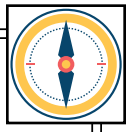
Chapter 12 Human Anatomy and Physiology: Support and Movement

The Skeletal System

This lesson introduces the anatomy and functions of the skeletal system. This lesson also explores how bone forms, remodels, and constantly changes as a person grows.

Skeletal System Overview

A human is born with roughly 270 bones. As a person grows, this number decreases to approximately 206. This is because many of the bones fuse.



FOR EXAMPLE

Half of the pelvic bone has three separate bones at birth: the ilium, ischium, and pubis. By adulthood, these bones fuse into one bone called the hipbone.

Anatomically, the skeletal system is divided into two major divisions: axial skeleton and appendicular skeleton. The **axial skeleton** consists of the bones of the skull, sternum, vertebral column, and ribcage. The **appendicular skeleton** comprises the bones of the upper and lower extremities and the associated girdles that connect the extremities to the vertebral column. The following table summarizes the number of bones found in each skeletal division.

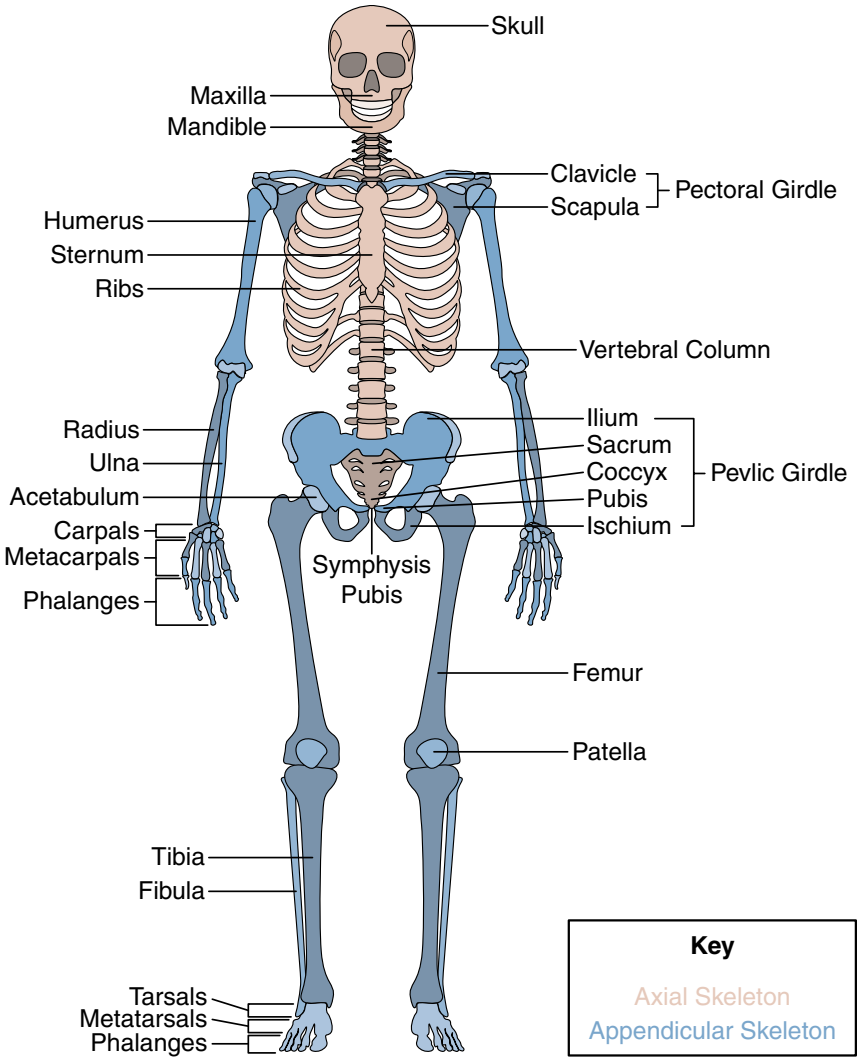
Axial	**80 bones**
Inner ear ossicles	6
Skull and hyoid	23
Sternum and ribs	25
Vertebral column	26
Appendicular	**126**
Pectoral girdle	4
Upper extremities	60
Pelvic girdle	2
Lower extremities	60

Twenty-four of the bones in the vertebral column are called the pre-sacral vertebrae. These consist of 7 cervical, 12 thoracic, and 5 lumbar vertebrae. The last two bones of the vertebral column are the sacrum and coccyx.

The skeletal system consists of **bones**, **cartilage**, and **ligaments** that are tightly bound together to form a strong, yet flexible, framework. Bone is an active form of **connective tissue**. This tissue plays a role in many of the functions of the skeletal system:

- **Support:** Bones and cartilage support body posture because both structures are rigid. They also allow a person to remain upright and provide a framework to which soft tissues like muscles and organs can attach.
- **Movement:** Bones of the skeletal system interact with the muscular system to help he body move. Bones themselves cannot move. But when connected to each other by ligaments, along with the action of muscles, a human body can move.
- **Protection:** The skeletal system protects vital organs from external damage. The skull protects the brain, the vertebral column protects the spinal cord, and the sternum and ribcage protect the lungs.
- **Mineral storage:** Bone functions as a storage site for important minerals like calcium and phosphorus. These minerals are used for a variety of physiological functions in the body.
- **Hematopoiesis:** This is the process bones use to produce red blood cells and stem cells, which differentiate to a variety of different cell types in the body.

The following image illustrates the anatomy of the skeletal system.



Example

Which of the following is part of the axial skeleton?

A. Carpals B. Femur C. Patella D. Skull

The correct answer is **D.** The axial skeleton consists of bones that do not belong to the upper and lower extremities: the skull, vertebral column, sternum, and ribcage.

Bone Shape and Structure

The overall structure of bone consists of an outer shell called **compact bone**. It encloses another type of bone tissue that is loosely organized called **spongy** or **cancellous bone**. Compact bone is made of units called **osteons**. These structures look like cylinders. They contain a mineral matrix and living bone cells. Each osteon also contains a **Haversian canal** that houses the bone's blood vessels and nerve fibers.

Surrounding the compact bone is a fibrous membrane called the **periosteum**. This consists of blood vessels, nerves, and lymphatic vessels that nourish the compact bone.

There are five types of bones in the human body: long, short, flat, irregular, and sesamoid. The following table details the characteristics of each and where they are found.

KEEP IN MIND

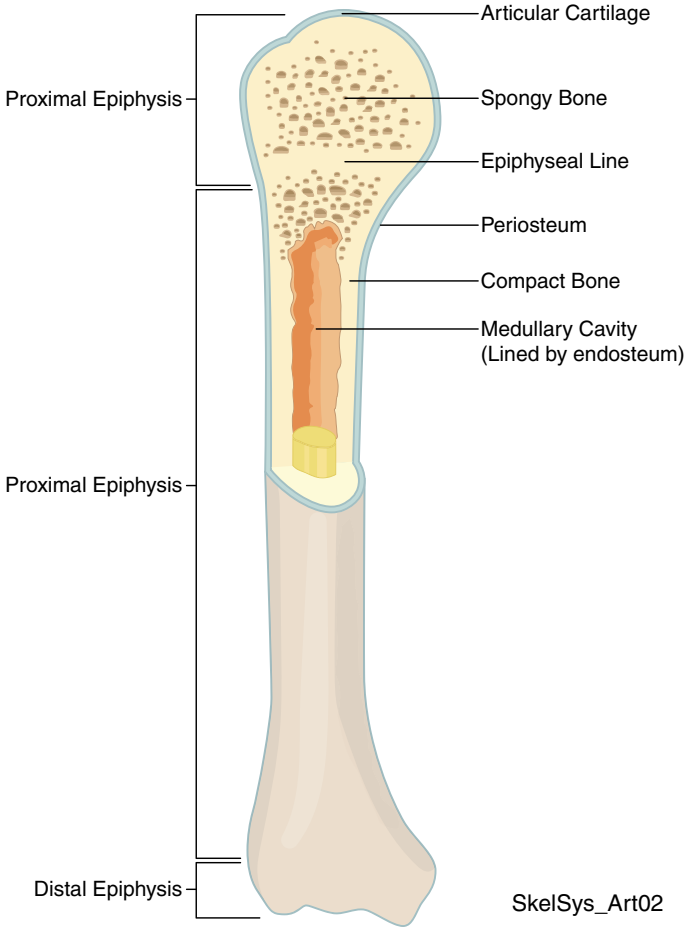
As the name implies, spongy bone is lighter and less dense than compact bone. It is spongy because it consists of open sections called pores. Viewed under a microscope, these sections look like a kitchen sponge.

Bone type	Appearance	Function	Example
Long	Elongated bones; longer than they are wide	Mechanical strength	Femur, tibia, clavicle, humerus, and metacarpals
Flat	Broad bones that are thin	Site of muscle attachment; provide protection	Scapula, hip bone (os coxa), sternum, nasal bone, and occipital/ parietal/ frontal bones of the skull
Irregular	Have a non-uniform shape that cannot be classified as any other bone type	Mechanical support for the body	Vertebrae
Sesamoid	Small bones	Mechanical support; provide protection	Patella (kneecap)
Short	About same width as length	Provide support; little movement	Carpal and tarsal bones of the wrist and feet

To visualize the anatomy of all bone types, it is helpful to view the anatomy of long bone. As shown in the following image, the long bone consists of three major sections: proximal epiphysis, diaphysis, and distal epiphysis.

- **Epiphysis:** This is found at each end of the long bone. It consists primarily of spongy bone with a thin layer of compact bone. Bone growth occurs at the epiphysis.
- **Articular cartilage:** This covers the epiphysis. It decreases frictions at the joints.

- **Diaphysis:** This is the longest part of the long bone. It consists primarily of compact bone.
- **Medullary cavity:** This is found inside the long bone. It is composed of red and yellow bone marrow. Red marrow is where hematopoiesis occurs. Yellow marrow consists primarily of fat cells.



Example

A histologist cracks open a tibia. While viewing the inside, what does he see?

A. Diaphysis
B. Soft tissue
C. Spongy bone
D. Proximal epiphysis

The correct answer is **C.** When looking inside a long bone, such as the tibia, the histologist sees the spongy bone. This is found at the proximal and distal ends of the epiphysis.

Ossification and Bone Remodeling

Although bone is a hard structure, it can grow. This is especially important in childhood. **Ossification** is the process of bone formation that occurs first during embryonic development. This process transforms soft, flexible cartilage to hard bone. It does so by replacing the cartilage with mineral deposits, specifically calcium and phosphorus. Ossification begins in the center of bones and spreads toward the end of the bones.

When a baby is born, a lot of cartilage is still found in the skeleton, particularly in the long bones. But there are **growth plates** at the end of long bones. This region is also made of cartilage. As the child grows, this area of cartilage at the growth plate experiences ossification to elongate the bone, enabling a person to grow taller.

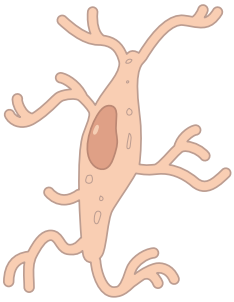
Ossification also plays a role in **bone remodeling**. Mature bone tissue is constantly being broken down through a process called **bone resorption**. Through ossification, new bone tissue replaces this old bone. There are three types of bone cells:

- **Osteocytes:** These are bone cells. They produce collagen and other substances that create the extracellular matrix of bone.
- **Osteoblasts:** These are called bone-forming cells. They are found on the surface of bone and can be stimulated to differentiate into other type of bone cells called osteocytes.
- **Osteoclasts:** These are called bone-resorbing cells. They are found on the surface of bone. They dissolve the bone.

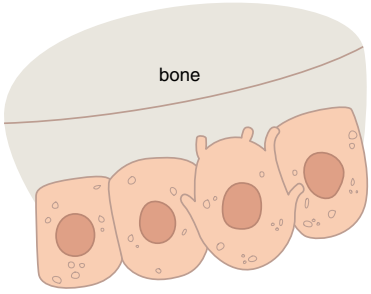
KEEP IN MIND

Bone resorption frees calcium and other minerals from bone for use in the body and clears out older pieces of bone. In doing so, this process promotes the deposition of new bone.

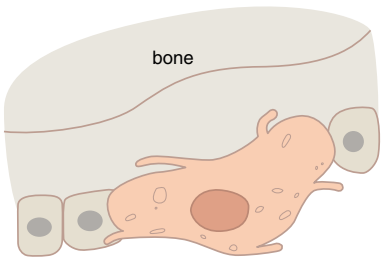
Recall that osteons are found in compact bone. As shown in the following image, the extracellular matrix of bone and osteocytes are found within the osteon. Osteoblasts and osteoclasts are found on the bone surface.



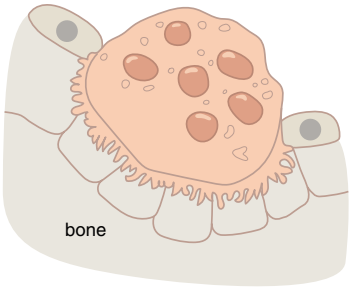
Osteocyte



Osteoblast



Osteogenic Cell



Osteoclast

Example

What bone cell is a bone-forming cell?

A. Osteoblast B. Osteoclast C. Osteocyte D. Osteon

The correct answer is **A.** Osteoblasts are bone-forming cells found on the bone's surface. They help form new bone as older bone is broken down through resorption.

Let's Review!

- The skeletal system provides structural support and protection, aids in movement, serves as a mineral reservoir, and helps produce cells.
- The appendicular skeleton consists of the upper and lower extremities.
- The axial skeleton consists of the skull, sternum, ribcage, and vertebral column.
- The five bone types in the human body are: long, short, flat, irregular, and sesamoid.
- Ossification is a bone-forming process typically performed in childhood.
- Bone remodeling is a process that involves replacing old, mature bone tissue with new bone.
- Osteons are bone cells found in compact bone that contain the Haversian canal, which is the site for blood vessels and nerve fibers.
- Osteoblasts are bone-forming cells, and osteoclasts are bone-dissolving or resorbing cells.
- Osteocytes are bone cells found deep within bone that produce substances like cartilage.

The Muscular System

This lesson introduces the anatomy of the muscular system, including the three different muscle tissues. This lesson also describes the role of the muscular system in movement and the physiology of muscle contraction.

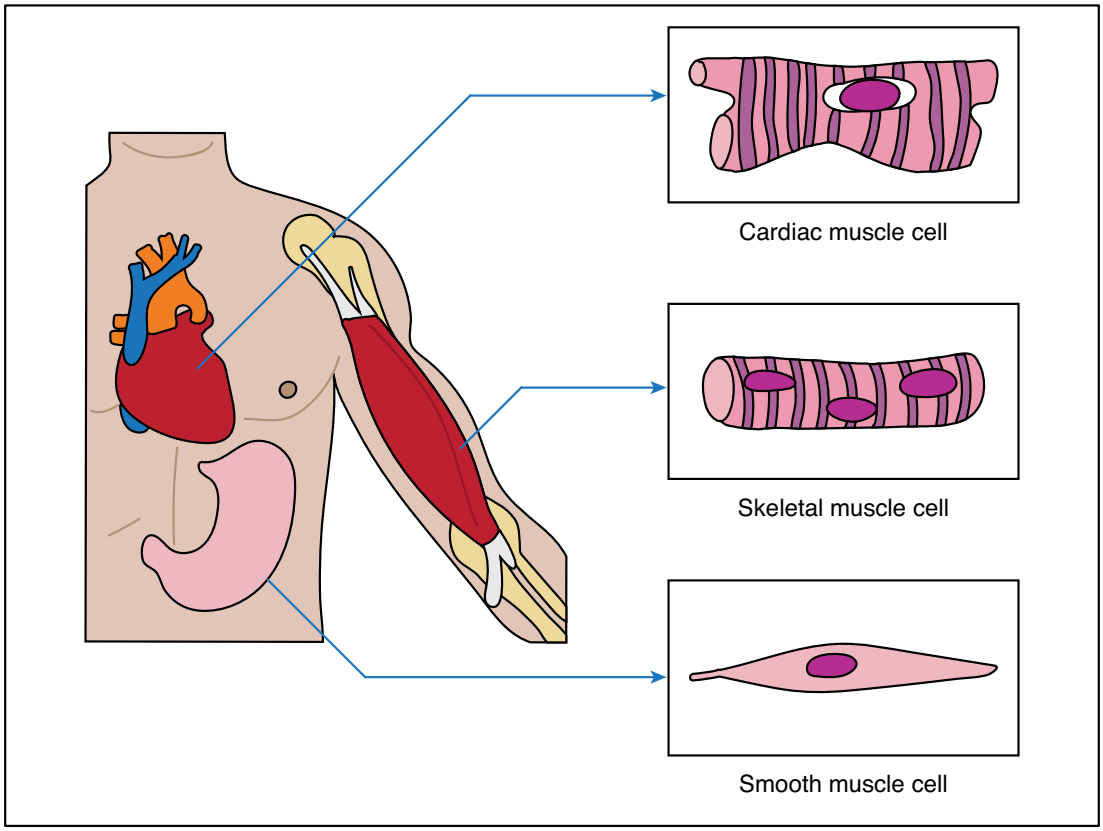
Anatomy of the Muscle

The **muscular system** is responsible for all types of body movement. Additional functions of this system include providing support, stabilizing joints, and generating heat for the body. All muscles consist of specialized cells known as **muscle fibers**, which contract to facilitate body movement. For the body to move, muscles must be attached to bones. Muscles are also attached to internal organs and blood vessels. Thus, most of the body's movements occur because of muscle contraction from muscle fibers.

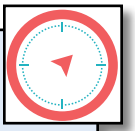
DID YOU KNOW?

There are over 600 muscles in the body. Muscles are grouped according to characteristics such as size, shape, and location.

The body is comprised of three types of muscles: cardiac, smooth, and skeletal. As shown in the image below, these muscles look different. They also perform different functions.



- **Cardiac muscle:** This muscle consists of muscle cells that are striated, short, and branched. These cells contain one nucleus, are branched, and are rectangular. Cardiac muscle contraction is an involuntary process, which is why it is under the control of the autonomic nervous system. This muscle is found in the walls of the heart.`
- **Skeletal muscle:** This muscle cell is striated, long, and cylindrical. There are many nuclei in a skeletal muscle cell. Attached to bones in the body, skeletal muscle contracts voluntarily, meaning that it is under conscious control.
- **Smooth muscle:** This muscle consists of non-striated muscle cells that are spindle-shaped. Like cardiac muscle cells, smooth muscle cells contain one nucleus. This muscle type is found in the walls of internal organs like the bladder and stomach. Smooth muscle contraction is involuntary and controlled by the autonomic nervous system.



BE CAREFUL!

Skeletal muscles are excited by the nervous system. Cardiac and smooth muscles are stimulated by the nervous system and by circulating hormones.

Despite the differences among cardiac, smooth, and skeletal muscles, they share four properties: excitability, contractility (muscle shortening), extensibility (muscle stretching), and elasticity.

Example

What is a purpose of the muscular system?

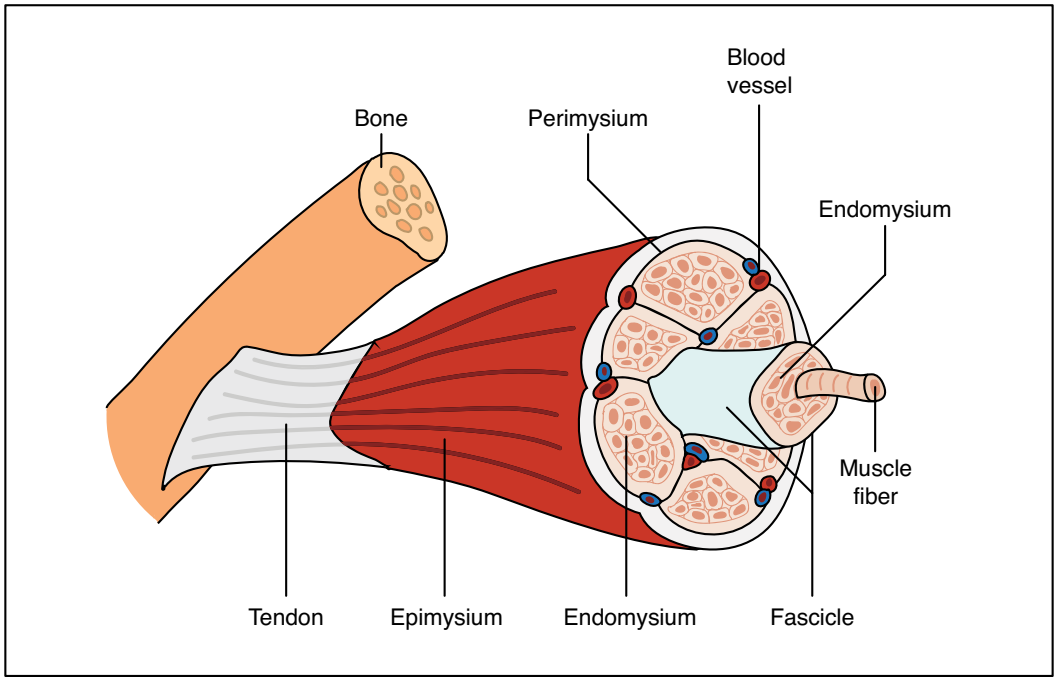
A. Connects one bone to another
B. Helps the bones of the body move
C. Protects the body from external injury
D. Determines how blood circulates in the body

The correct answer is **B.** One of the primary functions of the muscular system is to aid in movement. Muscles help the bones of the skeletal system move. Muscles contract and relax to facilitate movement.

Skeletal Muscle Anatomy

Bones move with the help of skeletal muscles, through contraction and extension. Skeletal muscles must be attached to the bones to pull on the bones and cause them to move. This movement is performed when the skeletal muscle shortens, or contracts.

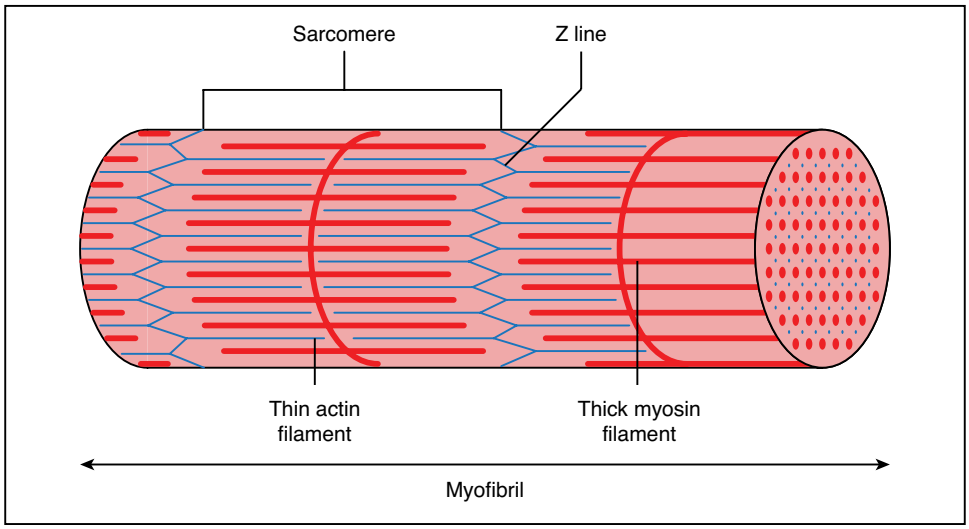
As shown in the following image, connective tissue attaches skeletal muscle to bone or other tissues. Skeletal muscle consists of three types of connective tissue. The **endomysium** encases individual skeletal muscle fibers. These muscle fibers are bundled together by a connective tissue called the **perimysium**. Bundles of skeletal muscle fibers are called **fasciculi.** Each fascicle is bundled together by a strong connective tissue called the **epimysium**.



KEEP IN MIND

The connective tissue supports and protects muscle fibers. This tissue also provides a way for nerve and blood vessels to innervate the skeletal muscle.

The cell membrane that surrounds a skeletal muscle fiber is called a **sarcolemma**. The cytoplasm of the skeletal muscle fiber is the **sarcoplasm**. One muscle fiber is filled with several long, cylindrical proteins called **myofibrils,** which are the contractile units of the fiber. The smallest contractile unit in a myofibril is a **sarcomere**. Several protein **myofilaments** make up a myofibril. There are two types of myofilaments: thick bands and thin bands. Thick bands, or myofilaments, are made of several protein molecules called **myosin**. Several protein molecules, called **actin,** link together to form the thin bands. These thin actin bands are attached to a **Z-disk** (or Z-line).



Example

What is the smallest contractile unit of skeletal muscle?

A. Actin B. Epimysium C. Myofibril D. Sarcomere

The correct answer is **D.** Several contractile units called myofibrils are found within a single muscle fiber. Smaller contractile units called sarcomeres make up a myofibril.

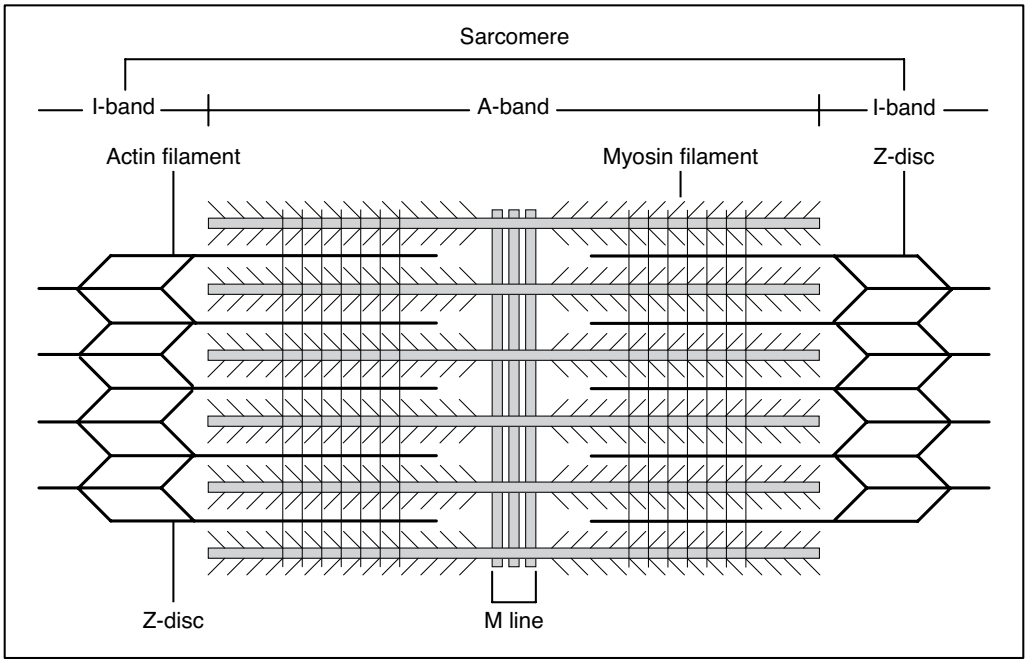
Muscle Contraction

Keep in mind that the dark, striped Z-disc marks where one sarcomere ends and another begins. As shown in the image below, there are light-colored bands called **I-bands** and dark-colored bands called **A-bands**. The Z-line is found in the middle of the I-bands, while the **H zone** is found in the middle of the A-bands. In the middle of the H-zone is the **M line**, which is the center of the sarcomere.

TEST TIP

The following guide can be used to remember the components of the various lines in a skeletal muscle:

A-band	Thick and thin filaments
I-band	Thin filaments only
Z-line	Actin filament attachment site
H-band	Thick filaments only



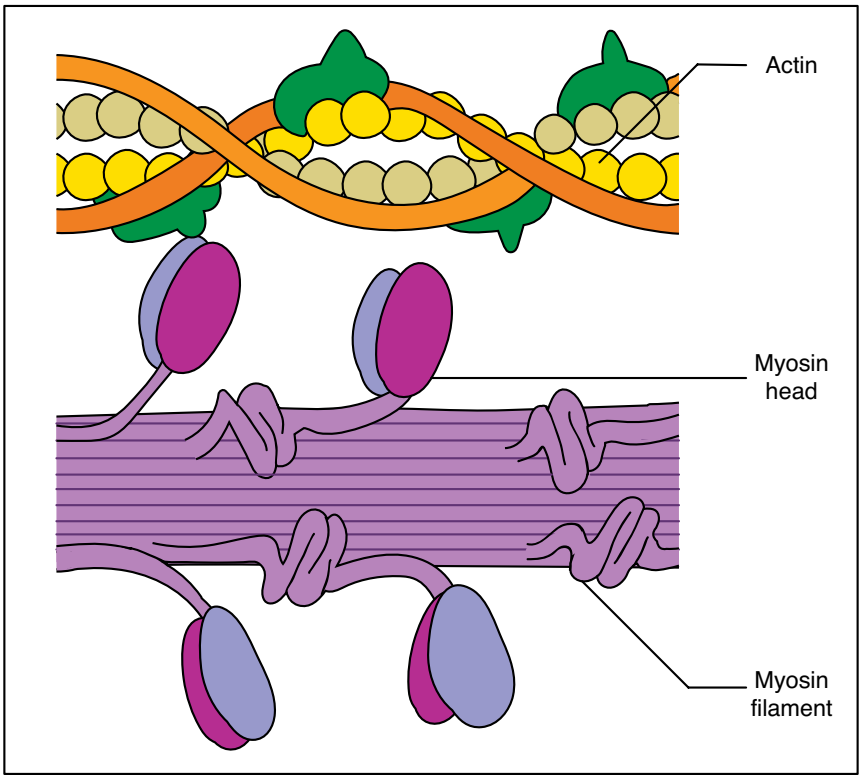
Slide filament theory explains muscle contraction. According to this theory, actin filaments slide past myosin filaments, pulling the actin filaments closer to the center of the sarcomere,

or M line. As shown in the image below, this sliding action happens because of interactions between the heads of actin and myosin. The heads of myosin form attachments with the actin myofilaments. These attachments are known as **crossbridges**.

KEEP IN MIND

The head of actin is a round protein shaped like a ball. Several of these round proteins link together to form a long chain, or thin myofilament. Myosin is a thick protein with a head that resembles a golf club. When several myosin proteins join together, they create a myosin filament, where the heads point outward.

With the help of energy in the form of ATP, the myosin heads are energized to attach to binding sites in actin and form a crossbridge. After energy in the myosin head is released, the myosin pulls actin myofilaments closer to the M line. This head can only form another crossbridge when another molecule of ATP attaches to the head, reenergizing it. Calcium also plays an important role in determining when contraction happens. This ion is found in the **sarcoplasmic reticulum**, which surrounds myofibrils.



Example

What structure is reenergized with ATP?

A. Actin B. Myosin C. Myofibril D. Sarcomere

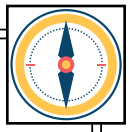
The correct answer is **B.** Myosin heads attach to thin actin filaments to form crossbridges. These attachments can only form when the myosin head is energized with ATP.

Coordinating Movement

Ligaments attach bones to bones. Where ligaments connect bones, they form a **joint**. Thus, joints are the site where individual bones meet. There are three types of joints:

- **Immovable:** Also known as fibrous joints, these consist of bones held together by connective tissues. The bones are in very close contact. An example of an immovable joint is the intersection of cranial bones in the skull.
- **Partly movable:** Also known as cartilaginous joints, these consist of bones held together by cartilage. These joints allow some degree of movement. Partly movable joints include the vertebral discs in the spine.
- **Synovial:** These allow the largest freedom of movement because the bones are separated by a joint cavity. Examples of synovial joints are the hip and shoulder.

The muscular system works with the skeletal system to move the body. Thus, the muscles must be attached to bone. **Tendons** attach muscle to bone. Tendons consist of tough connective tissue that is found on either side of the joint where two bones are connected. Tendons work with skeletal muscles to move bones. When muscles contract, they shorten. This pulls on the bones, with the help of the tendon, to allow the body to move.



FOR EXAMPLE

Biceps and triceps muscles in the arm work together to bend and lengthen the elbow. As a biceps muscle contracts, the triceps muscle remains elongated, or relaxed. Thus, the biceps is the flexor and the triceps is the extensor of the elbow joint.

Muscles must work in pairs to move bones at the joint. The muscle that causes a joint to bend is called a **flexor muscle**. The muscle that contracts and causes a joint to straighten is called an **extension muscle**. If one muscle in the pair contracts, the other remains elongated.

Example

How many muscles must work together during contraction and extension?

A. 2 B. 10 C. 206 D. 600

The correct answer is **A.** Muscles work in pairs during contraction and extension. When one muscle contracts, the other extends, or relaxes.

Let's Review!

- A muscle is a fibrous tissue that aids in body movement, provides support, and generates heat energy for the body.
- Cardiac, smooth, and skeletal muscles are the three muscle types found in the body.
- Cardiac and smooth muscle are under involuntary control, while skeletal muscle is under voluntary control.
- Cardiac and skeletal muscles are striated, while smooth muscle is non-striated.

- Three types of muscle tissues comprise a skeletal muscle: epimysium, endomysium, and perimysium.
- A single skeletal muscle fiber consists of several contractile units called myofibrils, which consist of actin and myosin myofilaments.
- According to the slide filament theory, actin and myosin myofilaments form crossbridges to shorten a sarcomere, which shortens a skeletal muscle.
- Tendons attach muscle to bone and help bones move.
- Joints are the regions between bones that influence the degree of flexibility with body movement.
- Skeletal muscles move bones by working in muscle pairs to contract and elongate.

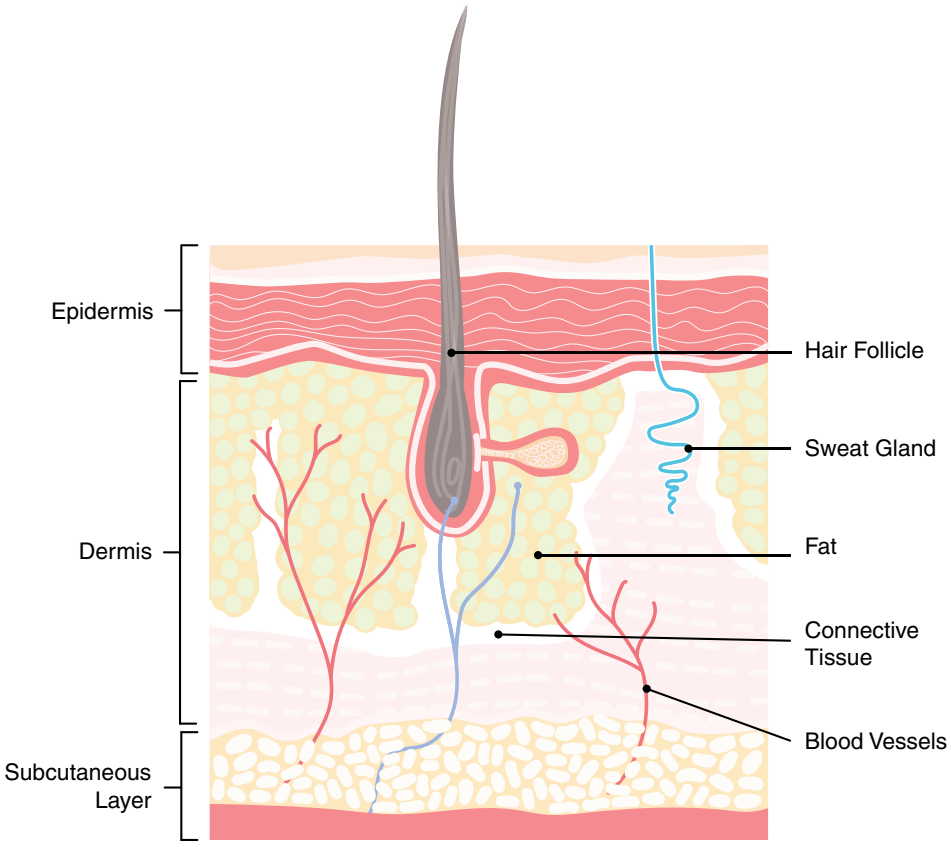
The Integumentary System

This lesson introduces the anatomy of the integumentary system, including the system's function. This lesson also describes the effects of aging and cancer on the integumentary system.

The Skin's Many Layers

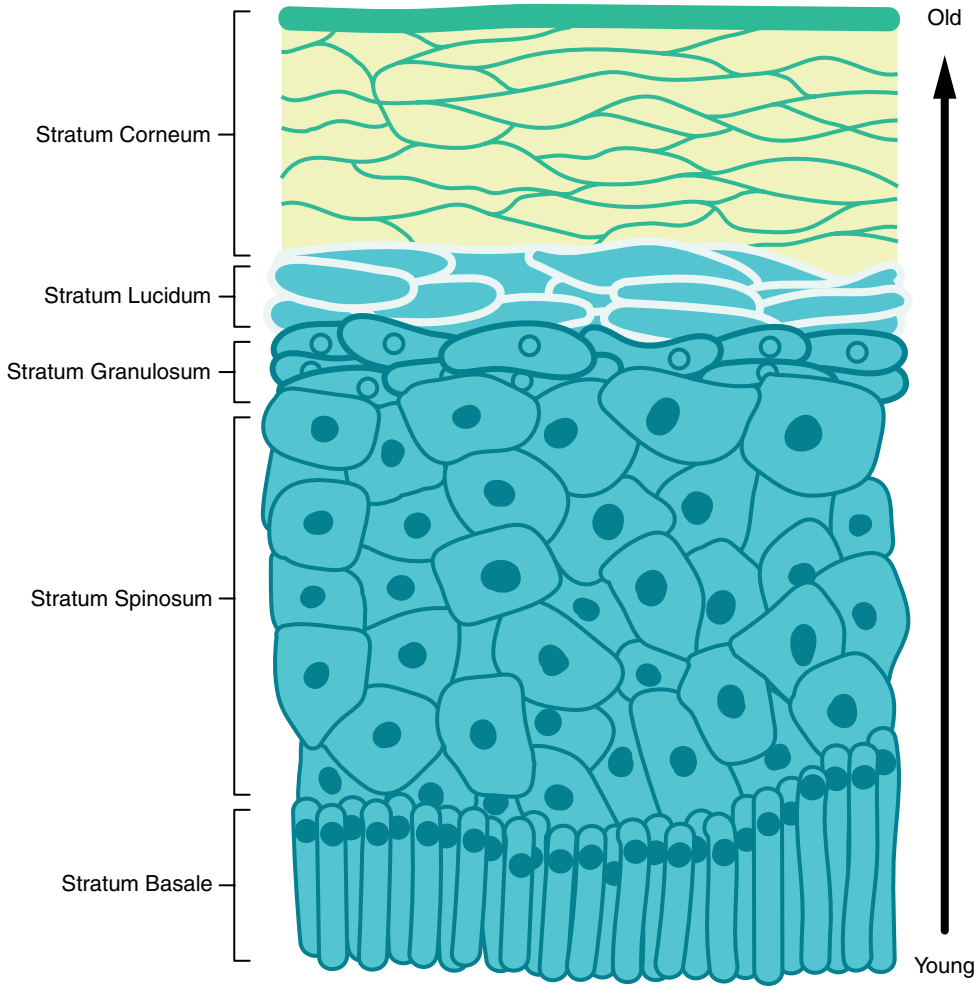
The **integumentary system** is a body system comprised of the skin and accessory structures, including the hair, sebaceous and sweat glands, and nails. This system protects the body, maintains homeostasis, and provides sensory information about the external environment.

The largest organ in the integumentary system is the skin. Often not thought of as an organ, the skin is made of four different tissues that work together to perform a variety of functions such as preventing toxic substances from entering the body and regulating body temperature.



As shown in the image, the skin consists of several layers. These layers are divided into three regions: epidermis, dermis, and subcutaneous tissue. The **epidermis** is the outermost layer composed of **keratin** and stratified squamous epithelium tissue. Keratin is made of keratinocytes, which toughen and waterproof skin. Other cell types that make up the epidermis are melanocytes, which give skin its color, merkel cells, and Langerhans cells. The epidermis can have either four or five layers depending on where it is located on the body. As shown in the

following image, these layers consist of the stratum basale (innermost layer), stratum spinosum, stratum granulosum, stratum lucidum, and stratum corneum.



FOR EXAMPLE

The soles of the feet have five layers because they are exposed to a lot of friction as a person walks. The epidermis on the leg consists of only four layers.

Nerve endings and blood vessels are not found in the epidermis. Epidermal cells are found deep in the stratum basale and constantly undergo mitosis to make new cells. As new cells are made, they travel to the outer skin surface, producing the protein keratin. Epidermal cells fill with keratin and die upon reaching the skin's surface. When this happens, the leftover keratin from the dead cells help form the stratum corneum, which is the waterproof layer. These dead epidermal cells are gradually shed from the skin and replaced with new cells.

Example

How many epidermal layers make up the face?

A. 3 B. 4 C. 5 D. 6

The correct answer is **B.** The epidermis consists of either four or five layers. This depends on the part of the body where the epidermis is located. The soles of the feet and palms of the hand have five layers, and all other parts of the body, including the face, have four layers.

The Dermis Layer, Hypodermis, and Glands

The **dermis**, or dermal layer, is found directly under the epidermis. This deep, thick layer is made of tough connective tissue. It is connected to the epidermis by collagen fibers. Unlike the epidermis, nerve endings and blood vessels flow through the dermis. This means the dermal layer is responsible for a person feeling the sensations associated with touch, pain, heat, and cold. There are two major regions of the dermis: papillary region and reticular region. Both these regions provide elasticity to the skin, enabling it to stretch. This is helpful during physiological events like pregnancy, during which the abdominal area must stretch.

DID YOU KNOW?

The dermis layer of a young person is more elastic than that of an elderly person. This is because the dermis of elderly people has fewer elastic fibers. As the body ages, there is a reduction in physiological processes such as cell division, blood circulation, and muscle strength. These changes lead to a less elastic and thinner dermis.

Hair follicles and glands are also part of the dermis. Hair follicles are the sites where hair strands originate before protruding from the epidermal layer and onto the skin's surface. The two types of glands found in the dermis are detailed below:

- **Sweat glands:** These glands produce a fluid that contains water, salts, and other waste products. They are made of ducts that extend through the epidermis and look like pores on the skin's surface. There are two types of sweat glands:
  - **Apocrine:** These glands are found primarily in the armpits and groin area, where hair follicles are abundant. These glands are attached to hair follicles and create a watery fluid that contains proteins and fats. Apocrine glands are typically inactive until a person reaches puberty. They produce sweat when the body is anxious or experiencing stress.
  - **Eccrine:** These glands are found all over the body, primarily on the forehead, neck, palms, and soles of feet. They are not connected to hair follicles. They regulate body temperature with sweating if the body becomes too hot.
- **Sebaceous glands:** These oil-producing glands are typically attached to hair follicles. They release **sebum**, which is a fatty, oily substance. It waterproofs the hair and skin, preventing

both structures from drying out. Sebum also has antimicrobial properties, which help the skin fight off infections.

DID YOU KNOW?

Sebaceous glands are found all over the body, but they are not found on the palms of the hands or soles of feet. The face and head contain the most sebum.

Right beneath the dermis is a third region of the integumentary system that contains subcutaneous tissue. This region is known as the **hypodermis**. It contains fat, or adipose tissue, that supplies energy for cells and provides insulation to regulate body temperature.

Example

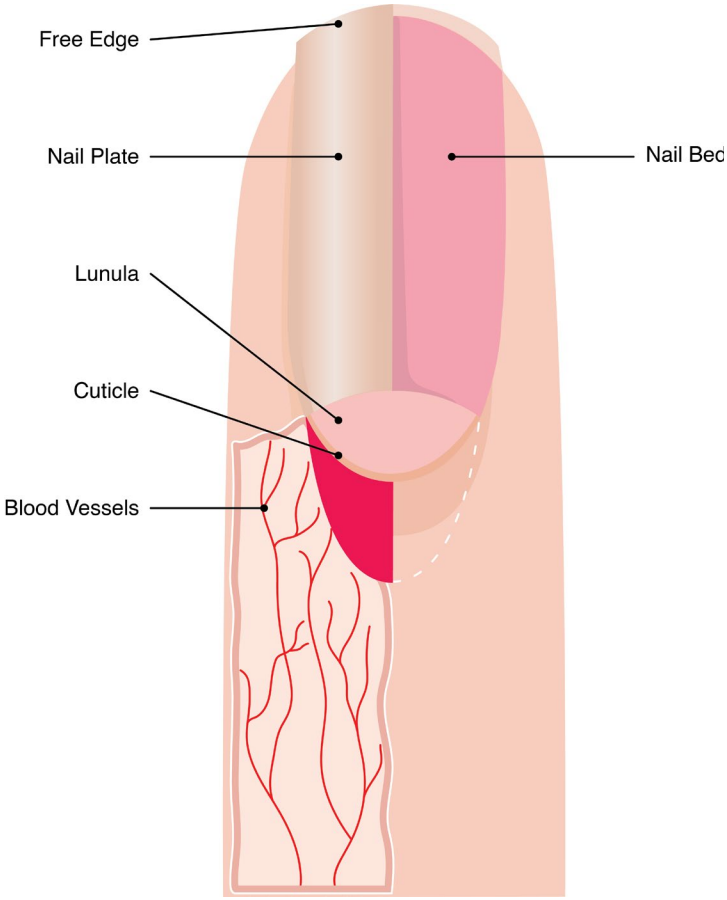
Which structure produces sebum?

A. Hair follicles
B. Eccrine glands
C. Langerhans cells
D. D Sebaceous glands

The correct answer is **D.** The dermis is made of sebaceous glands and sweat glands. Eccrine and apocrine glands are two types of sweat glands, neither of which produce sebum. Sebaceous glands produce sebum, which is a fluid that flows through a hair follicle.

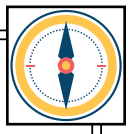
Hair and Nails

Nails and hair are accessory organs of the integumentary system. Fingernails and toenails are made of keratin, which is also found in the hair and skin. In addition to mechanical functions such as grasping things and picking up objects, nails prevent injuries to the ends of fingers. As shown in the image below, the nail is made of several parts.



The nail plate is the hard outer part of the nail. Adjoining the nail plate is the free edge, which overhangs the fingertip. This is the part of the nail that is commonly groomed and cut down. The nail bed is a layer of skin found under the nail plate. This layer of skin is comprised of epidermal cells. The white space between the nail bed and **cuticle** is called

the **lunula**. The cuticle is a layer of dead skin cells that accumulate and form a thick overhang layer at the base of the nail and around the nail edge. During nail care, cuticles are removed. Beneath the cuticle is the **matrix**, which is a layer of tissue that contains blood vessels and nerves.



FOR EXAMPLE

Consider eyelashes and eyebrows. These structures protect the eyes from irritants like dirt and water. In the nose, there are tiny hairs that trap dust particles and microorganisms to keep the air entering the lungs clean.

Hair

Hair consists of dead keratinized cells and grows from the dermis out of the epidermis and onto the surface of the body. This accessory organ provides insulation for the body, especially for the head.

KEEP IN MIND

Aging affects the accessory organs. It causes hair and nails to thin over time.

Recall that within the dermis is the hair follicle. This is where hair strands in the epidermis originate. The **hair shaft** is not attached to the follicle. It consists of the hair that is exposed on the surface of the body. The **hair root** is attached to the follicles and found beneath the skin's surface. Extending beyond the root, deep beneath the skin is the **hair bulb**, which contains actively dividing basal cells.

Example

What is the outer layer of the nail called?

A. Bed B. Matrix C. Plate D. Shaft

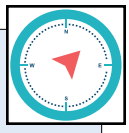
The correct answer is **C.** The nail plate is the outer part of the nail that protects the edges of the finger. This structure is hard and connected to the free edge of the nail.

Skin Cancer

Skin cancer is the most common type of cancer that affects the integumentary system. There are many causes of skin cancer, including as genetics, but the strongest risk factor is exposure to ultraviolet (UV) radiation. Sources of UV radiation include sunlight and tanning beds.

Overexposure to UV radiation damages DNA in the body's cells. Exposure to UV radiation causes distinct mutations in skin cells. If the body does not repair the damage to these cells, the mutations accumulate. As a result, the cells can transform into cancerous cells and grow uncontrollably. The uncontrolled cell growth can lead to cancerous tumor formations. Most tumors are harmless, but some produce cells that can move away from the original site of DNA damage and establish new tumors in other organs. This process is called **metastasis**.

DID YOU KNOW?



There are different types of UV rays. UVA rays penetrate the dermis and can cause skin cancer. UVB rays penetrate the epidermis and cause damage to epidermal cells. UVB rays are responsible for sunburn and most skin cancers.

There are three types of skin cancer:

1. **Basal cell carcinoma:** This is the most common type of skin cancer that occurs in the basal cells of the epidermis. These cells are found in the stratum basale layer and divide to create keratinocytes. Basal cell carcinoma rarely spreads or undergoes metastasis.
2. **Squamous cell carcinoma:** This type of skin cancer occurs in the squamous cells of the epidermis. It affects the keratinocytes in the stratum spinosum. This is the second-most-common type of skin cancer. Because this type of skin cancer is more aggressive than basal cell carcinoma, if this carcinoma is not removed it can metastasize.
3. **Malignant melanoma:** This type of skin cancer occurs when there is an uncontrolled growth of melanocytes in the epidermis. Because melanocytes contribute to the pigmentation of the skin, melanoma is often associated with a dark patch on the body. It is the most dangerous and fatal type of skin cancer.

Example

What is a source of UV radiation?

A. Tanning bed
B. Indoor lighting
C. Topical products
D. Outdoor irritants

The correct answer is **A.** Tanning beds and overexposure to the sun are common sources of UV radiation. UVA and UVB rays are known to cause skin cancer in people.

Let's Review!

- The integumentary system is a body system composed of the skin, hair and nails.
- Skin is the largest organ of the body that primarily functions to protect the body and maintain homeostasis.
- The epidermis, dermis, and subcutaneous layer are the three layers of skin.
- The epidermis has four or five layers: the stratum basale, stratum granulosum, stratum lucidum, stratum spinosum, and stratum corneum.
- Two types of glands, sebaceous glands and sweat glands, are found in the dermis.
- Eccrine glands are found all over the body. Apocrine glands are found mainly in the armpits.
- Hair, nails, and skin all contain keratin, which hardens and toughens each structure.
- Exposure to UV radiation can cause three types of skin cancer.
- Aging affects the integrity and structure of the skin, hair, and nails.

Chapter 12 Human Anatomy and Physiology: Support and Movement Practice Quiz

1. **Epidermal cells are found in the _____ before traveling to the skin's surface.**
   A. stratum basale
   B. stratum lucidum
   C. stratum corneum
   D. stratum granulosum

2. **Which layer contains nerve endings?**
   A. Dermis
   B. Epidermis
   C. Stratum basale
   D. Subcutaneous tissue

3. **Which is a characteristic of smooth muscle?**
   A. Enables blood vessels to constrict
   B. Contributes to bone and joint flexibility
   C. Plays a role in how fast the heart contracts
   D. Consists of striated fibers that are branched

4. **Which of the following organs contains cardiac muscle?**
   A. Bladder
   B. Brain
   C. Heart
   D. Skin

5. **Which organ does the vertebral column protect?**
   A. Brain
   B. Heart
   C. Spinal cord
   D. Pelvic girdle

6. **What does the skeletal system provide?**
   A. Circulation
   B. Energy
   C. Immunity
   D. Support

Chapter 12 Human Anatomy and Physiology: Support and Movement Practice Quiz — Answer Key

1. A. Epidermal cells are found deep in the stratum basale. From there, they travel to the skin's surface, producing keratin along the way. This keratin creates the waterproof layer, or stratum corneum. **See Lesson: Integumentary System.**

2. A. The skin is comprised of three layers: epidermis, dermis, and subcutaneous tissue layer. The epidermis is the outermost layer and does not contain nerve endings. The dermis is the middle layer of skin that contains nerve endings. **See Lesson: Integumentary System.**

3. A. Smooth muscle is a non-striated muscle cell found in the internal walls of hollow organs like blood vessels. Under involuntary control, smooth muscle helps blood vessels contract and relax. **See Lesson: Muscular System.**

4. C. Cardiac muscle is a striated, branched type of muscle found only in the heart. Cardiac muscle is under involuntary control. **See Lesson: Muscular System.**

5. C. The vertebral column is part of the axial skeleton. It protects the spinal cord from external damage. **See Lesson: Skeletal System.**

6. D. The skeletal system serves many purposes, including providing support. Bones and cartilage help maintain body posture and comprise the framework of the skeletal system. **See Lesson: Skeletal System.**