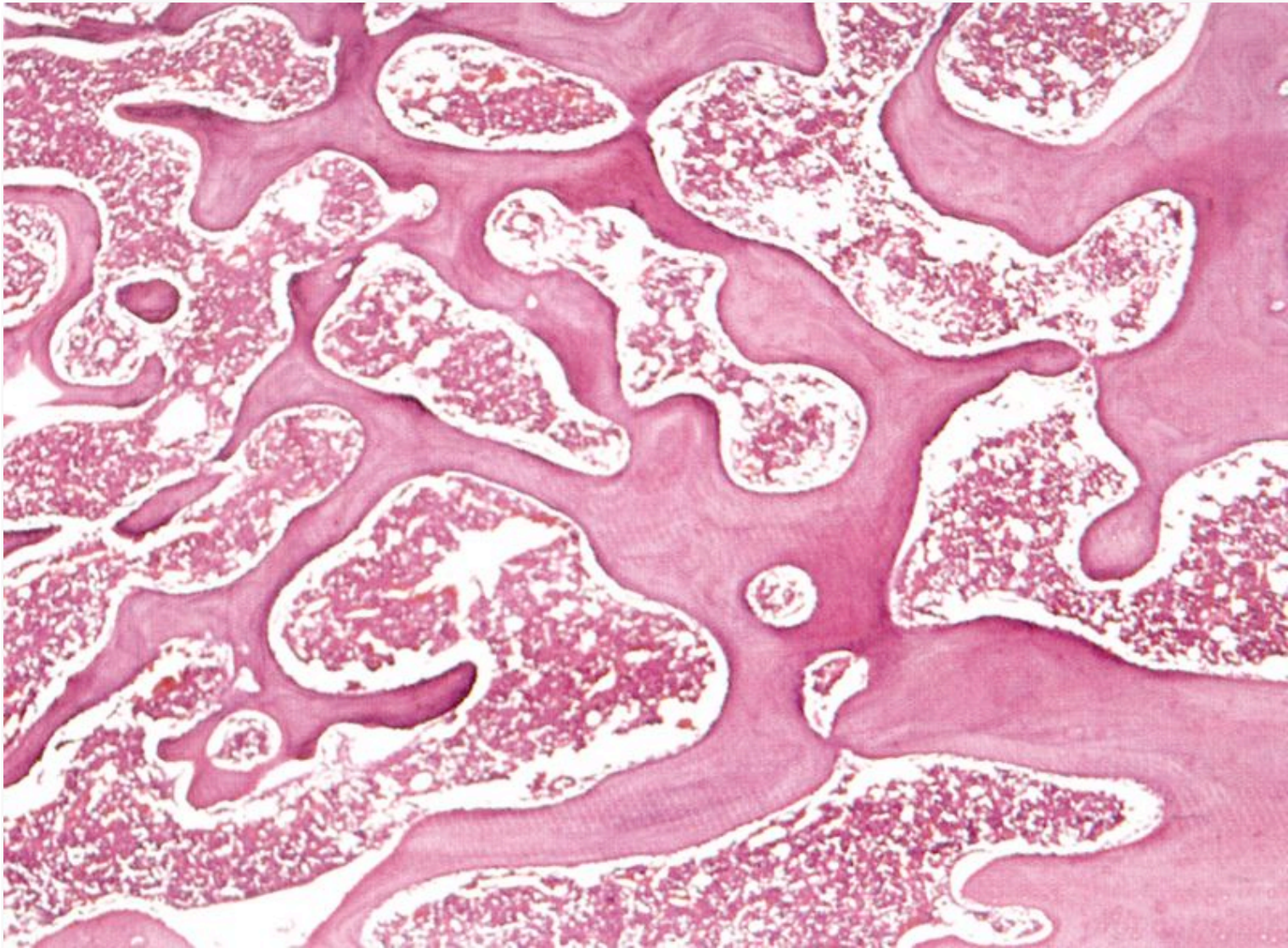
Provides resilience





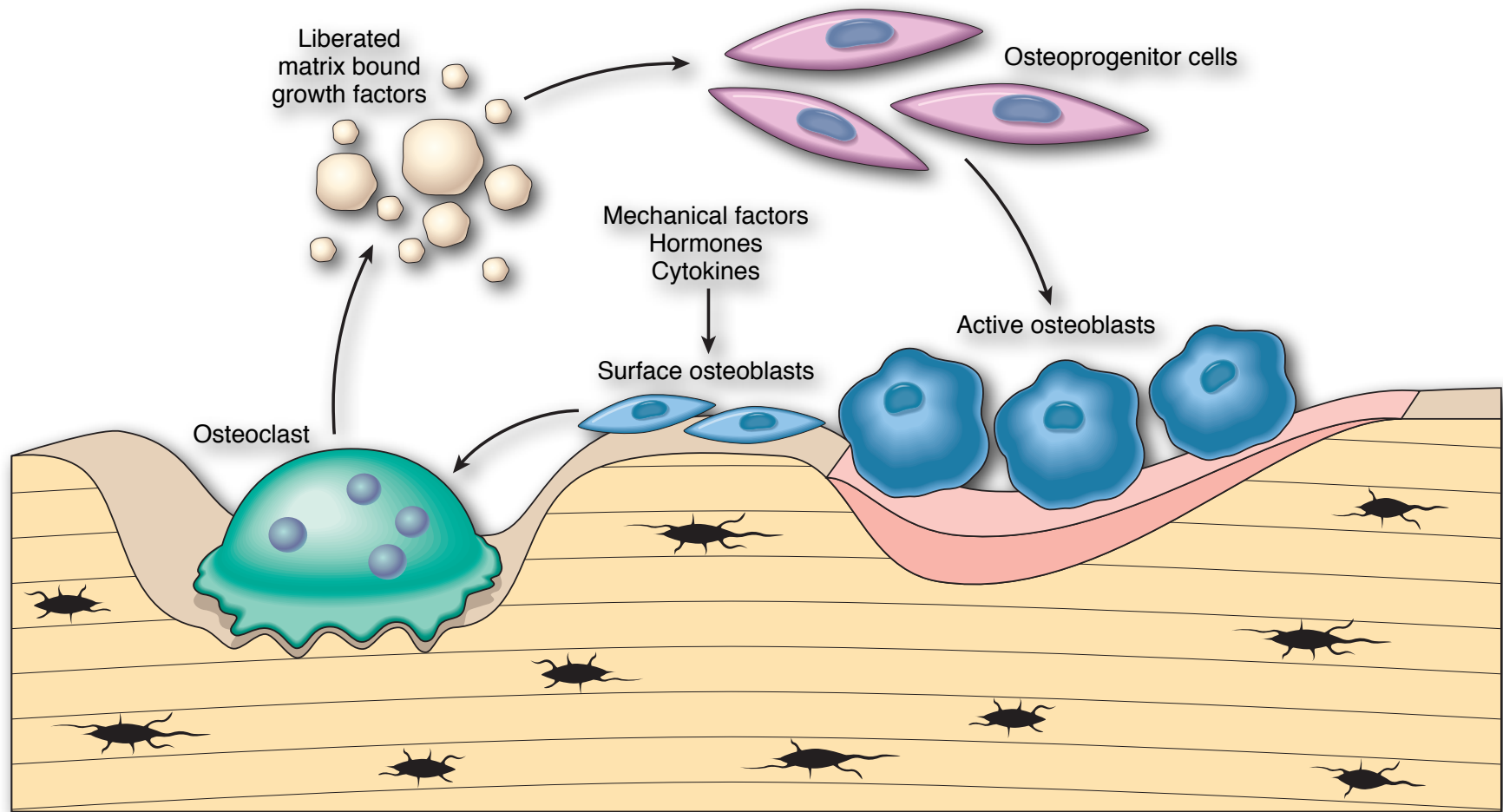


# Spongy (trabecular) Bone





# Bone Remodeling

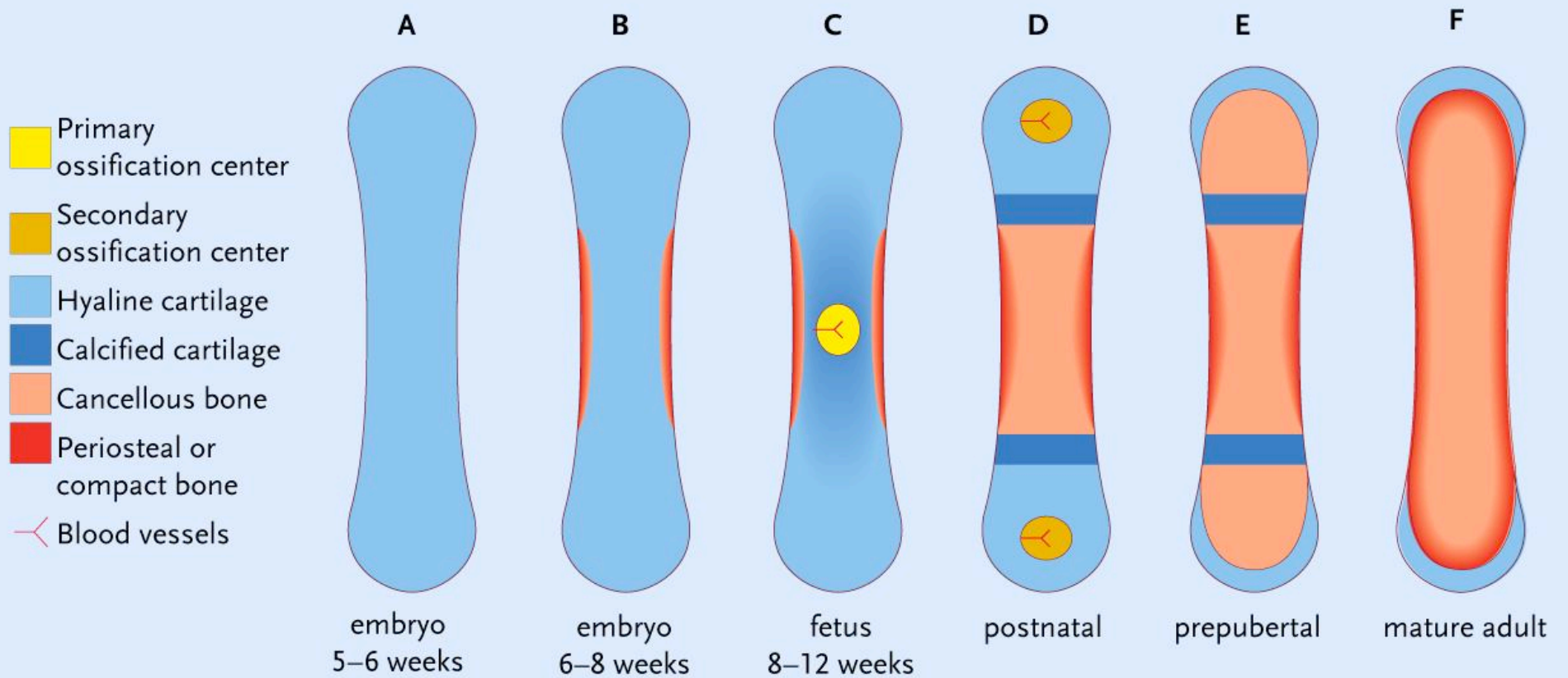


# Bone Formation and Growth

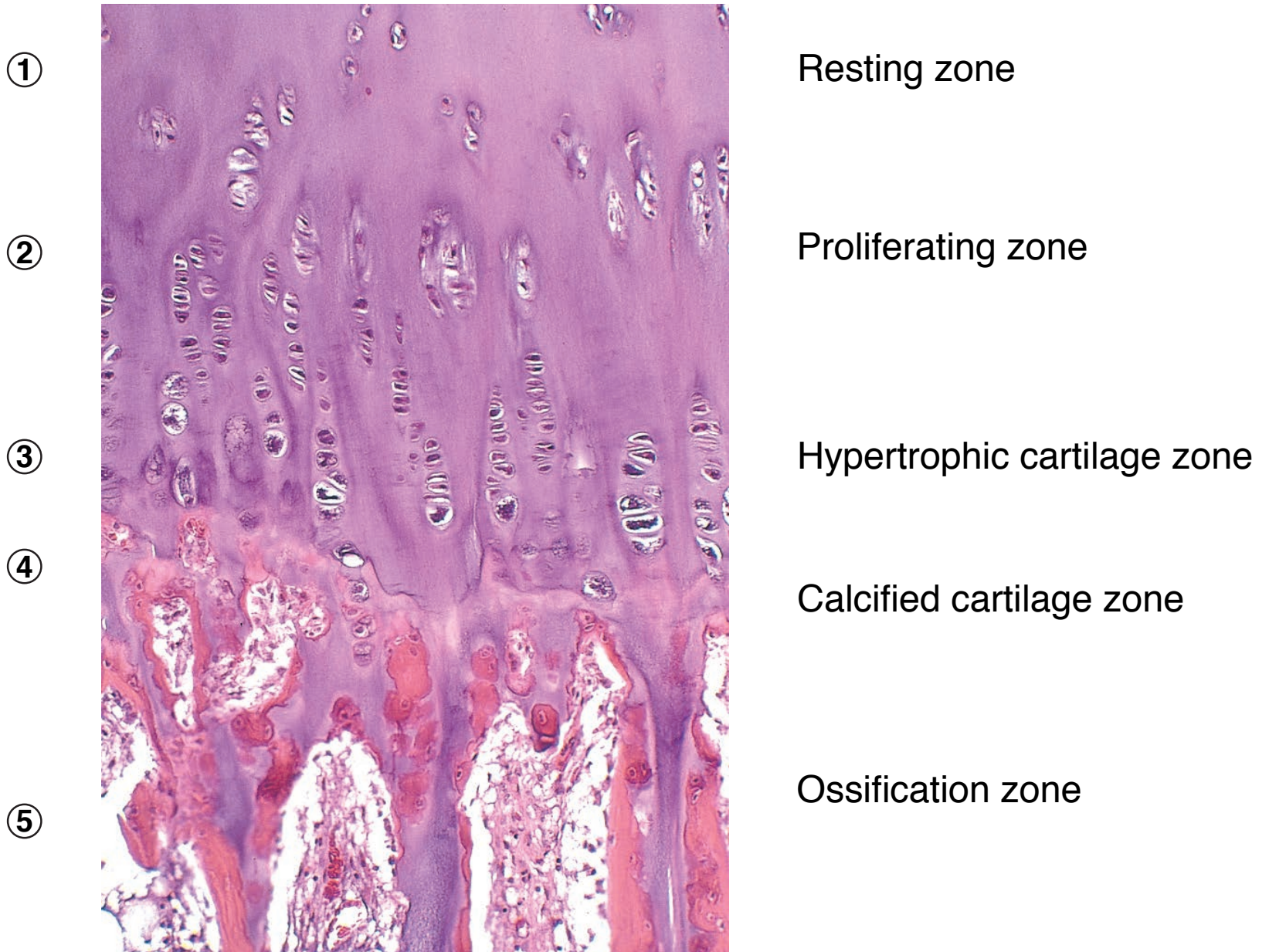
- Plate bones such as the calvarium of the skull are made by intramembranous (appositional) bone formation
- Long bones increase in width by intramembranous (appositional) bone formation
- Long bones increase in length by endochondral bone formation



# Endochondral Ossification



# Enchondral Bone Formation



# Bone and Joint Diseases

- Bone

- Developmental conditions
- Post-traumatic lesions
- Metabolic diseases
- Infectious diseases
- Cysts
- Benign and malignant tumors



# Developmental Conditions

# Achondrodyplasia



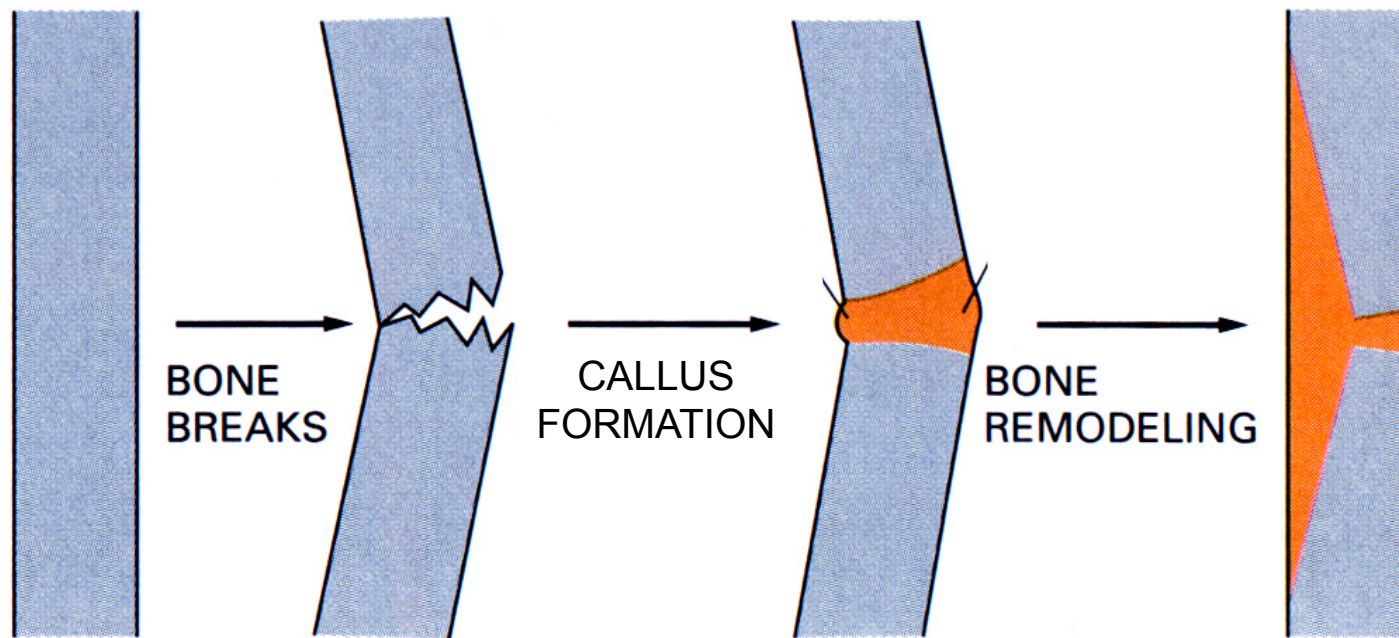
# Osteogenic Imperfecta



# Post-Traumatic Lesions



# Bone remodeling is an essential aspect of bone repair



# Fracture Repair



Recent



6 weeks later

# Healing Fracture

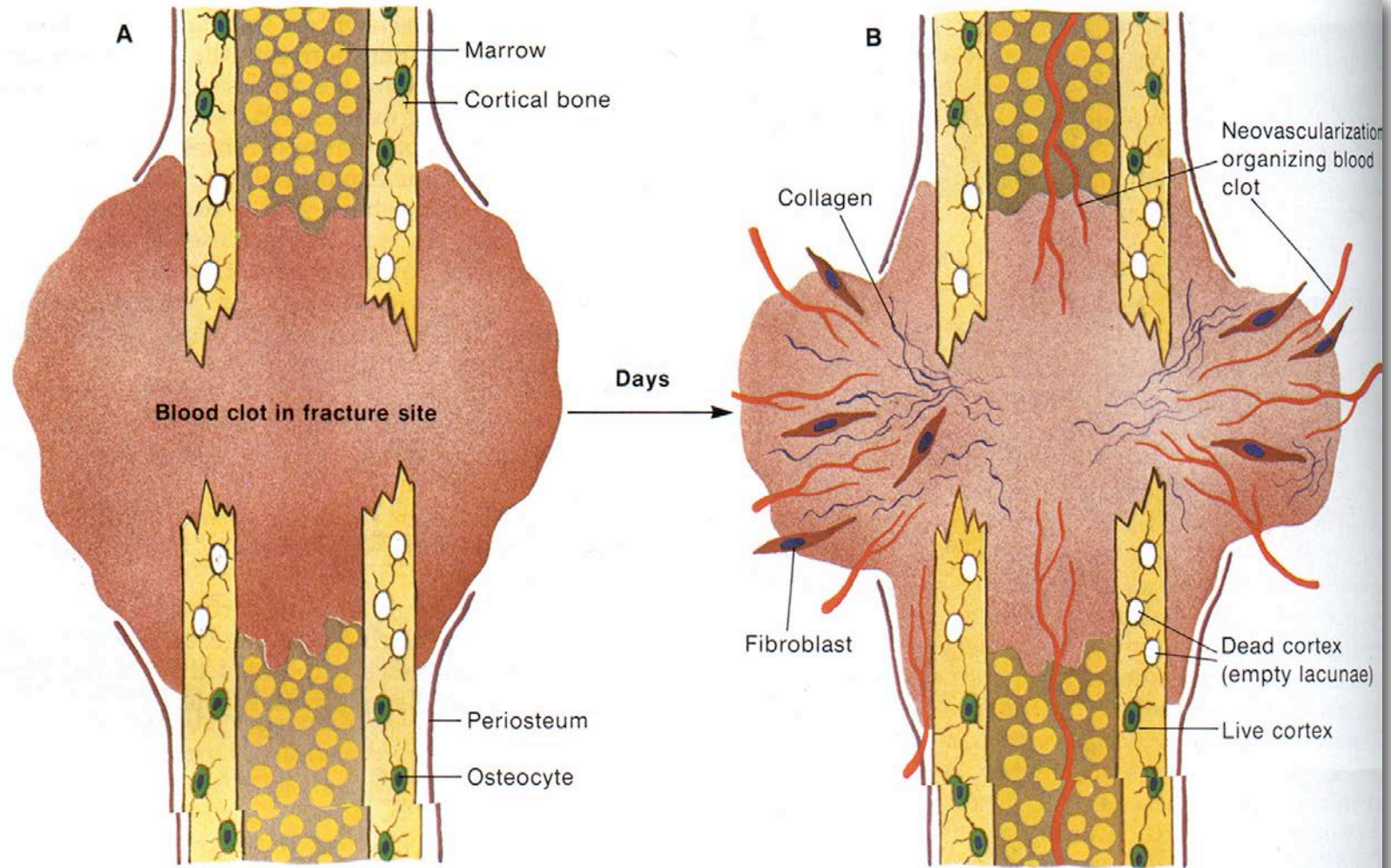


FIGURE 26-15

Healing of a fracture. (A) Soon after a fracture is sustained, an extensive blood clot forms in the subperiosteal and soft tissue, as well as in the marrow cavity. The bone at the fracture site is jagged. (B) The inflammatory phase of fracture healing is characterized by neovascularization and beginning organization of the blood clot. Because the osteocytes in the fracture site are dead, the lacunae are empty. The osteocytes of the cortex are necrotic well beyond the fracture site, owing to the traumatic interruption of the perforating arteries from the periosteum.



# Healing Fracture

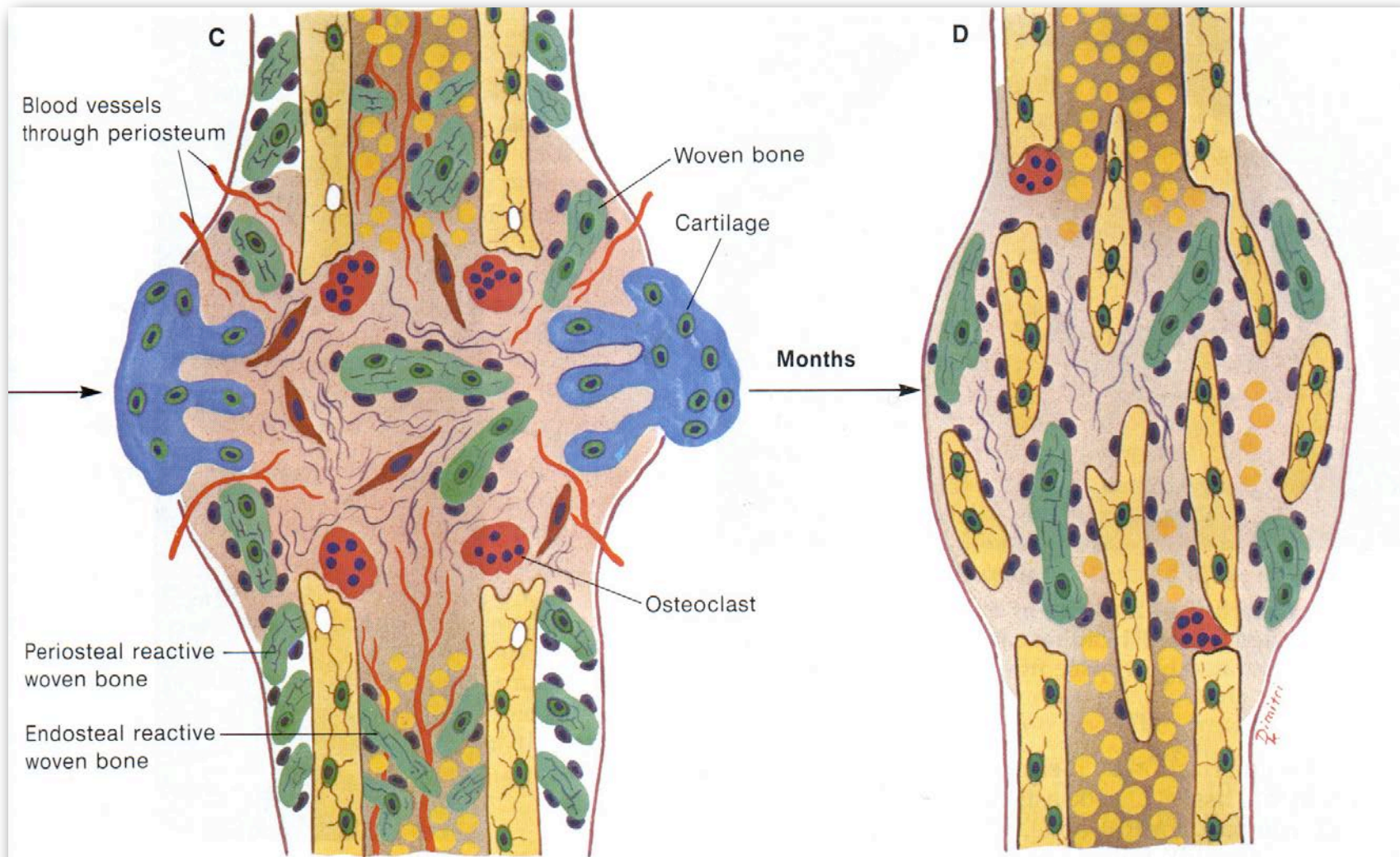
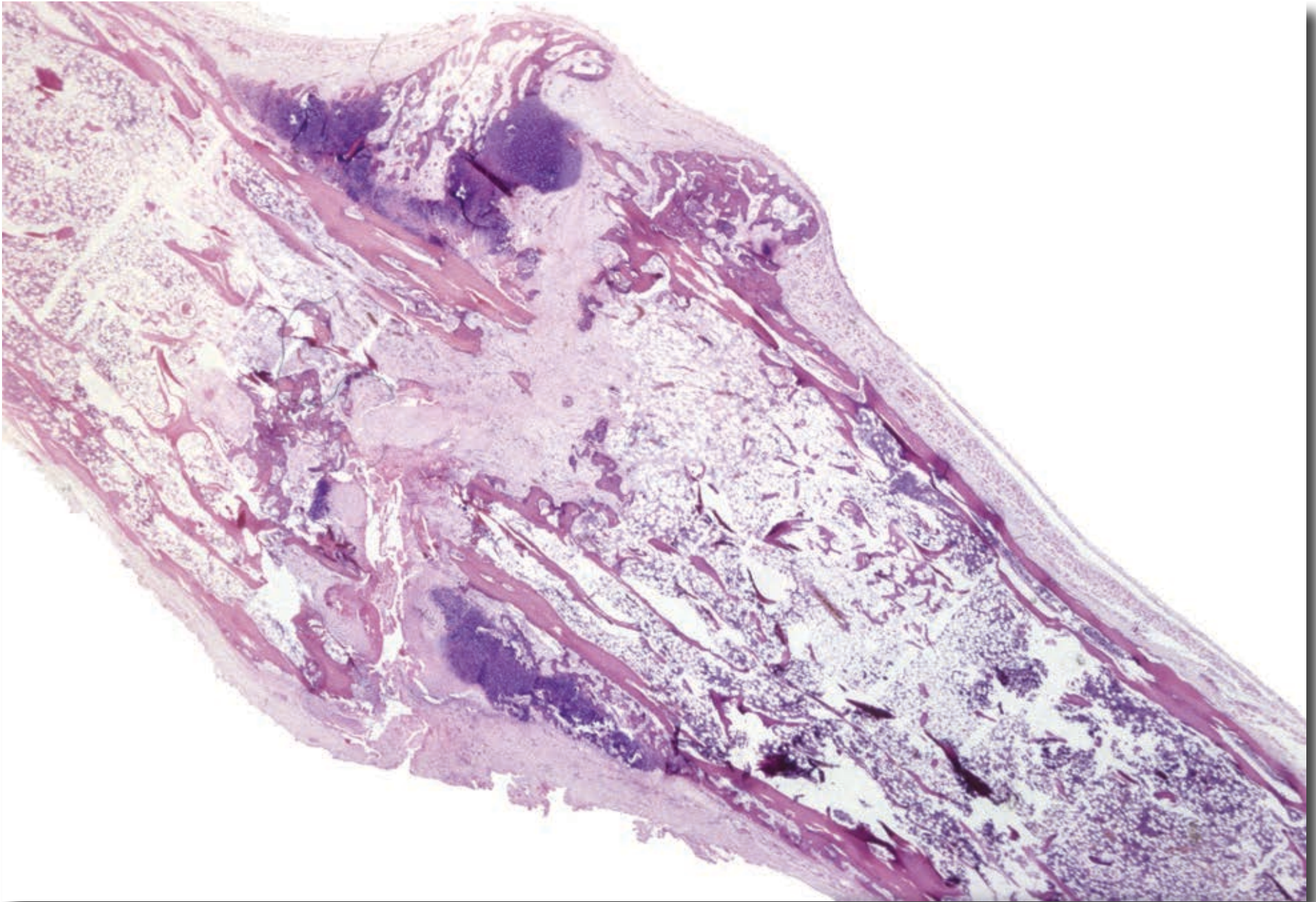


FIGURE 26-15 (continued).

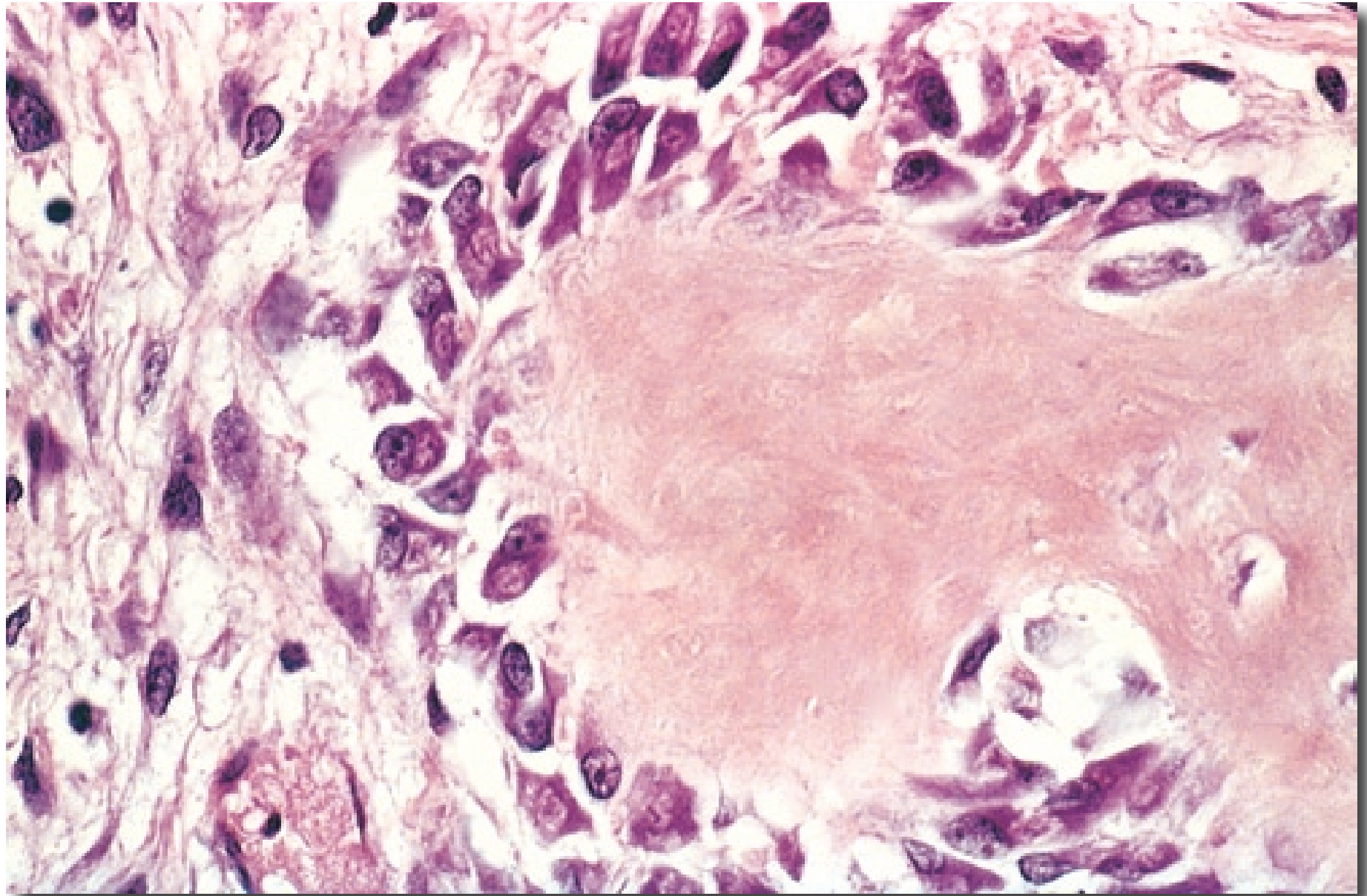
(C) The reparative phase of fracture healing is characterized by the formation of a callus of cartilage and woven bone near the fracture site. The jagged edges of the original cortex have been remodeled and eroded by osteoclasts. The marrow space has been revascularized and contains reactive woven bone, as does the periosteal area. (D) In the remodeling phase, during which the cortex is revitalized, the reactive bone may be lamellar or woven. The new bone is organized along stress lines and mechanical forces. Extensive osteoclastic and osteoblastic cellular activity is maintained.



# Healing Fracture

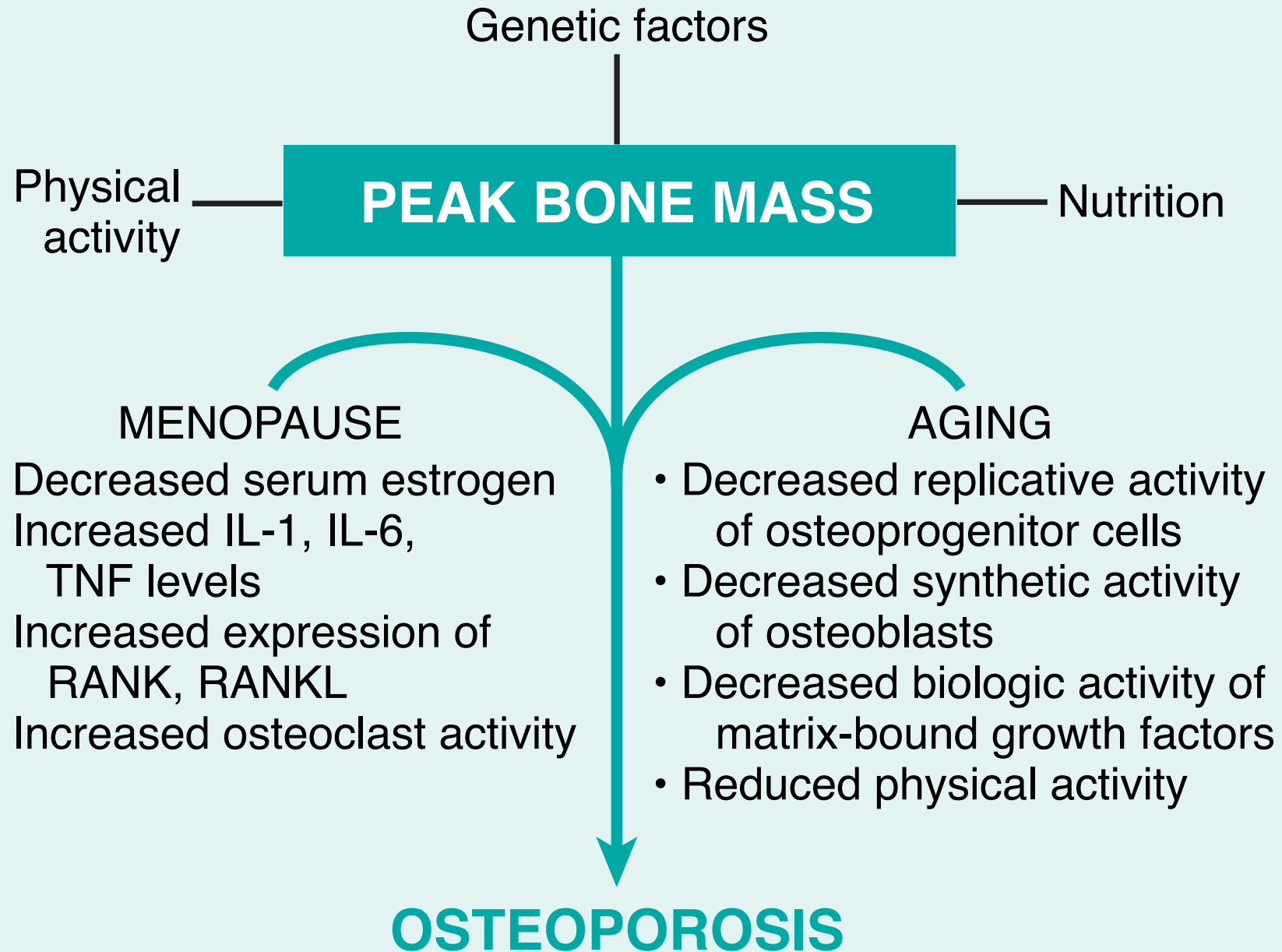


# Osteoid Formation



# Metabolic Bone Diseases





# Osteoporosis

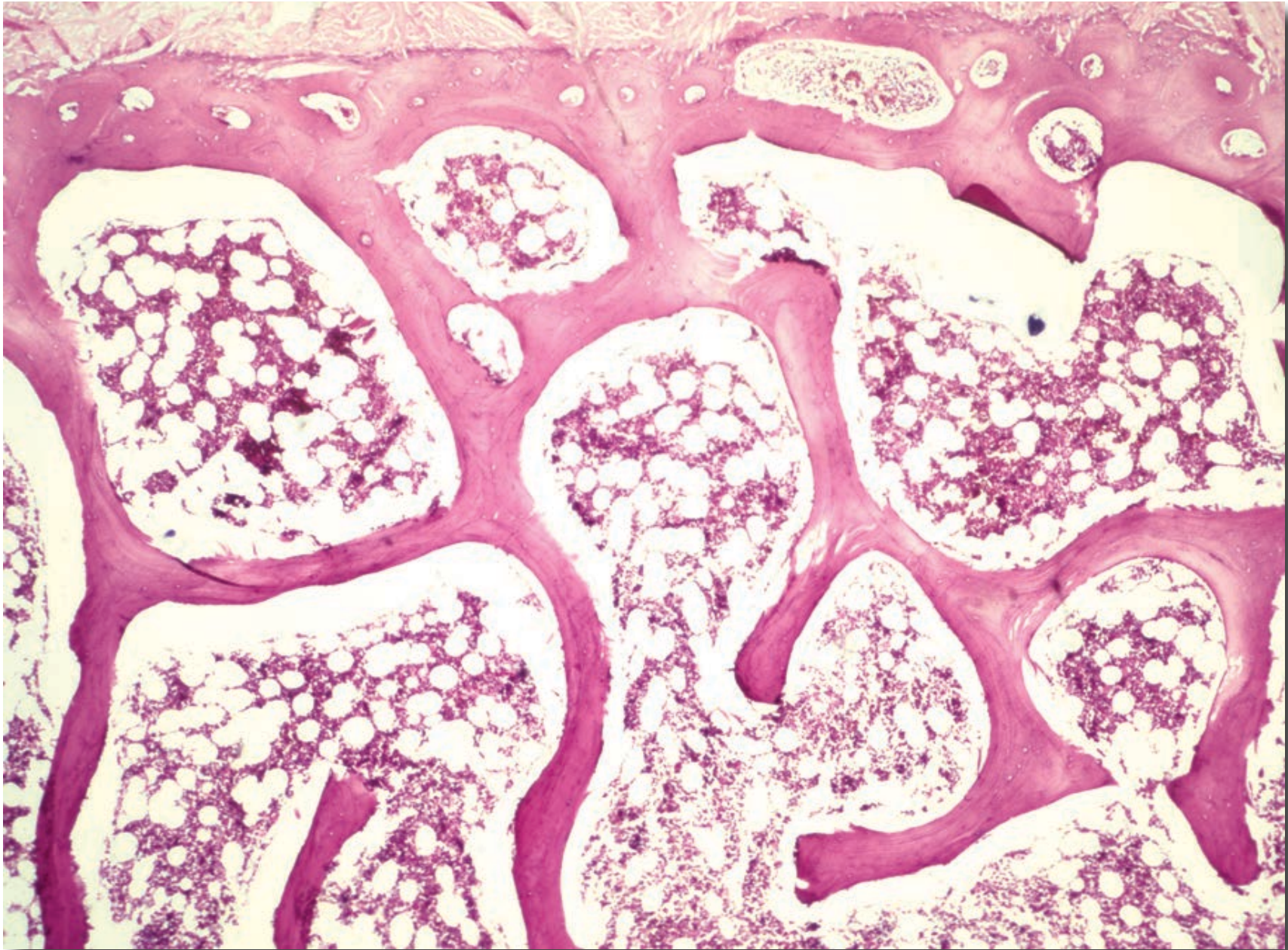


Normal Vertebral Body

Compression Fracture

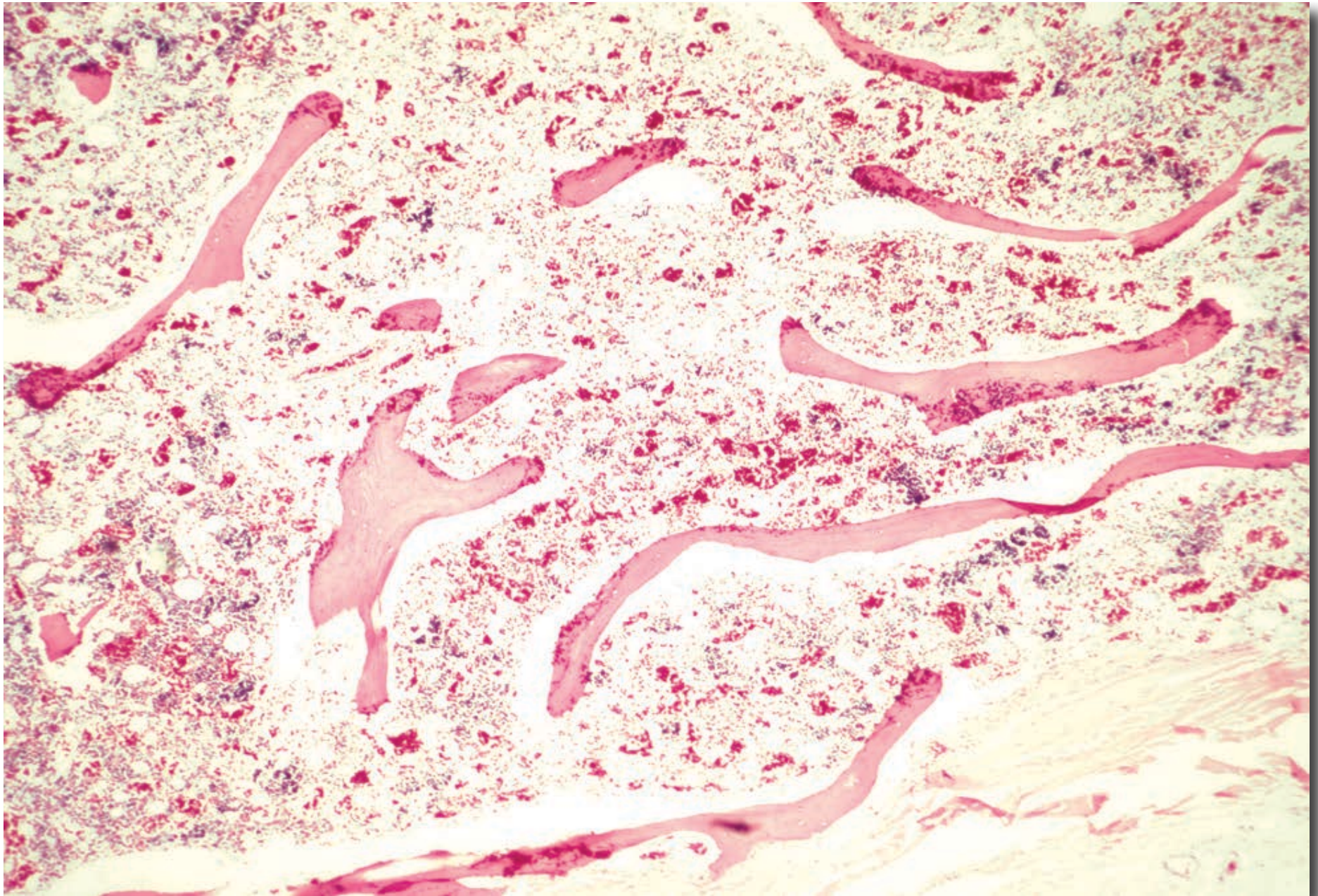


# Normal Bone



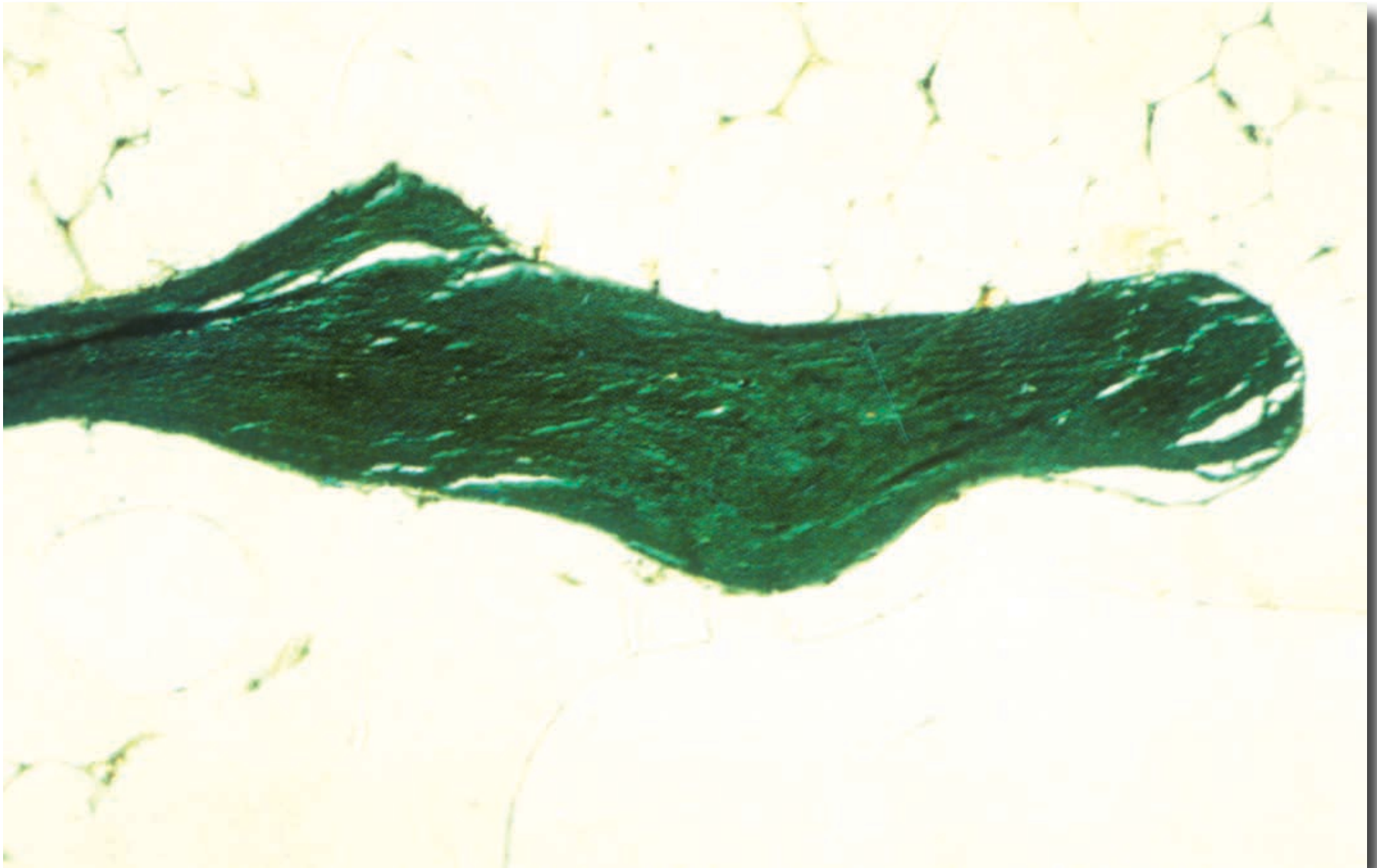


# Osteoporosis



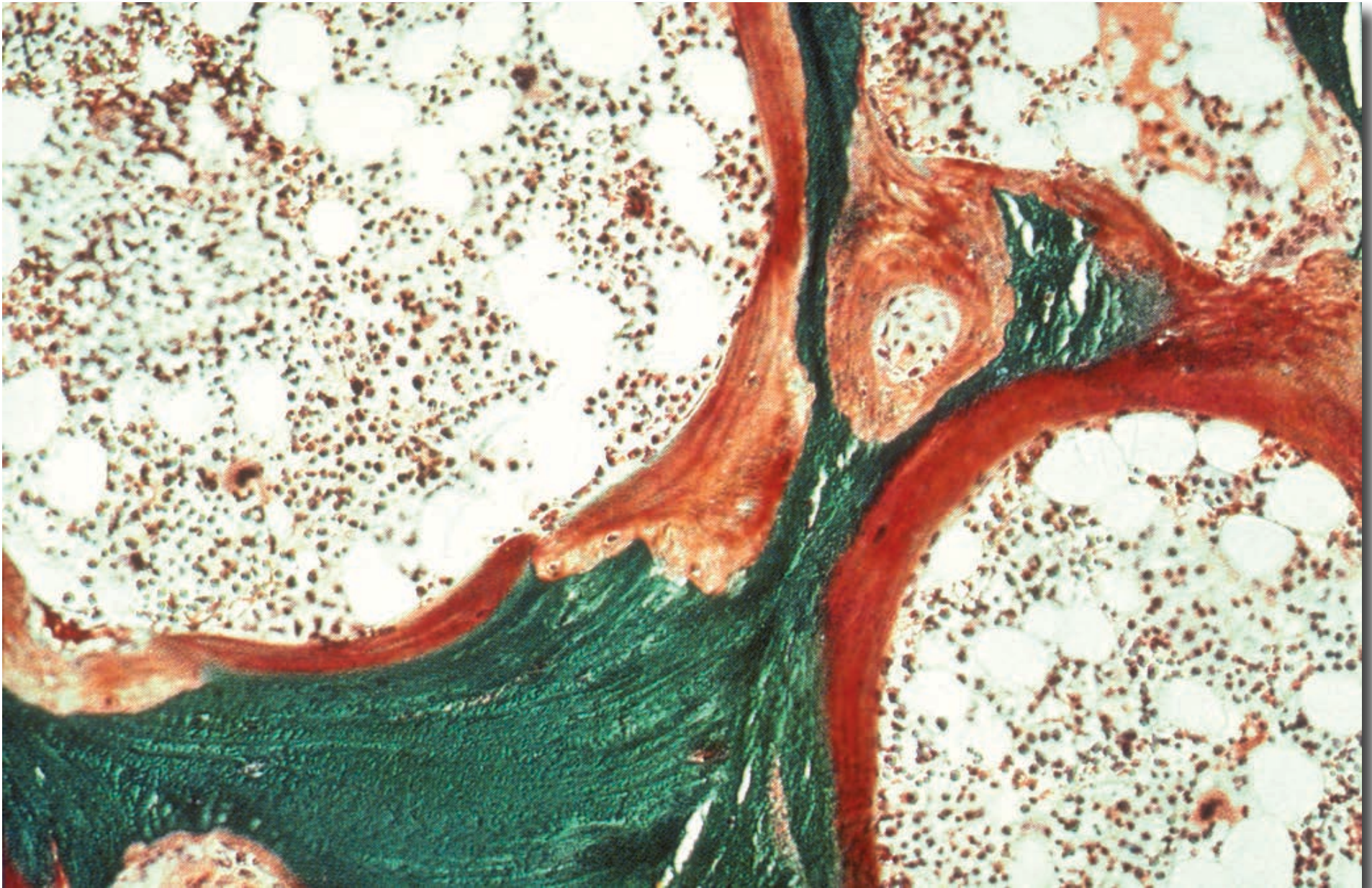


# Normal Bone



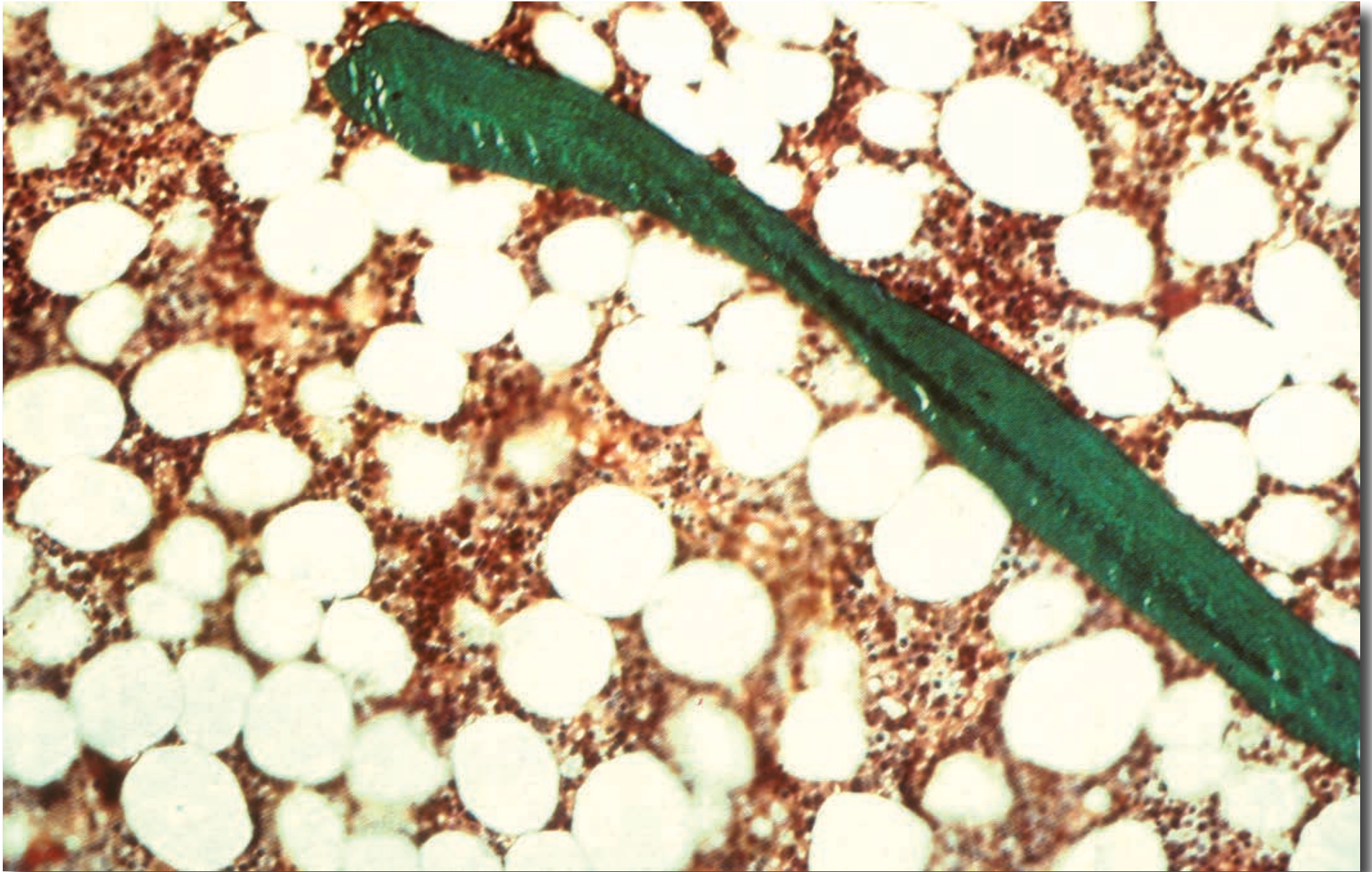


# Osteomalacia



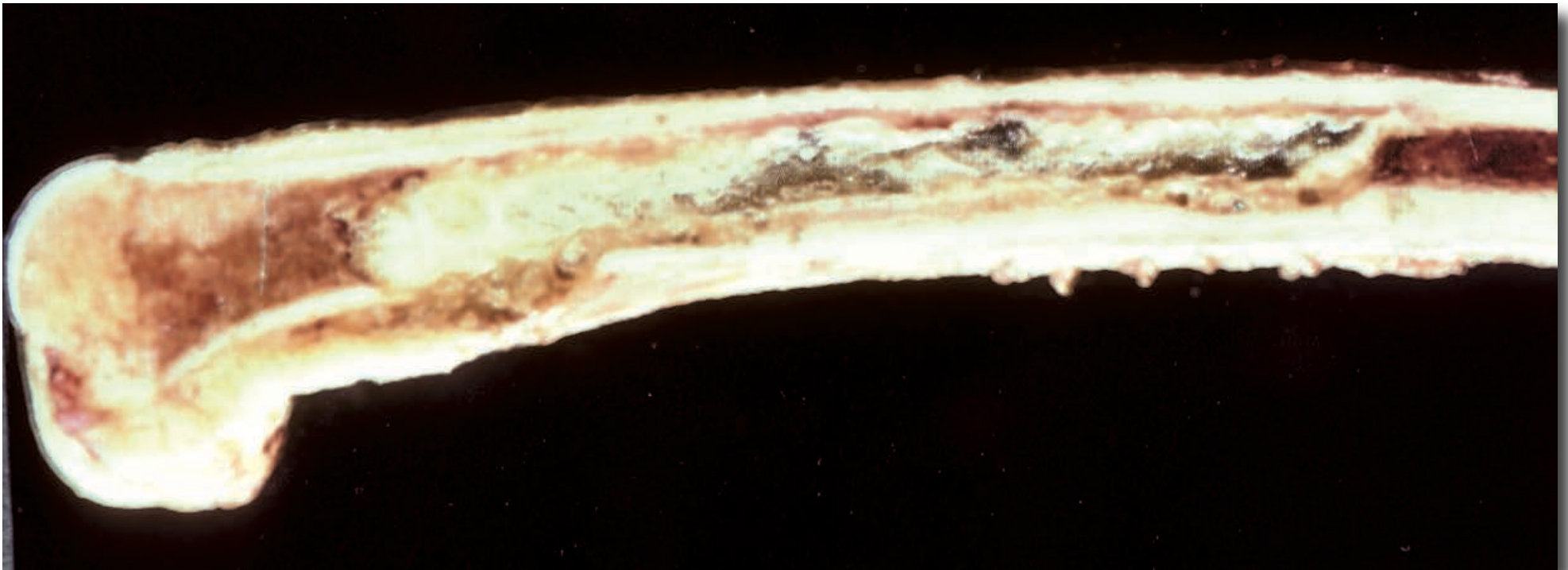


# Osteoporosis



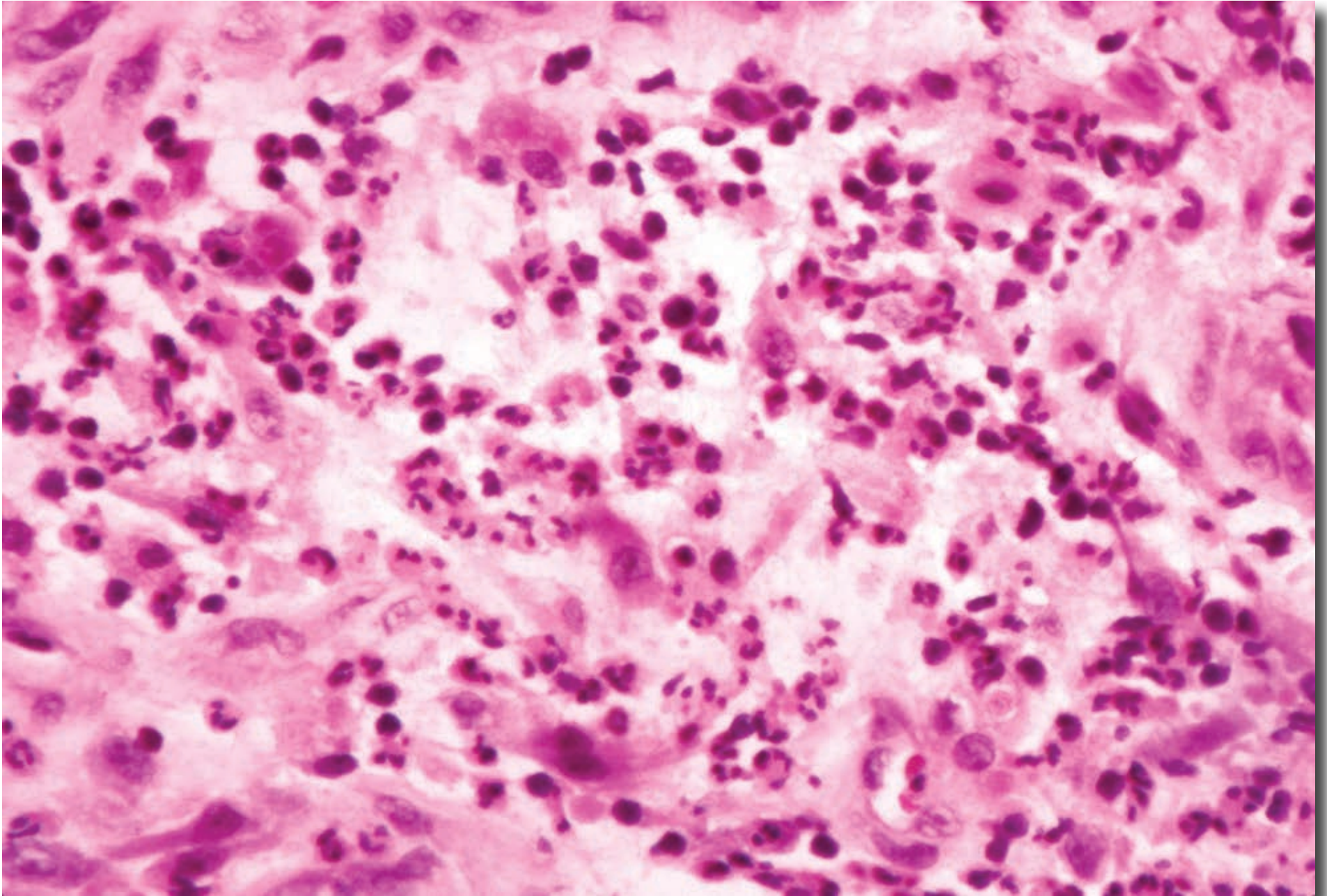
# Infectious Bone Diseases

## Acute Osteomyelitis



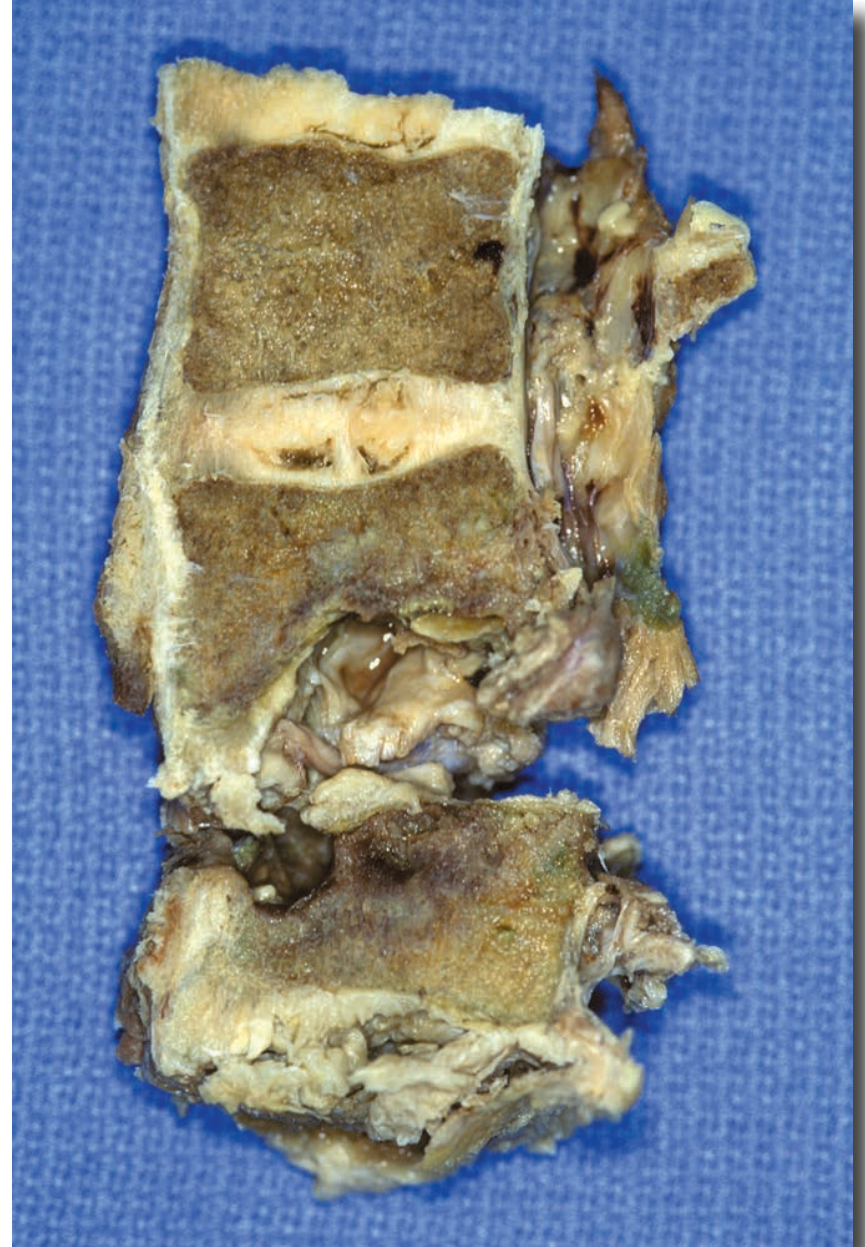
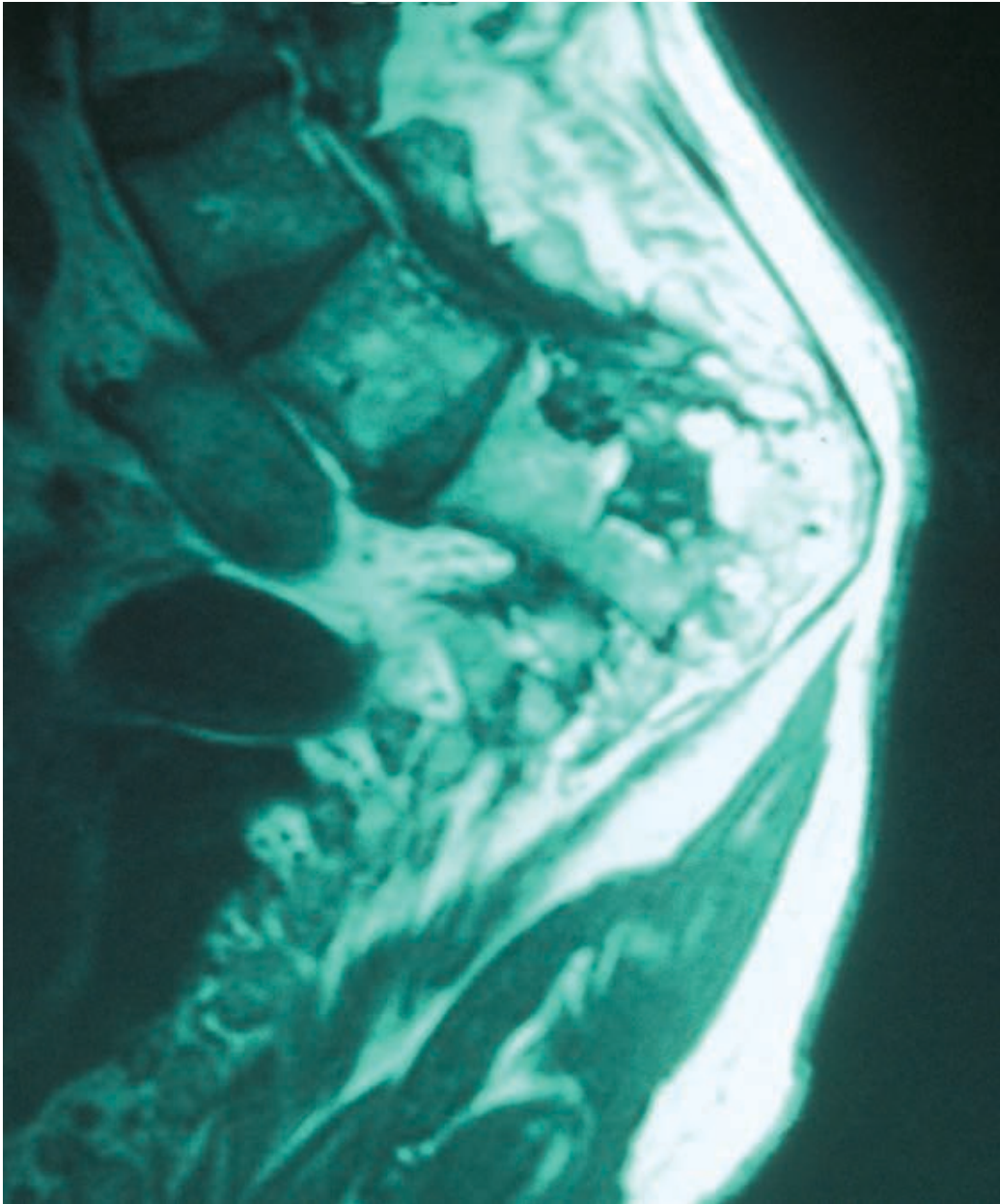


# Acute Osteomyelitis



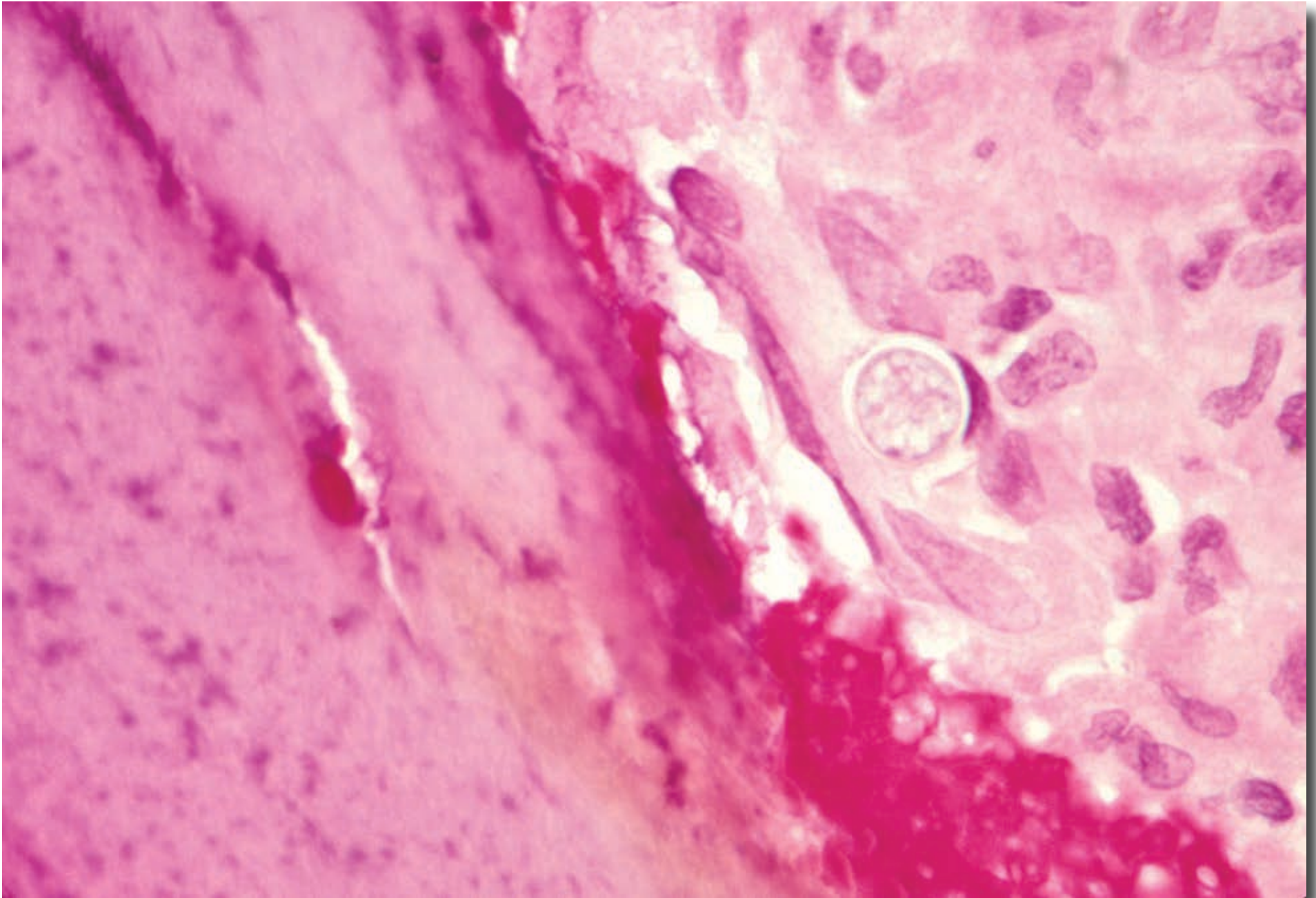


# Pott Disease (TB Osteomyelitis)





# Chronic Coccidioidomycosis of Bone





# Bone Tumors

# Bone Neoplasia

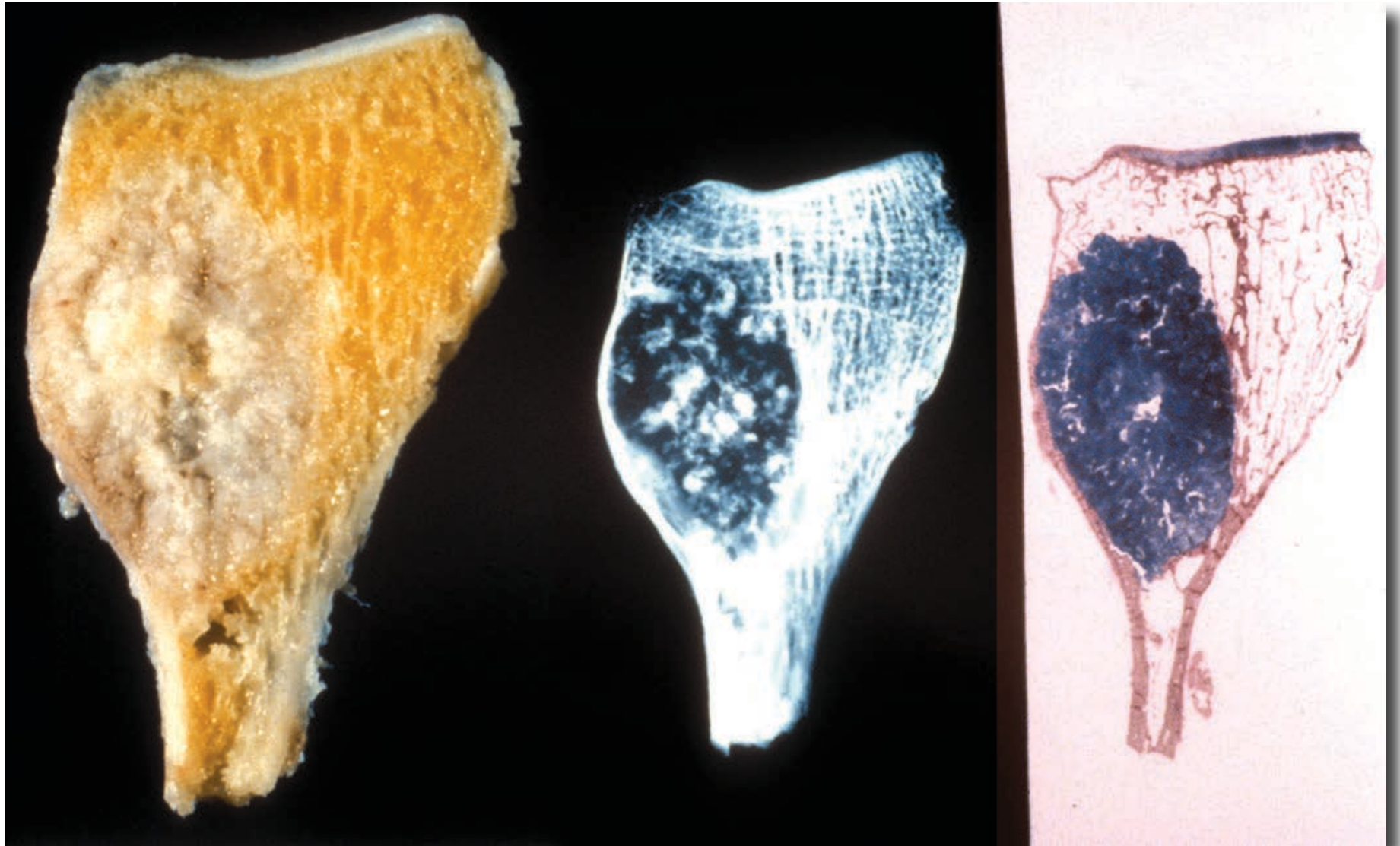
- Clinical history
- Bone involvement
  - Bone (e.g., femur)
  - Location of tumor in the affect bone (e.g., metaphysis)
- X-ray findings
- Biopsy

# Enchondroma

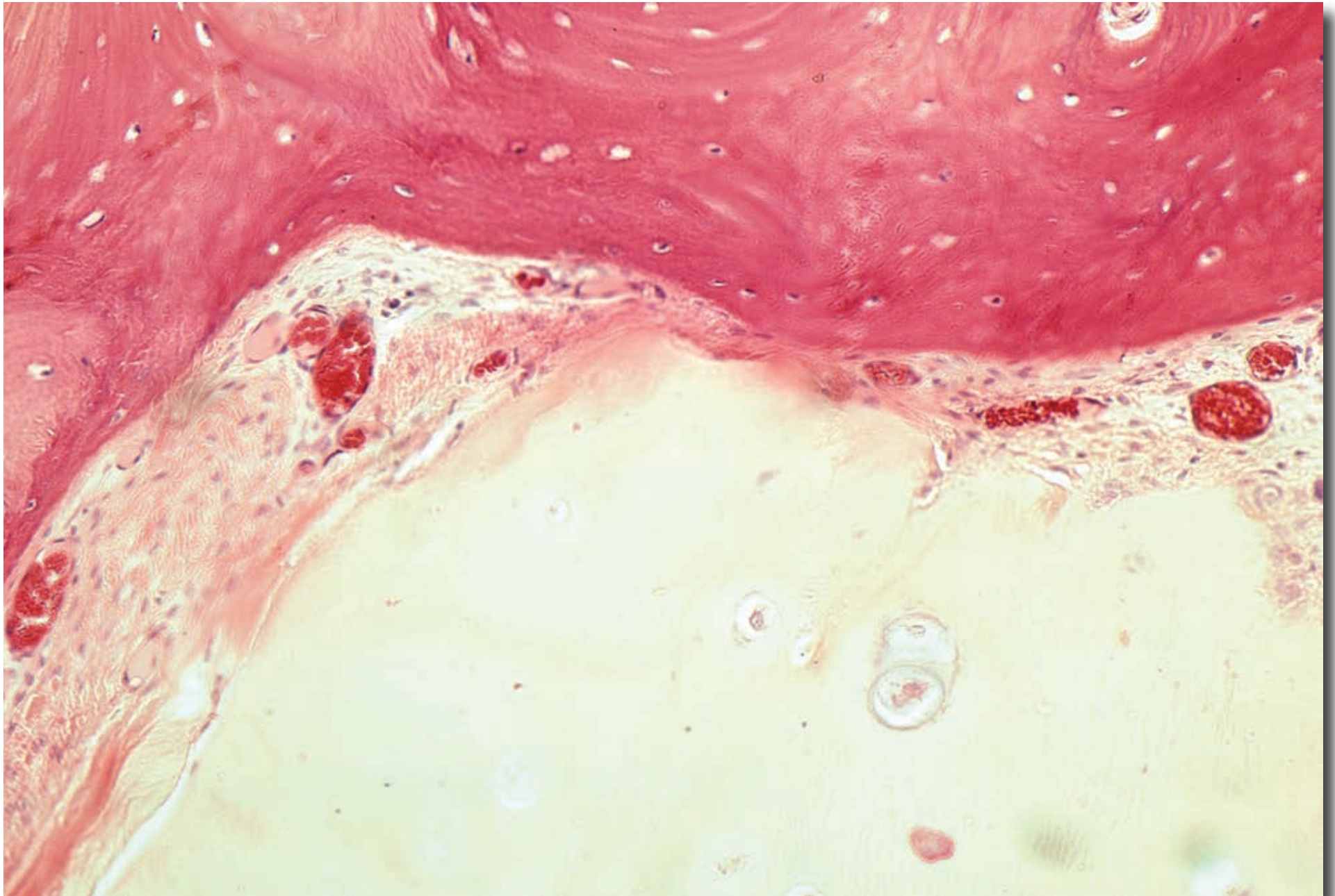




# Enchondroma



# Enchondroma



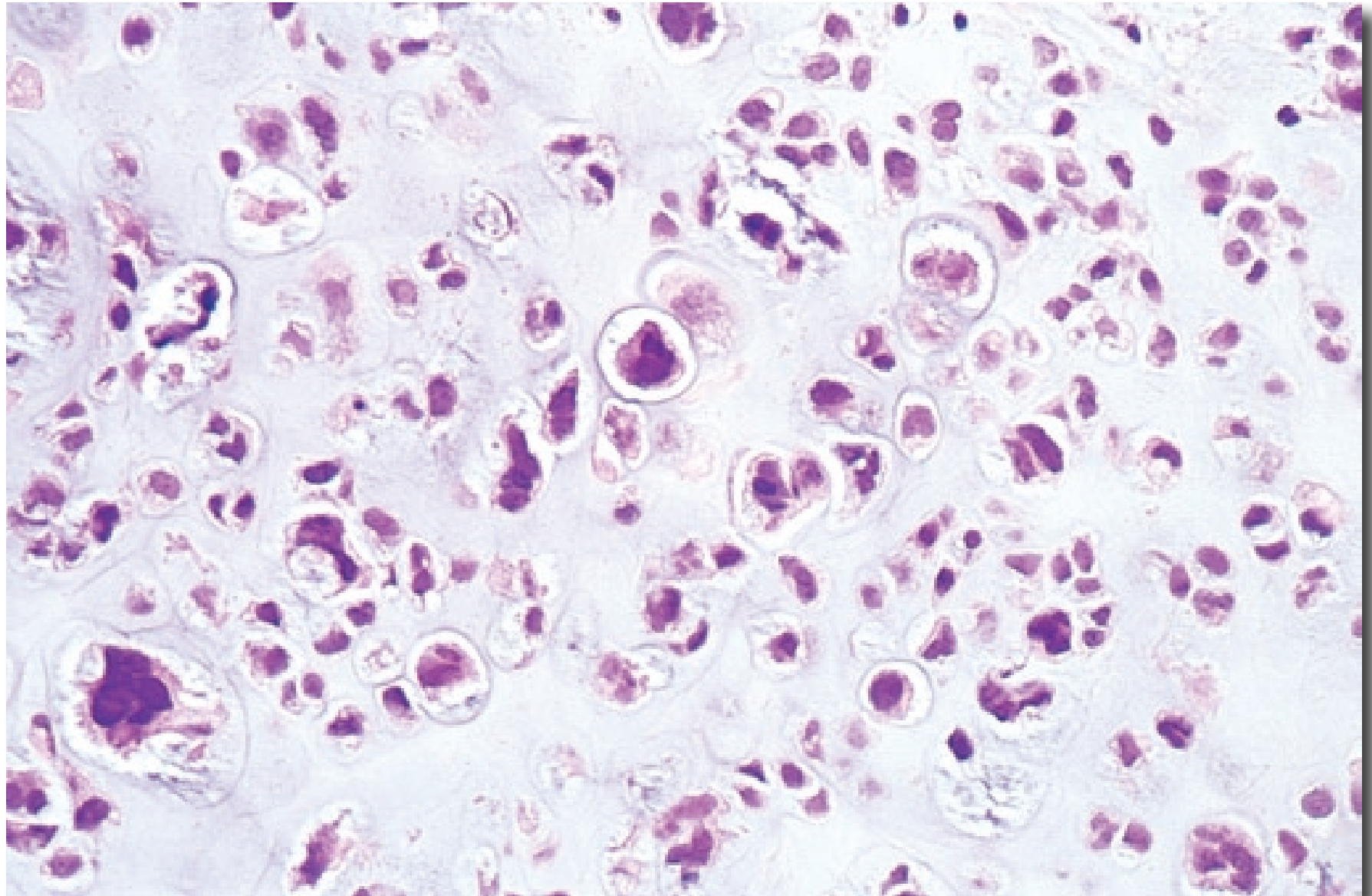


# Chondrosarcoma

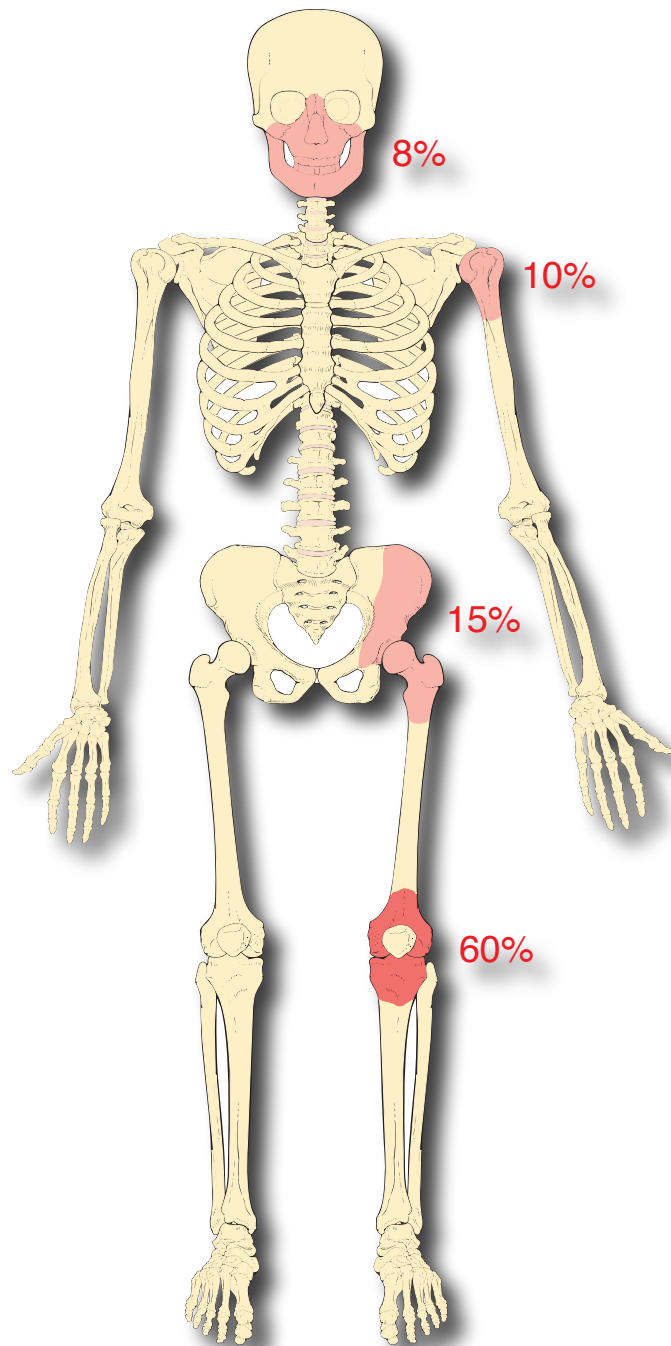




# Chondrosarcoma

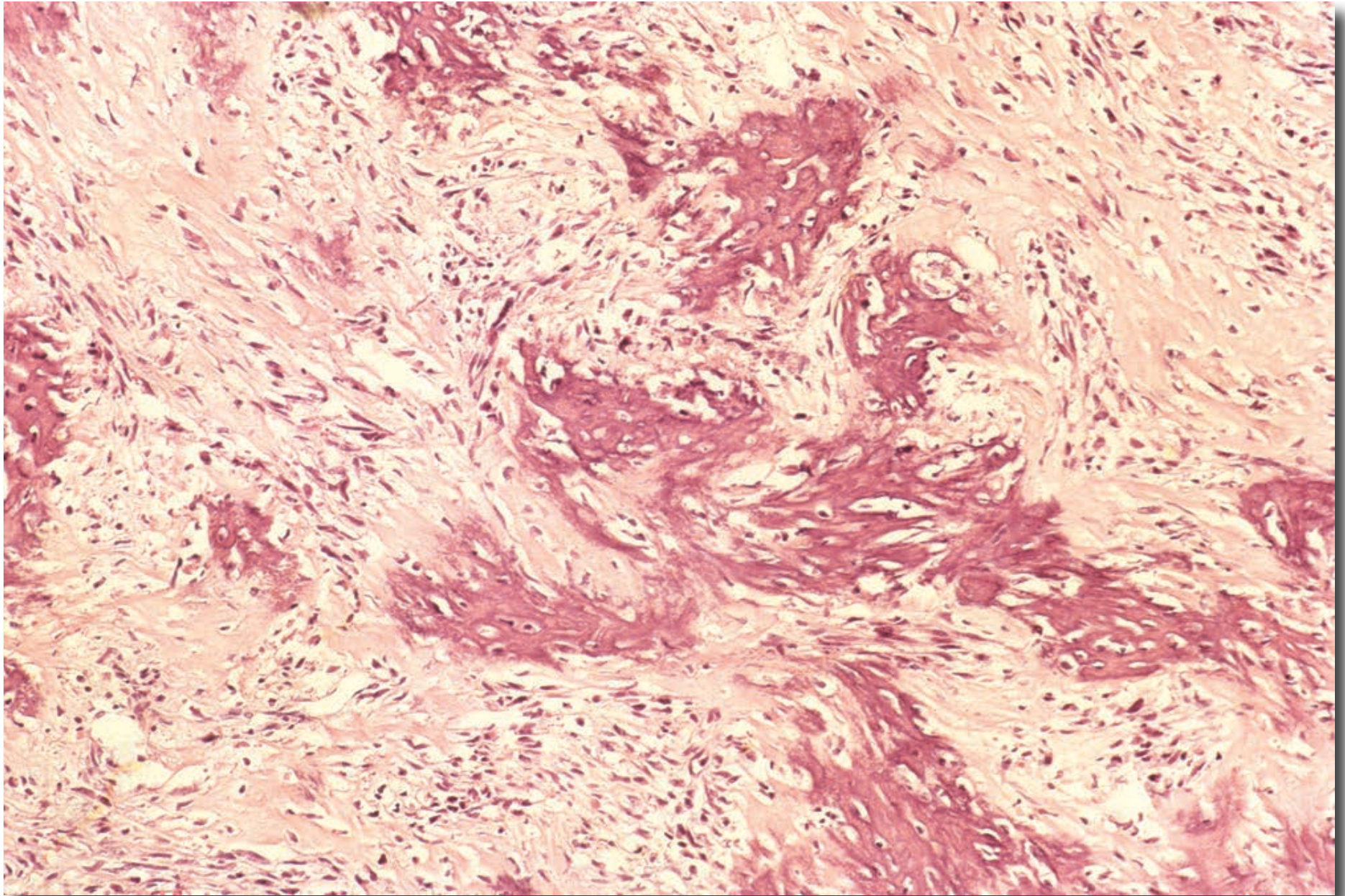


# Osteogenic Sarcoma





# Osteogenic Sarcoma





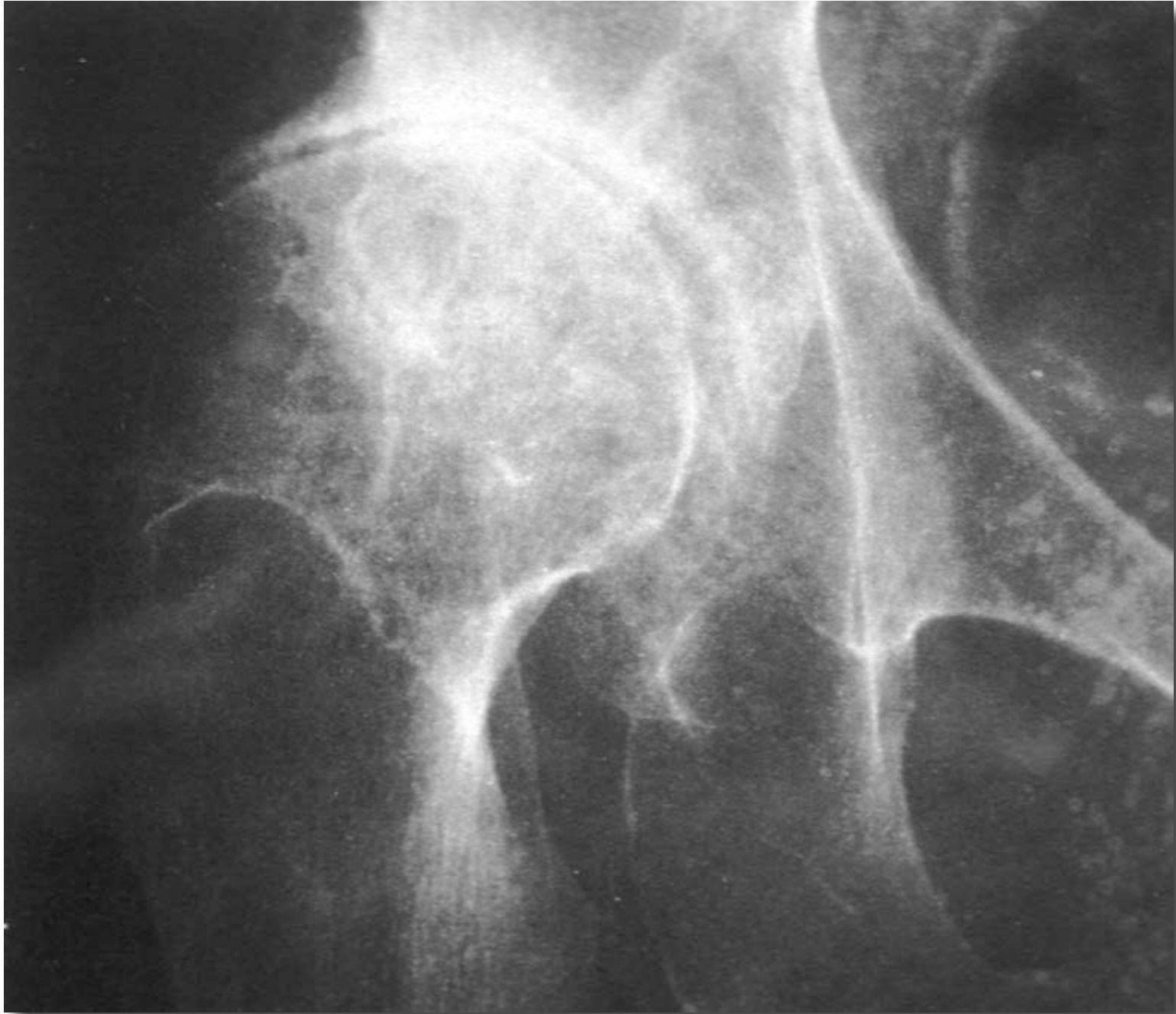
# Bone and Joint Diseases

- Joint

- Degenerative arthritis
- Rheumatoid arthritis
- Metabolic arthritis (e.g., gout)
- Infectious arthritis
- Proliferative/metabolic diseases
- Neoplasms

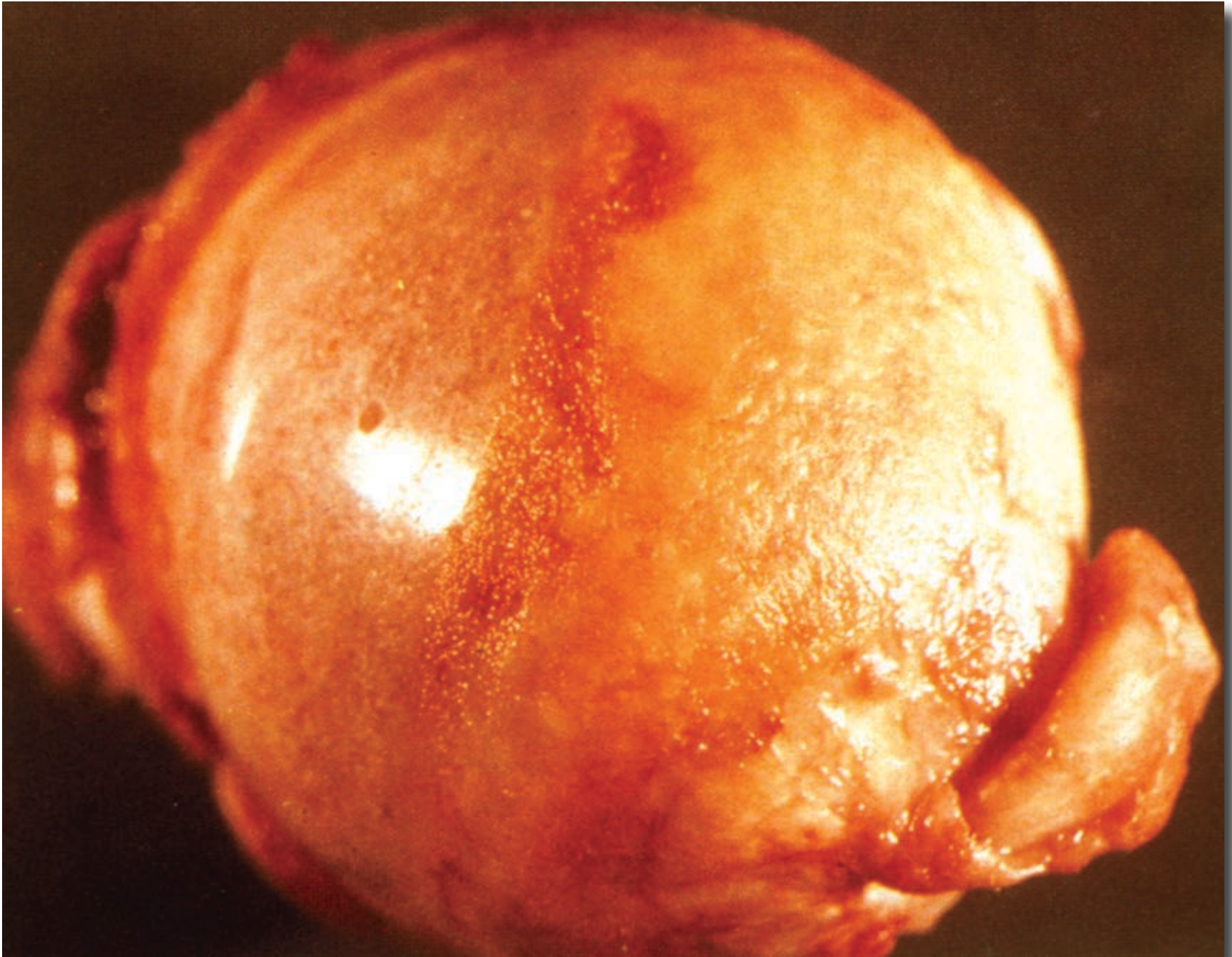
# Degenerative Joint Disease

# Degenerative Joint Disease

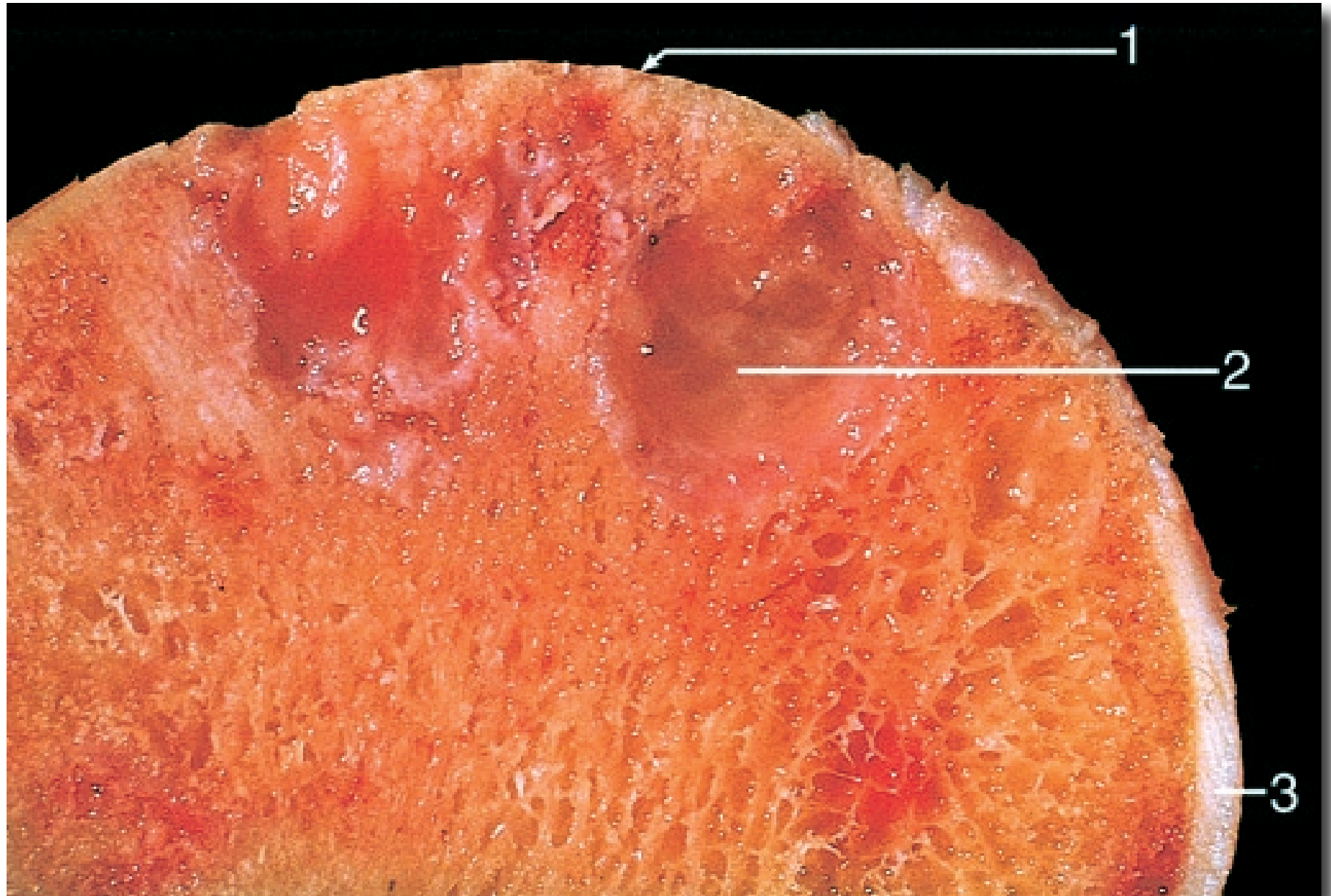




# Degenerative Joint Disease

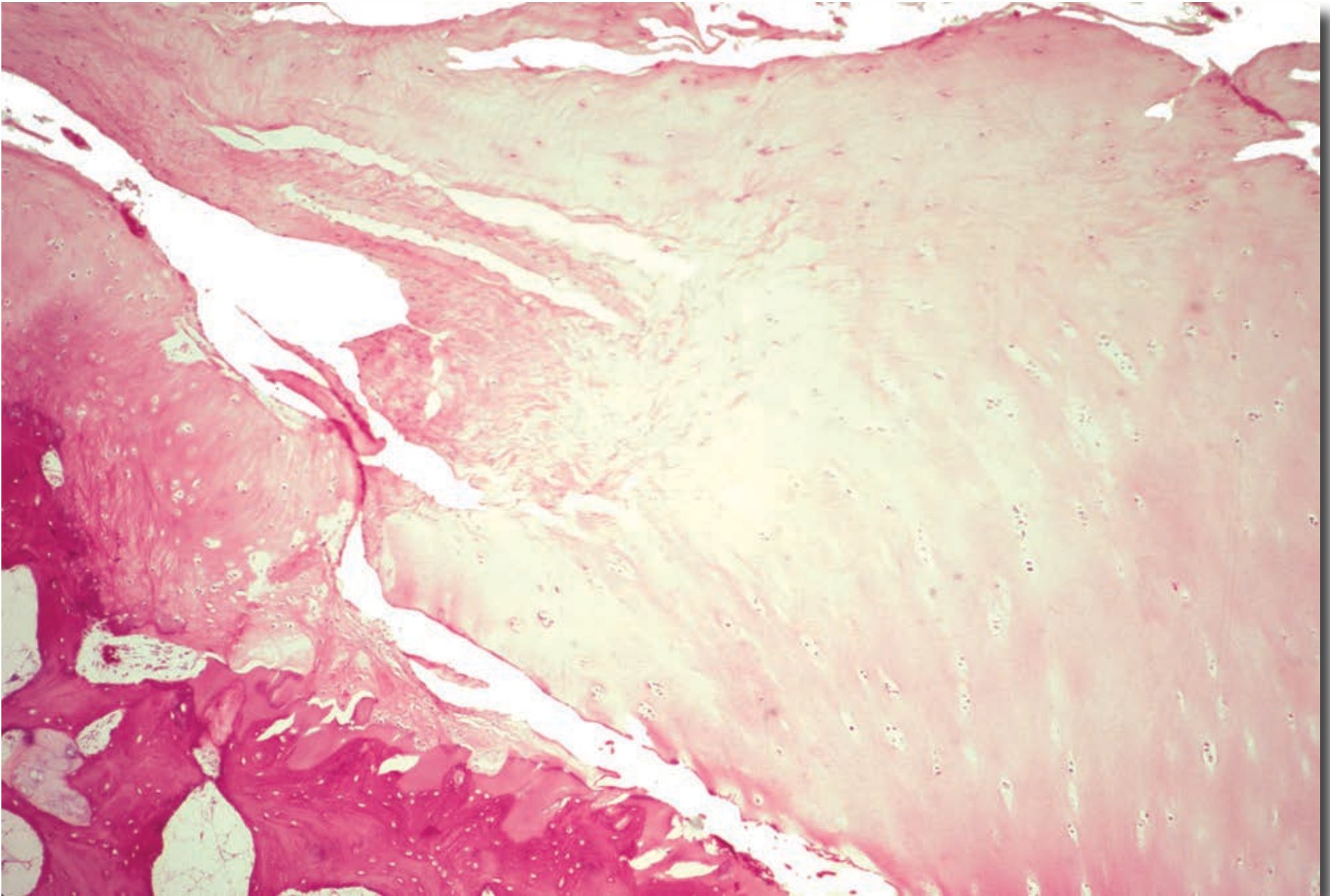


# Degenerative Joint Disease



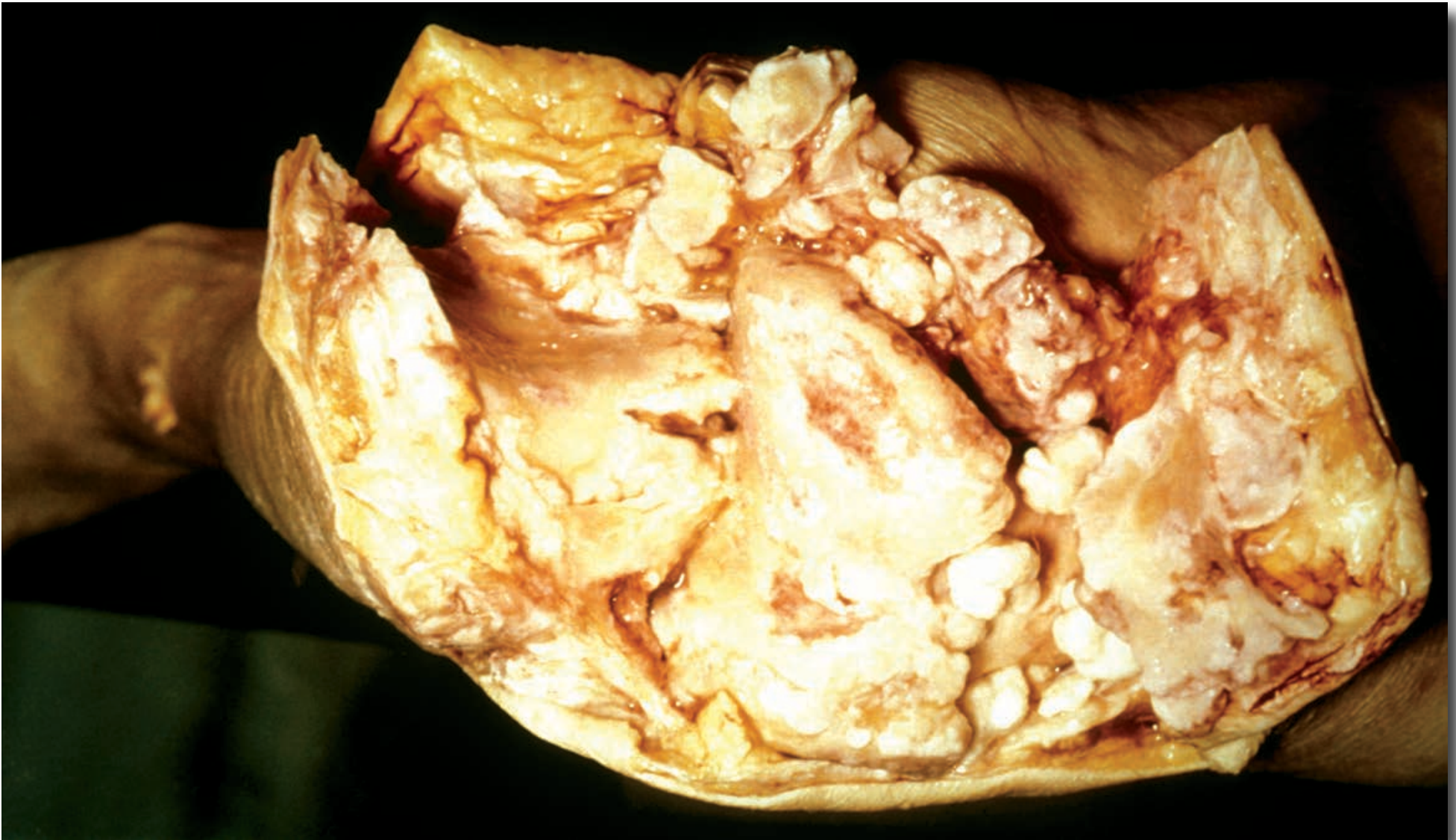


# Degenerative Joint Disease





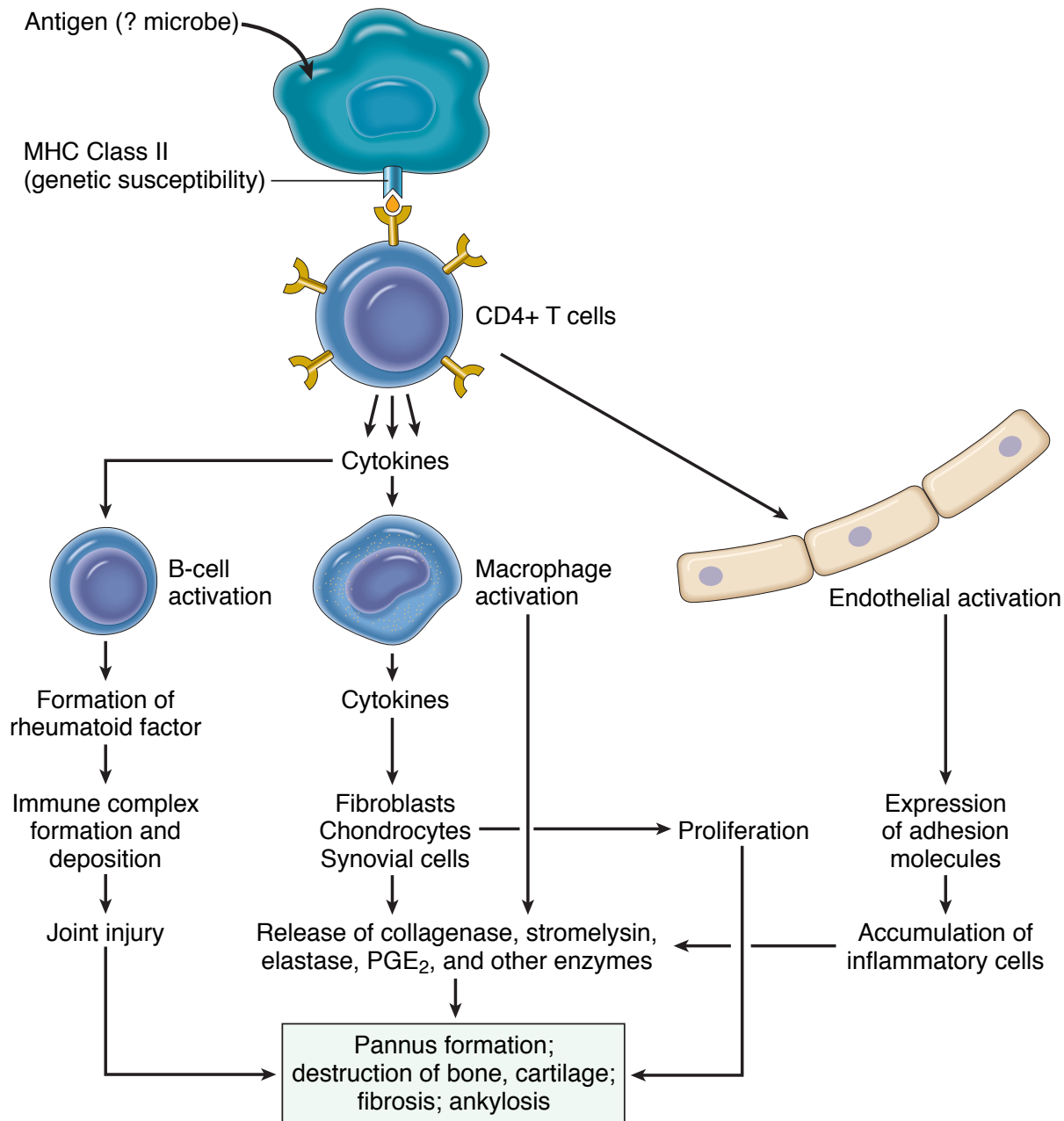
## Severe Osteoarthritis



# Rheumatoid Arthritis

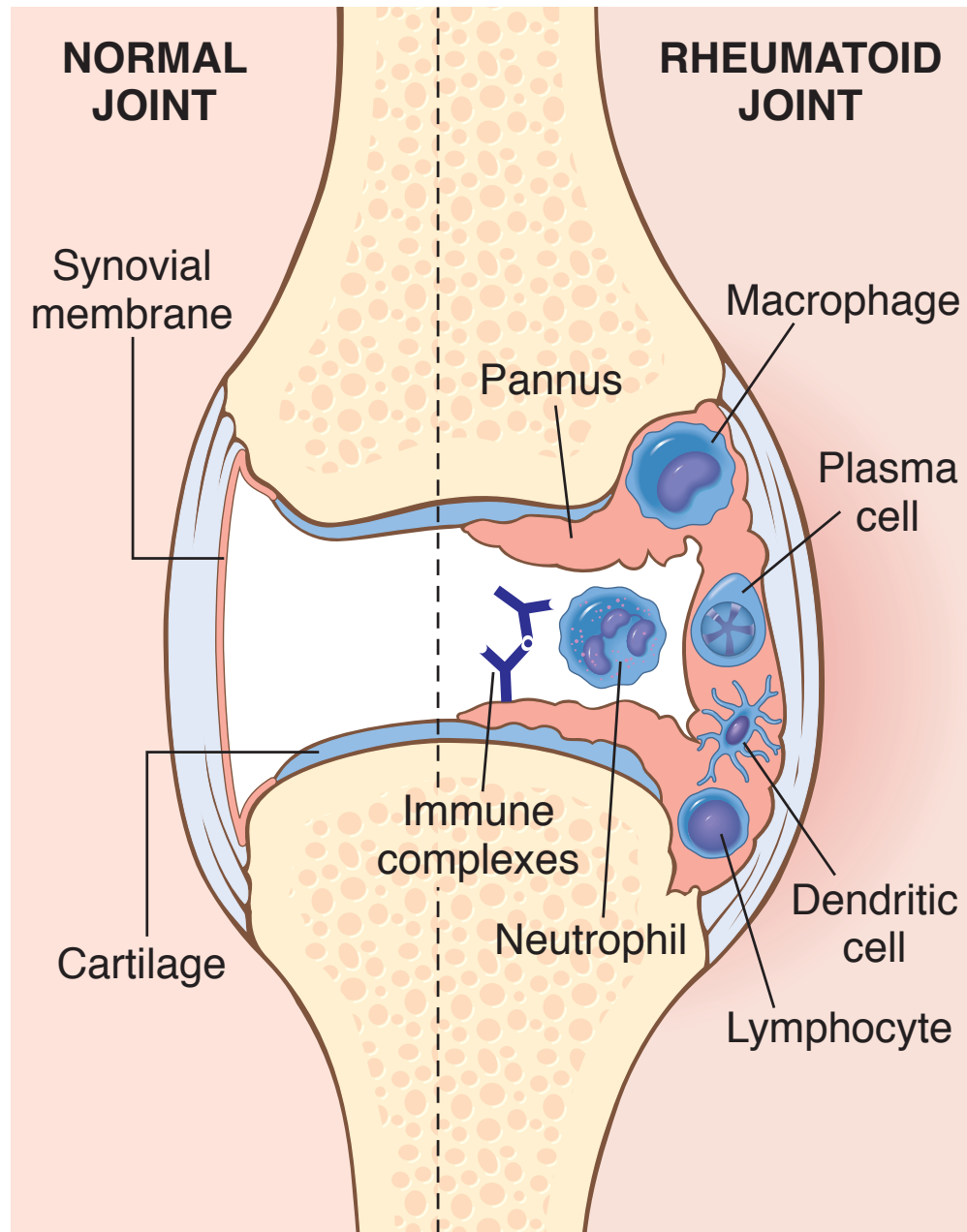
- Definition - a systemic autoimmune disease most common in women

# Pathogenesis of Rheumatoid Arthritis





# Rheumatoid Arthritis

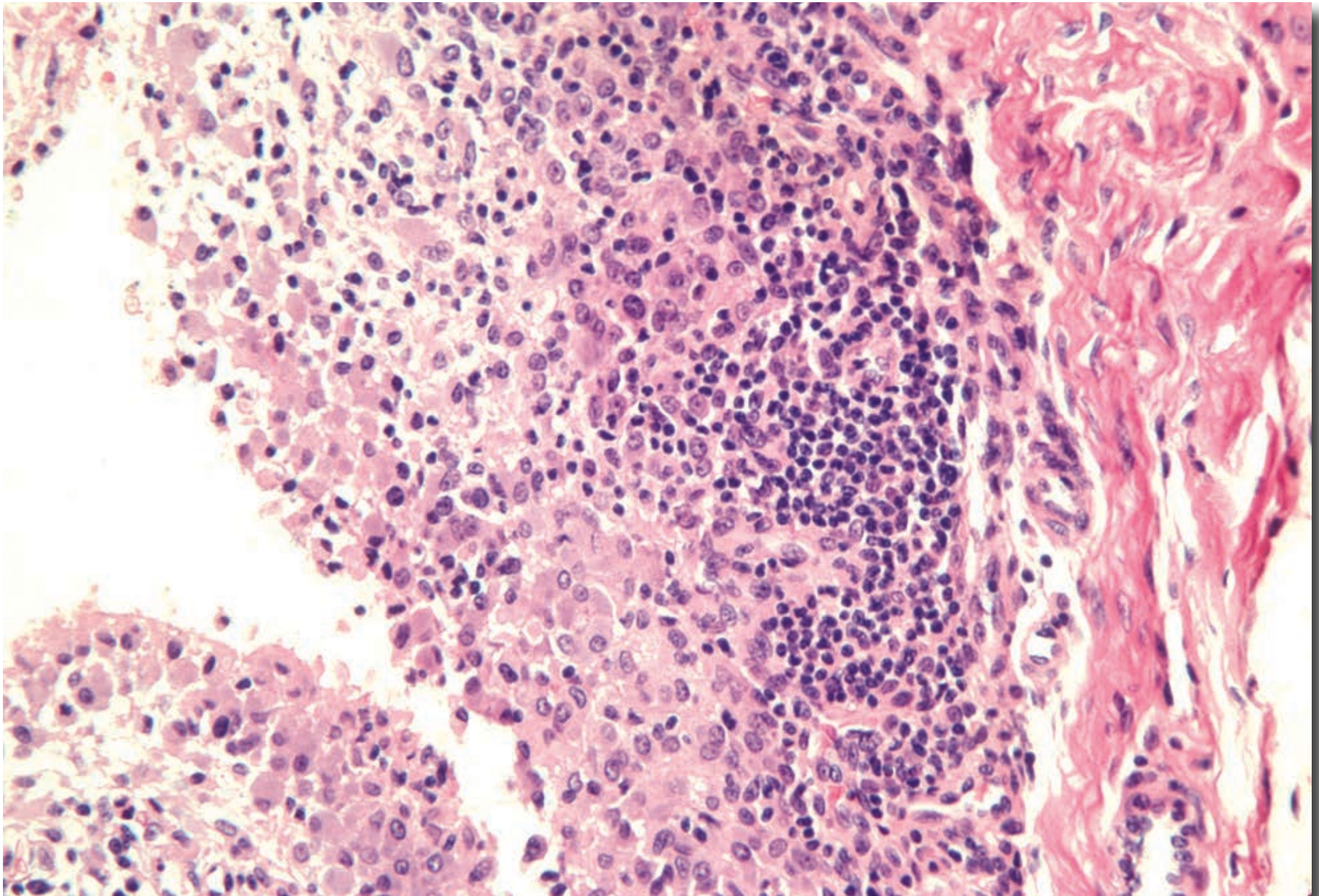


# Rheumatoid Arthritis



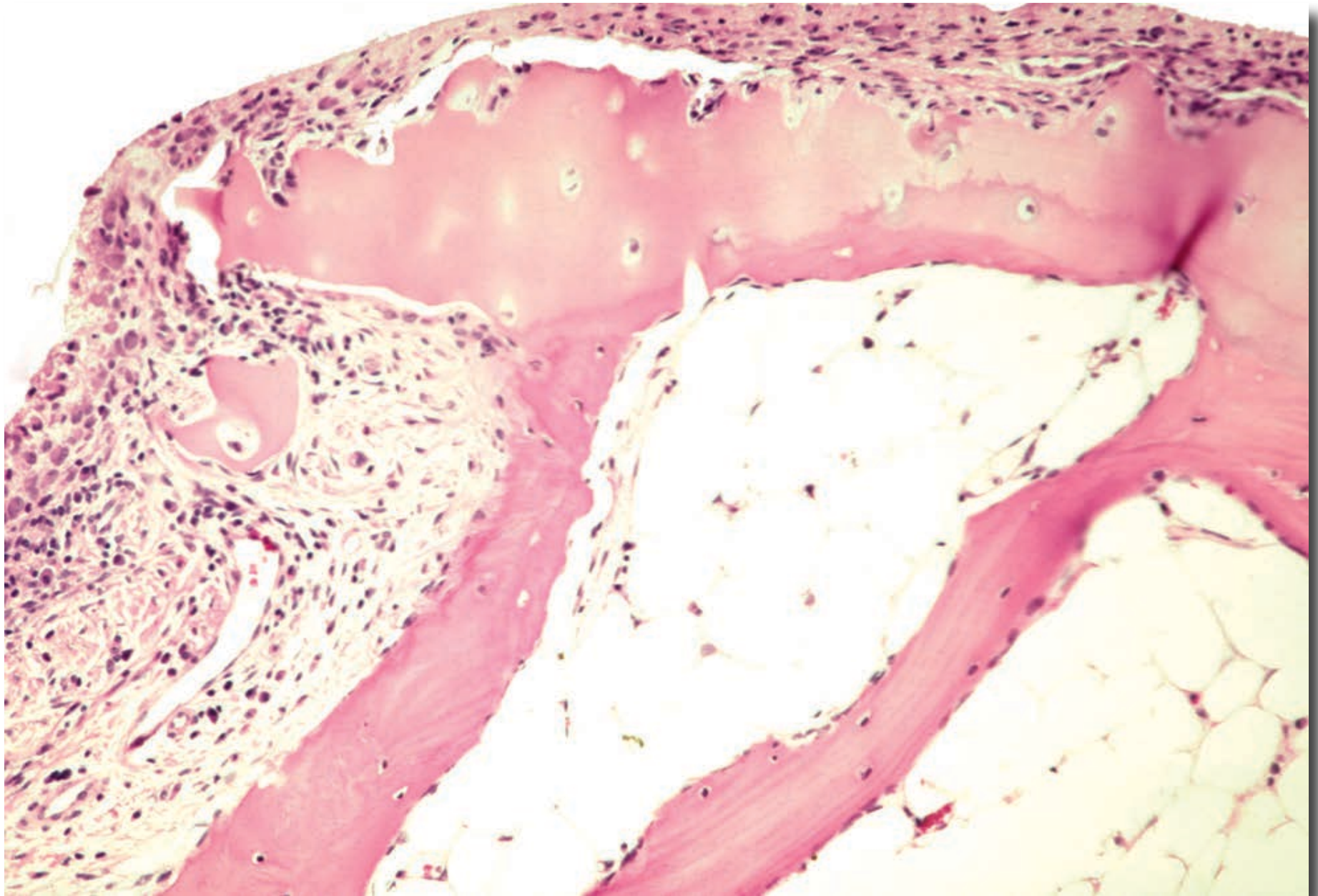


# Rheumatoid Arthritis

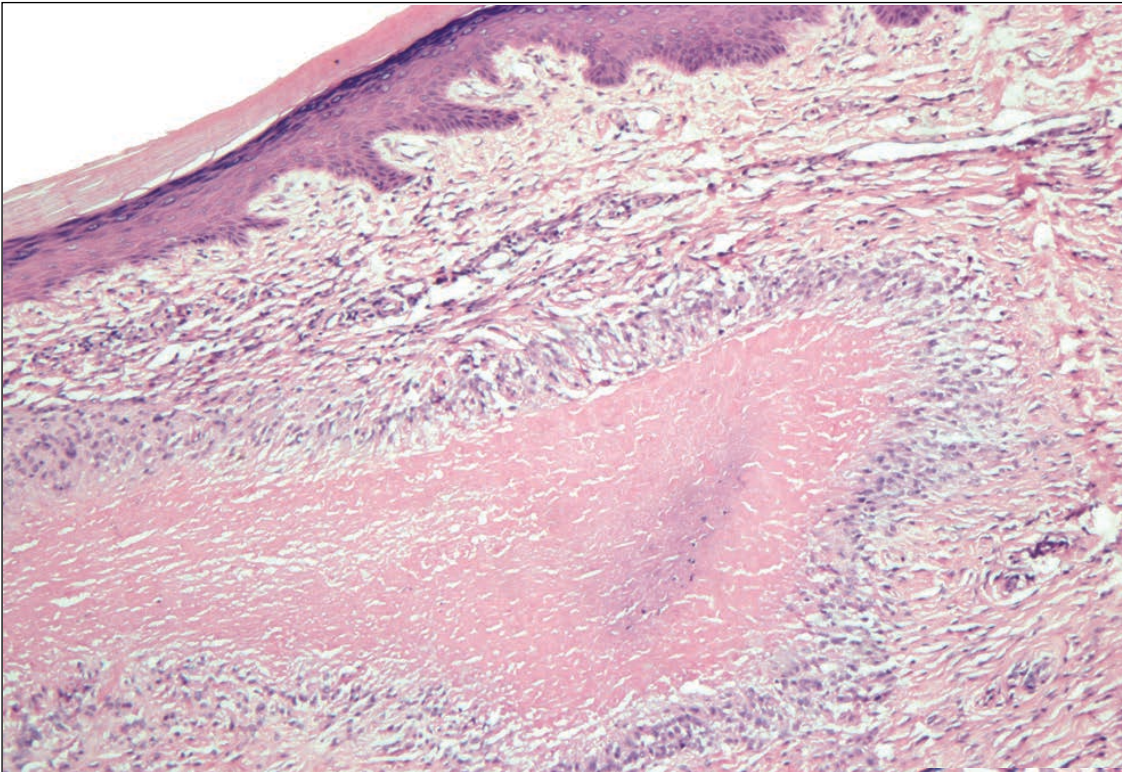




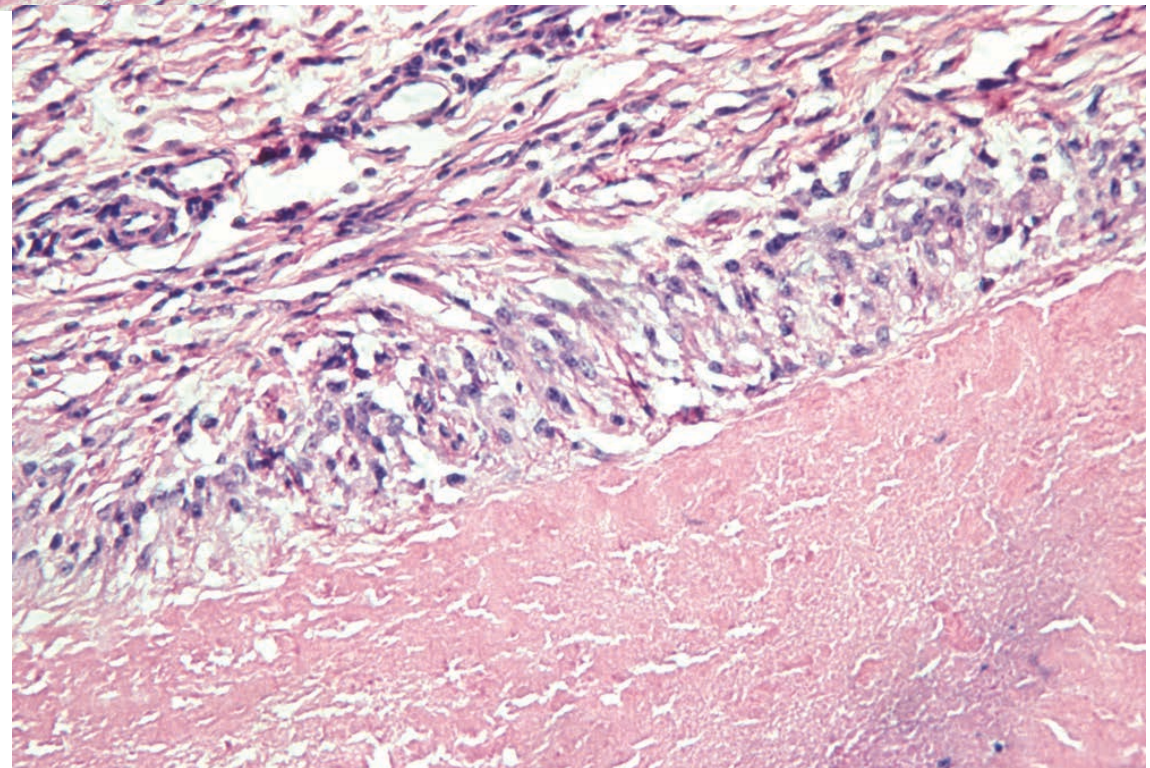
## Rheumatoid Arthritis: “Pannus”







**Rheumatoid Nodule**

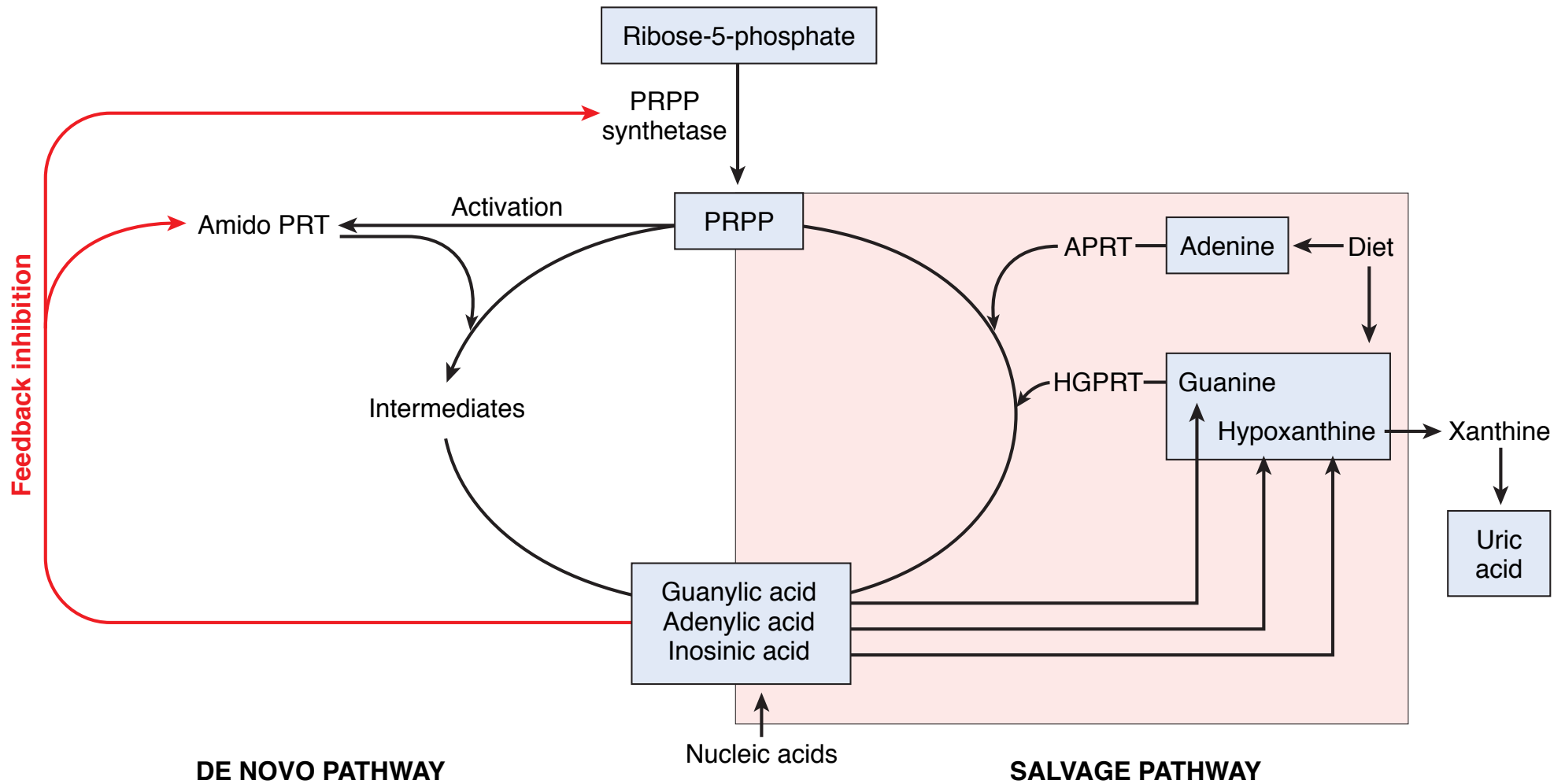




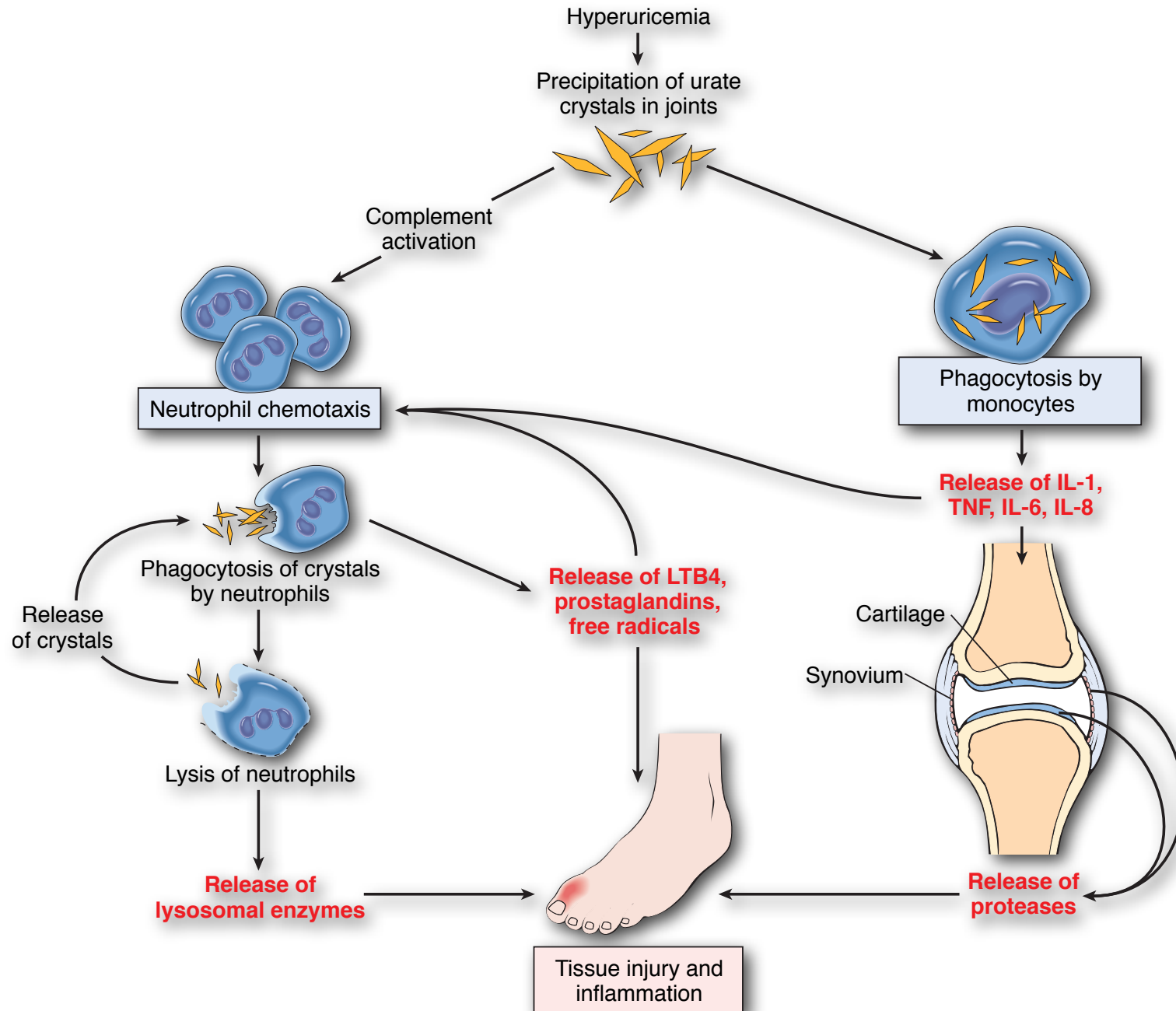
Gout



# Biochemistry of Gout



# Pathogenesis of Gout



## Gouty Toe: “Podagra”



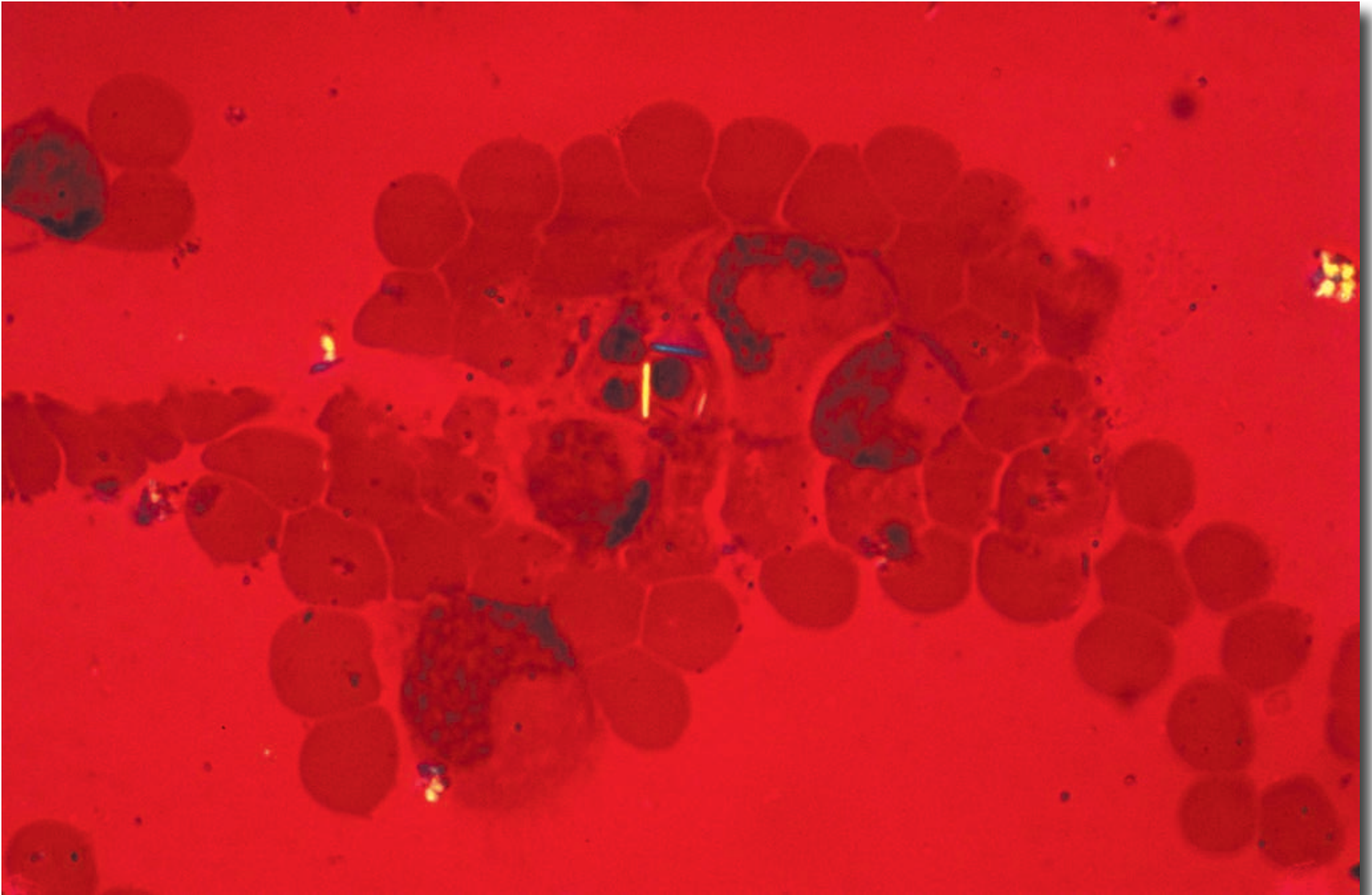


# Gouty Arthritis



Knee

# Gout



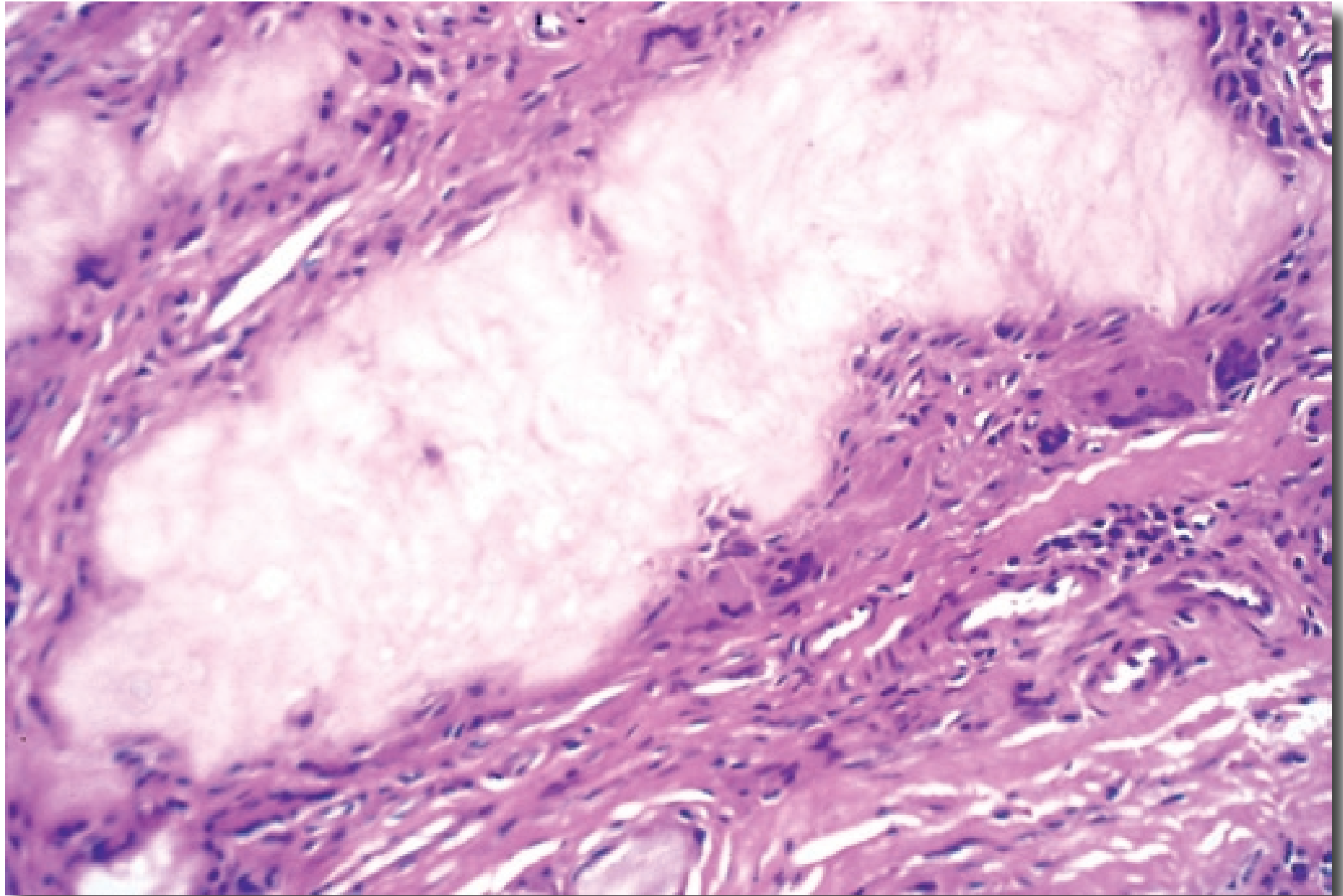


# Gout: “Tophy”





# Gout



# Infectious Arthritis

- Direct penetration
- Extension from infected adjacent bone
- Hematogenous route
- Acute or chronic