BP101T – Human Anatomy & Physiology-I

Skeletal and Muscular System (Detailed Theory Notes)

Created by: Amarjeet Kashyap

📌 1. Divisions of the Skeletal System

The human skeletal system is a strong framework made up of 206 bones. It provides support, protection, movement, and mineral storage. The skeleton is divided into two main parts:

1. Axial Skeleton (80 Bones)

The axial skeleton forms the central framework of the body. It includes:

* 1. Skull (22 bones)

Cranial Bones (8): Protect the brain.

Frontal (1)

Parietal (2)

Temporal (2)

Occipital (1)

Sphenoid (1)

Ethmoid (1)

Facial Bones (14): Give shape to the face.

Nasal (2), Maxilla (2), Zygomatic (2), Mandible (1), Lacrimal (2), Palatine (2), Inferior nasal concha (2), Vomer (1).

* 1. Hyoid Bone (1 Bone)

A small U-shaped bone in the neck that helps in swallowing.

© Vertebral Column (26 Bones)

Forms the backbone and protects the spinal cord.

Divisions of the vertebral column:

Cervical (7 vertebrae) – Neck region.

Thoracic (12 vertebrae) – Upper back, connects to ribs.

Lumbar (5 vertebrae) – Lower back, bears most body weight.

Sacrum (1 bone, fused) – Connects the spine to the pelvis.

Coccyx (1 bone, fused) – Also called the tailbone.

* 1. Thoracic Cage (25 Bones)

Sternum (1 bone): A flat bone in the center of the chest.

Ribs (24 bones in 12 pairs):

True ribs (1-7) – Directly attached to the sternum.

False ribs (8-10) – Indirectly attached to the sternum.

Floating ribs (11-12) – Not attached to the sternum.

€ Auditory Ossicles (6 Bones)

Tiny bones in the middle ear that help in hearing:

Malleus (2), Incus (2), Stapes (2).

1. Appendicular Skeleton (126 Bones)

The appendicular skeleton includes the bones of the limbs and girdles that help in movement.

* 1. Pectoral Girdle (4 Bones)

Clavicle (collarbone) – 2

Scapula (shoulder blade) – 2

* 1. Upper Limbs (60 Bones)

Humerus (2) – Upper arm bone.

Radius (2) & Ulna (2) – Forearm bones.

Carpals (16) – Wrist bones.

Metacarpals (10) – Palm bones.

Phalanges (28) – Finger bones.

© Pelvic Girdle (2 Bones)

Hip bones (Ilium, Ischium, and Pubis fused into 1 bone on each side).

* 1. Lower Limbs (60 Bones)

Femur (2) – Thigh bone, strongest in the body.

Patella (2) – Kneecap.

Tibia (2) & Fibula (2) – Lower leg bones.

Tarsals (14) – Ankle bones.

Metatarsals (10) – Foot bones.

Phalanges (28) – Toe bones.

📌 2. Types of Bones

Bones are classified based on their shape and function into five types:

1. Long Bones

Shape: Longer than they are wide.

Function: Provide support and movement.

Examples: Femur, Humerus, Radius, Ulna, Tibia, Fibula.

1. Short Bones

Shape: Cube-like.

Function: Provide stability with limited movement.

Examples: Carpals (wrist), Tarsals (ankle).

1. Flat Bones

Shape: Thin, flat, and often curved.

Function: Protect internal organs and provide muscle attachment.

Examples: Skull bones, Sternum, Ribs, Scapula.

1. Irregular Bones

Shape: Complex, not fitting into other categories.

Function: Protect organs and provide support.

Examples: Vertebrae, Hip Bones, Sphenoid, Ethmoid.

1. Sesamoid Bones

Shape: Small, round, embedded in tendons.

Function: Reduce friction and protect tendons.

Example: Patella (kneecap).

📌 3. Organization of Skeletal Muscle

Structure of Skeletal Muscle

Muscle Fiber (Muscle Cell): Long and cylindrical.

Sarcolemma: Outer membrane of muscle fiber.

Sarcoplasm: Fluid inside the muscle.

Myofibrils: Tiny filaments inside muscle fibers.

Sarcomere: Smallest unit of muscle contraction.

📌 4. Physiology of Muscle Contraction

Steps of Muscle Contraction (Sliding Filament Theory)

1. A nerve impulse reaches the muscle.
2. Acetylcholine (Ach) is released, starting the contraction process.
3. Calcium (Ca²⁺) is released from the sarcoplasmic reticulum.
4. Calcium binds to troponin, moving tropomyosin away from actin binding sites.
5. Myosin binds to actin and pulls it, causing contraction.
6. ATP is required for muscle relaxation after contraction.

📌 5. Neuromuscular Junction

Structure of Neuromuscular Junction (NMJ)

Motor Neuron: Sends signals to the muscle.

Synaptic Cleft: The gap between the nerve and muscle.

Synaptic Vesicles: Contain acetylcholine (Ach).

Receptors on Muscle Fiber: Receive Ach, leading to contraction.

Process of Nerve Impulse Transmission at NMJ

1. A nerve impulse reaches the axon terminal.
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4. Sodium (Na⁺) enters the muscle fiber, creating an action potential.
5. Calcium is released, triggering contraction.

🔹 Summary

✔ The skeletal system consists of 206 bones, divided into axial (80) and appendicular (126).

✔ Bones are classified into long, short, flat, irregular, and sesamoid.

✔ Muscle contraction happens through actin-myosin interaction and ATP usage.

✔ The neuromuscular junction transmits nerve signals to muscles, allowing movement.

📖 Importance of These Notes:

✔ Help in understanding body movement.

✔ Useful in bone and muscle injury studies.

✔ Explain how nerves control muscles.

# These detailed notes are based on the AKTU B. Pharm syllabus and ensure easy understanding and memorization. Let me know if you need further expansion on any topic! **BP101T – Human Anatomy & Physiology-I**

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# **📌 1. Divisions of the Skeletal System**

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### **(A) Skull (22 bones)**

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* **Facial Bones (14):** Give shape to the face.
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### **(B) Hyoid Bone (1 Bone)**

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* Forms the backbone and protects the spinal cord.
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### **2. Appendicular Skeleton (126 Bones)**

The **appendicular skeleton** includes the **bones of the limbs and girdles** that help in movement.

### **(A) Pectoral Girdle (4 Bones)**

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* **Shape:** Thin, flat, and often curved.
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* **Examples:** Skull bones, Sternum, Ribs, Scapula.

### **4. Irregular Bones**

* **Shape:** Complex, not fitting into other categories.
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* **Examples:** Vertebrae, Hip Bones, Sphenoid, Ethmoid.

### **5. Sesamoid Bones**

* **Shape:** Small, round, embedded in tendons.
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# **🔹 Summary**

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✔ **Bones are classified** into long, short, flat, irregular, and sesamoid.  
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