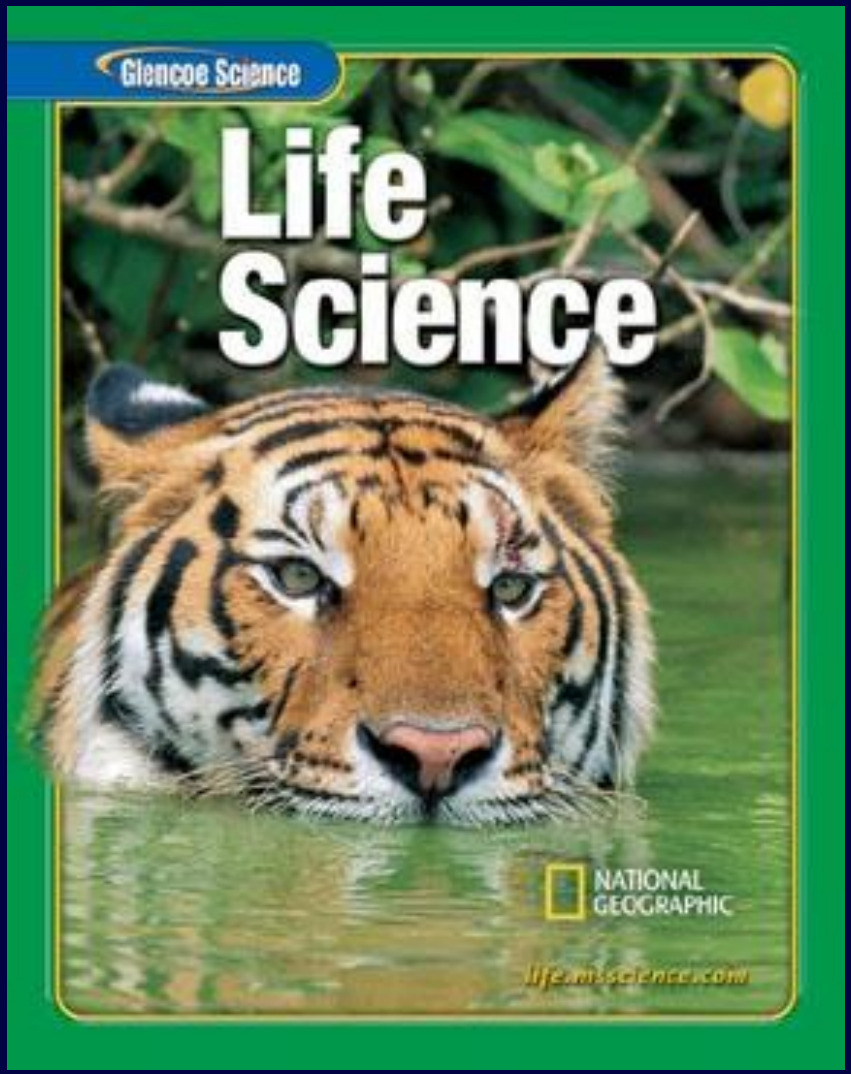
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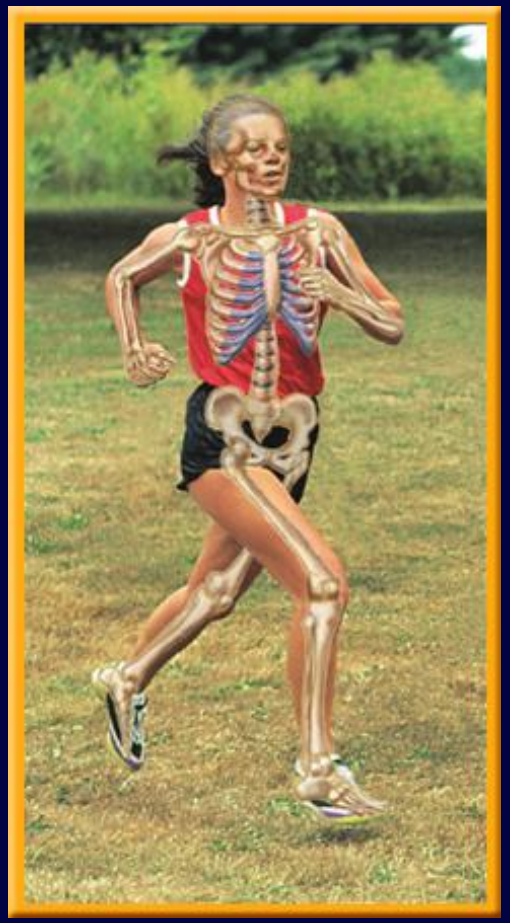
Chapter: Structure and Movement

1

Living Bones

- The bones in your body are very much alive. Each is a living organ made of several different tissues.
- Like all the other living tissues in your body, bone tissue is made of cells that take in nutrients and use energy. Bone cells have the same needs as other body cells.



1

Functions of Your Skeletal System

- All the bones in your body make up your **skeletal system**.
- The skeletal system is the framework of your body and has five major functions.
  1. The skeleton gives shape and support to your body.
  2. Bones protect your internal organs. For example, ribs surround the heart and lungs, and the skull encloses the brain.

1

Functions of Your Skeletal System

3. Major muscles are attached to bone and help them move.
4. Blood cells are formed in the center of many bones in soft tissue called red marrow.
5. Major quantities of calcium and phosphorous compounds are stored in the skeleton for later use. Calcium and phosphorous make bones hard.

1

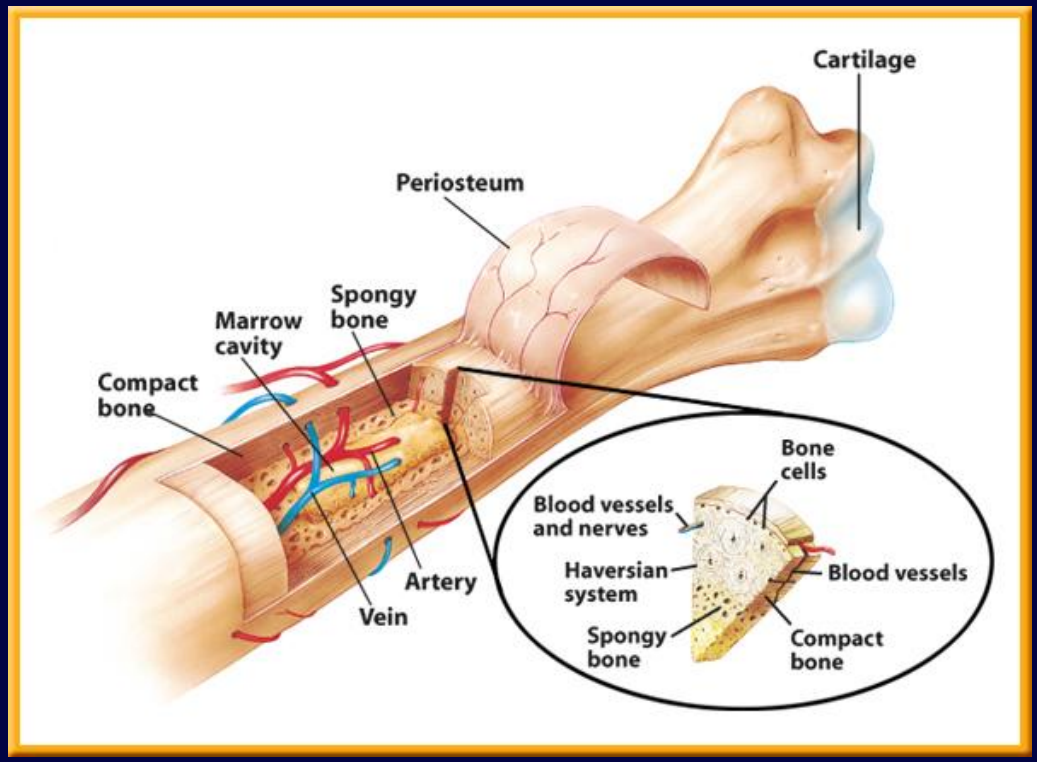
Bone Structure

- Bones have bumps, edges, round ends, rough spots, and many pits and holes.
- Muscles and ligaments attach to some of the bumps and pits.
- In your body, blood vessels and nerves enter and leave through the holes.

1

Bone Structure

- A living bone's surface is covered with a tough, tight-fitting membrane called the **periosteum** (per ee AH stee um).
- Small blood vessels in the periosteum carry nutrients into the bone.



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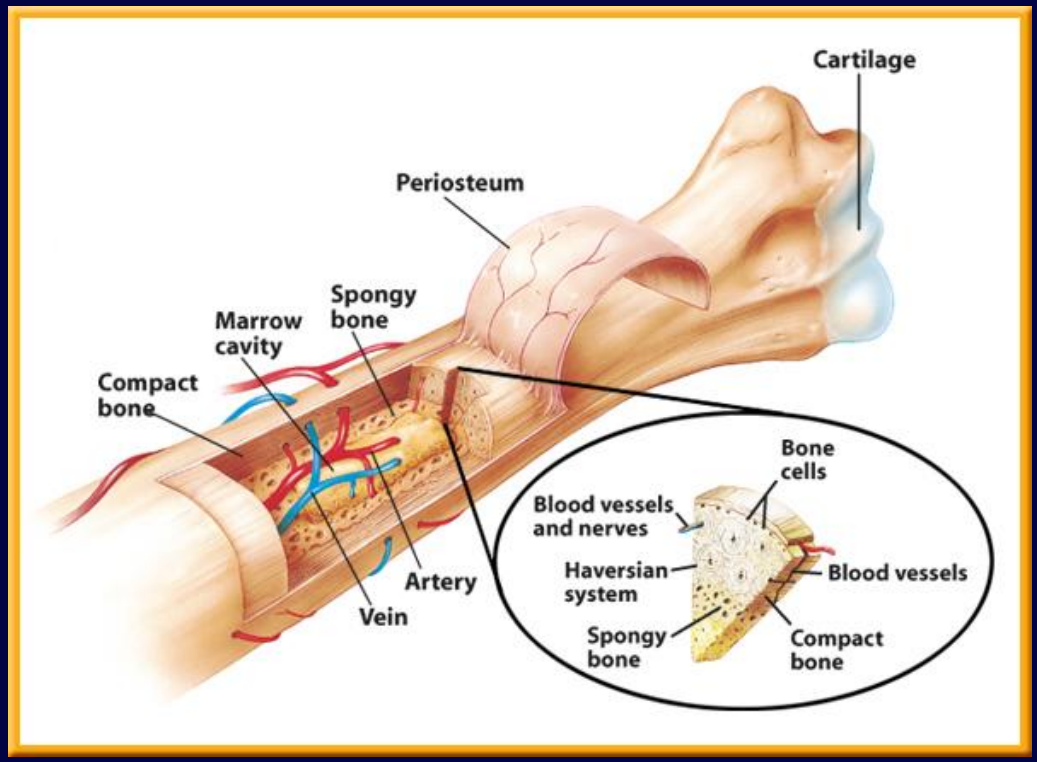
Bone Structure

- Cells involved in the growth and repair of bone also are found in the periosteum.
- Under the periosteum are two different types of bone tissue—compact bone and spongy bone.



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Compact Bone

- Directly under the periosteum is a hard, strong layer called compact bone, which gives bones strength.
- It has a framework containing deposits of calcium phosphate, which make the bone hard.
- Bone cells and blood vessels also are found in this layer.

1

Spongy Bone

- Spongy bone is located toward the ends of long bones such as those in your thigh and upper arm.
- Spongy bone has many small, open spaces that make bones lightweight.

1

Spongy Bone

- In the centers of long bones are large openings called cavities. These cavities and the spaces in spongy bone are filled with a substance called marrow.
- Some marrow is yellow and is composed of fat cells.
- Red marrow produces red blood cells at an incredible rate of 2 million to 3 million cells per second.

1

Cartilage

- The ends of bones are covered with a smooth, slippery, thick layer of tissue called **cartilage**.

- Cartilage does not contain blood vessels or minerals.

1

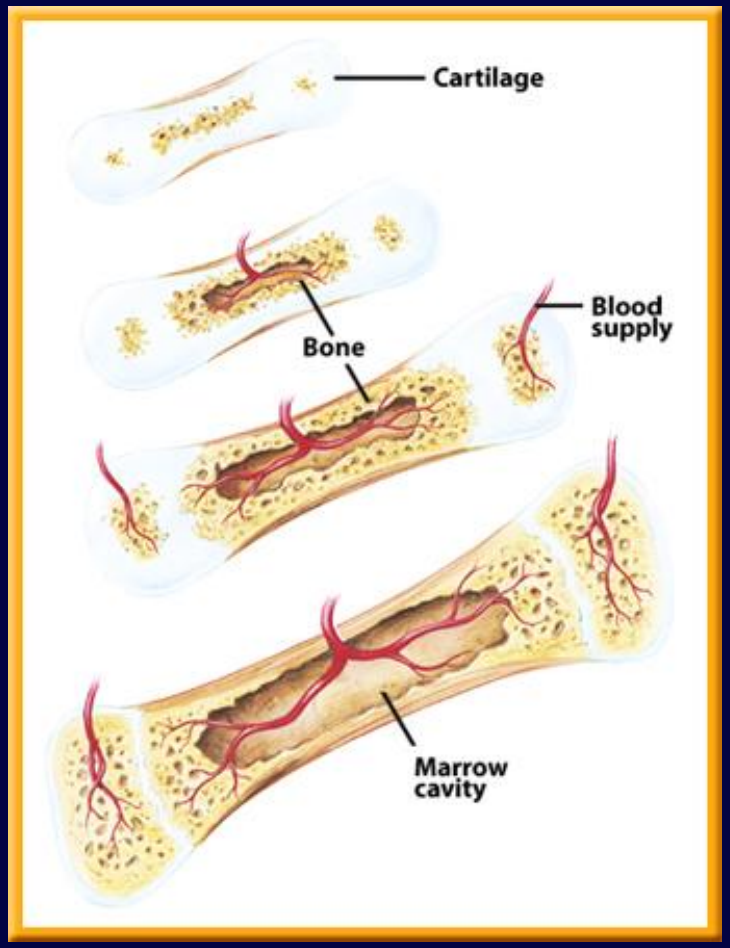
Cartilage

- Cartilage is flexible and important in joints because it acts as a shock absorber.
- It also makes movement easier by reducing friction that would be caused by bones rubbing together.

1

Bone Formation

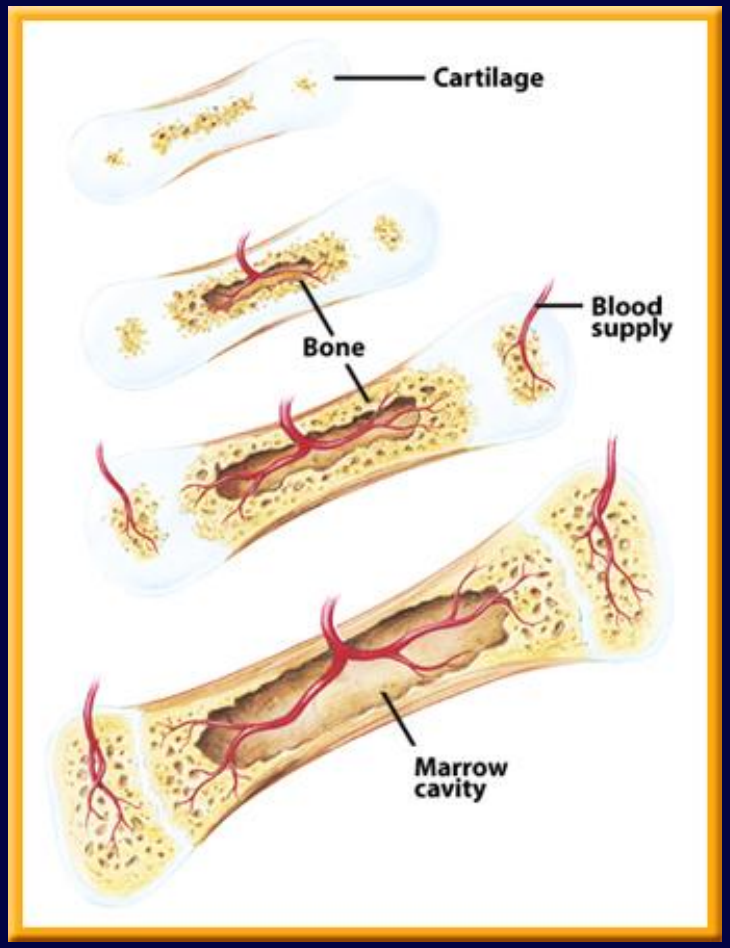
- Months before your birth, your skeleton was made of cartilage.
- Gradually the cartilage broke down and was replaced by bone.



1

Bone Formation

- Cartilage is replaced slowly by bone as solid tissue grows outward. Over time, the bone reshapes to include blood vessels, nerves, and marrow.



1

Bone Formation

- Bone-forming cells called osteoblasts (AHS tee oh blasts) deposit the minerals calcium and phosphorous in bones, making the bone tissue hard.
- At birth, your skeleton was made up of more than 300 bones.
- As you developed, some bones fused, or grew together, so that now you have only 206 bones.

1

Bone Formation

- Osteoblasts build up bone.
- Another type of bone cell, called an osteoclast, breaks down bone tissue in other areas of the bone.
- When osteoclsats break bone down, they release calcium and phosphorous into the bloodstream.
- This process maintains the elements calcium and phosphorous in your blood at about the levels they need to be.

1

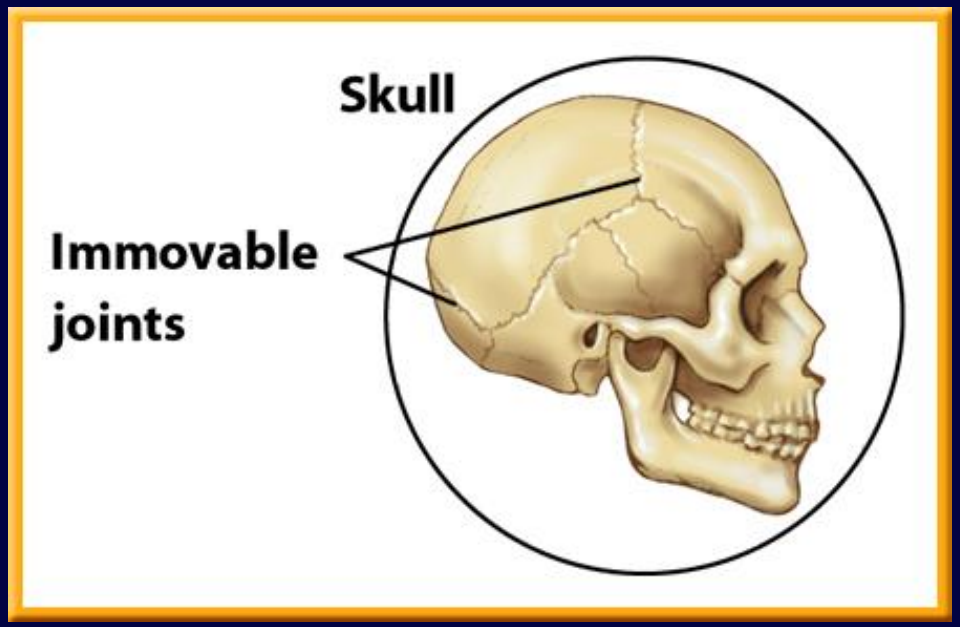
Joints

- Anyplace where two or more bones come together is a **joint**.
- The bones making up healthy joints are kept far enough apart by a thin layer of cartilage.
- The bones are held in place at these joints by a tough band of tissue called a **ligament**.
- Muscles move bones by moving joints.

1

Immovable Joints

- Joints are broadly classified as immovable or movable.
- An immovable joint allows little or no movement.
- The joints of the bones in your skull and pelvis are classified as immovable joints.



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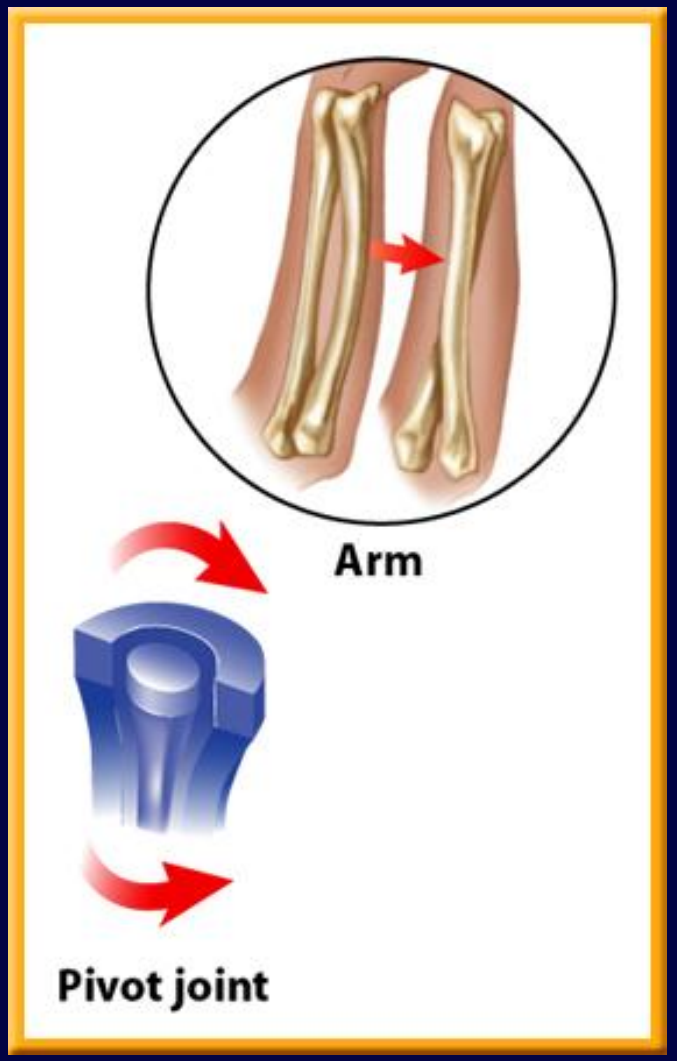
Movable Joints

- In a pivot joint, one bone rotates in a ring of another bone that does not move.
- Turning your head is an example of a pivot movement.



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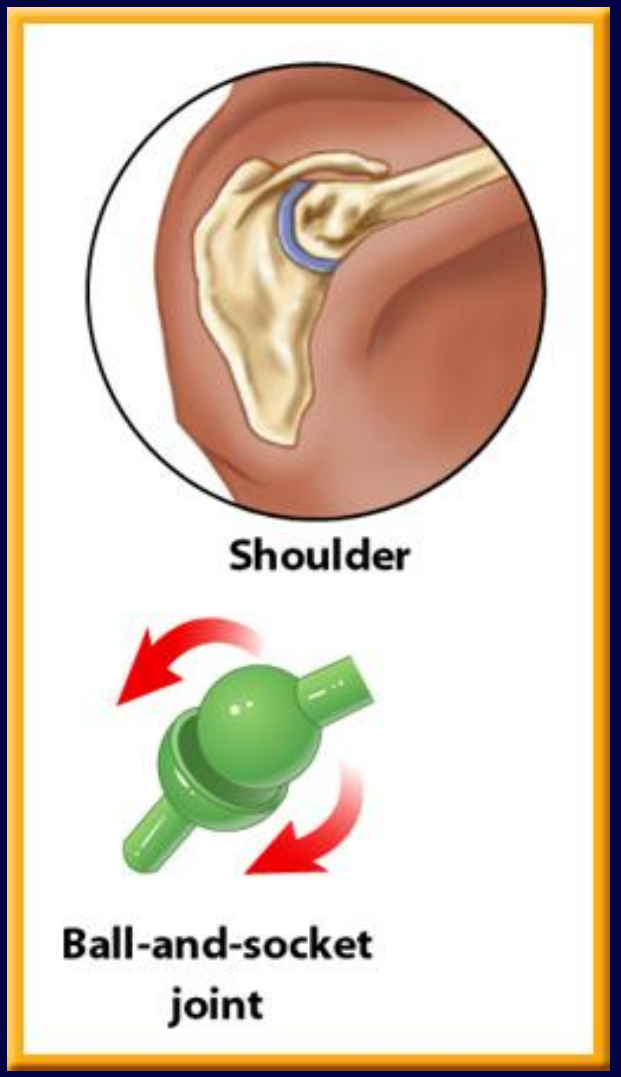
Movable Joints

- A ball-and-socket joint consists of a bone with a rounded end that fits into a cuplike cavity on another bone.
- A ball-and-socket joint provides a wider range of motion than a pivot joint does.



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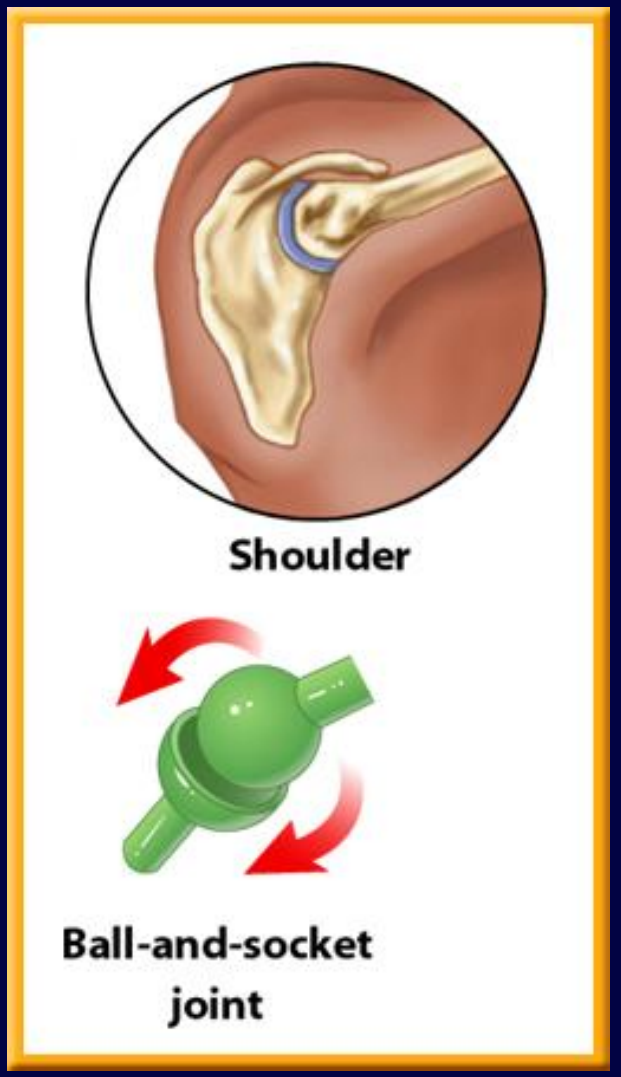
Movable Joints

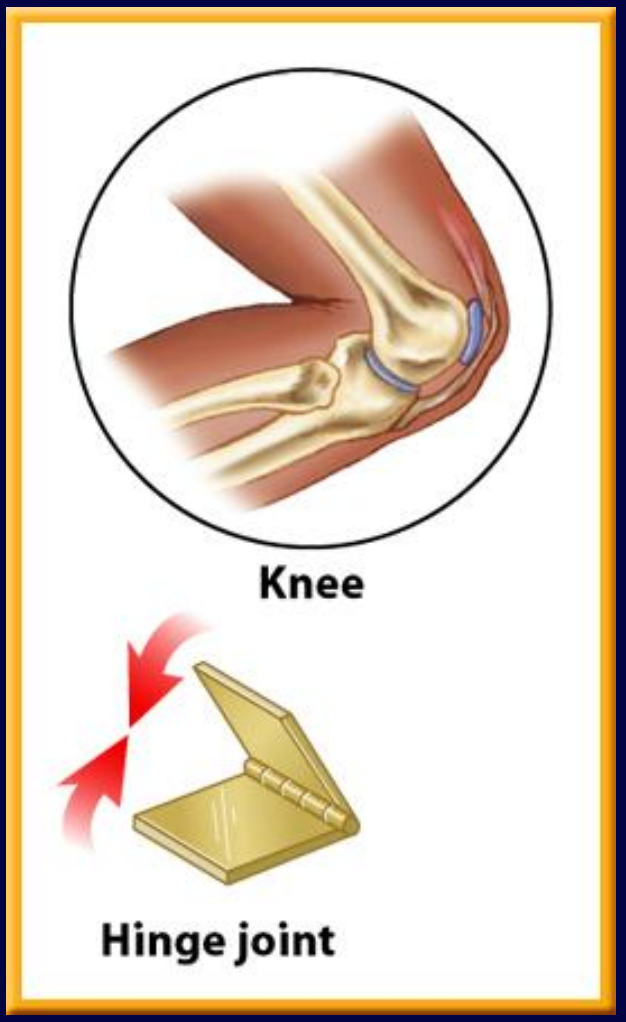
- That's why your legs and arms can swing in almost any direction.



1

Movable Joints

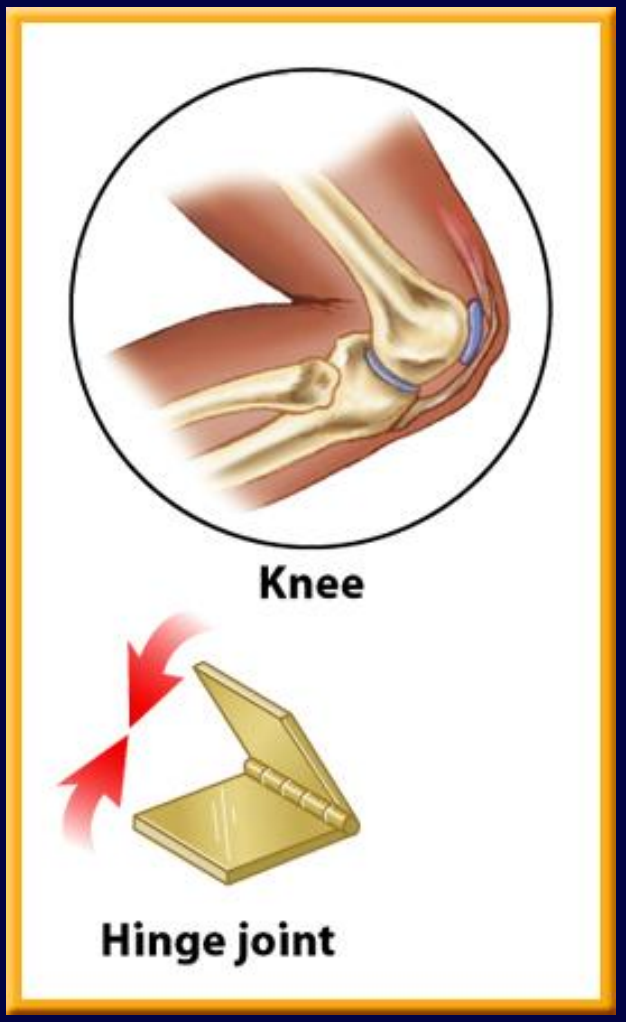
- A third type of joint is a hinge joint.
- This joint has a back-and-forth movement like hinges on a door.



1

Movable Joints

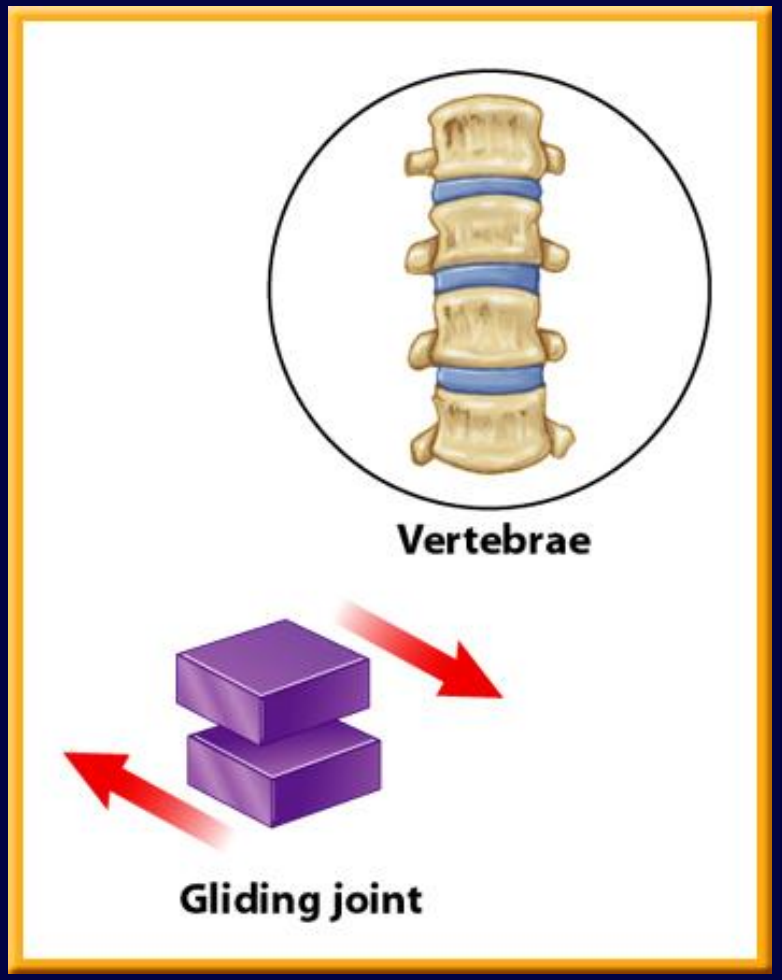
- Elbows, knees, and fingers have hinge joints.
- Hinge joints have a smaller range of motion and are not dislocated as easily, or pulled apart, as a ball-and-socket joint can be.



1

Movable Joints

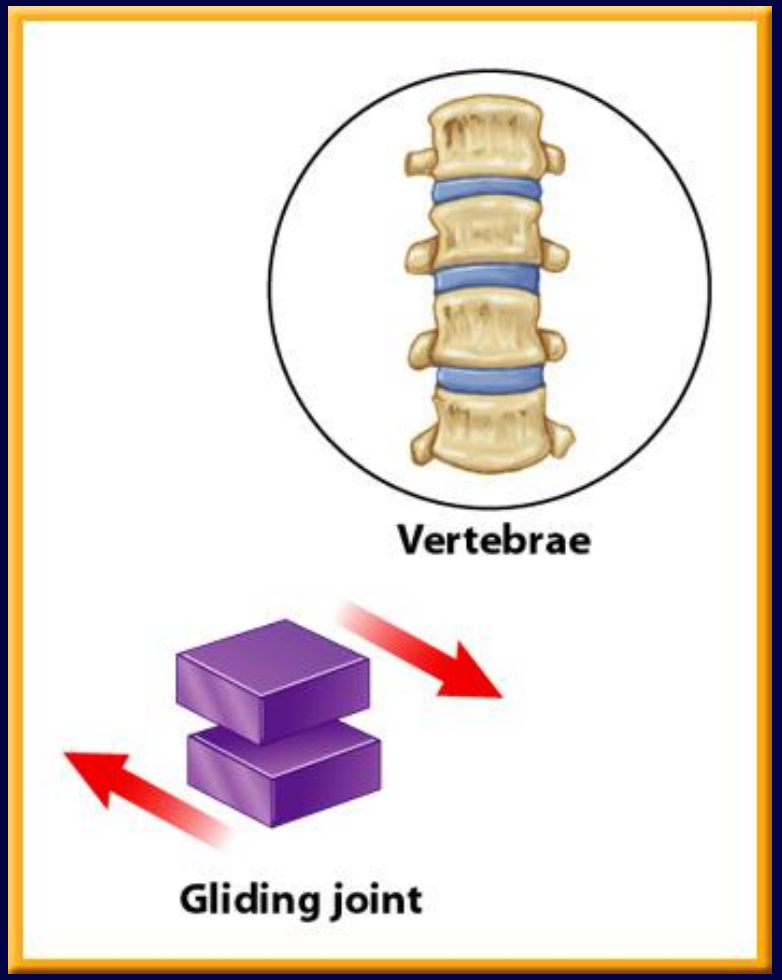
- A fourth type of joint is a gliding joint in which one part of a bone slides over another bone.



1

Movable Joints

- Gliding joints also move in a back-and-forth motion and are found in your wrists and ankles and between vertebrae.
- Gliding joints are used the most in your body.



1

Moving Smoothly

- Without the protection of the cartilage at the end of your bones, they also would wear away at the joints.

- Cartilage helps make joint movement easier. It reduces friction and allows bones to slide more easily over each other.

1

Common Joint Problems

- Arthritis is the most common joint problem.
- About one out of every seven people in the United States suffers from arthritis with the same symptoms: pain, stiffness, and swelling of the joints.
- Osteoarthritis results when cartilage breaks down because of years of use.
- Rheumatoid arthritis is an ongoing condition in which the body's immune system tries to destroy its own tissues.

1

Question 1

Which is NOT a function of your skeletal system?

A. gives shape and support to body
B. protects internal organs
C. produces blood cells
D. produces calcium and phosphorous

1

Answer

The answer is D. Calcium and phosphorous are stored in bones but they are not produced in bones

1

Question 2

What type of joint is shown in this diagram?

A. ball-and-socket
B. gliding
C. hinge
D. immovable

1

Answer

The answer is C. A hinge joint has back and forth movement like the hinges on a door. Elbows, knees, and fingers have hinge joints.

1

Question 3

Which is a place where two or more bones come together?

A. cartilage
B. ligament
C. muscle
D. joint

1

Answer

The answer is D. Cartilage keeps the bones in joints far enough apart that they don’t rub together.

2

Movement of the Human Body

- Muscles help make all of your daily movements possible.
- A **muscle** is an organ that can relax, contract, and provide the force to move your body parts.

2

Movement of the Human Body

- In the process, energy is used and work is done.
- Some muscles in your body are always moving.

2

Muscle Control

- Muscles that you are able to control are called **voluntary muscles**.
- Your hand, arm, and leg muscles are voluntary.
- You can choose to move them or not move them.

2

Muscle Control

- **Involuntary muscles** are muscles you can't control consciously.
- They go on working all day long, all your life.
- Blood gets pumped through blood vessels, and food is moved through your digestive system by the action of involuntary muscles.

2

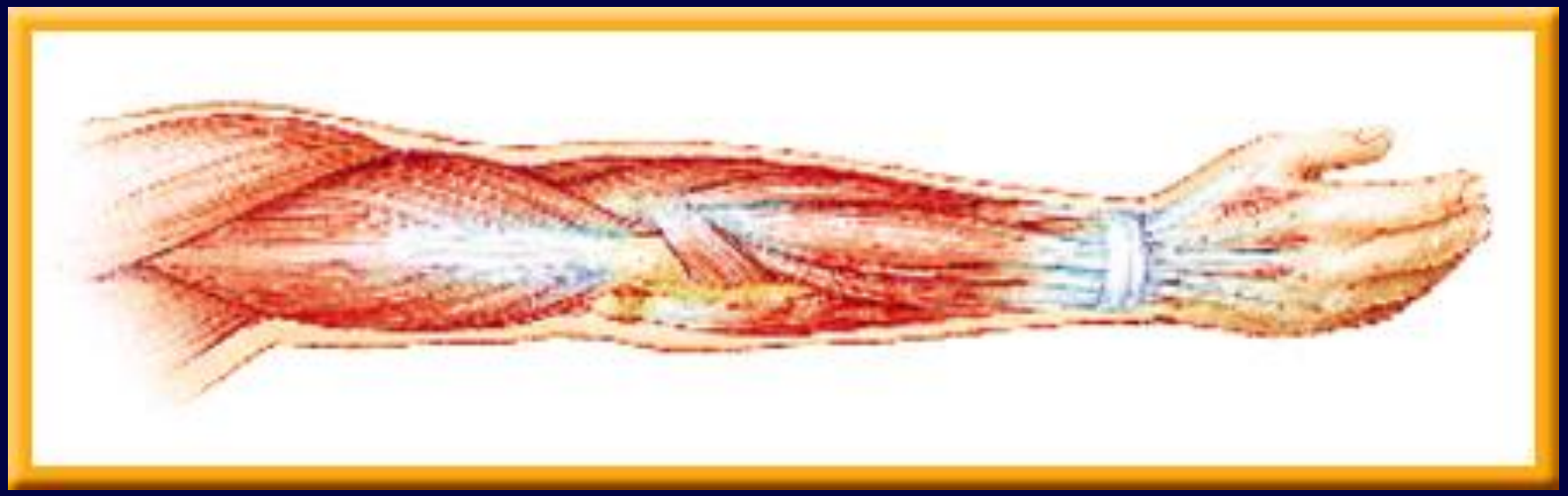
Your Body's Simple Machines—Levers

- The action of muscles, bones, and joints working together is like a lever.
- In your body, bones are rods, joints are fulcrums, and contraction and relaxation of muscles provide the force to move body parts.
- Levers are classified into three types—first-class, second-class, and third-class, all of which are found in the human body.

2

Classification of Muscle Tissue

- The three types of muscles are skeletal, smooth, and cardiac.
- The muscles that move bones are **skeletal muscles.**



2

Classification of Muscle Tissue

- They are more common than other muscle types and are attached to bones by thick bands of tissue called **tendons**.

2

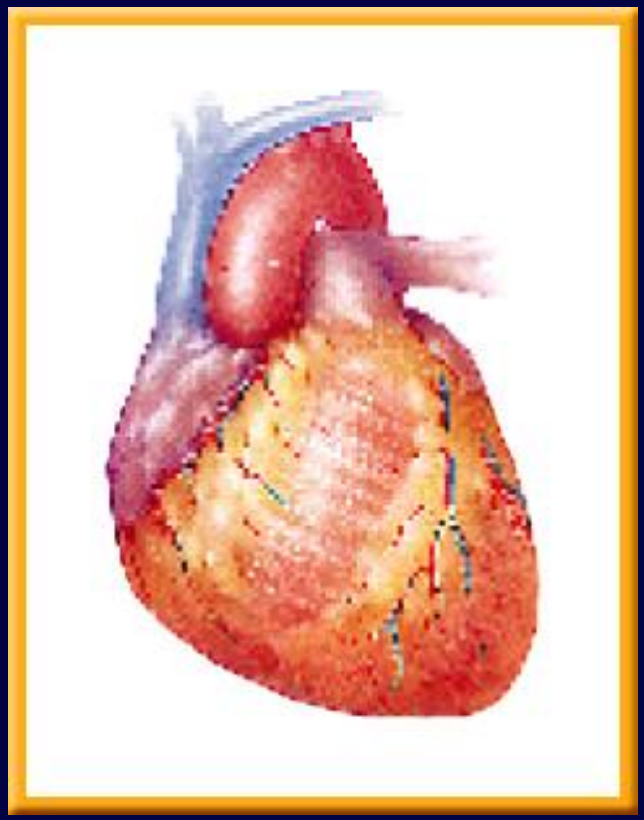
Classification of Muscle Tissue

- When viewed under a microscope, skeletal muscle cells are striated (STRI ay tud), and appear striped.
- Skeletal muscles are voluntary muscles.
- They tend to contract quickly and tire more easily than involuntary muscles do.

2

Classification of Muscle Tissue

- **Cardiac muscle** is found only in the heart.
- Like skeletal muscle, cardiac muscle is striated and involuntary.
- This type of muscle contracts about 70 times per minute every day of your life.



2

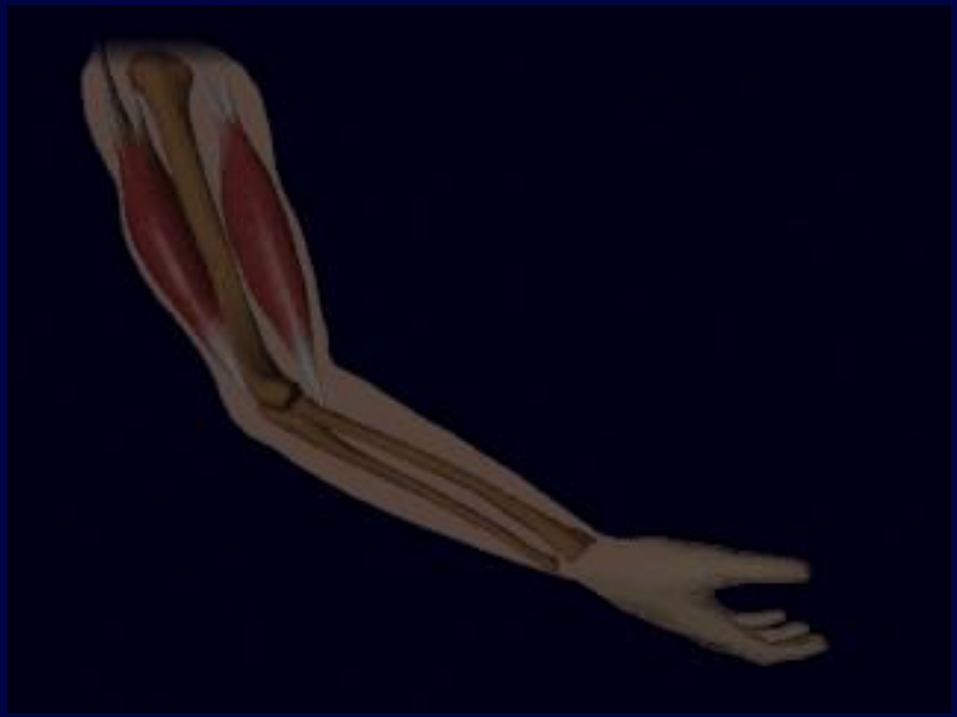
Classification of Muscle Tissue

- **Smooth muscles** are found in your intestines, bladder, blood vessels, and other internal organs.
- They are nonstriated, involuntary muscles that slowly contract and relax.
- Internal organs are made of one or more layers of smooth muscle.

2

Working Muscles

- You move because pairs of skeletal muscles work together.
- When one muscle of a pair contracts, the other muscle relaxes, or returns to its original length.



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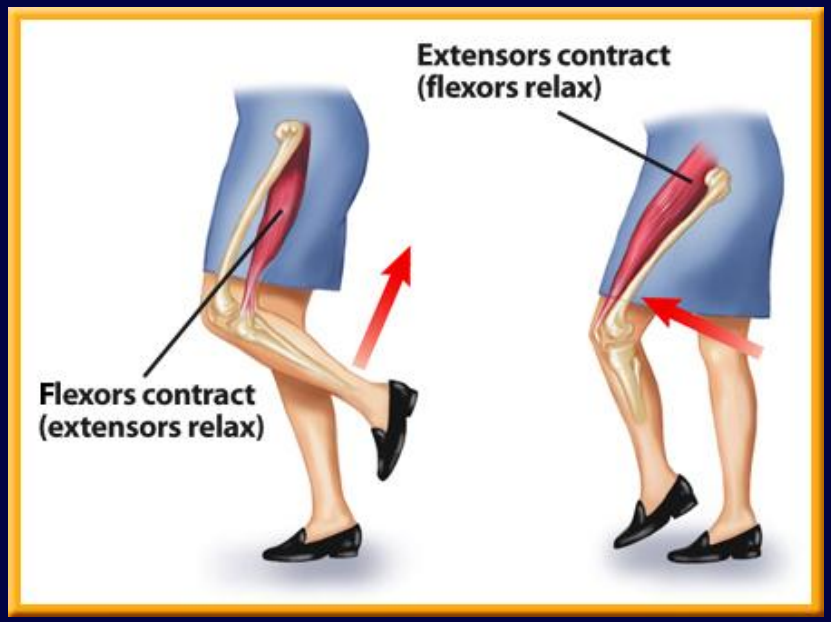
2

Working Muscles

- Muscles always pull. They never push.
- When the muscles on the back of your upper leg contract, they shorten and pull your lower leg back and up.
- When you straighten your leg, the back muscles lengthen and relax, and the muscles on the front of your upper leg contract.



2

Changes in Muscles

- Over a period of time, muscles can become larger or smaller, depending on whether or not they are used.
- Some of this change in muscle size is because of an increase in the number of muscle cells.
- However, most of this change in muscle size is because individual muscle cells become larger.

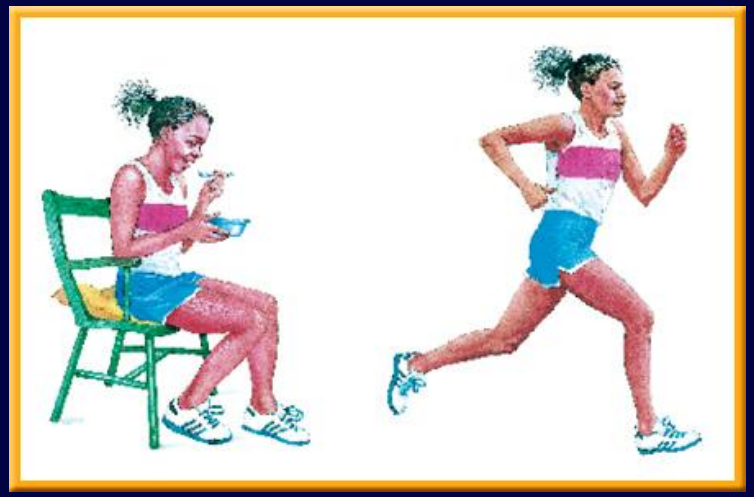
2

Changes in Muscles

- In contrast, if you participate only in nonactive pastimes, your muscles will become soft and flabby and will lack strength.
- Muscles that aren't exercised become smaller in size.
- When someone is paralyzed, his or her muscles become smaller due to lack of exercise.

2

How Muscles Move



- Your muscles need energy to contract and relax.
- Your blood carries energy-rich molecules to your muscle cells where the chemical energy stored in these molecules is released.
- As the muscle contracts, this released energy changes to mechanical energy (movement) and thermal energy (heat).

2

How Muscles Move

- When the supply of energy-rich molecules is used up, the muscle becomes tired and need to rest.
- During the resting period, your blood supplies more energy-rich molecules to your muscle cells.
- The heat produced by muscle contractions helps keep your body temperature constant.

2

Question 1

The skeletal and muscular system working together can be described as a _____.

A. lever
B. inclined plane
C. screw
D. wheel and axle

2

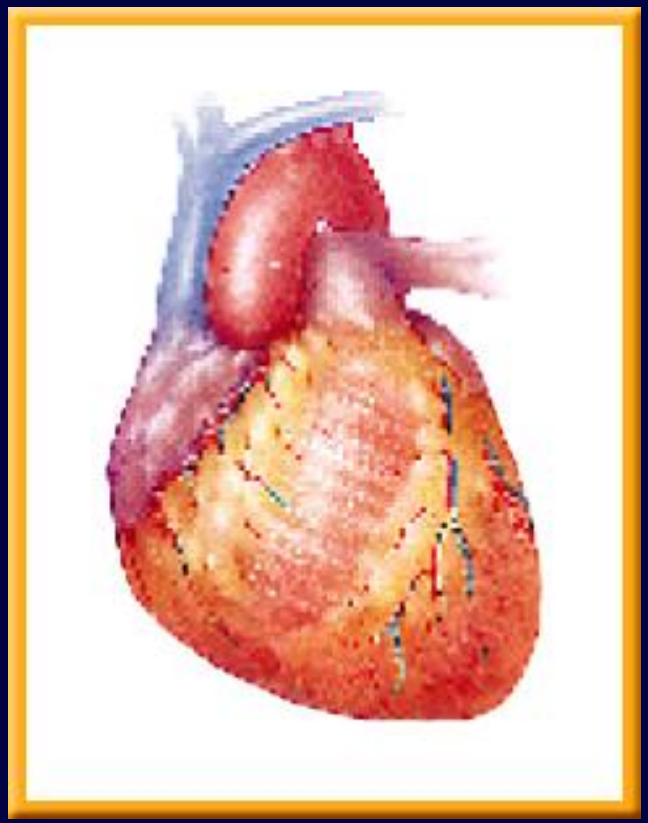
Answer

The correct answer is A. In your body, bones are rods, joints are fulcrums, and contraction and relaxation of muscles provide the force to move body parts.

2

Question 2

What type of muscle makes up this organ?



A. cardiac
B. skeletal
C. smooth
D. rough

2

Answer

The answer is A. Cardiac muscle is found only in the heart.

2

Question 3

Describe how muscles increase in size.

Answer

Muscles that are given regular exercise respond quickly to stimuli. Some change in muscle size is due to an increase in the number of muscle cells. However, most increase in size is because individual muscle cells become larger.

3

Your Largest Organ

- Your skin is the largest organ of your body.
- Much of the information you receive about your environment comes through your skin.
- You can think of your skin as your largest sense organ.

3

Your Largest Organ

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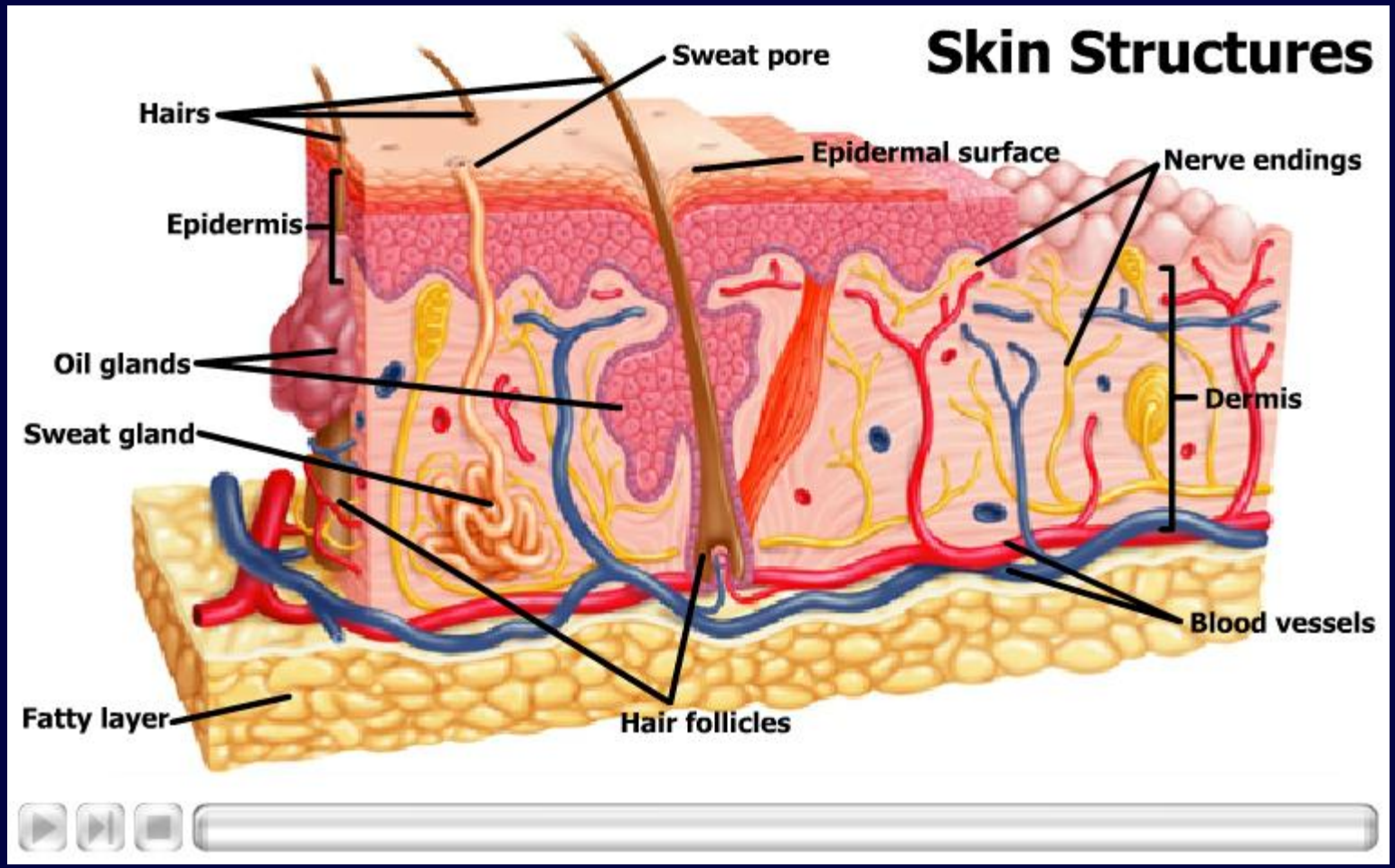


3

Melanin

- Cells in the epidermis produce the chemical melanin (MEL uh nun).
- **Melanin** is a pigment that protects your skin and gives it color.
- The different amounts of melanin produced by cells result in differences in skin color.

3

Melanin

- When your skin is exposed to ultraviolet rays, melanin production increases and your skin becomes darker.
- Lighter skin tones have less protection from the Sun
- Such skin burns more easily and may be more susceptible to skin cancer.

3

Skin Functions

- The most important function of the skin is protection.
- The skin forms a protective covering over the body that prevents physical and chemical injury.
- Some bacteria and other disease-causing organisms cannot pass through the skin as long as it is unbroken.

3

Skin Functions

- Glands in the skin secrete fluids that can damage or destroy some bacteria.
- The skin also slows down water loss from body tissues.
- Specialized nerve cells in the skin detect and relay information to the brain, making the skin a sensory organ, too.

3

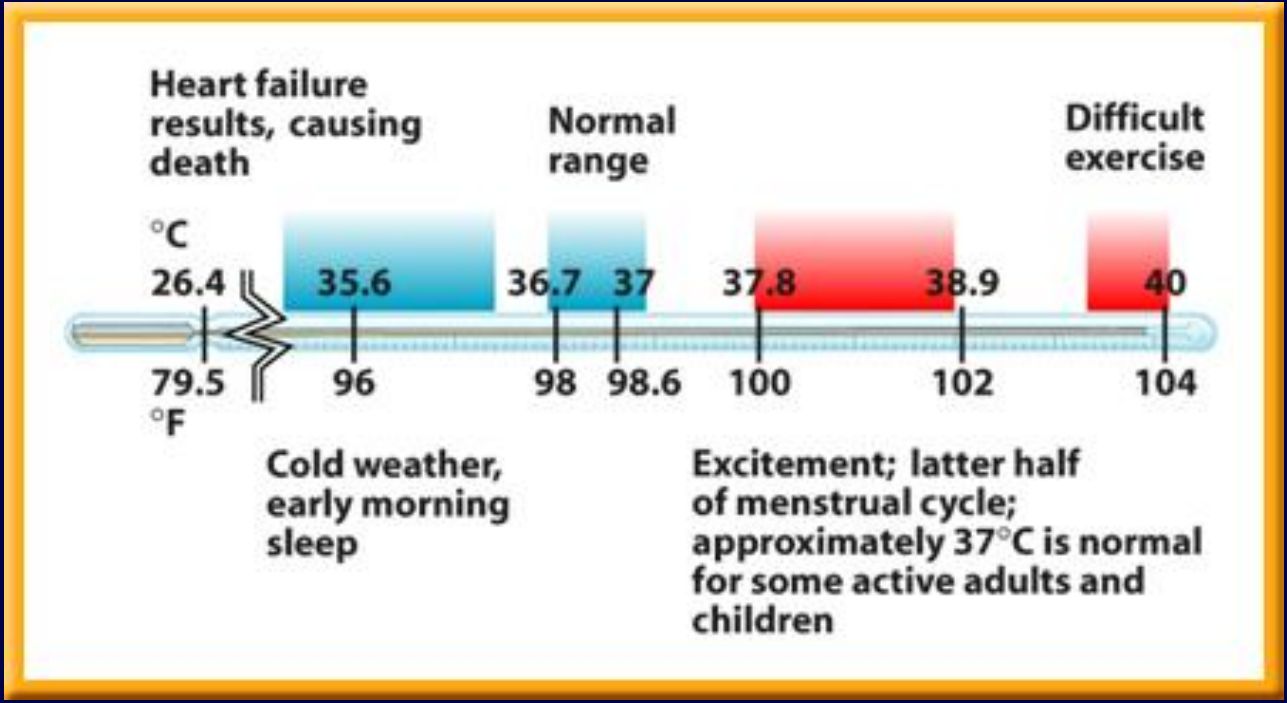
Vitamin D Formation

- Another important function of skin is the formation of vitamin D.
- Small amounts of this vitamin are produced in the presence of ultraviolet light from a fatlike molecule in your epidermis.
- Vitamin D is essential for good health because it helps your body absorb calcium into you blood from food in your digestive tract.

3

Heat and Waste Exchange

- Humans can withstand a limited range of body temperatures.



3

Heat and Waste Exchange

- Your skin plays an important role in regulating your body temperature.
- Blood vessels in the skin can help release or hold heat. If the blood vessels expand, or dilate, blood flow increases and heat is released.
- In contrast, less heat is released when the blood vessels constrict.

3

Heat and Waste Exchange

- Sweat glands help regulate the body's temperature and excrete wastes.
- When the blood vessels dilate, pores open in the skin that lead to the sweat glands.
- Perspiration, or sweat, moves out onto the skin.
- Heat transfers from the body to the sweat on the skin.
- Eventually, this sweat evaporates, removing the heat and cooling the skin.

3

Heat and Waste Exchange

- As your cells use nutrients for energy, they produce wastes that can act as poisons.
- In addition to helping regulate your body's temperature, sweat glands release water, salt, and other waste products.
- If too much water and salt are released by sweating during periods of extreme heat or physical exertion, you might feel light-headed or may even faint.

3

Skin Injuries and Repair

- Your skin often is bruised, scratched, burned, ripped, and exposed to harsh conditions like cold and dry air.
- In response, the skin produces new cells in its epidermis and repairs tears in the dermis.

3

Bruises

- When you have a bruise, your skin is not broken but the tiny blood vessels underneath the skin have burst.
- Red blood cells leak into the surrounding tissue and break down, releasing a chemical called hemoglobin.
- The hemoglobin gradually breaks down into its components, called pigment, which causes the bruised area to turn shades of blue, red, and purple.

3

Bruises

- Swelling also may occur.

- As the injury heals, the bruise eventually turns yellow as the pigment in the red blood cells is broken down even more and reenters the bloodstream.

3

Bruises

- After all of the pigment is absorbed into the bloodstream, the bruise disappears and the skin looks natural again.

3

Cuts

- Blood flows out of a cut until a clot forms over it.
- A scab then forms, preventing bacteria from entering the body.
- Cells in the surrounding blood vessels fight infection while the skin cells beneath the scab grow to fill the gap in the skin.
- In time, the scab fall off, leaving the new skin behind.
- If the cut is large enough, a scar may develop.

3

Cuts

- When severe burns, some diseases, and surgeries result in injury to large areas of skin, not enough skin cells are left that can divide and replace this lost layer.
- If not treated, this can lead to rapid water loss from skin and muscle tissues, leading to infection and possible death.

3

Skin Grafts

- Pieces of skin that are cut from one part of a person's body and then moved to the injured or burned area where there is no skin are called skin grafts.
- This skin graft is kept alive by nearby blood vessels and soon becomes part of the surrounding skin.
- Successful skin grafts must be taken from the victim's own body or possibly an identical twin.

3

Skin Grafts

- Since the 1880s, doctors have used the skin of dead humans, called cadavers, to treat temporarily severe burn victims who have little healthy skin left.
- However, the body usually rejects this skin, so it must be replaced continually until the burn heals.

3

Skin Grafts

- A recent advancement in skin repair uses temporary grafts from cadavers to prevent immediate infections, while scientists grow large sheets of epidermis from small pieces of the burn victim's healthy skin.
- After 19 to 21 days, the cadaver skin patch is removed and the new epidermis is applied.

3

Question 1

Which lies directly below the epidermis?

A. dermis
B. fatty layer
C. hairs
D. melanin

3

Answer

The answer is A. This layer is thicker than the epidermis and contains many blood vessels, nerves, muscles, oil and sweat glands, and other structures.

3

Question 2

Which is NOT a function of skin?

A. digestion of nutrients
B. formation of vitamin D
C. protection
D. regulation of body temperature

3

Answer

The answer is A. The digestive system is responsible for processing nutrients.

3

Question 3

Explain how a bruise forms.

Answer

A bruise forms when capillaries and other tiny blood vessels beneath the skin burst. Red blood cells from these broken blood vessels leak into the surrounding tissue and the hemoglobin that is released eventually breaks down into its pigments which give a bruise its color.

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End of Chapter Summary File