# IQRA NATIONAL UNIVERSITY

## DEPARTMENT OF ALLIED HEALTH SCIENCES

**Mid-Term Examination (Summer 2020) (BS DT 1st, BS MLT 1st, BS RAD 1st)**

**Course Title: Human Anatomy-l** **Instructor: Ms. Maria Feroze**

**Time: 4 hours**

**Note:**

- **Attempt all questions from this section, all questions carry equal marks.**

Q1. Define the following terms:

A) Motor unit
B) Ipsilateral
C) Supination
D) Axial skeleton
E) Arteriosclerosis
F) Shunt

Q2. Differentiate between type 1 and type 2 muscle fibers.

Q3. Classify the bones according to their shape.

Q4. What is the difference between artery, vein and capillary?

Q5. What do you know about the mechanism of skeletal muscle contraction?

Q6. What is the anatomical position of scapula and clavicle in human body?

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**BS: MLT SEC A**

**SUBJECT: ANATOMY (THEORY)**

**TEACHER: MAM MARIA FEROZ**

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# ANS 1:

**Defining the following terms:**

**G) Motor unit**

H) **Ipsilateral**
I) **Supination**
J) **Axial skeleton**
K) **Arteriosclerosis**
L) **Shunt**

## A- MOTOR UNIT

A motor unit, the functional unit of muscle contraction, is a single motor nerve and the associated muscle fibers that are innervated upon stimulation from the nerve.A collection of motor units is referred to as a motor pool.

## B- IPSILATERAL

On the same side, as opposed to contralateral. For example, a **tumor** involving the right side of the brain may affect vision ipsilaterally'that is, in the right eye.

## C- Supination

Rotation of the arm or leg outward. In the case of supination of the arm, the palm of the hand faces forward. .**Supination** means that when you walk, your weight tends to be more on the outside of your foot.

## D- _AXIAL SKELETON

The **axial skeleton** forms the vertical, central axis of the body and includes all bones of the head, neck, chest, and back. It serves to protect the brain, spinal cord, heart, and lungs. It also serves as the attachment site for muscles that move the head, neck, and back, and for muscles that act across the shoulder and hip joints to move their corresponding limbs.

## E- ARTERIOSCLEROSIS

Hardening and thickening of the walls of the arteries. Arteriosclerosis can occur because of fatty deposits on the inner lining of arteries (atherosclerosis), calcification of the wall of the arteries, or thickening of the muscular wall of the arteries.

## F- SHUNT

To move a body fluid, such as cerebrospinal fluid, from one place to another. A catheter (tube) that carries cerebrospinal fluid from a ventricle in the brain to another area of the body. A shunt may be placed to relieve pressure from hydrocephalus.

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## ANS 2:

### TYPE I

**Slow-twitch** muscle fibers have high concentrations of mitochondria and myoglobin. Although they are smaller than the fast-twitch fibers, they are surrounded by more capillaries . This combination **supports aerobic metabolism** and **fatigue resistance**, particularly important for prolonged submaximal (aerobic) exercise activities.

Type I fibers **produce less force** and are **slower to produce maximal tension** (lower myosin ATPase activity) compared to type II fibers. But they are **able to maintain longer-term contractions**, key for stabilization and postural control.

Remember:

- Small muscle fibers
- Low, slow force
- Fatigues slower than fast-twitch, type II
- Long-term contractions
- Supports fatigue resistance for aerobic activities, stabilization and postural control

### TYPE II

Fast-twitch type II muscle fibers are further divided into Type IIx and Type IIa.

Typically, these have lower concentrations of mitochondria, myoglobin, and capillaries compared to our slow-twitch fibers, which means they are **quicker to fatigue**.

These larger-sized fibers are also **produce a greater and quicker force**, an important consideration for **power activities.**.

**Type IIX** (also known as **Type IIB**) fibers **produce the most force**, but are **incredibly inefficient** based on their high myosin ATPase activity, low oxidative capacity, and heavy reliance on anaerobic metabolism .

**Type IIA** fibers, also known as *intermediate muscle fibers,* are a **mix of type I and type IIx**, with comparable tension. Able to **use both aerobic and anaerobic energy systems**, these fibers have a higher oxidative capacity and fatigue more slowly than type IIx .

Remember:

- Large muscle fibers
- Greater and quicker force
- Fatigues faster than slow-twitch type I
- Two types: Type II**x** and Type II**a**
  - Type IIx produces the most force but inefficient (fatigues very fast)
  - Type IIa is a mix of type I and type IIx muscle fibers (fatigues slower than Type IIx)
- Short-term contractions
- Supports

| Characteristic | Slow-Twitch Type I | Fast-Twitch Type IIA | Fast-Twitch Type IIX or IIB |
|---|---|---|---|
| Activities | Marathons, distance running, swimming, cycling, power walking, endurance training | Powerlifting, sprinting, jumping, strength and agility training | Powerlifting, sprinting, jumping, strength and agility training |
| Muscle Fiber Size | Small | Large | Large |
| Force Production | Low | High | Very High |
| Resistance to Fatigue | Slow | Quick | Very Quick |
| Contraction Speed | Slow | Quick | Very Quick |
| Mitochondria | High | Medium | Low |
| Capillaries | High | Medium | Low |
| Myoglobin | High | Medium | Low |

| | | | |
|---|---|---|---|
| ATPase Level | Low | Medium | High |
| Oxidative Capacity | High | Medium | Low |

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## ANS 3:

Bones are classified according to their shape.

### Long Bones

A long bone is one that is cylindrical in shape, being longer than it is wide. Keep in mind, however, that the term describes the shape of a bone, not its size. Long bones are found in the arms (humerus, ulna, radius) and legs (femur, tibia, fibula), as well as in the fingers (metacarpals, phalanges) and toes (metatarsals, phalanges). Long bones function as levers; they move when muscles contract.

### Short Bones

A short bone is one that is cube-like in shape, being approximately equal in length, width, and thickness. The only short bones in the human skeleton are in the carpals of the wrists and the tarsals of the ankles. Short bones provide stability and support as well as some limited motion.

## Flat Bones

The term ‘‘flat bone’’ is somewhat of a misnomer because, although a flat bone is typically thin, it is also often curved. Examples include the cranial (skull) bones, the scapulae (shoulder blades), the sternum (breastbone), and the ribs. Flat bones serve as points of attachment for muscles and often protect internal organs.

## Irregular Bones

An irregular bone is one that does not have any easily characterized shape and therefore does not fit any other classification. These bones tend to have more complex shapes, like the vertebrae that support the spinal cord and protect it from compressive forces. Many facial bones, particularly the ones containing sinuses, are classified as irregular bones.

## Sesamoid Bones

A sesamoid bone is a small, round bone that, as the name suggests, is shaped like a sesame seed. These bones form in tendons (the sheaths of tissue that connect bones to muscles) where a great deal of pressure is generated in a joint. The sesamoid bones protect tendons by helping them overcome compressive forces. Sesamoid bones vary in number and placement from person to person but are

typically found in tendons associated with the feet, hands, and knees. The patellae (singular = patella) are the only sesamoid bones found in common with every person.

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## ANS 4:

| ARTERIES | VEINS | CAPILLARIES |
| --- | --- | --- |
| 1) These blood vessels have thick walls and carry blood from the heart to different body parts. | 1) These blood vessels have thin walls and carry blood from different body parts to the heart. | 1) These blood vessels are narrow and have very thin walls, they connect arteries and veins. |
| 2) They do not have valves. | 2) They have valves and prevent backflow of blood. | 2) They do not have valves. |
| 3) All the arteries carry oxygenated blood except the pulmonary artery. | 3) All the veins carry deoxygenated blood except the pulmonary vein. | 3) As it connects arteries and veins, therefore, it contains both oxygenated and deoxygenated blood. |

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## ANS 5:

# MUSCULAR CONTRACTION

**Muscle contraction begins when the nervous system generates a signal. The signal, an impulse called an action potential, travels through a type of nerve cell called a motor neuron. The neuromuscular junction is the name of the place where the motor neuron reaches a muscle cell. Skeletal muscle tissue is composed of cells called muscle fibers. When the nervous system signal reaches the neuromuscular junction a chemical message is released by the motor neuron. The chemical message, a neurotransmitter called acetylcholine, binds to receptors on the outside of the muscle fiber. That starts a chemical reaction within the muscle.**

## =Acetylcholine Is Released and Binds to Receptors on the Muscle Membrane

**A multistep molecular process within the muscle fiber begins when acetylcholine binds to receptors on the muscle fiber membrane. The proteins inside muscle fibers are organized into long chains that can interact with each other, reorganizing to shorten and relax. When acetylcholine reaches receptors on the membranes of muscle fibers, membrane channels open and the process that contracts a relaxed muscle fibers begins:**

- Open channels allow an influx of sodium ions into the cytoplasm of the muscle fiber.
- The sodium influx also sends a message within the muscle fiber to trigger the release of stored calcium ions.
- The calcium ions diffuse into the muscle fiber.
- The relationship between the chains of proteins within the muscle cells changes, leading to the contraction.

## =Muscle Fibers Relax When the Nervous System Signal Is No Longer Present

When the stimulation of the motor neuron providing the impulse to the muscle fibers stops, the chemical reaction that causes the rearrangement of the muscle fibers' proteins is stopped. This reverses the chemical processes in the muscle fibers and the muscle relaxes.

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ANS 6: CLAVICLE

**The clavicle (collarbone) is an S-shaped bone located on the anterior side of the shoulder. It is attached on its medial end to the sternum of the thoracic cage, which is part of the axial skeleton. The lateral end of the clavicle articulates (joins) with the scapula just above the shoulder joint. You can easily palpate, or feel with**

**your fingers, the entire length of your clavicle. The clavicle is the only long bone that lies in a horizontal position in the body.**

**it serves to protect the underlying nerves and blood vessels as they pass between the trunk of the body and the upper limb.**

**The clavicle has three regions: the medial end, the lateral end, and the shaft. The medial end, known as the sternal end of the clavicle, has a triangular shape and articulates with the manubrium portion of the sternum. This forms the sternoclavicular joint, which is the only bony articulation between the pectoral girdle of the upper limb and the axial skeleton. Medially, the clavicle articulates with the manubrial portion of the sternum, forming the sternoclavicular joint (SC joint). This joint, surrounded by a fibrous capsule, contains an intra-articular disc in between the clavicle and the sternum. Superiorly, the interclavicular ligament connects the ipsilateral and contralateral clavicle, together providing further stability**

## SCAPULA

**The scapula is also part of the pectoral girdle and thus plays an important role in anchoring the upper limb to the body. The scapula is located on the posterior side of the shoulder. It is surrounded by muscles on both its anterior (deep) and posterior (superficial) sides, and thus does not articulate with the ribs of the thoracic cage.**

**The scapula has several important landmarks. The three margins or borders of the scapula, named for their positions within the body, are the superior border of the scapula, the medial border of the scapula, and the lateral border of the scapula. The suprascapular notch is located lateral to the midpoint of the superior border. The corners of the triangular scapula, at either end of the medial border, are the superior angle of the scapula, located between the medial and superior borders, and the inferior angle of the scapula, located between the medial and lateral borders. The inferior angle is the most inferior portion of the scapula, and is particularly important because it serves as the attachment point for several powerful muscles involved in shoulder and upper limb movements. The remaining corner of the scapula, between the superior and lateral borders, is the location of the glenoid cavity (glenoid fossa). This shallow depression articulates with the humerus bone of the arm to form the glenohumeral joint (shoulder joint). The small bony bumps located immediately above and below the glenoid cavity are the supraglenoid tubercle and the infraglenoid tubercle, respectively. These provide attachments for muscles of the arm.**

***THE END***

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