

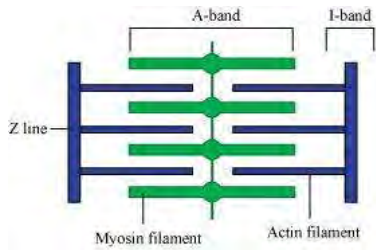
#425102

Topic: Muscular system

Draw the diagram of a sarcomere of skeletal muscle showing different regions.

Solution

The diagrammatic representation of a sarcomere is as follows:



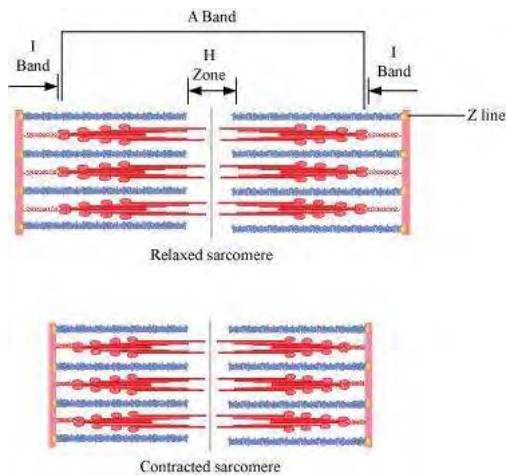
#425103

Topic: Muscular system

Define sliding filament theory of muscle contraction.

Solution

The sliding filament theory explains the process of muscle contraction during which the thin filaments slide over the thick filaments, which shortens the myofibril.



Each muscle fibre has an alternate light and dark band, which contains a special contractile protein, called actin and myosin respectively. Actin is a thin contractile protein present in the light band and is known as the I-band, whereas myosin is a thick contractile protein present in the dark band and is known as the A-band. There is an elastic fibre called z line that bisects each I-band. The thin filament is firmly anchored to the z line. The central part of the thick filament that is not overlapped by the thin filament is known as the H-zone.

During muscle contraction, the myosin heads or cross bridges come in close contact with the thin filaments. As a result, the thin filaments are pulled towards the middle of the sarcomere. The Z line attached to the actin filaments is also pulled leading to the shortening of the sarcomere. Hence, the length of the band remains constant as its original length and the I-band shortens and the H-zone disappears.

#425104

Topic: Muscular system

Describe the important steps in muscle contraction.

Solution

During skeletal muscle contraction, the thick filament slides over the thin filament by a repeated binding and releases myosin along the filament. This whole process occurs in a sequential manner.

Step 1:

Muscle contraction is initiated by signals that travel along the axon and reach the neuromuscular junction or motor end plate. The neuromuscular junction is a junction between a neuron and the sarcolemma of the muscle fibre. As a result, acetylcholine (a neurotransmitter) is released into the synaptic cleft by generating an action potential in the sarcolemma.

Step 2:

The generation of this action potential releases calcium ions from the sarcoplasmic reticulum in the sarcoplasm.

Step 3:

The increased calcium ions in the sarcoplasm lead to the activation of actin sites. Calcium ions bind to the troponin on actin filaments and remove the tropomyosin, wrapped around actin filaments. Hence, active actin sites are exposed and this allows myosin heads to attach to this site.

Step 4:

In this stage, the myosin head attaches to the exposed site of actin and forms cross bridges by utilizing energy from ATP hydrolysis. The actin filaments are pulled. As a result, the H-zone reduces. It is at this stage that the contraction of the muscle occurs.

Step 5:

After muscle contraction, the myosin head pulls the actin filament and releases ADP along with inorganic phosphate. ATP molecules bind and detach myosin and the cross bridges are broken.

Step 6:

This process of formation and breaking down of cross bridges continues until there is a drop in the stimulus, which causes an increase in calcium. As a result, the concentration of calcium ions decreases, thereby masking the actin filaments and leading to muscle relaxation.

#425106

Topic: Muscular system

Write true or false. If false change the statement so that it is true.

- (a) Actin is present in thin filament.
- (b) H-zone of striated muscle fibre represents both thick and thin filaments.
- (c) Human skeleton has 206 bones.
- (d) There are 11 pairs of ribs in man.
- (e) Sternum is present on the ventral side of the body.

Solution

(a) Muscle fibers are composed of myofibrils. The filaments of myofibrils consist of two types, thick and thin. The thick filaments are made of the protein myosin. The thin filaments are made of the protein actin.

So, the statement is true.

(b) The region of a striated muscle fibre that contains only thick (myosin) filaments is the H zone. It appears as a lighter band in the middle of the dark A band at the centre of a sarcomere.

So, the statement is false. H-zone of striated muscle fibre represents thick filament.

(c) The human skeleton is the internal framework of the body. It is composed of around 270 bones at birth which decreases to around 206 bones by adulthood after some bones get fused together.

So, the statement is true.

(d) Ribs are the long curved bones which form the rib cage. They protect the lungs, heart, and other internal organs of the thorax. There are 24 ribs in the human body, divided into two sets of 12 curved, flat bones.

So, the statement is false. There are 12 pairs of ribs in man.

(e) The sternum or breastbone is a long flat bone shaped located in the center of the chest. It lies at the anterior (ventral) middle part of the chest.

So, the statement is true.

#425107

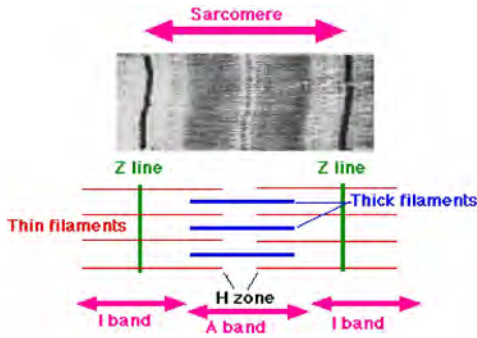
Topic: Muscular system

State whether the given statement is true or false.

H-zone of striated muscle fibre represents both thick and thin filaments.

Solution

The given statement is a false statement. H-zone of striated muscle fibre is the central part of the thick filament that is not overlapped by the thin filament.



#425108

Topic: Skeletal system

State whether the given statement is true or false.

Human skeleton has 206 bones.

Solution

The given statement is a true statement.

The skeleton of an adult human consists of 206 bones. It is composed of 300 bones at birth, which decreases to 206 bones by adulthood as some of the bones fuse. It consists of 80 bones in the axial skeleton (28 in the skull and 52 in torso) and 126 bones in the appendicular skeleton.

#425110

Topic: Skeletal system

State whether the given statement is true or false. Sternum is present on the ventral side of the body.

Solution

The given statement is a true statement. The sternum, or breastbone, is a flat bone at the front centre of the chest. The ribs and sternum fuse to form the ribcage. It protects the lungs from mechanical injury.

#425112

Topic: Muscular system

Write the difference between:

- (a) Actin and Myosin
- (b) Red and White muscles
- (c) Pectoral and Pelvic girdle

Solution

(a) Actin

1. Actin is a thin contractile protein.
2. It is present in light bands and is called an isotropic band.

Myosin

1. Myosin is a thick contractile protein.
2. It is present in dark bands and is called an anisotropic band.

(b) Red muscle fibre

1. Red muscle fibres are thin and smaller in size.
2. They are red in colour as they contain large amounts of myoglobin.
3. They contain numerous mitochondria.
4. They carry out slow and sustained contractions for a long period.
5. They provide energy by aerobic respiration.

White muscle fibre

1. White muscle fibres are thick and larger in size.
2. They are white in colour as they contain small amounts of myoglobin.
3. They contain less number of mitochondria.

(c) Pectoral girdle

1. It is a skeletal support from where the forelimbs of vertebrates are attached.
2. It is composed of two bones namely, clavicle or collar bones and scapula or shoulder bone.

Pelvic girdle

1. It is a skeletal support from where the hind limbs of vertebrates are attached.
2. It is composed of three bones, upper ileum, inner pubic, and ischium.
4. They carry out fast work for the short duration.
5. They provide energy by anaerobic respiration

#425114

Topic: Skeletal system

Distinguish between pectoral and pelvic girdle.

Solution

Pectoral girdle	Pelvic girdle
1. It is a skeletal support from where the forelimbs of vertebrates are attached.	1. It is a skeletal support form where the hind limbs of vertebrates are attached form where the hind limbs of vertebrates are attached.
2. It is composed of two bones namely, clavicle or collar bones and scapula or shoulder bone.	2. It is composed of three bones, upper ileum, inner pubic, and ischium.pubic, and ischium.

#425115

Topic: Skeletal system

What are the different types of movements exhibited by the cells of human body?

Solution

Movement is a characteristic feature of living organisms. The different types of movement exhibited by cells of the human body are:

- Amoeboid movement: Leucocytes present in the blood show amoeboid movement. During tissue damage, these blood cells move from the circulatory system towards the injury site to initiate an immune response.
- Ciliary movement: Reproductive cells such as sperms and ova show ciliary movement. The passage of ova through the fallopian tube towards the uterus is facilitated by this movement.
- Muscular movement: Muscle cells show muscular movement.

#425118

Topic: Skeletal system

Name the type of joint between the following.

- (a) Atlas/axis
- (b) Carpal/metacarpal of thumb
- (c) Between phalanges
- (d) Femur/acetabulum
- (e) Between cranial bones
- (f) Between pubic bones in the pelvic girdle

Solution

Atlas/axis: Pivotal joint

Pivot joint, also called as rotary joint, or trochoid joint, in vertebrate anatomy, a joint that allows only rotary movement. It is exemplified by the joint between the atlas and the axis (first and second cervical vertebrae), directly under the skull, which allows for turning of the head from side to side.

Carpal/metacarpal of thumb: Saddle joint

A saddle joint is a synovial joint where one of the bones forming the joint is shaped like a saddle with the other bone resting on it like a rider on a horse. Saddle joints provide stability to the bones while providing more flexibility than a hinge or gliding joint.

Between phalanges: Hinge joint

A hinge joint is a common class of synovial joint that includes the ankle, elbow, and knee joints. Hinge joints are formed between two or more bones where the bones can only move along one axis to flex or extend.

Femur/acetabulum: Ball and socket joint

Ball and socket joint is a natural or manufactured joint or coupling, such as the hip joint, in which a partially spherical end lies in a socket, allowing multidirectional movement a rotation.

Between cranial bones: Fibrous joint

Fibrous joints are joints that have no joint cavity and are connected via fibrous connective tissue. The skull bones are connected by fibrous joints.

Between pubic bones in the pelvic girdle: Ball and socket joint

Ball and socket joint is a natural or manufactured joint or coupling, such as the hip joint, in which a partially spherical end lies in a socket, allowing multidirectional movement a rotation.

#425119

Topic: Skeletal system

Name the type of joint between carpal/metacarpal of a thumb.

Solution

Carpal/metacarpal of a thumb is joined by the saddle-shaped synovial joint. A synovial joint is a joint where one of the bones forming the joint is shaped like a saddle with the other bone resting on it like a rider on a horse. Saddle joints provide stability to the bones while providing more flexibility than a hinge or gliding joint.

#425121

Topic: Skeletal system

Name the type of joint between femur/acetabulum.

Solution

Femur/acetabulum or the hip joint is a synovial joint, the most common type of joint in the body.

#425122

Topic: Skeletal system

Name the type of joint between cranial bones.

Solution

Fibrous joints are present between cranial bones. These joints are immovable joints which have no joint cavity and are connected via fibrous connective tissue. The skull bone are connected by fibrous joints.

#425123

Topic: Skeletal system

Name the type of joint between pubic bones in the pelvic girdle.

Solution

Pubic symphysis or symphysis pubis is a cartilaginous joint which binds the right and the left pubic bones in the pelvic girdle.

#425125

Topic: Skeletal system

- (a) All mammals (except a few) have cervical vertebra.
- (b) The number of phalanges in each limb of human is
- (c) Thin filament of myofibril contains 2 F actins and two other proteins namely and
- (d) In a muscle fibre, Ca^{++} is stored in
- (e) and pairs of ribs are called floating ribs.
- (f) The human cranium is made up of bones.

Solution

All mammals (except a few) have seven cervical vertebrae.

As a rule, all mammals have the same number of vertebrae in their necks regardless of whether they are a giraffe, a mouse, or a human. But, both, sloths and manatees are exceptions to this rule having abnormal numbers of cervical vertebrae.

The number of phalanges in each limb of a human is 14.

Phalanges are better known as your fingers and toes. You have 14 phalange bones in each hand and 14 in each foot, grand total comes up to 56 phalanges.

A thin filament of myofibril contains 2 'F' actins and two other proteins, namely troponin and tropomyosin.

Tropomyosin and troponin are two other proteins found in small quantities in muscle. They help regulate muscle contraction.

Troponin is associated with the thin filaments and can bind to the actin molecules. There is usually one troponin per 6-8 actin molecules.

Tropomyosin is a long thin protein that extends between, and binds to, the troponin molecules.

In a muscle fibre, Ca^{++} is stored in the sarcoplasmic reticulum.

The sarcoplasmic reticulum is a specialized type of smooth ER that regulates the calcium ion concentration in the cytoplasm of striated muscle cells.

There are 12 pairs of bones found in human rib cage. 11th and 12th pairs of ribs are as called floating ribs.

The human cranium is made up of eight bones.

The entire group of bones that make up the head is called the skull and it too can be divided into two primary groups: the Cranium and the Facial area.

There are eight bones that make up the cranium, and six bones make up the facial area.

#425127

Topic: Muscular system

Thin filament of myofibril contains 2 F actins and two other proteins namely and

Solution

A thin filament of myofibril contains 2 'F' actins and two other proteins, namely troponin and tropomyosin. Tropomyosin and troponin regulate muscle contraction. Troponin binds to the calcium ions and removes the tropomyosin from the actin myosin binding site which allows the muscle contraction. When the calcium ions are not attached to the troponin, it pushes the tropomyosin to block the binding site and the muscle relaxes.

#425128

Topic: Muscular system

In a muscle fibre, Ca^{++} is stored in

Solution

The endoplasmic reticulum in the muscle fiber is known as sarcoplasmic reticulum. It stores calcium ions which regulate the muscle contraction. It helps in the activation of contractile proteins like troponin and tropomyosin.

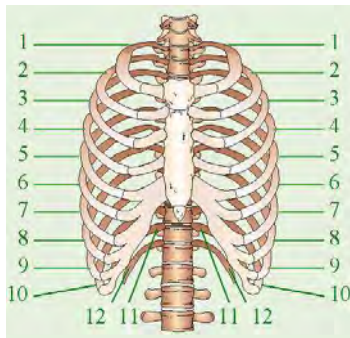
#425129

Topic: Skeletal system

..... and pairs of ribs are called floating ribs.

Solution

There are 12 pairs of bones found in human rib cage. 11th and 12th pairs of ribs are known as floating ribs.



#425130

Topic: Skeletal system

The human cranium is made up of bones.

Solution

The brain is protected by a bony covering known as the skull. It is made up of eight bones. It protects the brain from mechanical injury. The skull has immovable joint known as sutures.

#425132

Topic: Muscular system

Match the following

Column I	Column II
Smooth muscle	Myoglobin
Tropomyosin	Thin filament
Red muscle	Sutures
Skull	Involuntary

Solution

Smooth muscle - Involuntary

Tropomyosin - Thin filament

Red muscle - Myoglobin

Skull - Sutures

#464538

Topic: Muscle tissue

What is the specific function of the cardiac muscle?

Solution

The uninucleated, striated, tubular and branched muscles that form the wall of heart are known as cardiac muscles. They serve to bring about rhythmic contraction and relaxation of heart to allow pumping of blood throughout the life. Since, these muscles contract without any nerve stimulation/control, they are involuntary in nature.

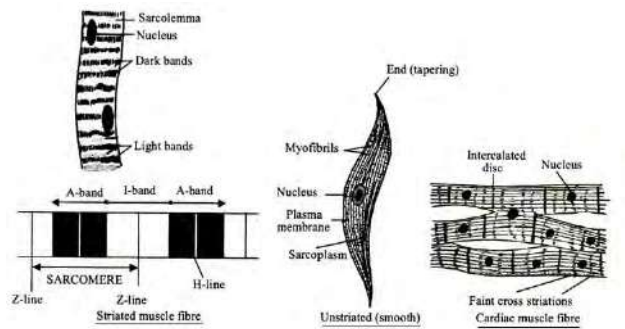
#465165

Topic: Muscle tissue

Diagrammatically show the difference between the three types of muscle fibres.

Solution

Three types of muscle fibres are smooth muscle (non-striated), cardiac muscles and skeletal muscles (striated muscles).



#634507

Topic: Skeletal system

A combination of bones and cartilages forms the of the body.

Solution

An internal or external, protective framework of bone, cartilage, or other rigid material supporting and containing the organs of the human body is termed as the skeleton.

There are several different skeletal types: exoskeleton, endoskeleton, hydroskeleton and cytoskeleton.

#634514

Topic: Skeletal system

Cockroaches have an outer skeleton.

☒ A True☐ B False**Solution**

An exoskeleton is the external skeleton that supports and protects an animal's body. Examples of animals with exoskeletons include insects such as grasshoppers and cockroaches, and crustaceans such as crabs and lobsters.

Cockroaches are winged insects found in nearly every part of the world. Like most other insects, cockroaches have an exoskeleton, meaning their skeleton is located on the outside of their bodies. They have three simple body parts: the head, thorax, and abdomen.

Hence, the answer is true.

#634517

Topic: Skeletal system

Which of the skull bones are movable?

Solution

There are 14 bones that support the muscles and organs of the face and are collectively known as facial bones. The mandible, or jaw bone, is the only movable bone of the skull forming the temporomandibular joint with the temporal bone.

#634520

Topic: Skeletal system

At which part does the arm rotate?

Solution

The ball and socket joint is a type of synovial joint in which the ball-shaped surface of one rounded bone fits into the cup-like depression of another bone. The distal bone is capable of motion around an indefinite number of axes.

Example: Shoulder joint, where the rounded head of the humerus (ball) rests in the cup-like glenoid fossa (socket) of the shoulder blade.

So, the arm rotates on the cup like depression (glenoid cavity).

#634522

Topic: Skeletal system

Name the places where two parts of the body are seen to be joined together.

Solution

Joints are points of contacts where two or more bones are attached/ joined together for the purpose of movement. There are different types of joints but the bones that join are of the same kind. There are three types of joints: Immovable joints, slightly movable joints and movable joints.

#634524

Topic: Skeletal system

Can bones be bent?

Solution

Bone is the hardest part of the body due to the deposition of calcium and phosphorus salts. Some bones are very big and some are very small. Bones cannot be bent due to their rigid and inelastic nature. They can break and result in fracture.

#634525

Topic: Skeletal system

Can we bend our body at every part?

Solution

The point of contact where two or more bones are attached/ joined together for the purpose of permitting body parts to move is called a joint. Joints are very important for movement and activity.

Therefore, we cannot bend our body at every body part. The body can be bent only at the joints.

#634532

Topic: Skeletal system

Give an example of fixed joint.

Solution

The joints in which bones cannot move or bend are called immovable or fixed joints. Examples include skull bones, teeth in sockets of jaw, etc.

#634538

Topic: Skeletal system

What are pelvic bones?

Solution

The bones which enclose the body part below the stomach are called pelvic bones. The pelvic bones include the hip bones, sacrum, and coccyx.

#634554

Topic: Disorders of muscular and skeletal system

Many people suffer from a problem called arthritis. Explain its connection with movement.

Solution

Arthritis is the inflammation of one or more joints. Symptoms of arthritis include pain, joint inflammation, swelling, reduced range of motion and stiffness. People suffering from arthritis have difficulty in moving from one place to another.

#634557

Topic: Skeletal system

What is skeleton? Draw a diagram to show the human skeleton.

Solution

An internal or external, protective framework of bone, cartilage, or other rigid material, supporting and containing the organs of the human body is termed as skeleton. Skeleton has three components: bones, joints and cartilage.

