Atrial natriuretic peptide (ANP) is a peptide hormone produced by atrial muscle cells of the heart. It reduces an expanded extracellular fluid volume by increasing renal sodium excretion.

CHAPTER-9 LOCOMOTION AND BODY MOVEMENTS

Evaluation

1.Muscles are derived from

(a) ectoderm **(b) mesoderm** (c) endoderm (d) neuro ectoderm

2.Muscles are formed by

(a) myocytes (b) leucocytes (c) osteocytes (d) lymphocytes

3.The muscles attached to the bones are called

(a) skeletal muscle (b) cardiac muscle (c) involuntary muscle (d) smooth muscles

4.Skeletal muscles are attached to the bones by

(a) tendon (b) ligament (c) pectin (d) fibrin

5.The bundle of muscle fibres is called

(a) Myofibrils **(b) fascicle** (c) sarcomere (d) sarcoplasm

6.The pigment present in the muscle fibre to store oxygen is

(a) myoglobin (b) troponin (c) myosin (d) actin

7.The functional unit of a muscle fibre is

(a) sarcomere (b) sarcoplasm (c) myosin (d) actin

8.The protein present in the thick filament is

(a) myosin (b) actin (c) pectin (d) leucin

9.The protein present in the thin filament is

(a) myosin **(b) actin** (c) pectin (d) leucin

10.The region between two successive Z-discs is called a

(a) sarcomere (b) microtubule (c) myoglobin (d) actin

11.Each skeletal muscle is covered by

(a) epimysium (b) perimysium (c) endomysium (d) hypomysium

12.Knee joint is an example of

(a) saddle joint **(b) hinge joint** (c) pivot joint (d) gliding joint

13.Name of the joint present between the atlas and axis is

(a) synovial joint **(b) pivot joint** (c) saddle joint (d) hinge joint

14.ATPase enzyme needed for muscle contraction is located in

(a) actinin (b) troponin **(c) myosin** (d) actin

15.Synovial fluid is found in

(a) Ventricles of the brain (b) Spinal cord

(c) Immovable joint **(d) Freely movable joints.**

16.Inflammation of joints due to accumulation of uric acid crystals is called as

(a) Gout (b) Myasthenia gravis

(c) Osteoporosis (d) Osteomalacia

17.Acetabulum is located in

(a) collar bone **(b) hip bone** (c) shoulder bone (d) thigh bone

18.Appendicular skeleton is

(a) girdles and their limbs (b) vertebrae

(c) skull and vertebral column (d) ribs and sternum

19.The type of movement exhibits by the macrophages are

(a) flagellar (b) ciliary (c) muscular **(d) amoeboid**

20.The pointed portion of the elbow is

(a) acromion process **(b) glenoid cavity**

(c) olecranon process (d) symphysis

21.Name the different types of movement.

Types of movement :

The different types of movements that occur in the cells of our body are amoeboid, ciliary, flagellar and muscular movement.

1. **Amoeboid movement:** Cells such as macrophages exhibit amoeboid movement for engulfing pathogens by pseudopodia formed by the streaming movement of the cytoplasm.
2. **Ciliary movement:** This type of movement occurs in the respiratory passages and genital tracts which are lined by ciliated epithelial cells.
3. **Flagellar movement:** This type of movement occurs in the cells which are having flagella or whip-like motile organelle. The sperm cells show flagellar movement.
4. **Muscular movement:** The movement of hands, legs, jaws, tongue are caused by the contraction and relaxation of the muscle which is termed as the muscular movement.

22.Name the filaments present in the sarcomere.

1. Sarcomere is the functional unit of a skeletal muscle.
2. Inside the sarcomere two types of filaments are present namely the thickand thin filaments.

23.Name the contractile proteins present in the skeletal muscle

Contraction of the muscle depends on the presence of contractile proteins such as **actin** and **myosin** in the myofilaments.

24.When describing a skeletal muscle, what does "striated" mean?

1. Each skeletal muscle is made up of bundles of muscle fibres calledfascicle.
2. Each muscle fibre contains hundreds to thousands of rod-like structures calledmyofibrils that run parallel to its length.
3. Along the length of each myofibril there are a repeated series of dark and light bands.
4. The dark A-bands (Anisotropic bands) and the light I-bands (Isotropic bands) are perfectly aligned with one another.
5. This type of arrangement gives the cell a striated appearance.

25.How does an isotonic contraction take place?

1. There are two primary types of muscle contractions. They are isotonic contraction and isometric contraction.

2. The types of contractions depend on the changes in the length and tension of the muscle fibres at the time of its contraction.

Isotonic contraction (iso-same, ton-weight/resistance) :

In isotonic contraction the length of the muscle changes but the tension remains constant.

1. Here, the force produced is unchanged.
   Eg: Lifting dumbbells and weight lifting.

26.How does an isometric contraction take place?

1. There are two primary types of muscle contractions. They are isotonic contraction and isometric contraction.
2. The types of contractions depend on the changes in the length and tension of the muscle fibres at the time of its contraction.

Isometric contraction (iso-same, metric-distance):

1. In isometric contraction the length of the muscle does not change but the tension of the muscle changes.
2. Here, the force produced is changed.
   Eg: Pushing against a wall, holding a heavy bag.

27.Name the bones of the skull.

The Skull is composed of two sets of bones –**Cranial bones** and **Facial bones**.

Cranial bones:

1. It consists of 22 bones of which 8 are cranial bones and 14 are facial bones.
2. The cranial bones form the brain box. They are a **paired parietal, paired temporal** and **individual bones** such as the **frontal, sphenoid, occipital** and**ethmoid.**

Facial bones:

1. In the facial bones **maxilla, zygomatic, palatine, lacrimal, nasal** are paired bones whereas mandible or lower jaw and vomer are unpaired bones. They form the front part of the skull. A single U-shaped hyoid bone is present at the base of the buccal cavity.
2. Each middle ear contains three tiny bones- **malleus, incus** and **stapes**collectively called **ear ossicles**.
3. The upper jaw is formed of the maxilla and the lower jaw is formed of the mandible.
4. The upper jaw is fused with the cranium and is immovable. The lower jaw is connected to the cranium by muscles and is movable.

28.Which is the only jointless bone in human body?

1. A single U-shaped hyoid bone is present at the base of the buccal cavity.
2. It is the only bone without joint.

29.List the three main parts of the axial skeleton.

Skeleton	Name of Bone		Number of bones	Total number of bones
Axial skeleton (80 bones)	Skull	Cranium	8	29
		Facial bone	14	
		Bones of middle	6	
		Ear	(2 × 3)	
		Hyoid bone	1	
	Vertebral column	Cervical	7	26 (in adults)
		Thoracic	12	
		Lumbar	5	
		Sacral	5 bones fused to 1 bone	
		Coccyx	4 bones fused to 1 bone	
	Sternum		1	1
	Ribs		12 × 2 = 24	24
Total number of bones in the axial skeleton = 80				

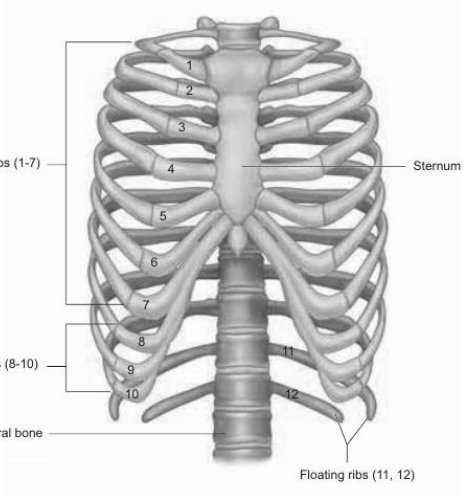
30.How is tetany caused?

Rapid muscle spasms occur in the muscles due to deficiency of parathyroid hormone resulting in reduced calcium levels in the body. This disease is called tetany and is a disorder of muscular system.

31.How is rigor mortis happened?

1. It is the state of stiffening of the body after death due to non separation of actin and myosin filaments.
2. ATP production stops and skeletal muscles become rigid.

32.What are the different types of rib bones that form the rib cage?



The Rib cage :

There are 12 pairs of ribs. Each rib is a thin flat bone connected dorsally to the vertebral column and ventrally to the sternum. It has two articulation surfaces on its dorsal end, hence called bicephalic.

True ribs:

The first seven pairs of ribs are called '**true ribs**' or**vertebro–sternal ribs**. Dorsally they are attached to the thoracic vertebrae and ventrally connected to the sternum with the help of hyaline cartilages.

False ribs:

The 8th, 9th and 10th pairs of ribs do not articulate directly with the sternum but joined with the cartilaginous (hyaline cartilage) part of the seventh rib. These are called '**false ribs**' or **vertebro-chondral ribs**.

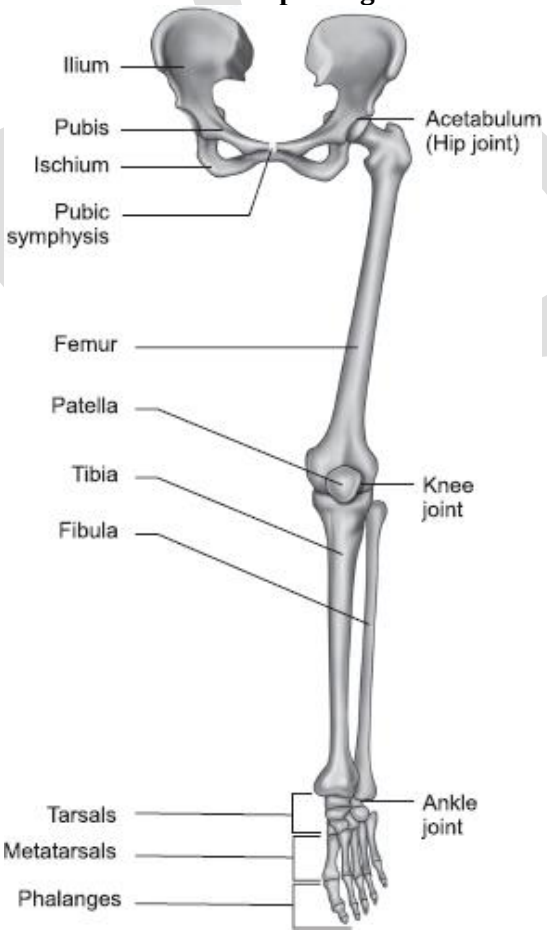
Floating ribs:

The last 11th and 12th pairs of ribs are not connected ventrally. Therefore, they are called as '**floating ribs**' or **vertebral ribs**.

Formation of rib cage :

1. Thoracic vertebrae, ribs and sternum together form the ribcage.
2. Rib cage protects the lungs, heart, liver and also plays a role in breathing.

33.What are the bones that make the pelvic girdle?



Pelvic Girdle :

1. The pelvic girdle is a heavy structure specialized for weight bearing. It is composed of two hip bones called**coxal bones** that secure the lower limbs to the axial skeleton. Together, with the sacrum and coccyx, the hip bones form the basin-like bony pelvis.
2. Each coxal bone consists of three fused bones, **ilium, ischium** and **pubis**. At the point of fusion of ilium, ischium, and pubis a deep hemispherical socket called the **acetabulum** is present on the lateral surface of the pelvis.
3. It receives the head of the femur or thigh bone at the hip joint and helps in the articulation of the femur.
4. The ilium is the superior flaring portion of the hip bone. Each ilium forms a secure joint with the sacrum posteriorly. The ischium is a curved bar of bone. The V-shaped pubic bones articulate anteriorly at the pubic symphysis.

The Lower limb:

1. The lower limb consists of 30 bones which carries the entire weight of the erect body.
2. The bones of the lower limbs are thicker and stronger than the upper limbs. The three segments of each lower limb are the thigh, the leg or the shank and the foot.
3. The femur is the single bone of the thigh. It is the largest, longest and strongest bone in the body. The head of femur articulates with the acetabulum of the pelvis to form the hip joint.
4. Two parallel bones, the tibia and fibula, form the skeleton of the shank. A thick, triangular patella forms the knee cap, which protects the knee joint anteriorly and improves the leverage of thigh muscles acting across the knee.
5. The foot includes the bones of **ankle**, the **tarsus**, the **metatarsus** and the**phalanges** or **toe bones.** The foot supports our body weight and acts as a lever to propel the body forward, while walking and running.
6. The tarsus is made up of seven bones called **tarsals**. The metatarsus consists of five bones called **metatarsals**. The arrangement of the metatarsals is parallel to each other. There are 14 phalanges in the toes which are smaller than those of the fingers.

34.List the disorders of the muscular system.

Disorders of muscular system:

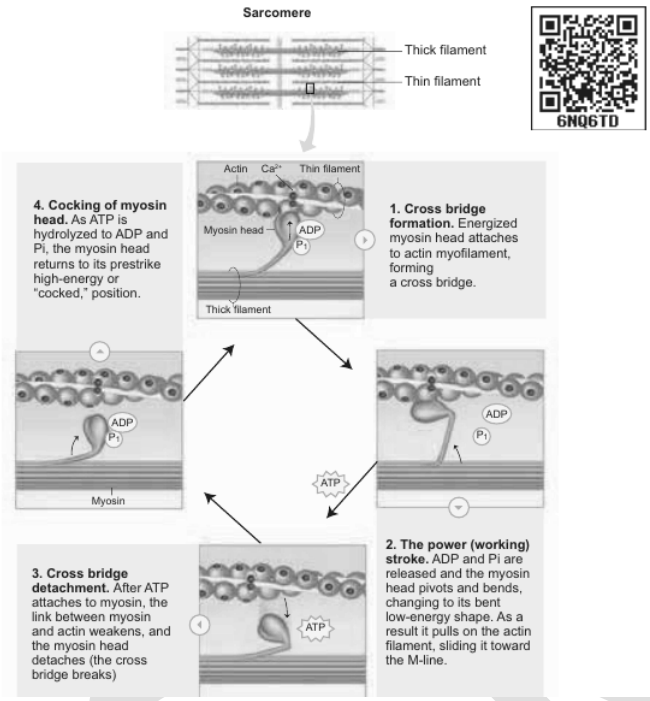
1. **Myasthenia gravis:** An autoimmune disorder affecting the action of acetylcholine at neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscles.
2. **Tetany:** Rapid muscle spasms occur in the muscles due to deficiency of parathyroid hormone resulting in reduced calcium levels in the body.
3. **Muscle fatigue:** Muscle fatigue is the inability of a muscle to contract after repeated muscle contractions.
4. **Atrophy:** A decline or cessation of muscular activity results in the condition called **atrophy** which results in the reduction in the size of the muscle and makes the muscle to become weak, which occurs with lack of usage as in chronic bedridden patients.
5. **Muscle pull:** Muscle pull is actually a muscle tear. A traumatic pulling of the fibres produces a tear known as **sprain**. This can occur due to sudden stretching of muscle beyond the point of elasticity.
6. **Muscular dystrophy:** The group of diseases collectively called the**muscular dystrophy** are associated with the progressive degeneration of skeletal muscle fibres, weakening the muscles and leading to death from lung or heart failure.

35.Explain the sliding-filament theory of muscle contraction.

Rolf Niedergerke Andrew F. Huxley (1954)proposed the sliding-filament theory to explain muscle contraction. According to this theory overlapping actin and myosin filaments of fixed length slide past one another is an energy requiring process resulting in muscle contraction.

1. Contraction is the creation of tension in the muscle and relaxation is the release of tension created by contraction.
2. Muscle contraction is initiated by a nerve impulse sent by the central nervous system (CNS) through a motor neuron.
3. The junction between the motor neuron and sarcolemma of the muscle fibre is called the **neuromuscular junction** or**motor end plate**. When nerve impulse reaches this junction acetylcholine is released.
4. An action potential is generated which initiates opening of multiple gated channels of sarcolemma.
5. This causes the flow of large quantities of calcium ions from sarcoplasmic reticulum. The Ca^{+} ions bind to the troponin of thin filaments. The active sites are exposed to the heads of myosin to form a cross bridge and phosphate ion is released.
6. Hydrolysis of ATP occurs and energy released helps the myosin head to rotate (90° angle with long axis of filament). In this position myosin binds to an actin and activates contraction – relaxation cycle which is followed by a power stroke.
7. Power stroke (cross – bridge tilting) begins after rest of myosin binding sites are uncovered. Myosin head and hinge region tilt from 90° angle to 45° angle. Cross bridges are transformed into high – force bonds as myosin releases phosphate ions allowing myosin head to swivel.
8. At the end of power stroke, the myosin head releases actin and swivels back to bind to a new actin molecule to start another contraction cycle. The power stroke repeats many times until a muscle fibre contracts. The process continues as long as muscle receives stimuli and there is steady flow of calcium ions.
9. Myosin returns back to relaxed state and releases ADP. A new ATP then binds to the head of myosin and cross-bridge is broken. The cycle of cross-bridge formation and breakage repeatedly causes sliding of the filaments. similar to motion of oar on a boat.
10. **Relaxation**

    i. Motor impulses stop.
    ii. Calcium ions are pumped back into sarcoplasm.
    iii. Masking of active sites of actin filament.
    iv. Failure of binding of myosin head with active sites of actin.
    v. The thin filaments assume their normal position and muscle is released.



36.What are the benefits of regular exercise?

a. Endurance or aerobic activities increase the breathing and heart rate. They keep the circulatory system healthy and improve overall fitness.
b. Strength exercises make the muscles stronger. They help to stay independent and carry out everyday activities such as climbing stairs and carrying bags.
c. Balance exercises help to prevent falls which is a common problem in older adults. Many strengthening exercises also improves balance.
d. Flexibility exercises help to stretch body muscles for more freedom of joint movements.

Regular exercises can produce the following beneficial physiological changes:

1. The muscles used in exercise grow larger and stronger.
2. The resting heart rate goes down.
3. More enzymes are synthesized in the muscle fibre.
4. Ligaments and tendons become stronger.
5. Joints become more flexible.
6. Protection from heart attack.
7. Influences hormonal activity.
8. Improves cognitive functions.
9. Prevents Obesity. Promotes confidence, esteem.
10. Prevents depression, stress and anxiety.