



Pathophysiology of Musculoskeletal System

Lecture: 2

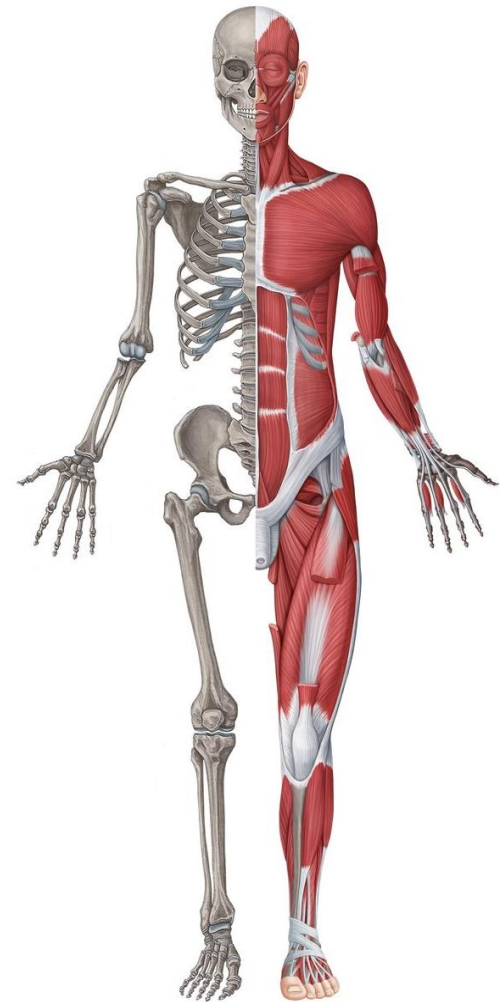
Dr. Payman Anwar Rashid

9/10/2023

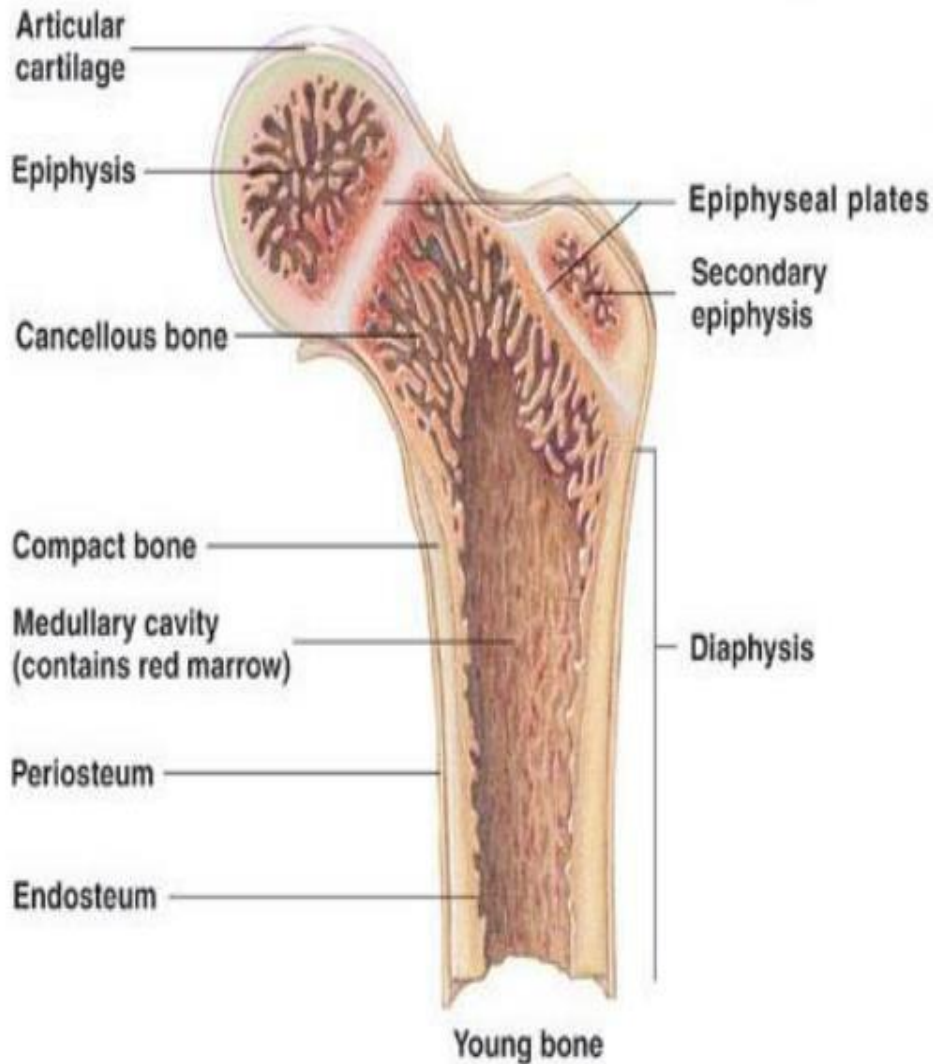
**Faculty of Applied Science
Physiotherapy Department
Fall Semester
Systemic Pathology
Second Grade**

Objectives:

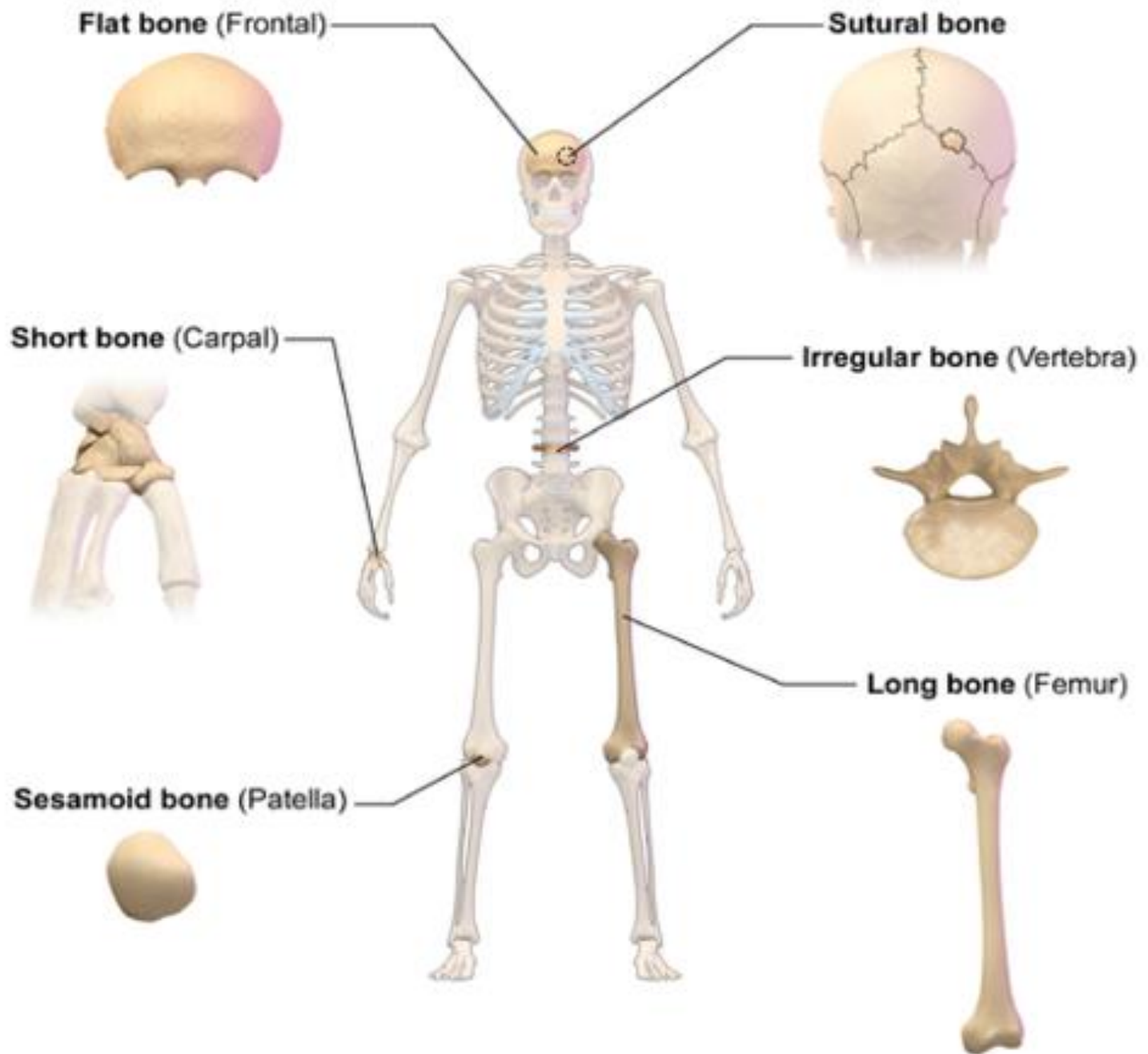
- 1. Study general organization of musculoskelal system.**
- 2. Explain the functions and parts of musculoskelal system.**



DEFINITION



- **Bone is a specialized connective tissue characterized by mineralized extracellular matrix.**
- **Bones are the organs of skeletal system; bone tissue is the structural component of bones.**



Classification of Bones by Shape

Classification of bones by location

Appendicular Skeleton

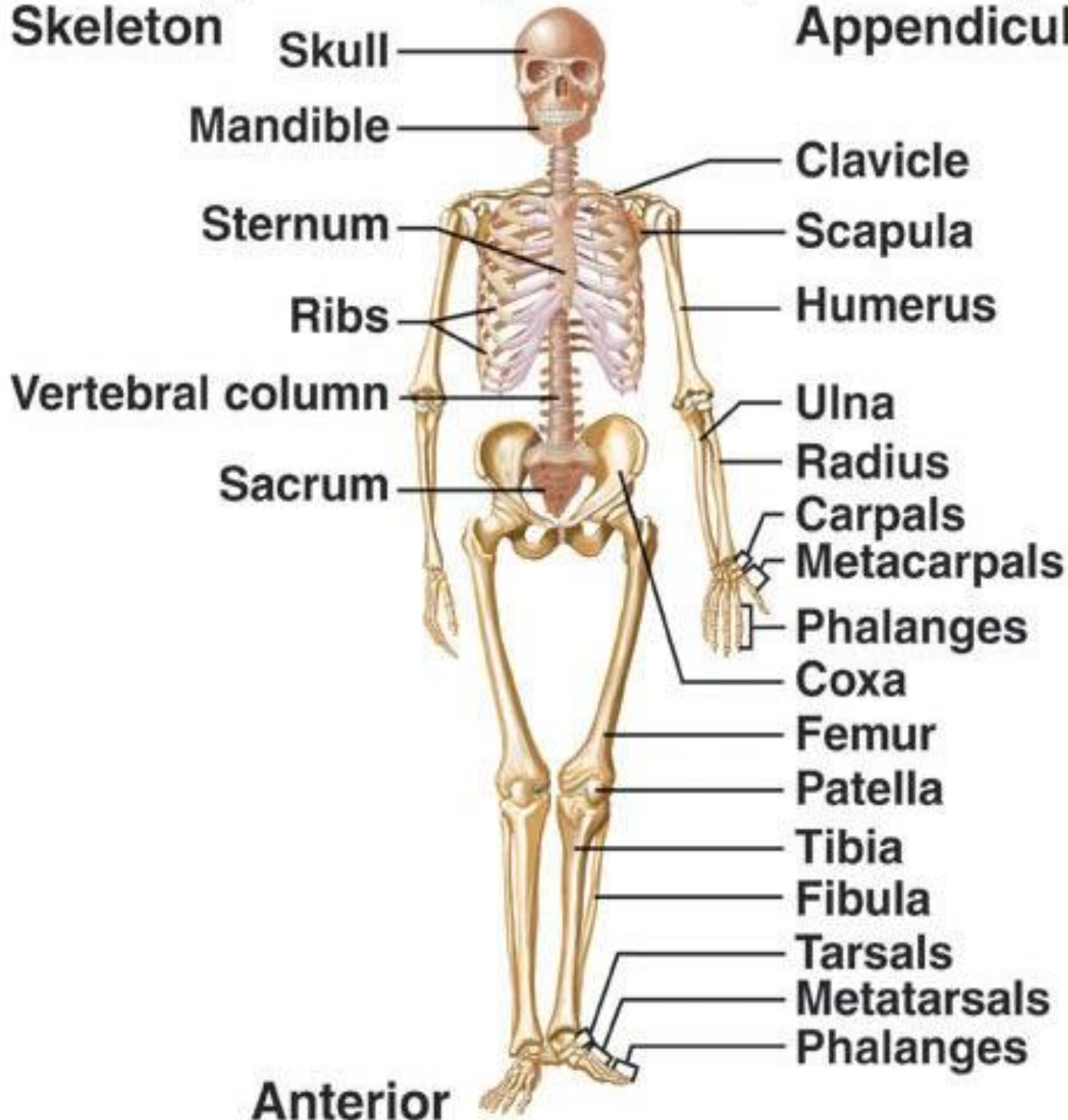


Axial Skeleton



Axial Skeleton

Appendicular Skeleton



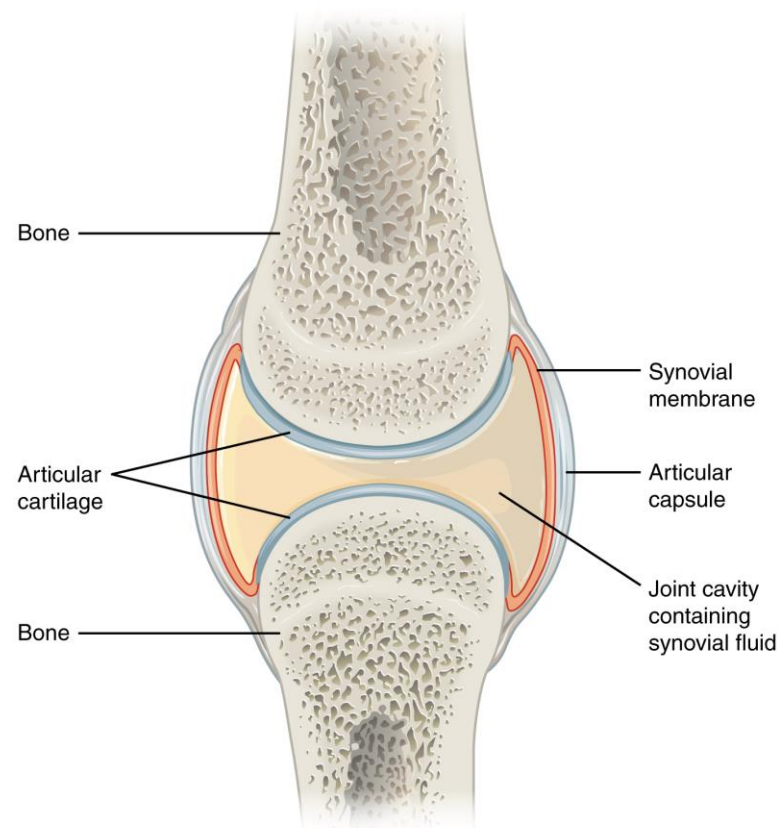
Anterior

Functions of Bones

- **Support of the body**
- **Protection of soft organs**
- **Movement due to attached skeletal muscles**
- **Storage of minerals and fats**
- **Blood cell formation**



JOINTS

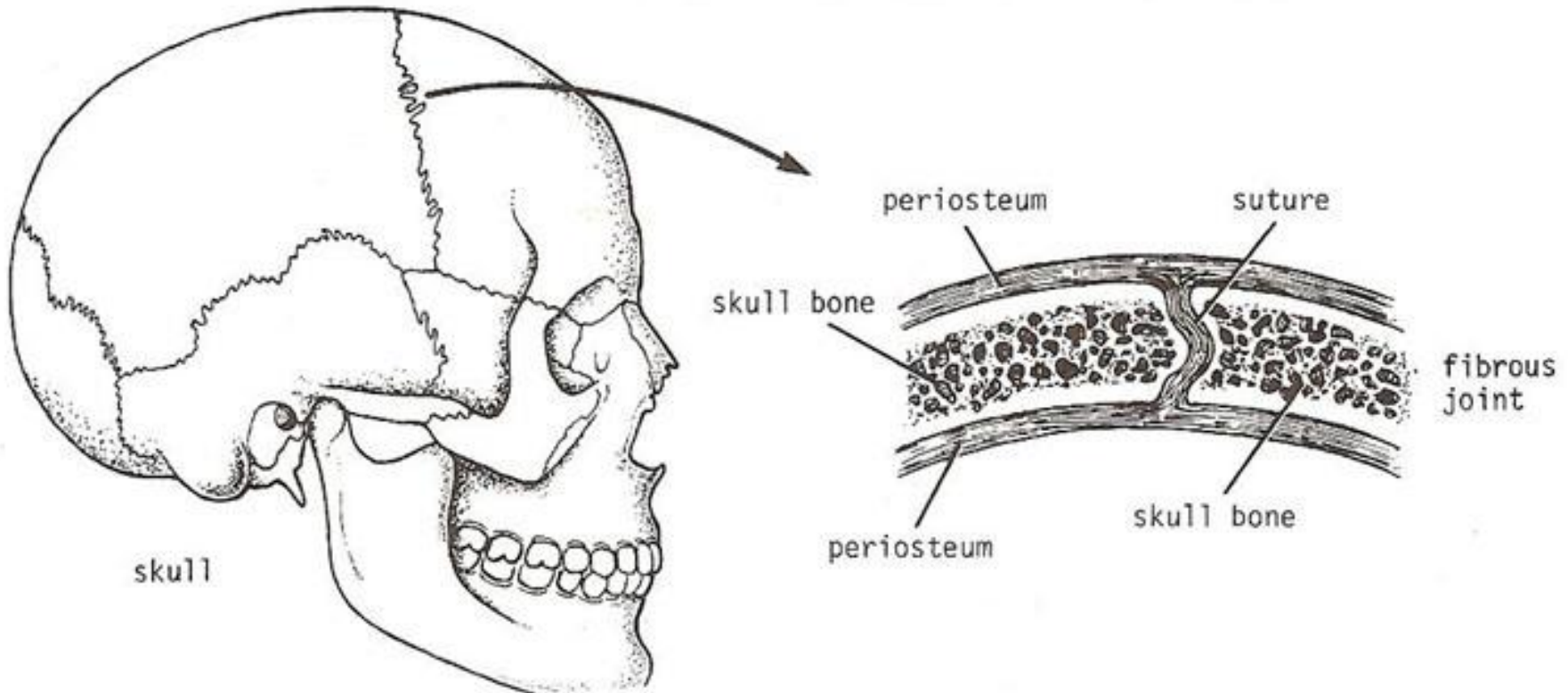


Definition: A point of contact between two bones, between two cartilages, between bone and cartilage, or between bone and teeth.

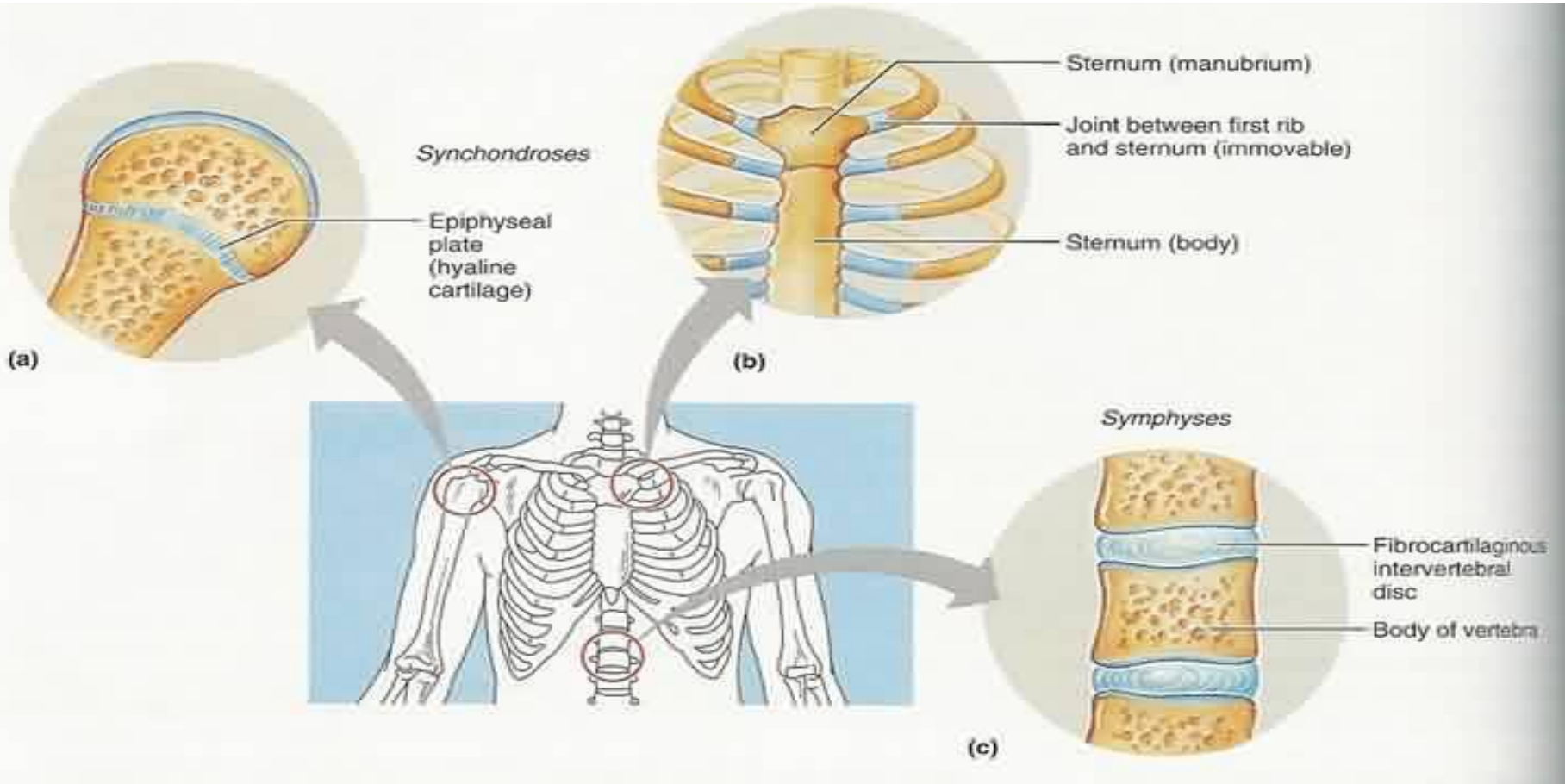
Types of Joints

➤ **Fibrous**-Fibrous joints connect bones without allowing any movement.

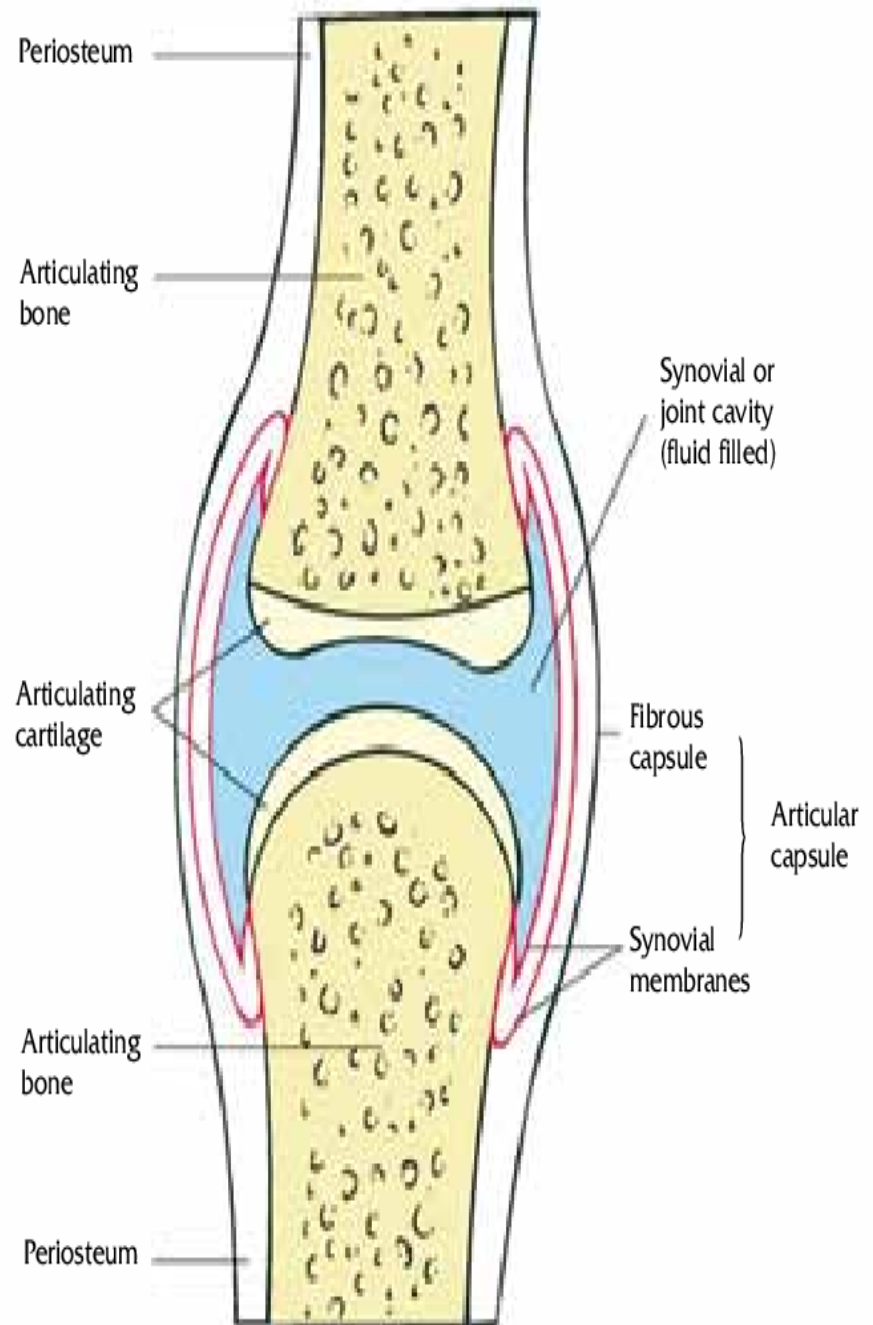
The bones of skull and pelvis are held together by fibrous joints.



➤ **Cartilaginous**-Cartilaginous joints are joints in which the bones are attached by cartilage. These joints allow for only a little movement, such as in the spine or ribs.



➤ **Synovial**-Synovial joints allow for much more movement than cartilaginous joints. Cavities between bones in synovial joints are filled with synovial fluid. This fluid helps lubricate and protect the bones. Bursa sacks contain the synovial fluid.

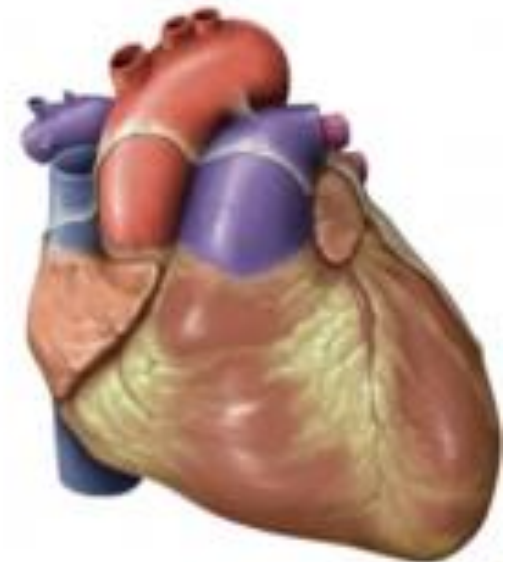
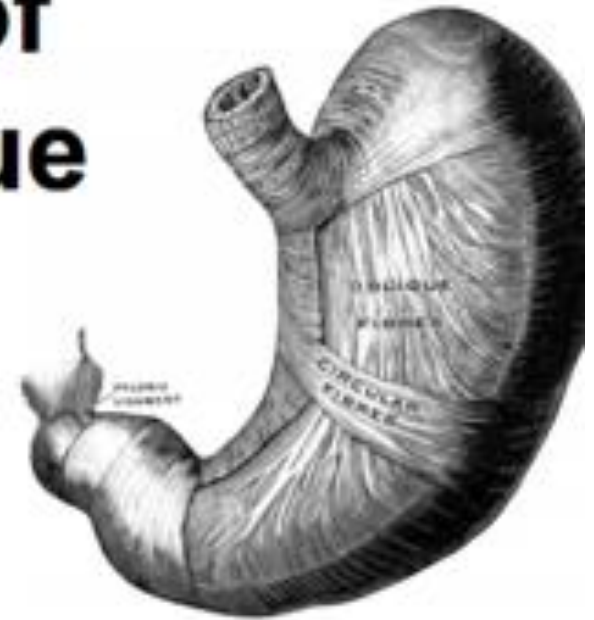


Muscle



Properties of Muscle Tissue

- **Excitability**
- **Contractility**
- **Elasticity**
- **Extensibility**

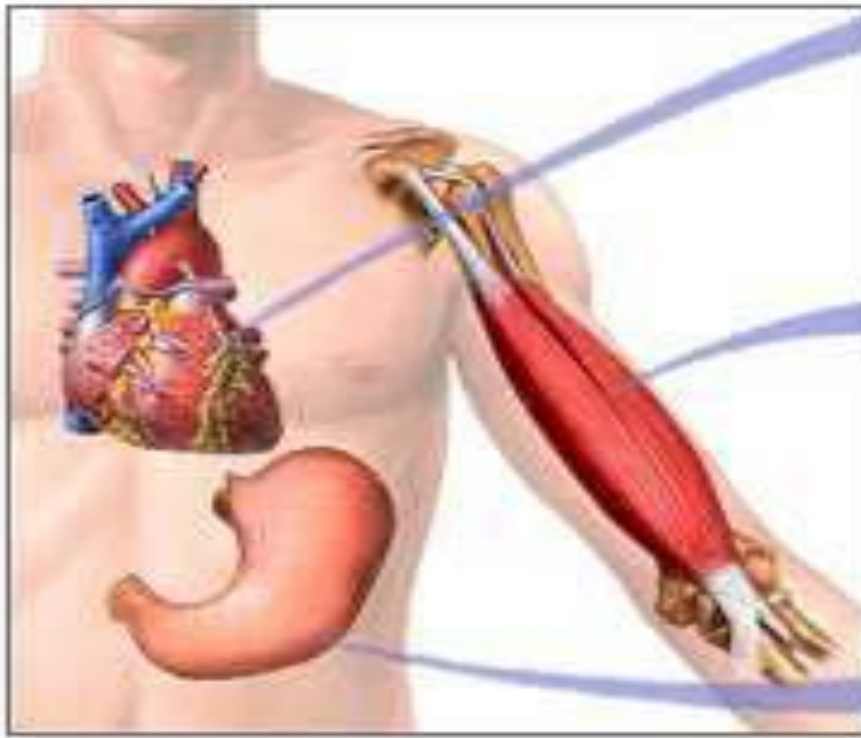


Properties of Muscle Tissue

- **Excitability:** capacity of muscle to respond to a stimulus.
- **Contractility:** ability of a muscle to shorten and generate pulling force

- **Elasticity**: ability of muscle to recoil to original resting length after stretched.
- **Extensibility**: muscle can be stretched back to its original length.

Types of muscle tissue



Cardiac muscle cell



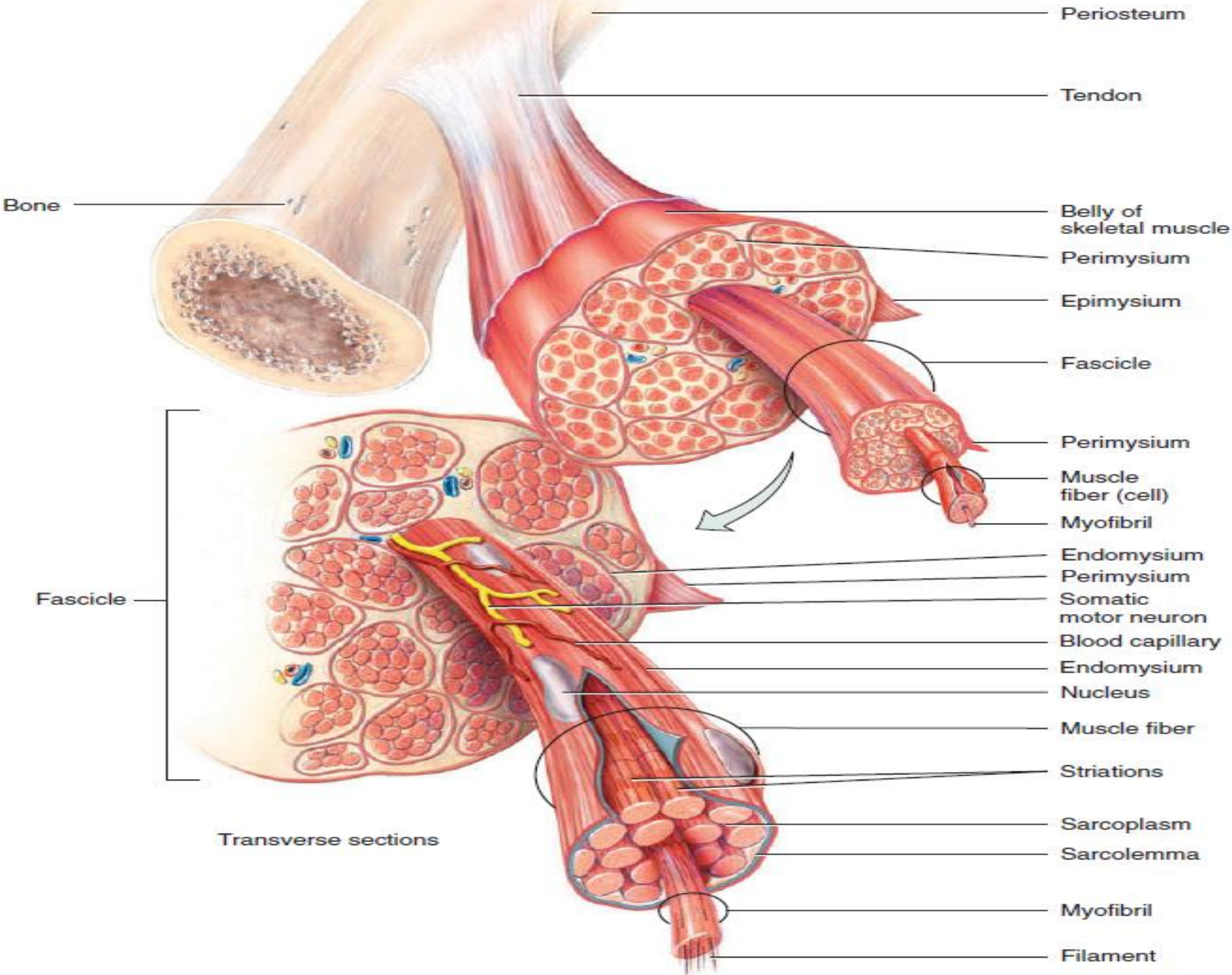
Skeletal muscle cell



Smooth muscle cell

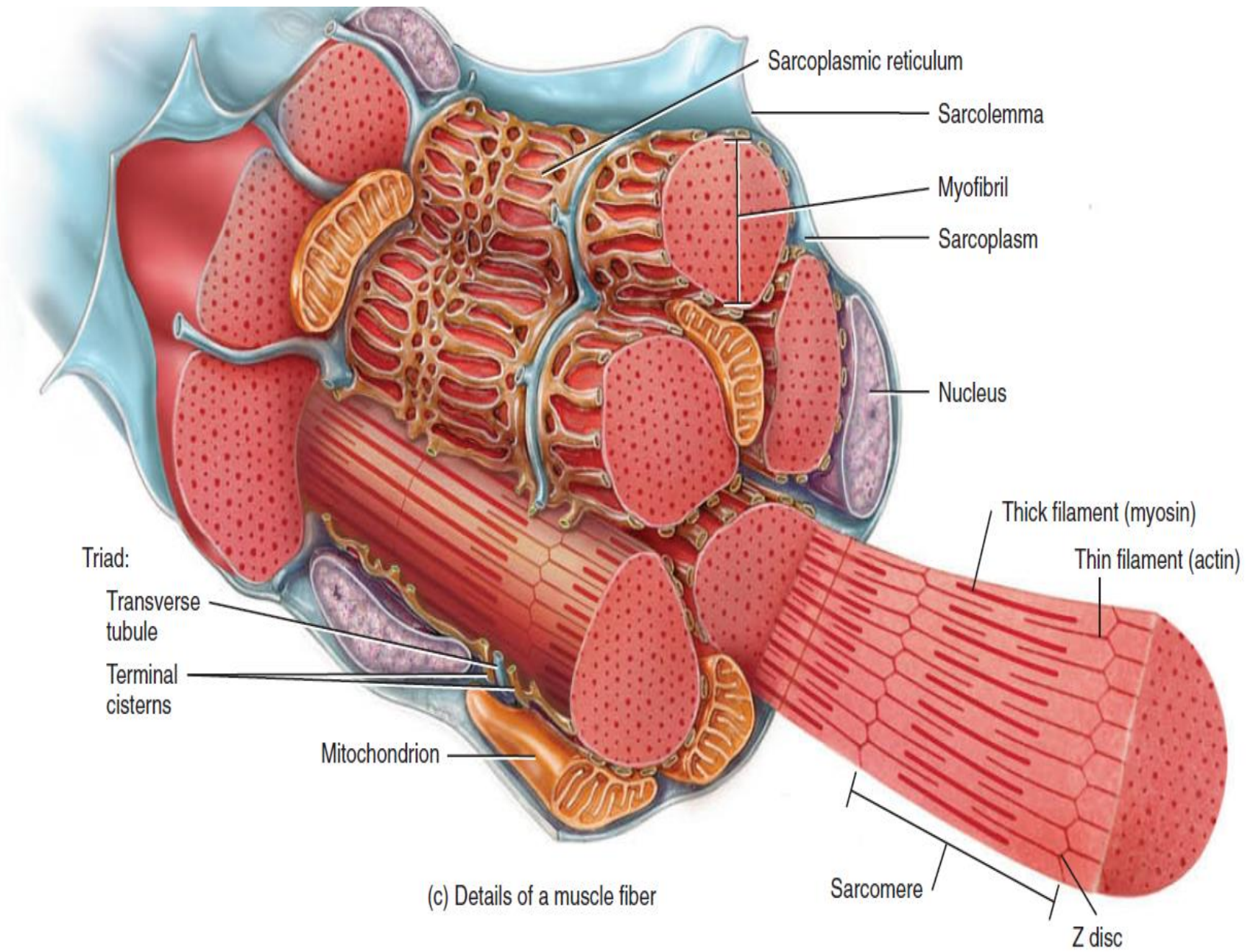
Muscle fibers

- ❖ Each skeletal muscle is a separate organ composed of hundreds to thousands of cells, which are called muscle fibers.
- Sarcolemma is the plasma membrane of a muscle cell.
- Tiny invaginations of the sarcolemma, called transverse (T) tubules, tunnel in from the surface toward the center of each muscle fiber.
- Within the sarcolemma is the sarcoplasm, the cytoplasm of a muscle fiber.



Transverse sections

Components of a skeletal muscle

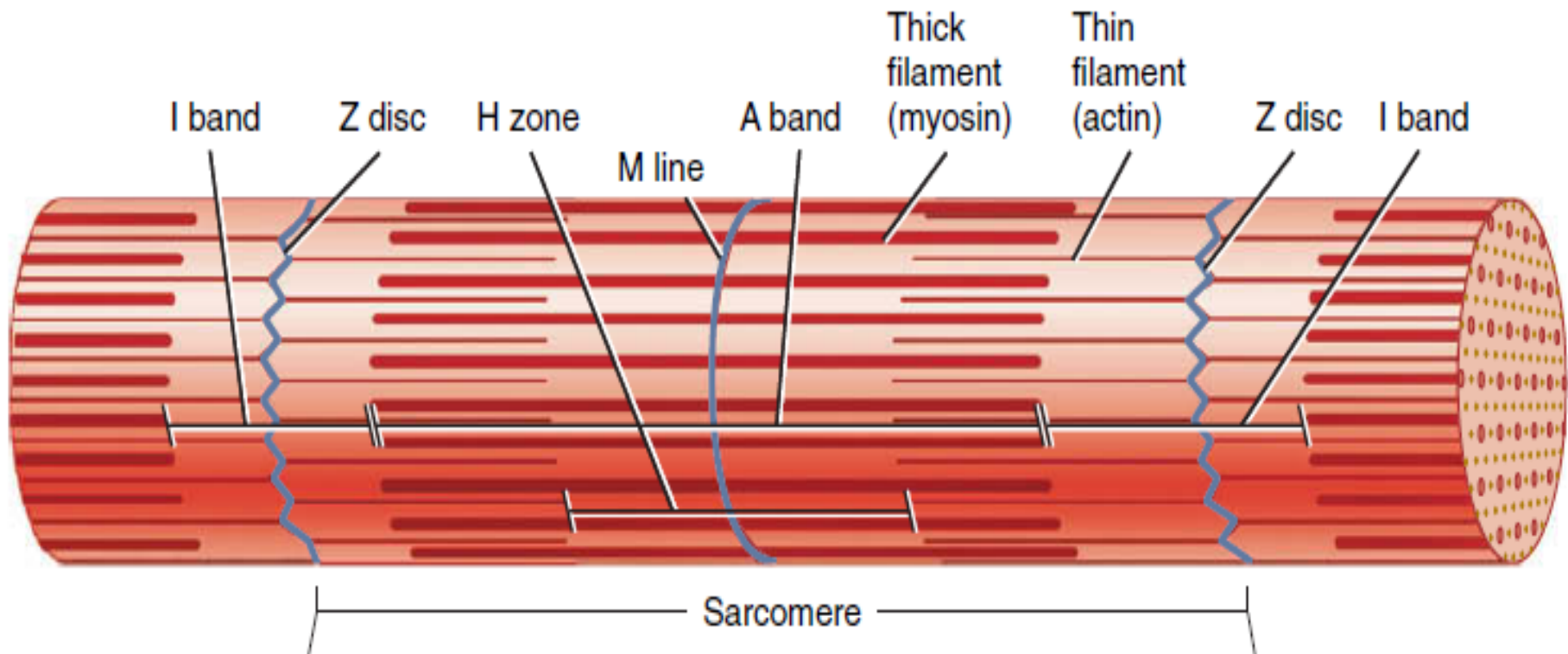


Thin and Thick Filaments

- At high magnification, the sarcoplasm appears stuffed with little threads which are the myofibrils (the contractile organelles of skeletal muscle)
- Within myofibrils are smaller protein structures called filaments or myofilaments.
- Thin filaments are composed mostly of the protein actin.
- thick filaments are composed mostly of the protein myosin.
- Both are directly involved in the contractile process.
- there are two thin filaments for every thick filament in the regions of filament overlap.

sarcomeres

- ✓ The filaments inside a myofibril do not extend the entire length of a muscle fiber. Instead, they are arranged in compartments called sarcomeres which are the basic functional units of a myofibril.
- ✓ Narrow, plate-shaped regions of dense protein material called Z discs separate one sarcomere from the next. Thus, a sarcomere extends from one Z disc to the next Z disc.

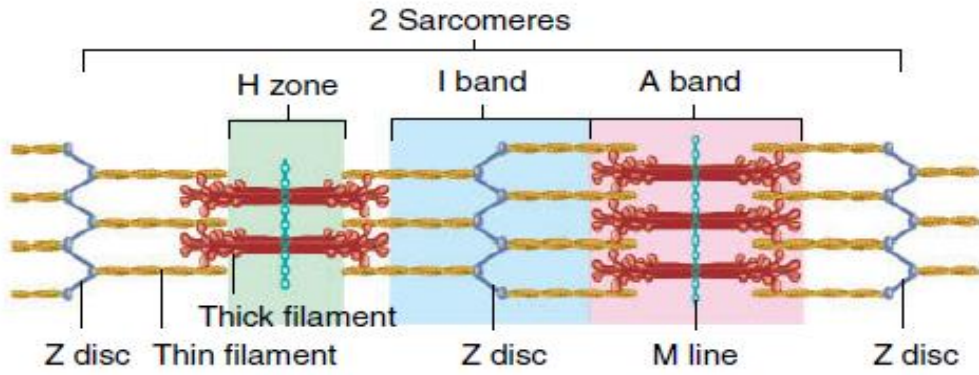


sarcomere

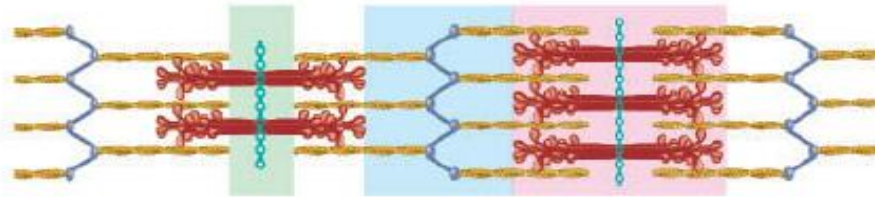
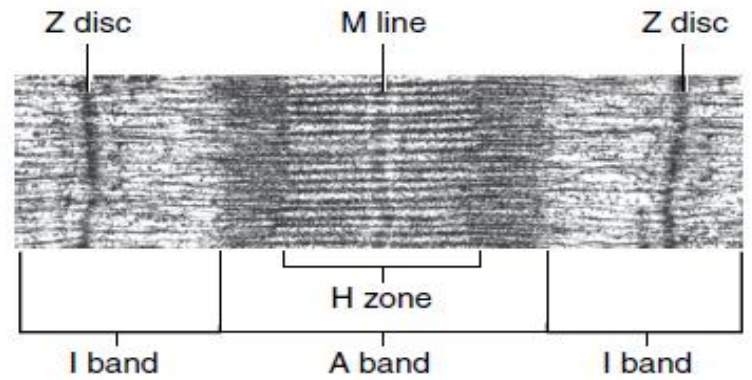
sliding filament mechanism

- ❑ the lengths of the thick and thin filaments are same in both relaxed and contracted muscle.
- ❑ muscle contraction is a folding process, somewhat like closing an accordion.
- ❑ skeletal muscle shortens during contraction because the thick and thin filaments slide past one another. The model describing this process is known as the sliding filament mechanism.

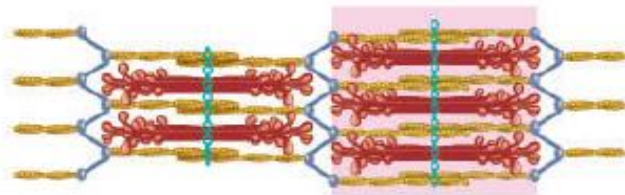
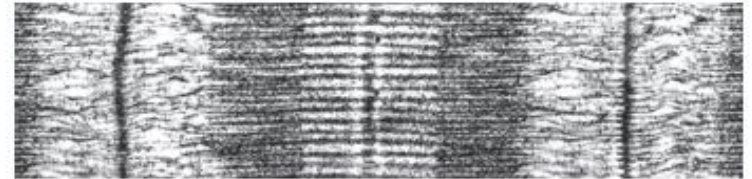




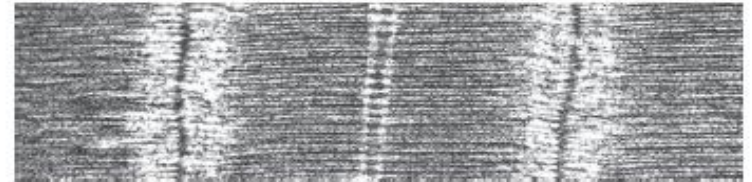
(a) Relaxed muscle



(b) Partially contracted muscle



(c) Maximally contracted muscle



Sliding filament mechanism of muscle contraction

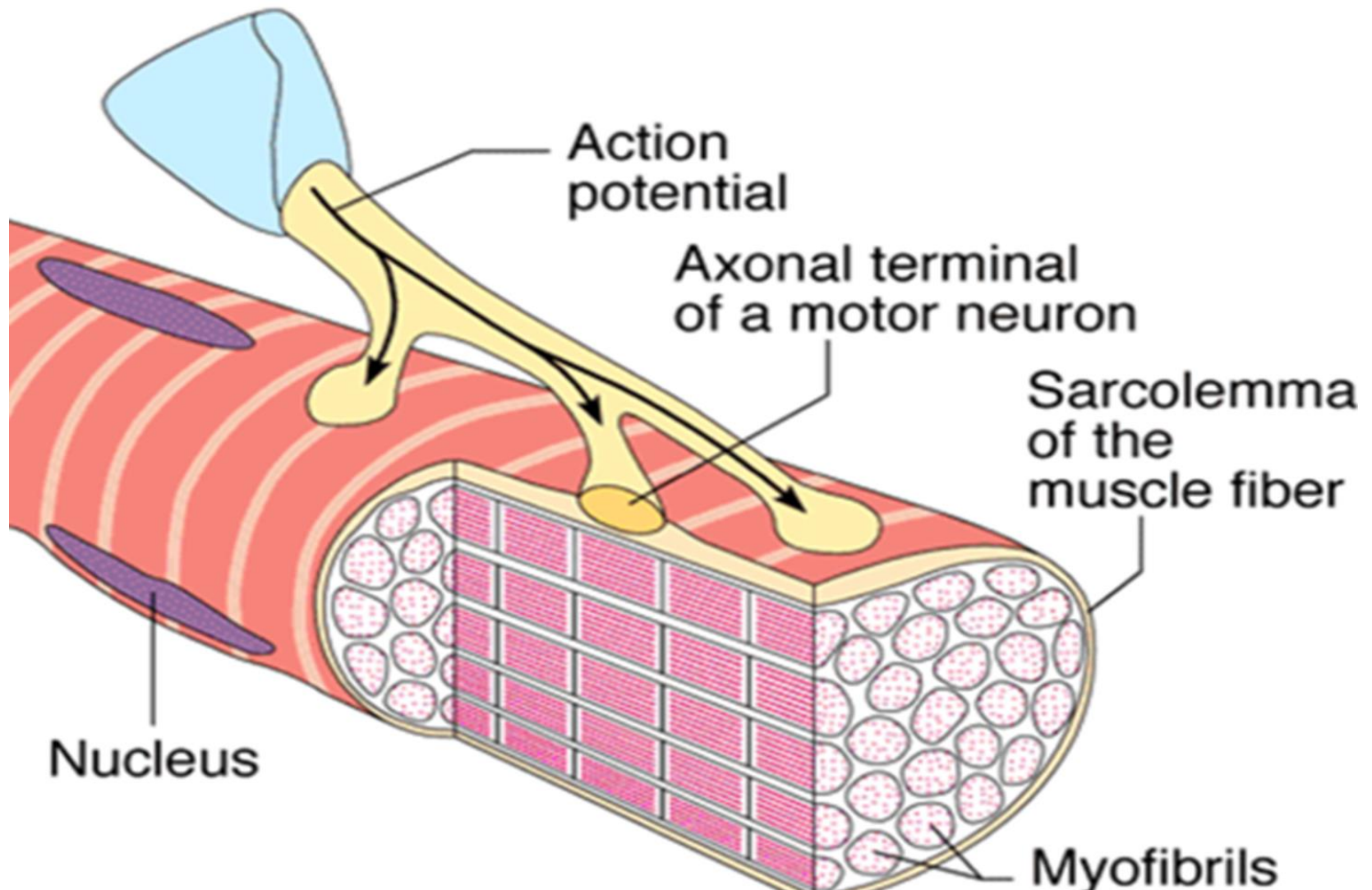
Neuromuscular Junction

- ❑ **Region where the motor neuron stimulates the muscle fiber.**
- ❑ **The neuromuscular junction is formed by :**
 - 1. End of motor neuron axon (axon terminal)**

Terminals have small membranous sacs (synaptic vesicles) that contain the neurotransmitter acetylcholine (ACh)
 - 2. The motor end plate of a muscle**

A specific part of the sarcolemma that contains ACh receptors.
- ❑ **Though exceedingly close, axonal ends and muscle fibers are always separated by a space called the **synaptic cleft****

Neuromuscular Junction



Muscular System Functions

- **Body movement (Locomotion)**
- **Maintenance of posture**
- **Respiration**
 - **Diaphragm and intercostal contractions**
- **Communication (Verbal and Facial)**
- **Constriction of organs and vessels**
 - **Peristalsis of intestinal tract**
 - **Vasoconstriction of b.v. and other structures (pupils)**
- **Heart beat**
- **Production of body heat (Thermogenesis)**

Thank You

Question

What is Cartilage?

Types of Cartilage?

Functions of Cartilage?