Biology 223
Human Anatomy and Physiology
Week 2; Lecture 1; Wednesday
Dr. Stuart S. Sumida

Overview of Adult Systems & Integument

Introduction to Support Systems

Skeleton: Physiology and Function

Mostly Somatopleure…
- Integumentary system
- Skeletal system
- Muscular system

Systems of Communication
- Nervous system
- Endocrine system

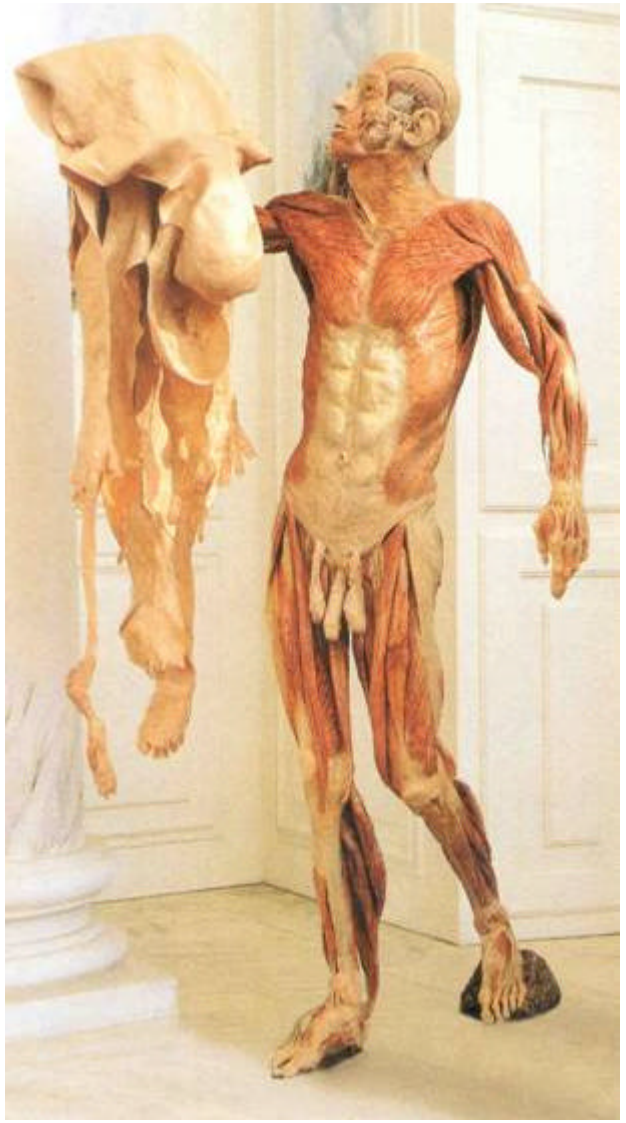
Circulatory systems
- Cardiovascular system - actively pumped system
- Lymphatic system - lymph glands, lymph nodes, lymph vessels

Digestive system
Respiratory system
Excretory system
Reproductive system

Integumentary System

Functions

- Protection
- Sensory
- Synthesis

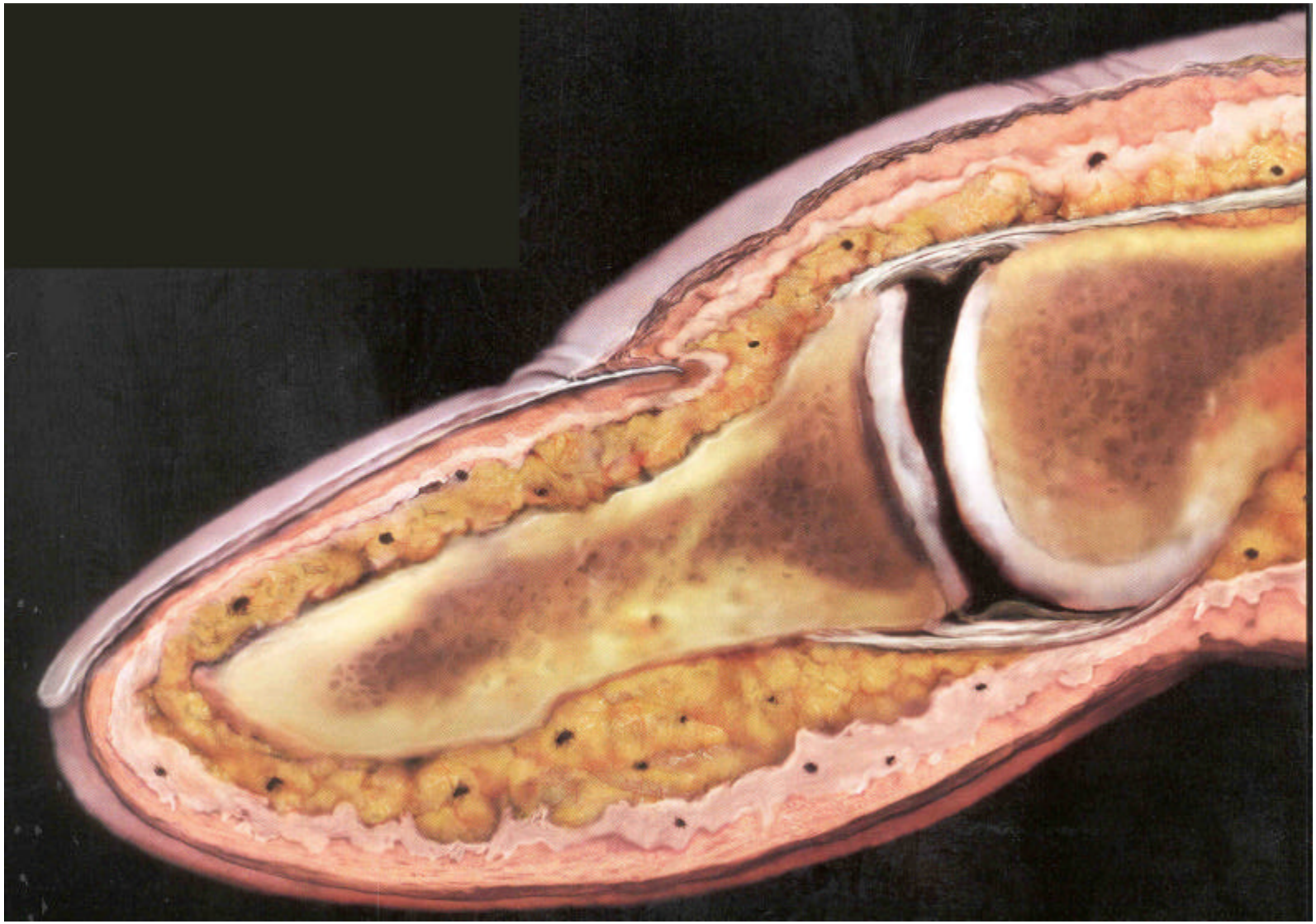


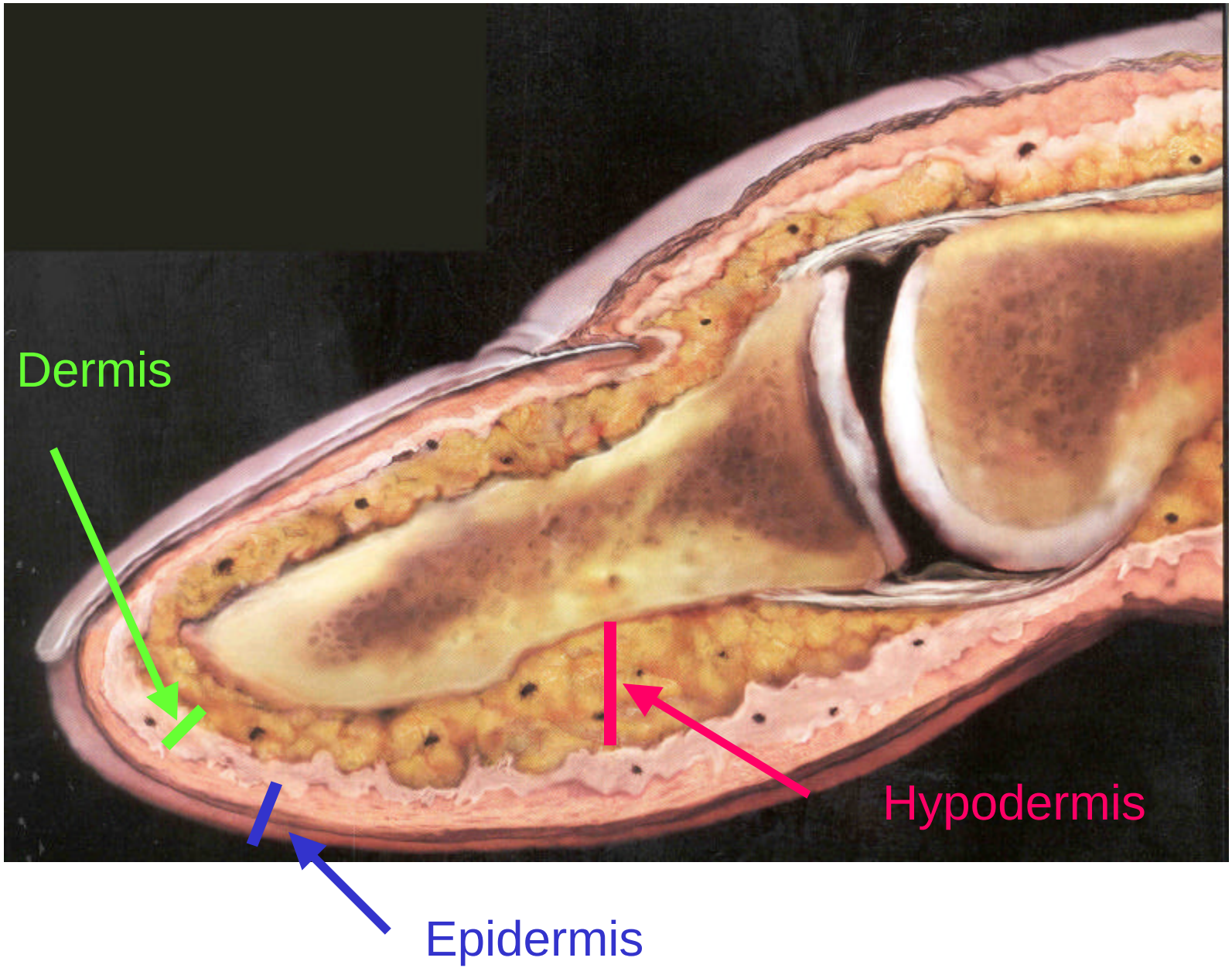
The Skin…

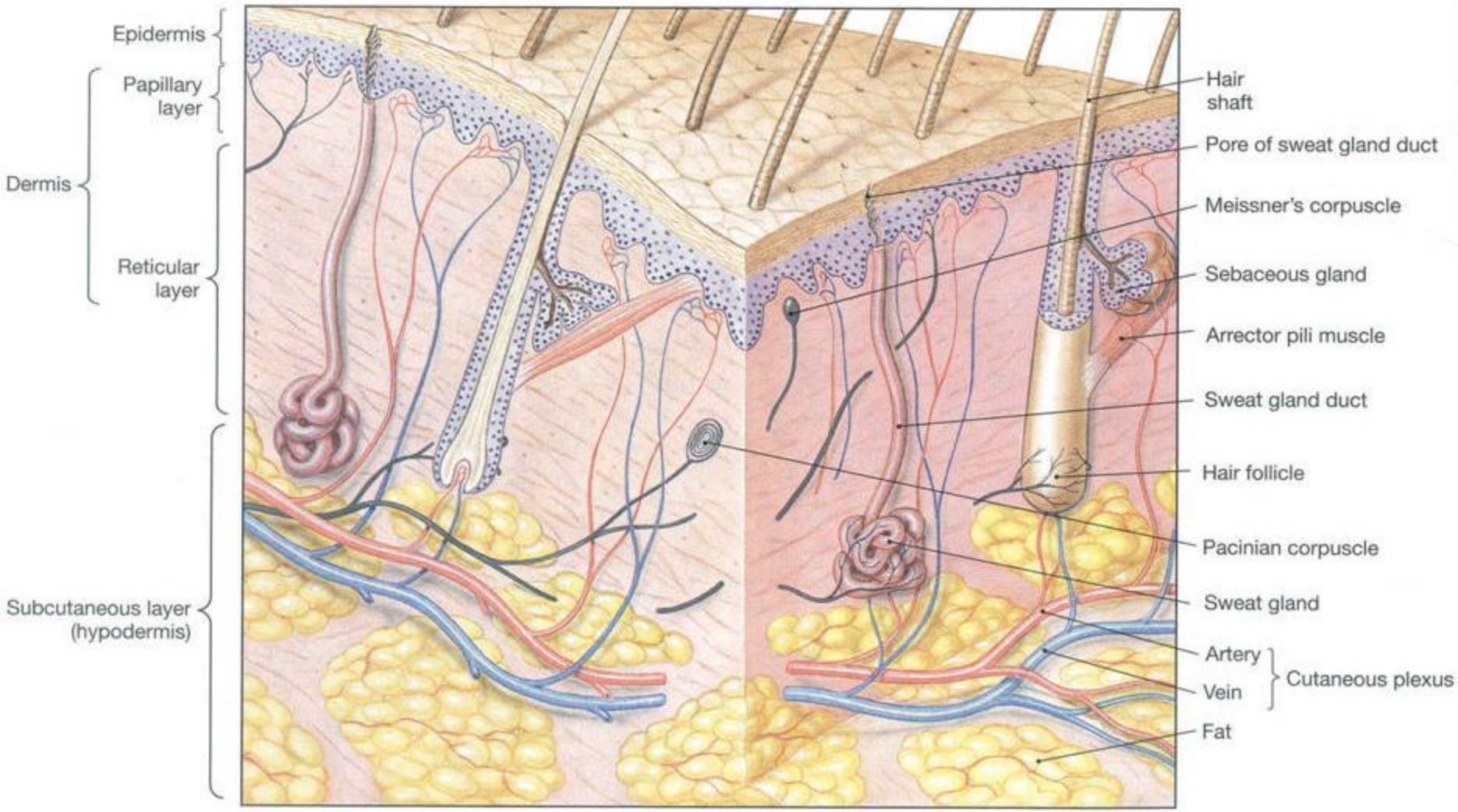
Epidermis - ectodermal; stratified squamos epithelium

Dermis - mesodermal; collagen, elastic fibers, papillary layer, and reticular layer

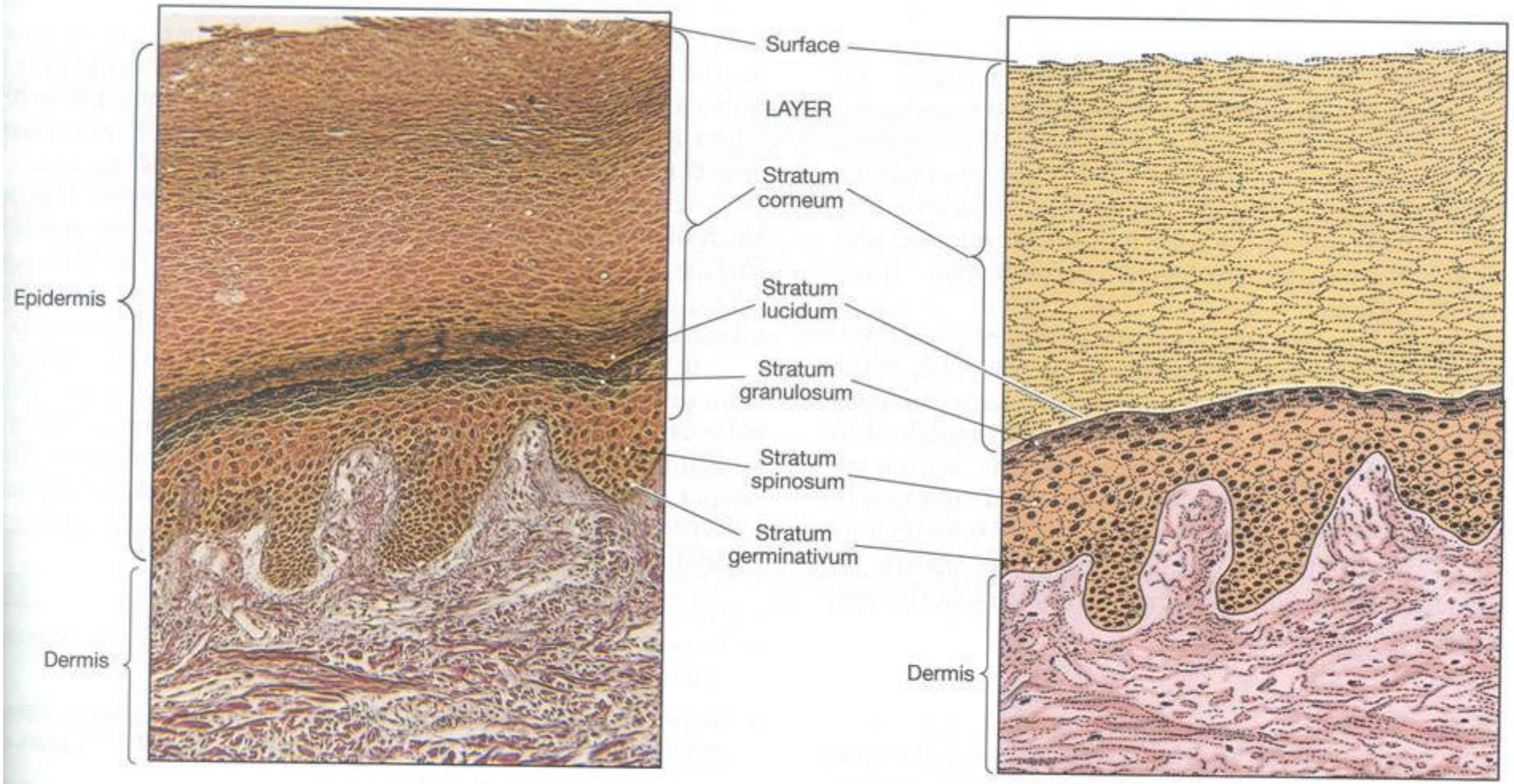
Hypodermis




Dermis
Hypodermis
Epidermis



Components of the Integumentary System. Relationships among the major components of the integumentary system (with the exception of nails, shown in Figure 4-15). The epidermis is a keratinized stratified squamous epithelium that overlies the dermis, a connective tissue region containing glands, hair follicles and sensory receptors. Underlying the dermis is the subcutaneous layer, which contains fat and blood vessels supplying the dermis.



The Structure of the Epidermis. A light micrograph and corresponding diagrammatic sketch through a portion of the epidermis, showing the major stratified layers of epidermal cells. (LM × 200)

Detail on Epidermis:

Stratum corneum (dead)

Stratum lucidum

Stratum granulosum

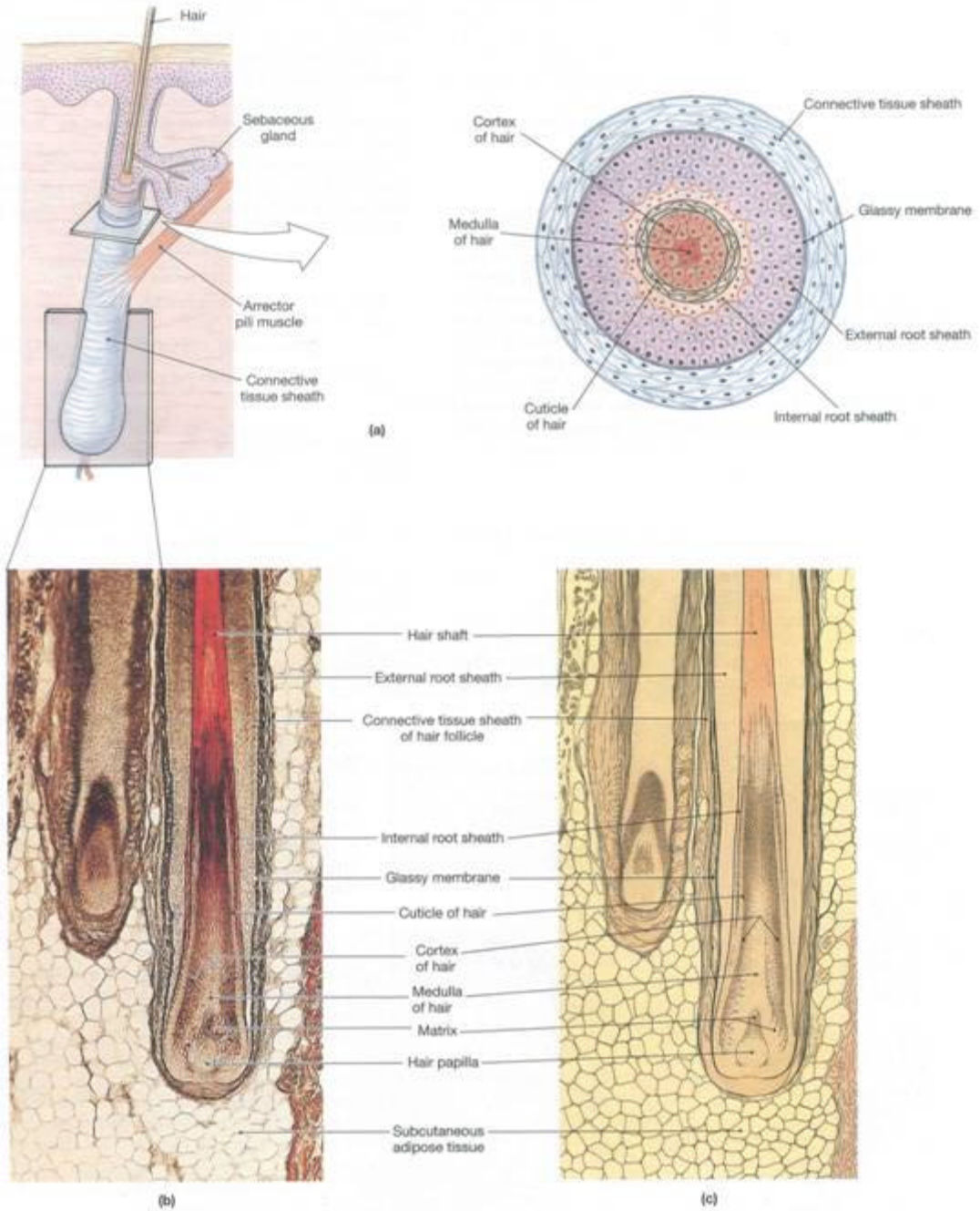
Stratum spinosum

Superficial

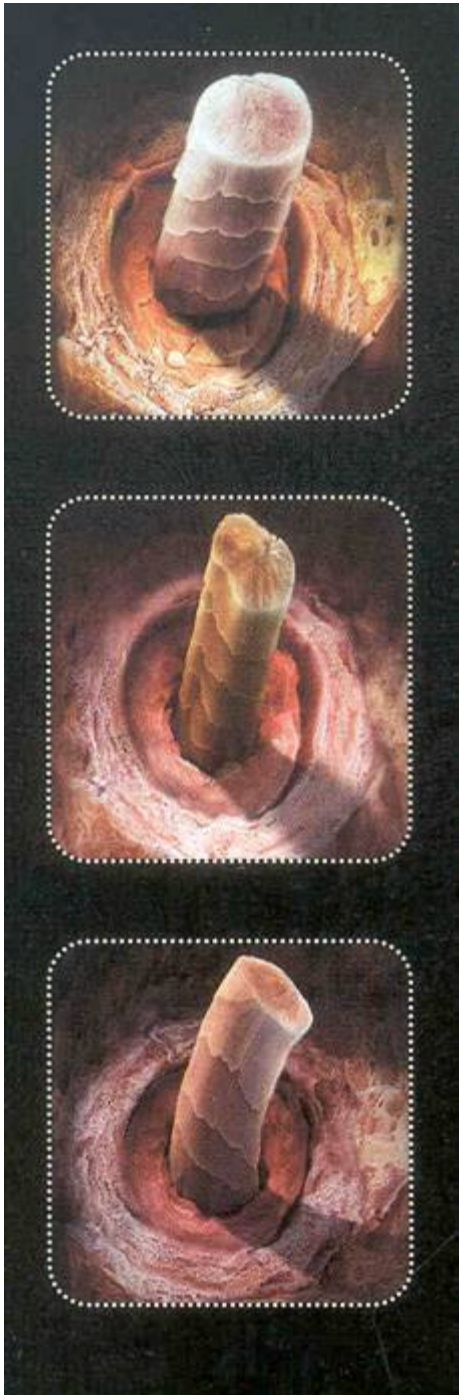
Deep
(Dermis)

Hair:

- Bulb
- Artery
- Vein
- Arrector Pila Muscle
- Gland
- Papilla
- Shaft



Hair Follicles. Hairs originate in hair follicles, which are complex organs. **(a)** A longitudinal section and a cross section through a hair follicle. Histological **(b)** and diagrammatic **(c)** sections along the longitudinal axis of a hair follicle. (LM × 60)



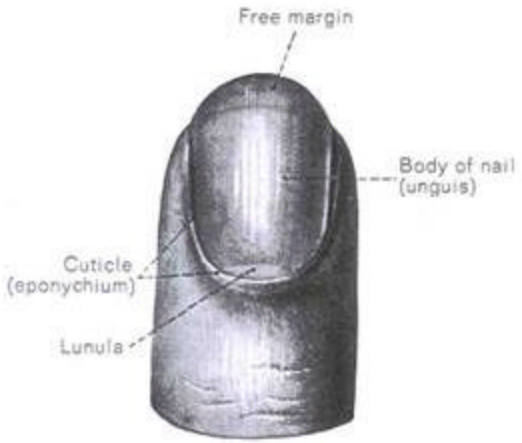
Different Hair Shaft Shapes give different characteristics:

Round Cross-section = straight hair

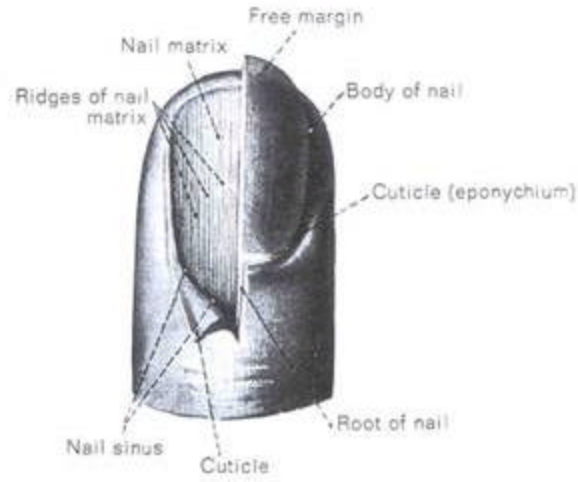
Oval Cross-section = Wavy Hair

Flat Cross-section = Kinky Hair

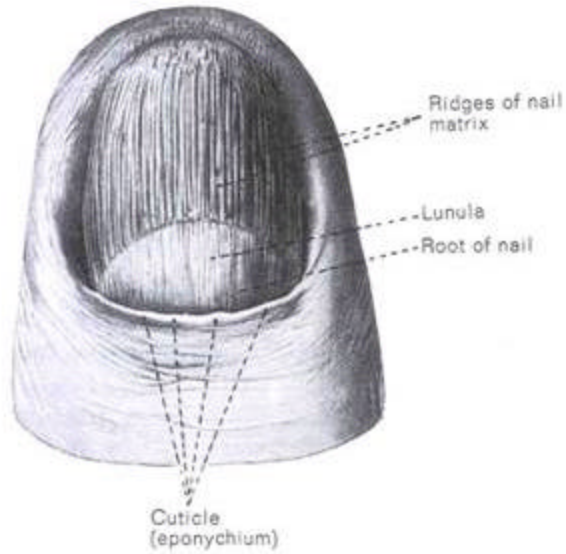
Nails



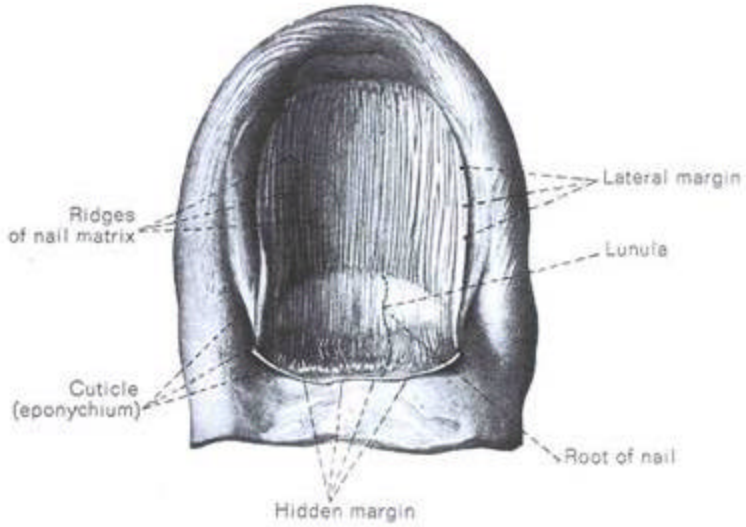
Finger Nail, Normal Position (Dorsal View)



Left Half of Finger Nail Bed Exposed



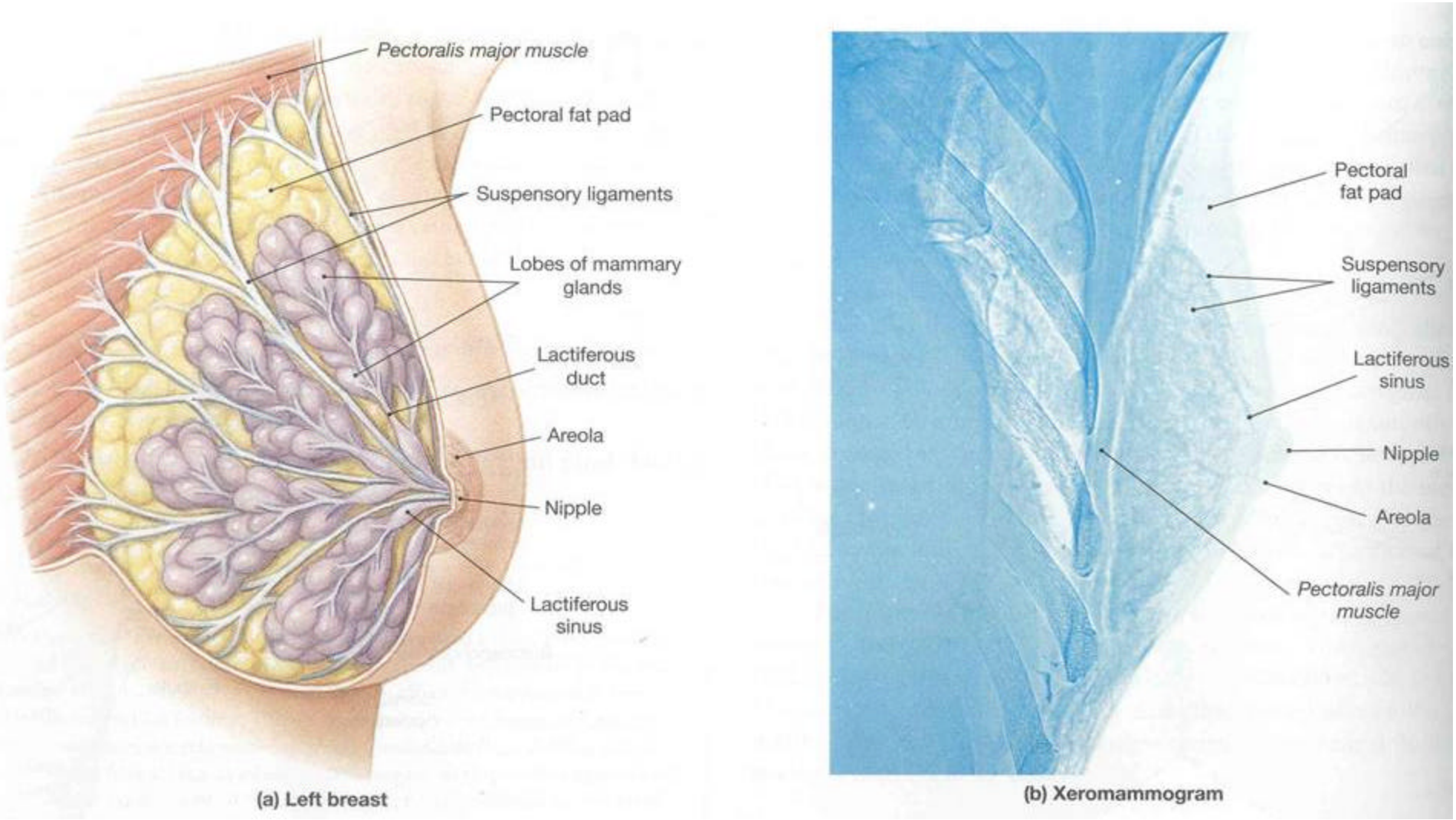
Nail Bed of Thumb after Removal of Nail



Nail Bed of Thumb and Reflection of Cuticle

Glands

- Eccrine
- Apocrine
- Mammary glands (Not reproductive organs!)



Mammary Gland – a skin gland, not a reproductive organ...

Support systems

- Support systems built of hard tissues, such as bone and cartilage

- Support systems produced by the manipulation of soft tissues

Soft tissue support - structures which maintain structural integrity without the use of a hard, internal skeleton.

- Constant volume
- Pressurize
- Hydrostatic skeleton

Tongue

- Muscle & Fluid-based structure
- Attached to what bones?

Coelom

- A space
- Stable & still base of support

The Skeleton

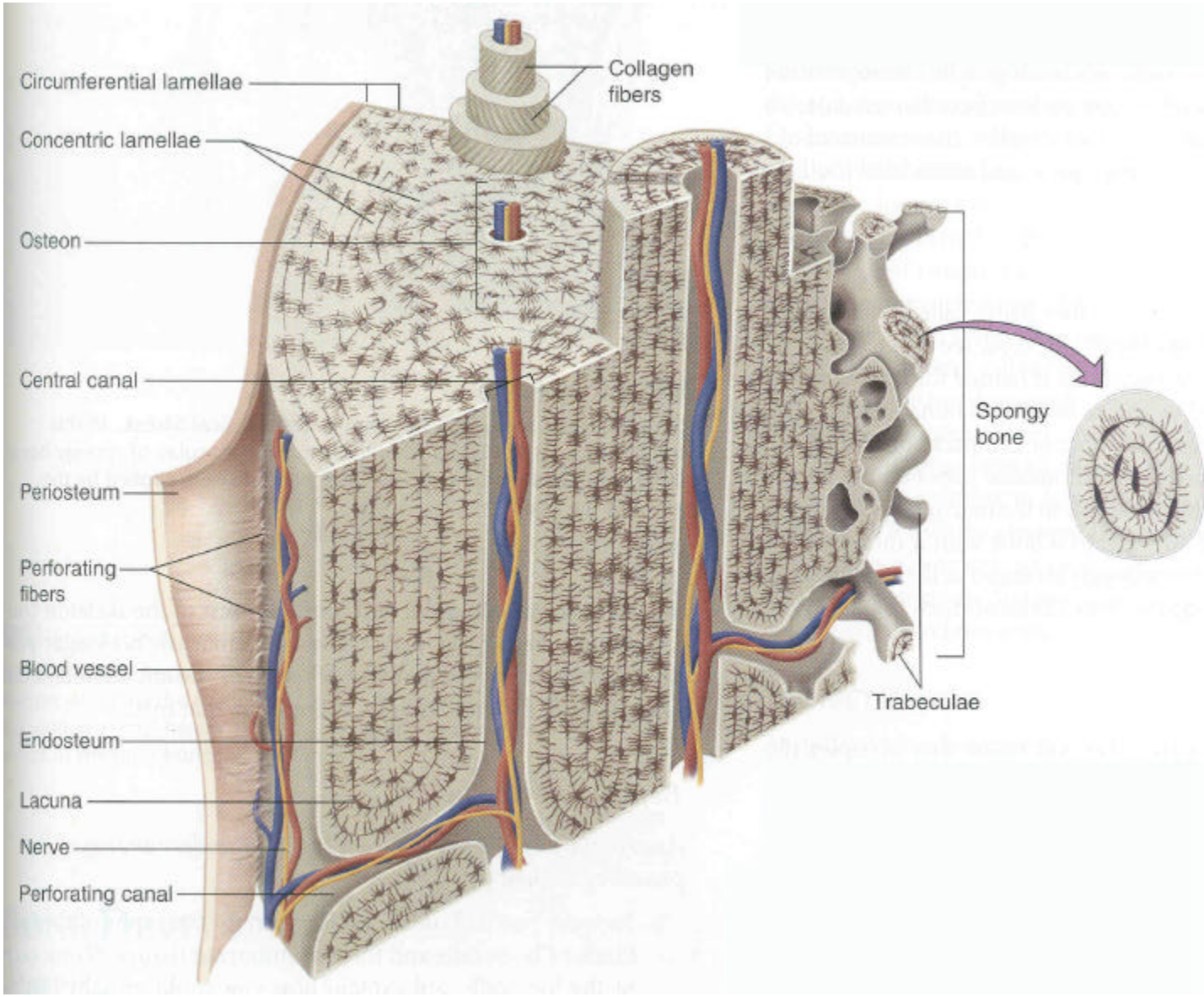
Cartilage

- Function
- Cartilage materials - chondrocytes
- Interstitial growth
- Perichondrium
- According to a scale from softest to hardest, where does cartilage belong, if other skeletal materials are bone, calcified cartilage, enamel, and dentin?

What is bone made of?

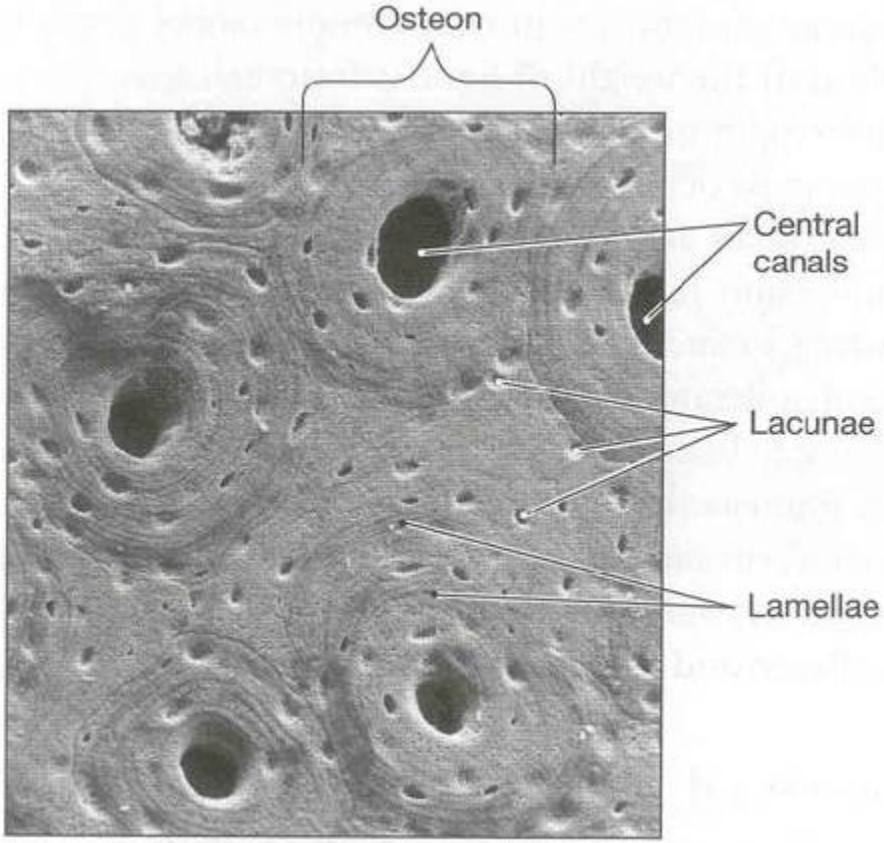
- Hydroxyapatite
- Bone organic content (Osteocytes)
- Bone mineral content

Bone structure

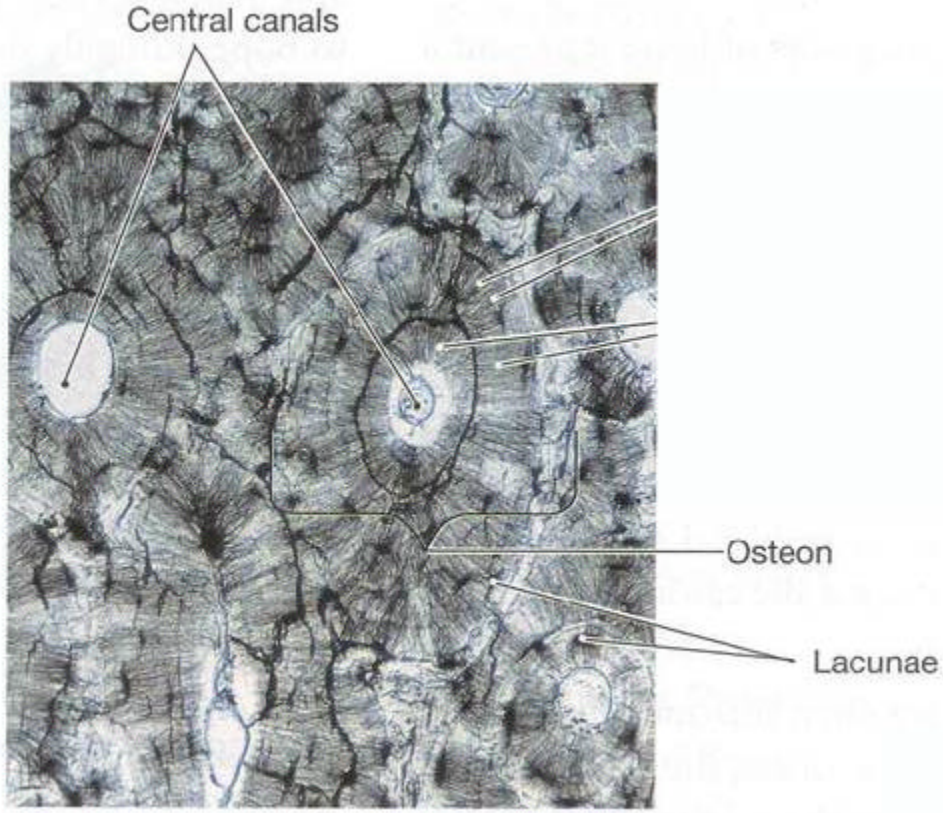


Haversian systems

- Haversian canals
- Lacunae
- Canaliculi

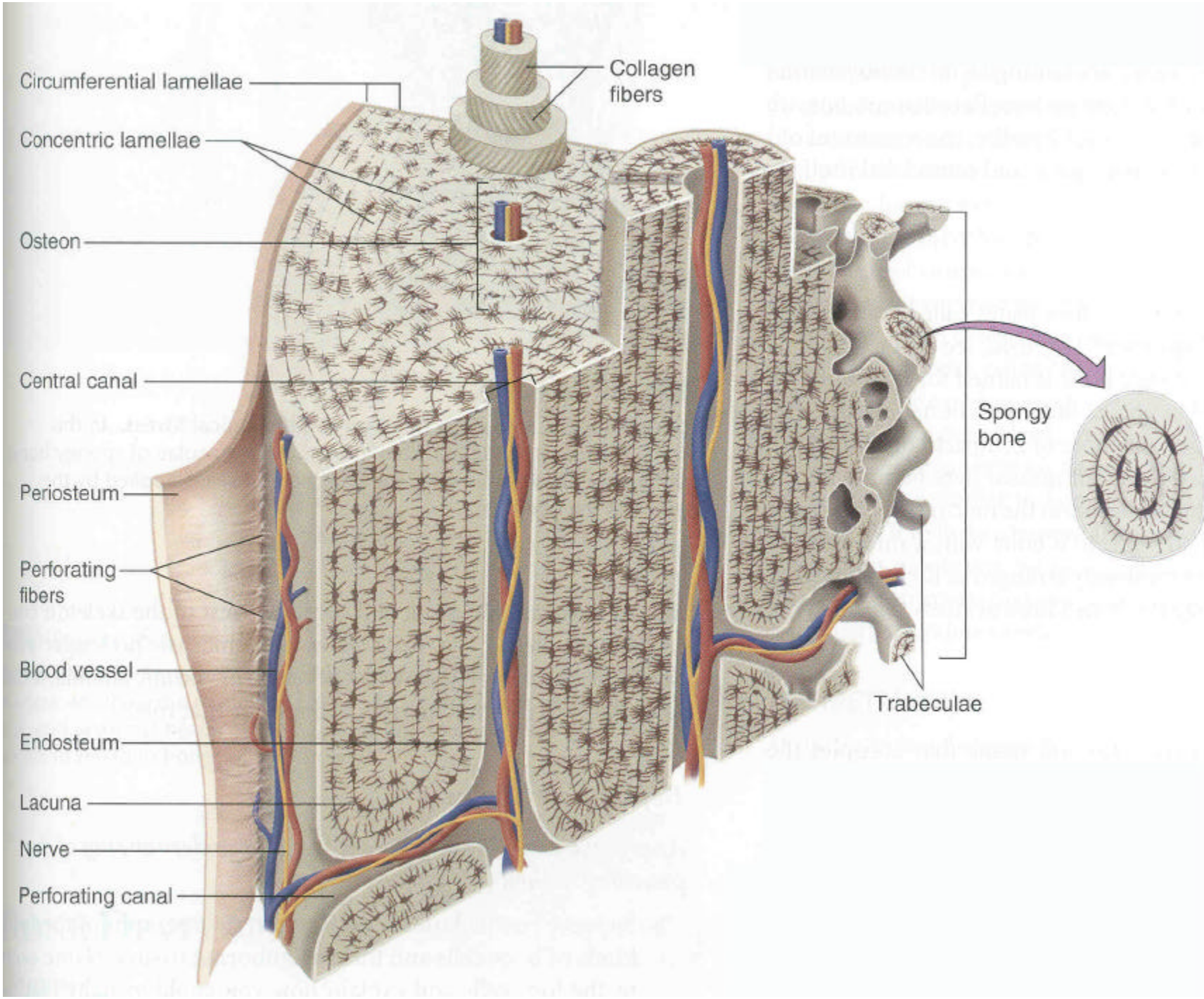


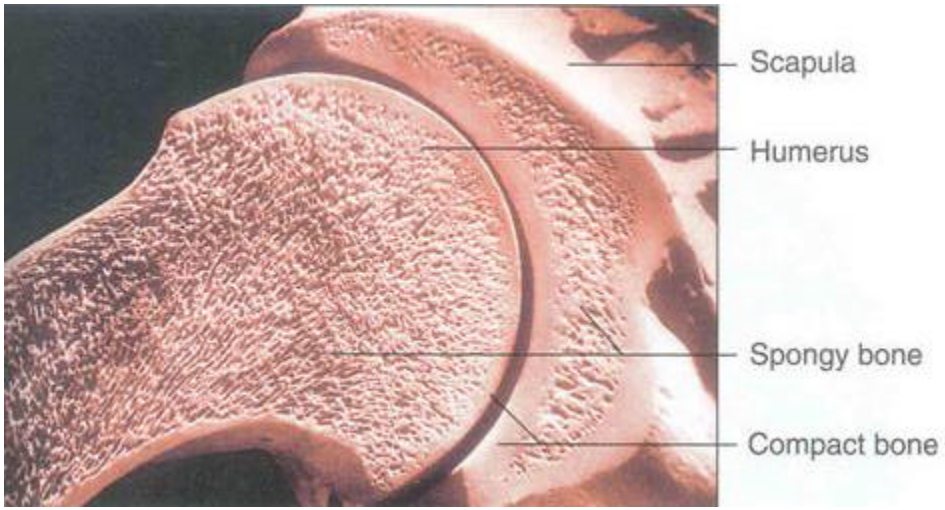
(b) SEM of osteons (× 182)



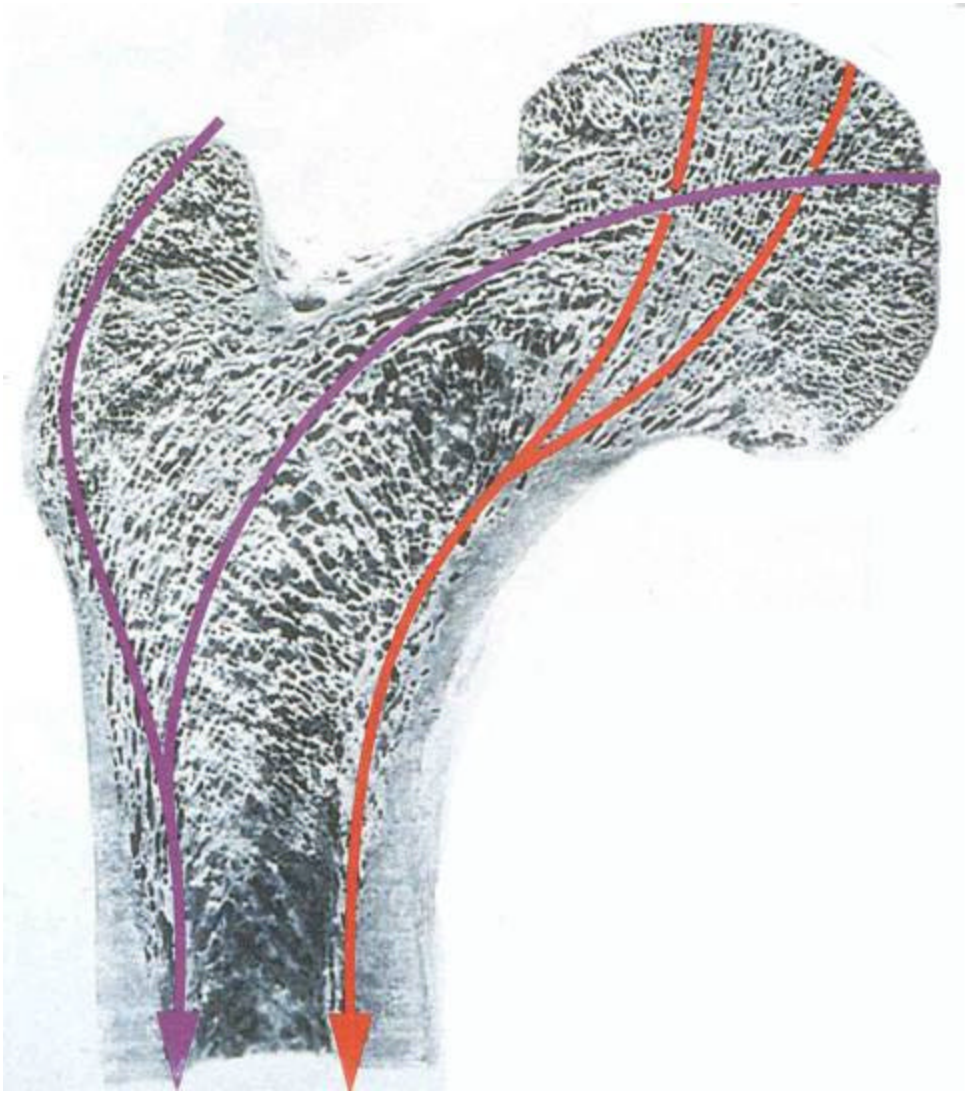
(c) Light micrograph of osteons (× 220)

Compact Bone
vs.
Spongy Bone
(Trabecular Bone)

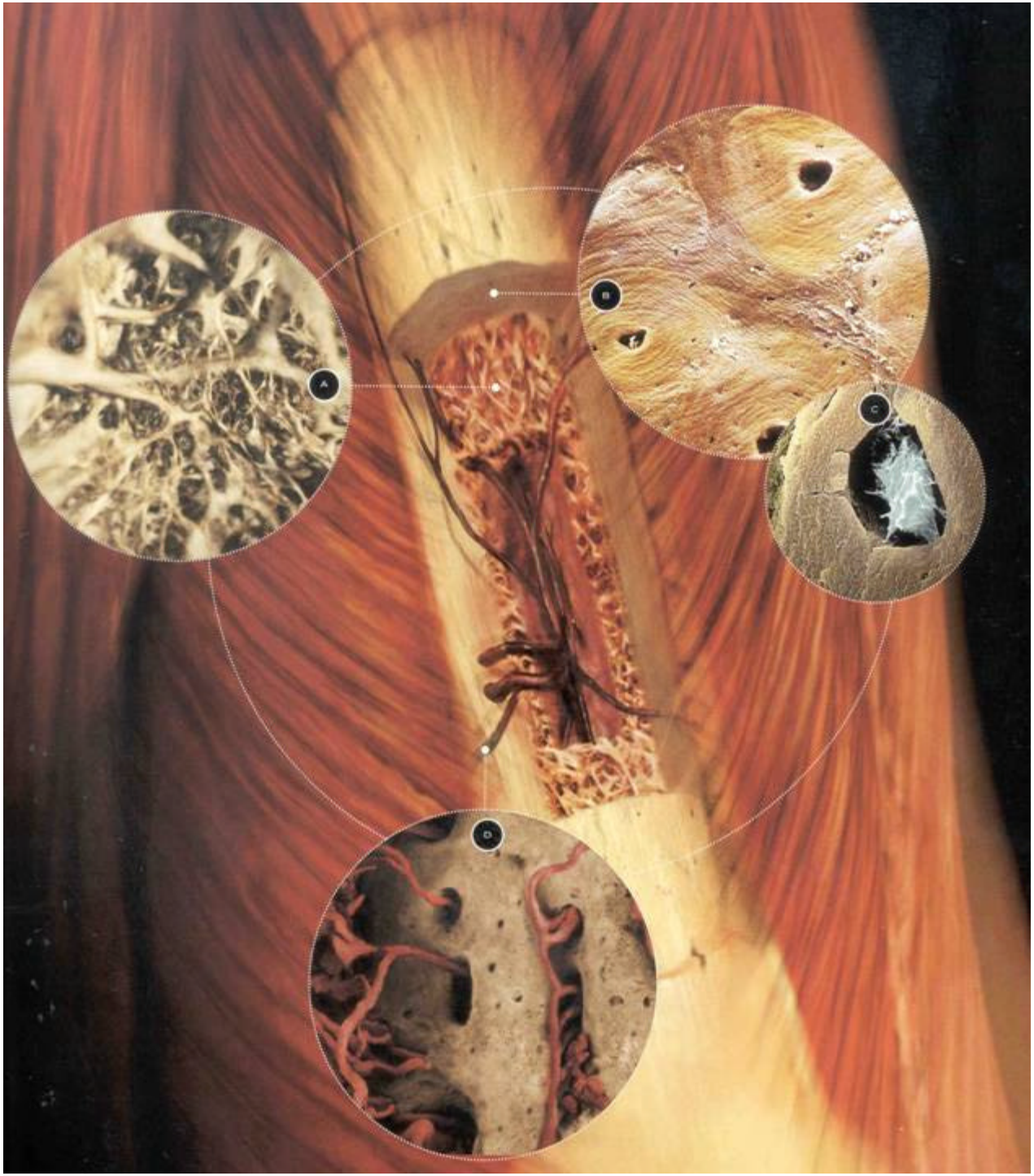

Circumferential lamellae
Concentric lamellae
Osteon
Central canal
Periosteum
Perforating fibers
Blood vessel
Endosteum
Lacuna
Nerve
Perforating canal
Collagen fibers
Spongy bone
Trabeculae



Shoulder Joint



Femur


A
B
C
D

Regional Classification of the Skeleton

- Endoskeleton vs. exoskeleton

- Visceral skeleton vs. Somatic Skeleton

Visceral skeleton

- Associated with Splanchnopleure (gut)

- Origin

Somatic skeleton

Associated with Somatopleure

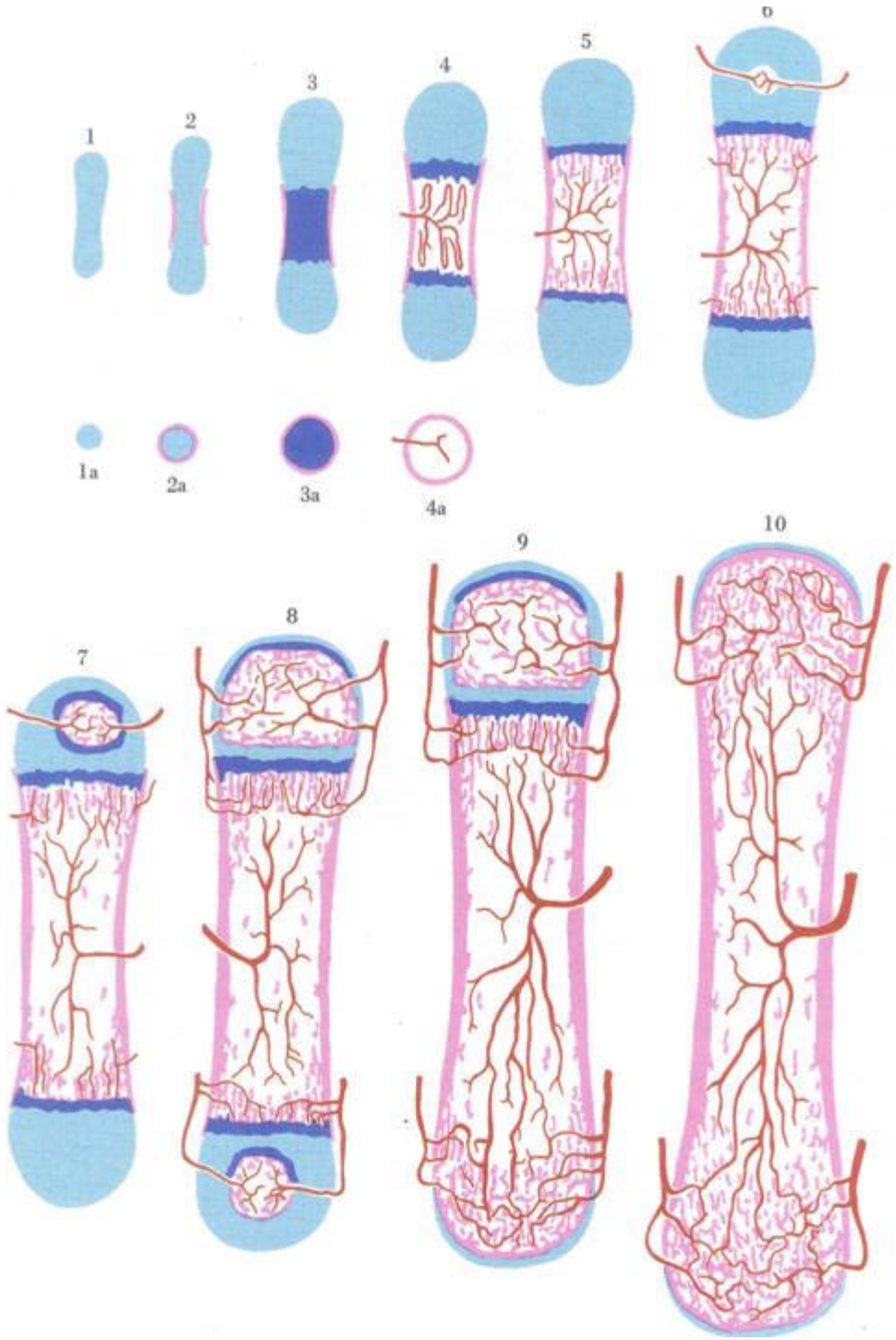
- Origin

- Axial skeleton
- Appendicular skeleton

Developmental Classification of the Skeleton

- Endochondral bones vs. dermal bones
- Endochondral - epiphysis & epiphyseal plates

- Dermal - "intramembranous bones"


1
2
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1a
2a
3a
4a
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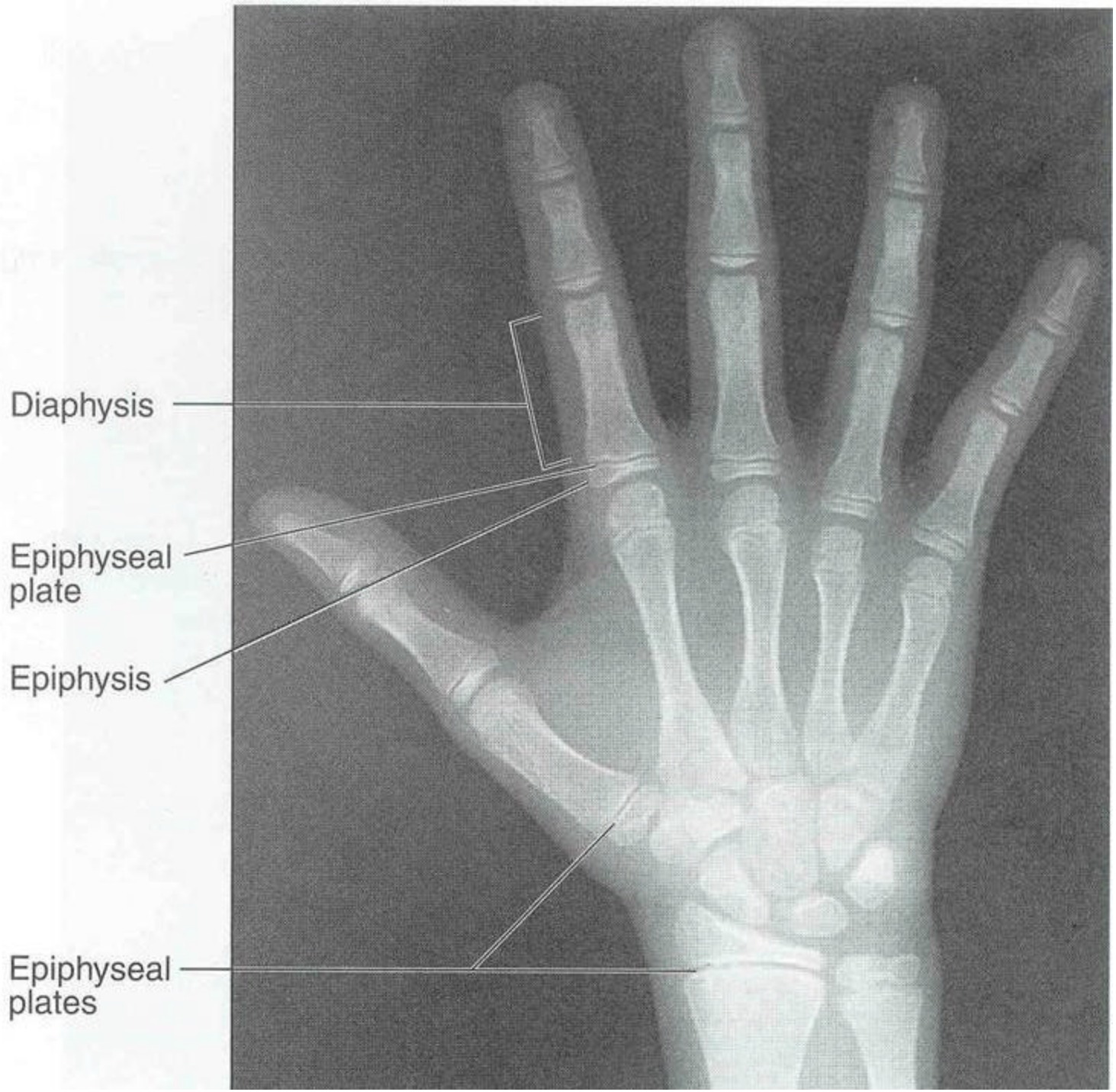
8
9
10


Diaphysis
Epiphyseal plate
Epiphysis
Epiphyseal plates

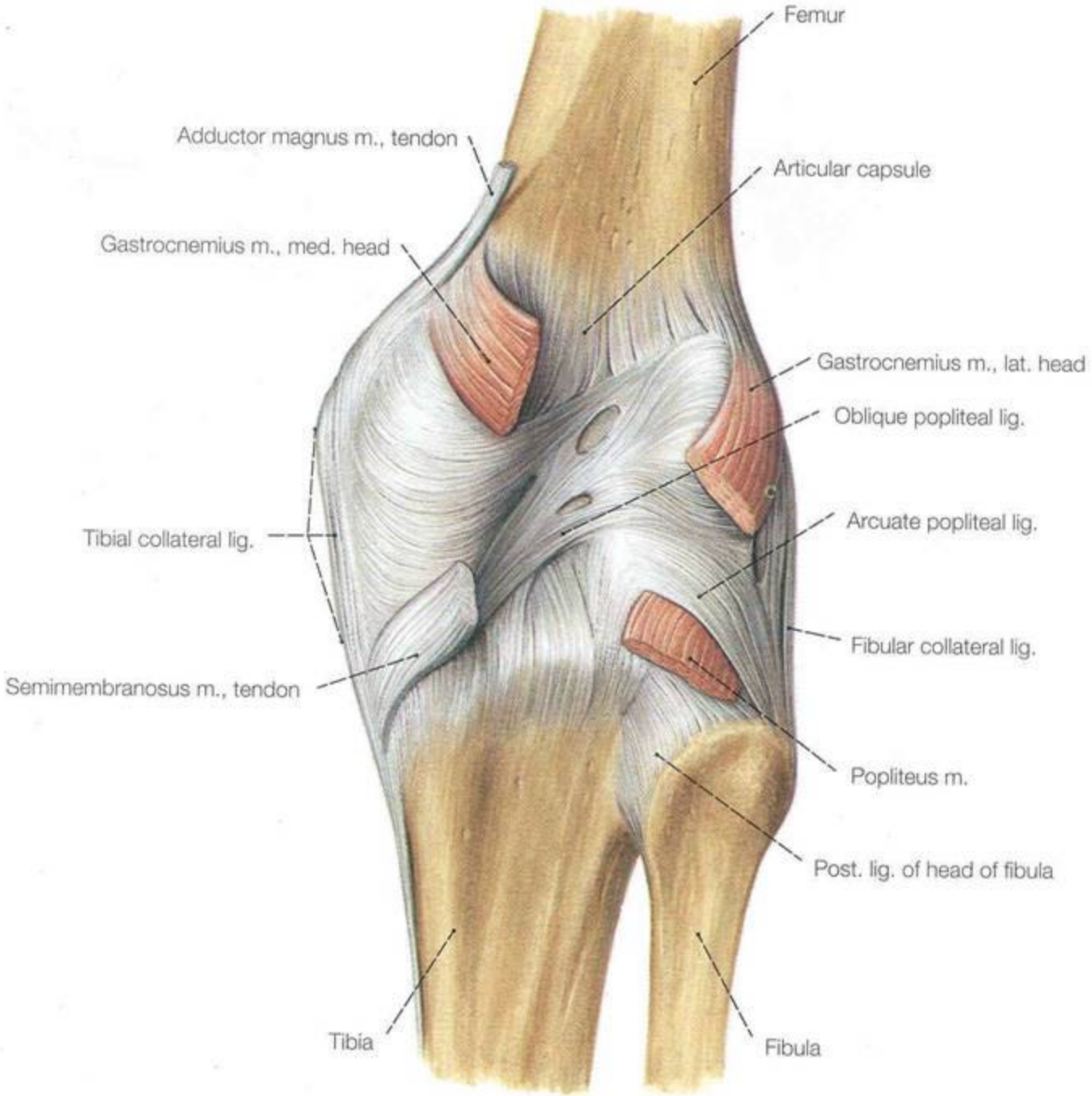
Bone Function

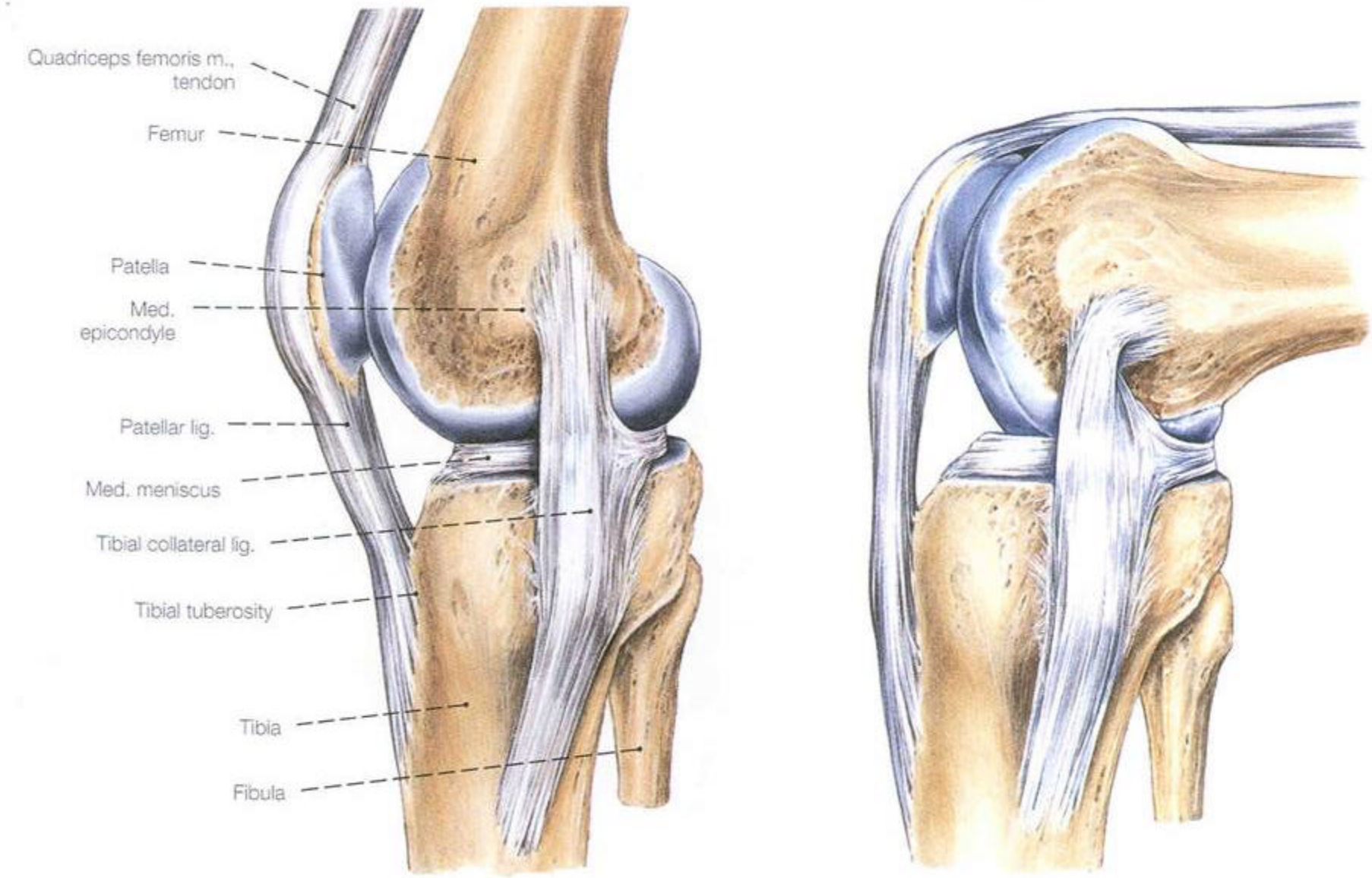
- Structural
- Red blood cell manufacture
- Homeopoietic tissue
- Red bone marrow vs. yellow bone marrow
- Mineral regulation
- Calcium levels
- Importance of phosphorus

Articulations

- Different types of bone attachments
- Ligaments
- The Joint Capsule

Joint Capsule of Knee





Examples of Major Ligaments of Knee

Movements and the Skeleton

- Flexion
- Extension
- Rotation
- Circumduction
- Abduction
- Adduction
- Protraction
- Retraction
- Depression
- Elevation
- Supination
- Pronation
- Opposition
- Reposition
- Inversion
- Eversion