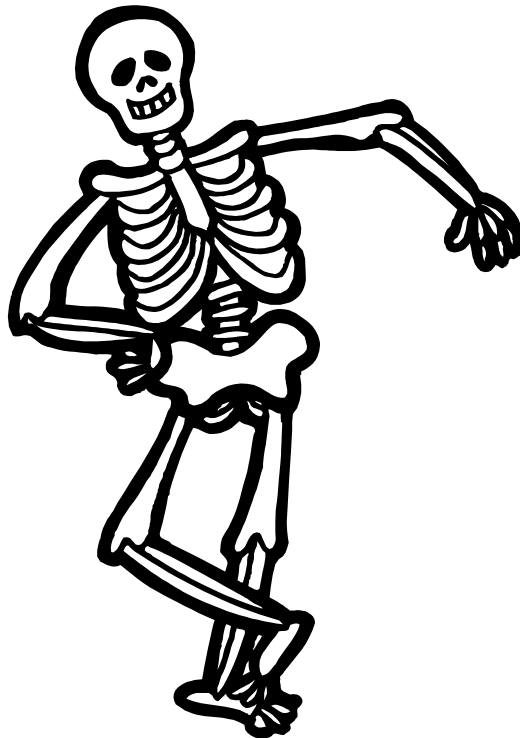


CHAPTER 14



Bones
Muscles
Skin

Chapter 14 Objectives

Section 1 – Body Organization and Homeostasis

1. Define homeostasis and give a specific example.
2. Explain why energy is important to the human body.
3. Describe the levels of organization of multicellular organisms.
4. Classify and identify the functions of the four basic types of tissue.
5. Identify the functions of the eleven body systems.

Section 2 – The Skeletal System

6. List the five functions of the skeletal system.
7. Describe the structure of a long bone and identify its parts and their functions.
8. Describe the structure and functions of cartilage.
9. Differentiate between tendons and ligaments.
10. Differentiate between movable and immovable joints and give examples of each.
11. Describe 3 movable joints.
12. Describe the disease osteoporosis and identify ways to prevent it.
13. Describe 2 ways to keep the skeletal system healthy.

Section 3 – The Muscular System

14. Classify, describe & identify the functions of the 3 types of muscle tissues.
15. Differentiate between voluntary and involuntary muscles.
16. Explain how muscles cause movement.
17. Describe 2 ways to prepare muscles for exercise.

Section 4 – The Skin

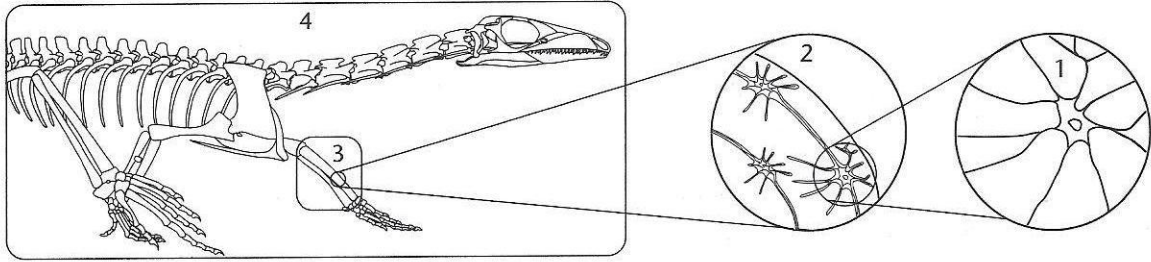
18. List 5 functions of the skin.
19. Differentiate between the two main layers of the skin.
20. Describe the structure and function of the epidermis.
21. Explain the main function of melanin, pores, and follicles.
22. Describe the structure and function of the dermis.
23. Identify 3 main ways to care for your skin.

Section 5 – Diagnosing Bone and Joint Injuries

24. Describe the three most common types of injuries to the skeletal and muscular systems.
25. Describe 2 ways to identify injuries to the skeletal system.
26. Explain the benefits of exercise to the skeletal and muscular systems.
27. Describe the most commonly used method for sprains (RICE).
28. Describe 2 ways to treat bone and joint injuries.
29. Identify the characteristics of arthritis.

Body Organization and Homeostasis

Directions: The reptile below shows the units of organization in a reptile. Label the numbered units in the space provided below



1. _____
2. _____
3. _____
4. _____

Directions: Fill in the blank

The _____ is the structure in a cell that contains information that determines the cell's characteristics.

_____ tissue makes up organs that are able to contract, or shorten. _____ tissue makes up the organs that send

messages to control the body. The inside of the digestive system is lined with

_____ tissue. The kidney is a(n)

_____. A(n) _____

is the basic unit of structure and function in a living thing.

_____ tissue provides support for your body and connects

all its parts. The _____ is the area between the cell membrane and the nucleus; it contains a clear, jelly-like substance.

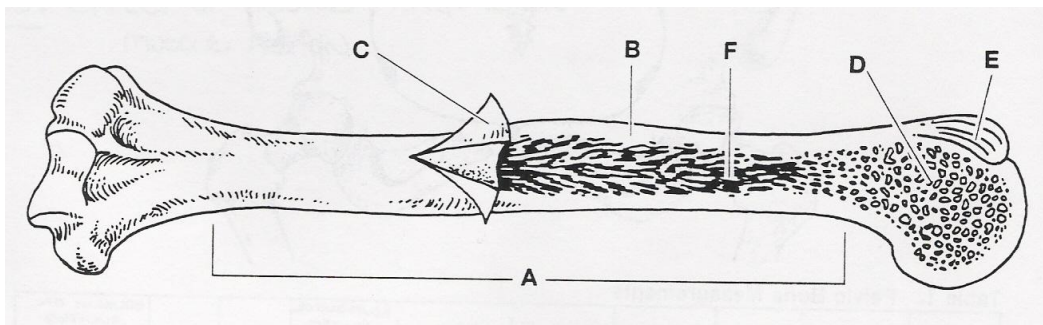
THE SKELETON SYSTEM

Directions: In the space provided, write the term that best matches each description.

- 1) _____ Your body has about 206 of these structures.
- 2) _____ A baby's skeleton is made mostly of this material.
- 3) _____ These tissues attach bone to muscles.
- 4) _____ This is the soft material that produces the body's blood cells
- 5) _____ These structures are found where bones come close together.
- 6) _____ These tissues connect bones to bones.

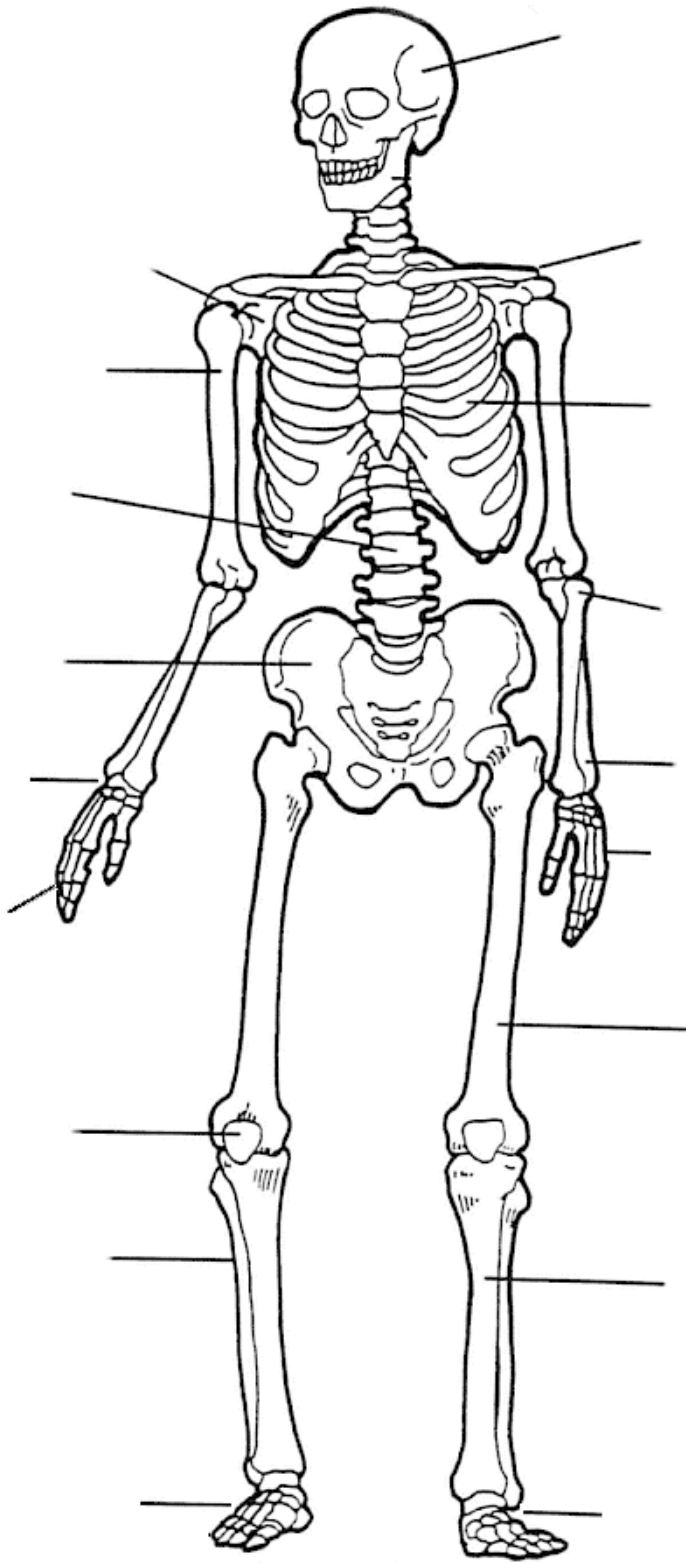
THE BONE DIAGRAM

DIRECTIONS: In the space provided, match the letter on the diagram with the corresponding term below.



- 1) _____ Cartilage
- 2) _____ Spongy Bone
- 3) _____ Shaft
- 4) _____ Marrow Cavity
- 5) _____ Compact Bone
- 6) _____ Membrane

Label the Skeleton

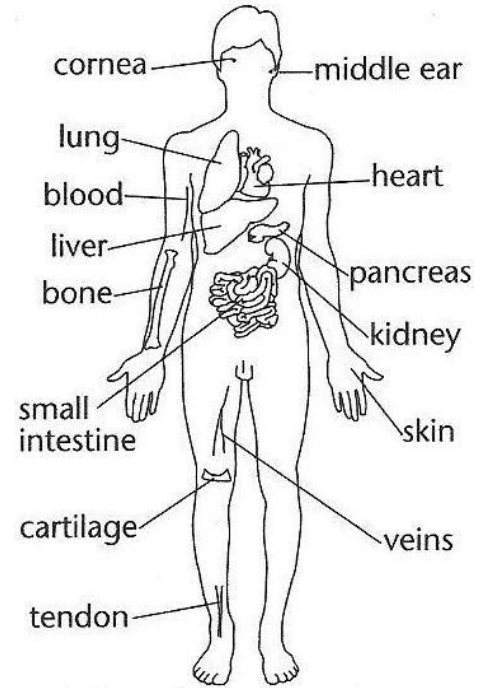


Organ and Tissue Transplants

When a doctor performs a transplant operation, he or she replaces a diseased or damaged organ or tissue. Sometimes a tissue is moved from one place to another on the same person. This procedure is called an *autograft*. (**Auto-** means “self” and **-graft** means “transplant”). A burn victim may have an *autograft* in which a section of his or her healthy skin is transplanted to cover the burn.

Sometime a person receives an organ or tissue from another person. This is called an *allograft*. (**Allo-** means “different”). An example of an allograft is the transplantation of a kidney from the body of one person into that of another person. One problem with an allograft is rejection. Rejection occurs when the patient’s body recognized the transplanted tissue or organ as foreign, similar to the way in which a mother can recognize a kitten from another litter as not belonging to her. Rejection is a serious problem because the body begins to attack the transplanted organ or tissue. One way of preventing rejection is by giving the patient certain drugs.

Transplants are performed to save a patient’s life or to correct a serious medical condition. For example, a person with severe liver disease might need a new liver in order to survive. Transplanting a part of the eye called the cornea can help some blind people to see. The illustration shows some of the many organs and tissues that doctors can transplant.



Directions: Answer the following questions

1. Autografts are never rejected. Why do you think this is true?
2. Why do you think doctors try to use autografts rather than allografts on burn patients?
3. A patient’s body is less likely to reject an allograft if it comes from a close relative. Why do you think this is true?
4. Do you think doctors would have more difficulty in transplanting an organ system than transplanting an organ? Think of an example to explain your answer.

How HANDY Are You?

BUILDING A MECHANICAL HAND

Introductory Statement

Students will construct a mechanical hand.

Objective

To work as a team and to design, build and test a mechanical hand to pick up a 'wad' of paper.

Materials

Foam paper plates, drinking straws, scissors, duct tape, yarn or string, large paper clips, large tongue depressors, glue guns, hot glue gun sticks, pens

Key Question

What is a mechanical hand?

How does a mechanical hand work?

Key Terms

- **Joints:** A place or part at which two or more things are joined. A point of articulation between two or more bones, especially such a connection that allows motion.
- **Tension:** A force that causes extension or stretching
- **Compression:** Volume reduced by pressure; a 'squeezing' force
- **Muscles:** A tissue composed of fibers capable of contracting to effect bodily movement.
- **Ligaments:** A sheet or band of tough, fibrous tissue connecting bones or cartilages at a joint or supporting an organ.

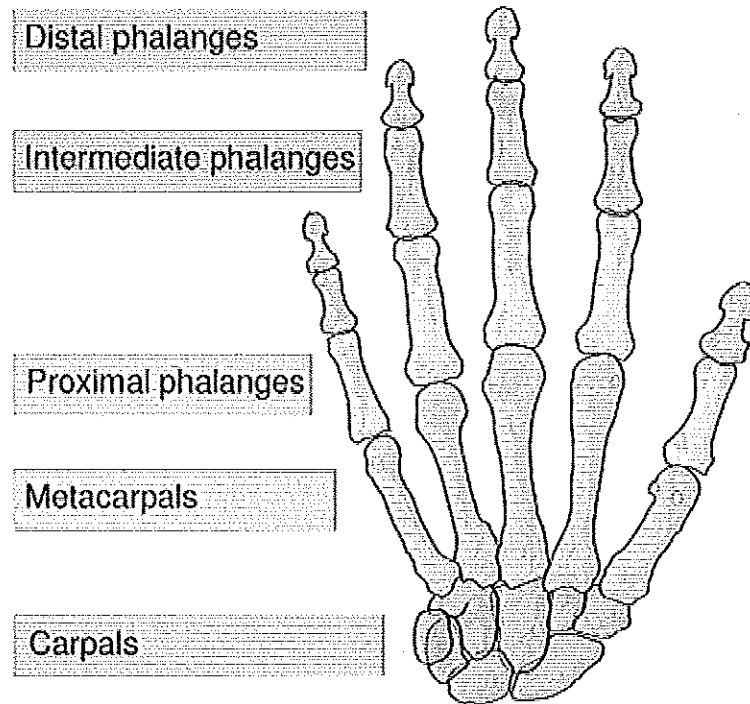
Anatomy: How do the finger joints normally work?

The bones in the palm of the hand are called *metacarpal bones*. One metacarpal connects to each finger and thumb. The five fingers of the hand are made up of *phalanges*, small bone shafts that line up to form each finger and thumb.

The main knuckle joint is formed by the connection of the phalanges to the metacarpals. This joint is called the *metacarpophalangeal joint*, abbreviated MCP. This joint acts like a hinge when you bend and straighten your fingers and thumb.

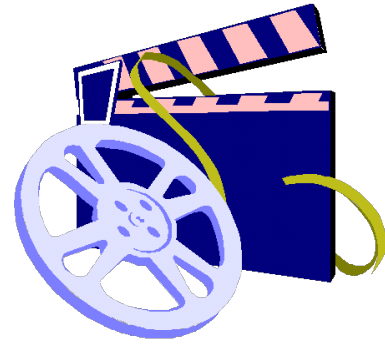
The three phalanges in each finger are separated by two joints, called, *interphalangeal* (IP) joints. The one closest to the MCP (knuckle) is called the PIP, or proximal IP joint. The joint near the end of the finger is called the DIP, or distal IP joint. The thumb only has one IP joint between the two thumb bones. The IP joints of the digits also work like hinge joints when you bend and straighten your hand.

The finger and thumb joints are covered on the ends with *articular cartilage*. This white, shiny material has a rubbery consistency. The function of articular cartilage is to absorb shock and provide an extremely smooth surface to facilitate motion. There is articular cartilage essentially everywhere that two bony surfaces move against one another, or articulate.



Procedure

1. Using a foam paper plate, cover the bottom of the plate with duct tape.
2. Trace your hand (four fingers and palm, but no thumb) on the top of the plate.
3. Cut out the hand and finger trace.
4. Score, using a pen, each finger horizontally in three places to make the joints. Each finger should have three, equally spaced score lines. Slightly bend the joints to make them flexible.
5. Using a glue gun, glue pieces of cut straws to each space between the joints of the fingers and palm. The straws on each finger should line up vertically. **(BIG HINT: The straws represent the bones of the hand. The diagram above should really help).**
6. Cut four pieces of yarn.
7. Make a knot on one end of each piece of yarn.
8. Take a piece of yarn and glue the knotted end of the yarn to a fingertip. Thread the rest of the yarn through each straw of the fingers and palm. Repeat for each finger.
9. Glue large tongue depressor or paint stirrer to bottom of the back of the hand.
10. Bend large paper clip into a 'c' shape and glue/tape one end to the back of the hand. This will represent the thumb.
11. Try to pick up the paper 'wad'. Re-engineer your hand if necessary.
12. We will have a competition to see who engineered the best hand.



Focus Questions: Skeletal System Movie

1. What are the 5 main functions of the skeletal system?
2. What are the 4 main parts of the musculoskeletal system?
3. What are mature bone cells called?
4. What are the 4 things that bones store?
5. How are bones classified? How many bones are there?
6. What are the 4 bone classifications? Give example of a bone in each class.
7. What are the names of the 2 parts the skeleton is divided into? What is included in each part?
8. How many facial bones are in the head? How many cranial?

Movie Focus Questions (cont.)

Identify location of each bone and give either a characteristic or common name.

Sternum: _____

Ribs: _____

Spine: _____

Scapula: _____

Humerus: _____

Ulna: _____

Radius: _____

Carpals: _____

Metacarpals: _____

Phalanges: _____

Femur: _____

Patella: _____

Tibia: _____

Fibula: _____

Tarsals: _____

Metatarsals: _____

9. What are the three types of joints? Give an example of each.

10. List the 6 types of synovial (moving) joints and give an example of each.

The Muscular System

In the human body, there are three types of muscle tissue:
skeletal muscle, smooth muscle, and cardiac muscle.

Directions: In the space provided, write the type of muscle that best matches each description.

- 1) _____ These muscles control breathing and digestion.
- 2) _____ These muscles never tire.
- 3) _____ These muscles move bones.
- 4) _____ These muscles are only found in the heart.
- 5) _____ These muscles control voluntary movements.
- 6) _____ These muscles react slowly and tire slowly.
- 7) _____ These muscles react quickly and tire quickly.
- 8) _____ These muscles are striated.

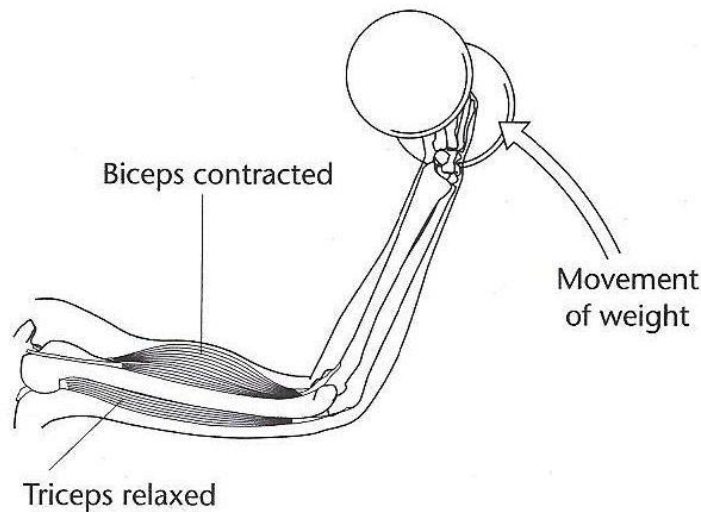
Directions: Fill in the following table

	TYPES OF MUSCLES		
	SKELETAL	SMOOTH	CARDIAC
Location in the body			
Voluntary or Involuntary?			
Striated or not striated?			
Reacts quickly? (yes or no)			
Tires quickly? (yes or no)			

PUMPING IRON

You know that exercise builds muscles, but how? When you exercise properly, you make individual muscle cells grow wider by stimulating protein synthesis. This causes the muscles to become thicker. Muscle increase in strength as they become thicker.

Any exercise that makes a muscle try to move an immovable object or to lift a heavy one can work toward increasing that muscle's strength. You can increase the difficulty of exercise by adding additional weight. The figure below demonstrates a biceps curl, a common strength-training exercise used to build arm muscles. The arrow shows the direction of movement, and the circles represent a weight.

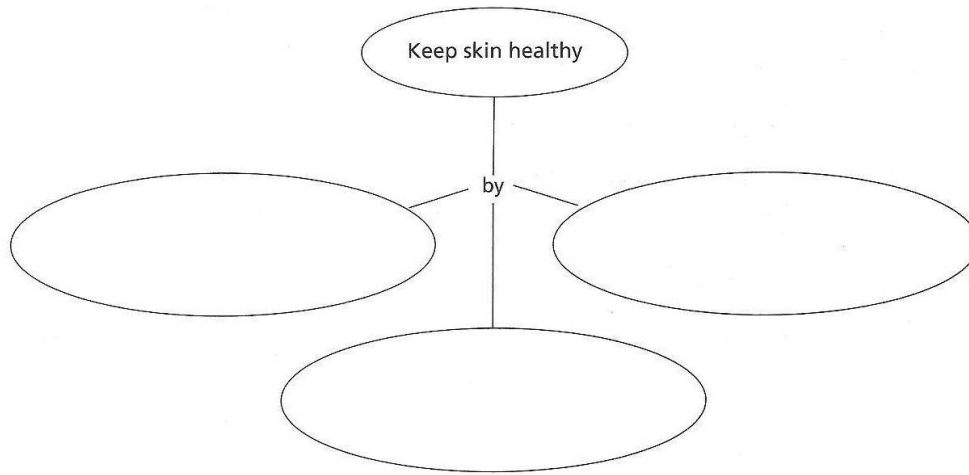


Directions: Answer the following questions.

1. How does exercise build muscles?
2. How can you increase the amount of exercise your arm muscles can do in the exercise pictured above?
3. How does the exercise shown above demonstrate that skeletal muscles must work in pairs?
4. Can you think of any exercise that would build biceps and triceps without the use of hand weights?

THE SKIN

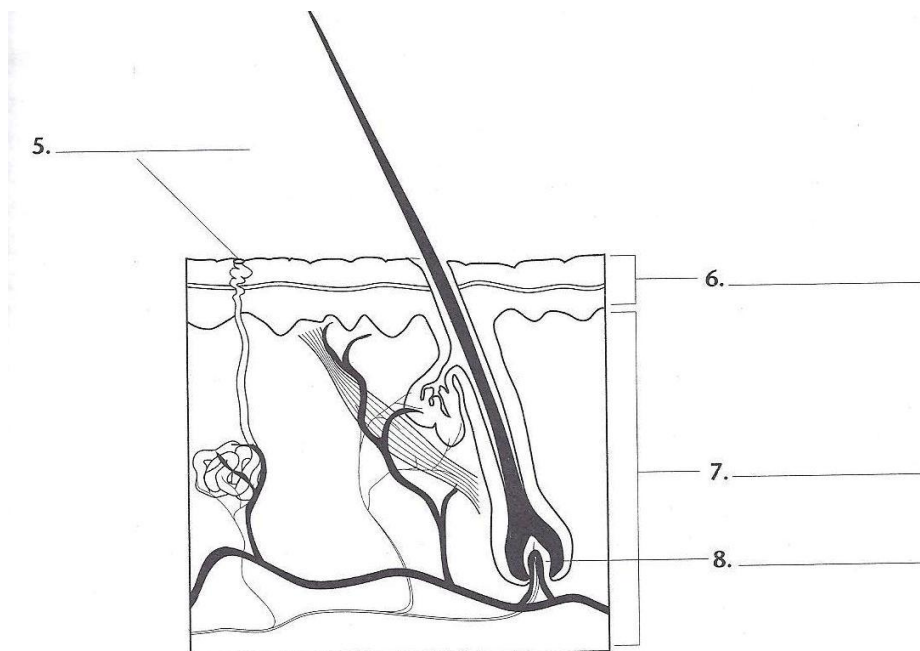
Directions: Fill in the following concept map



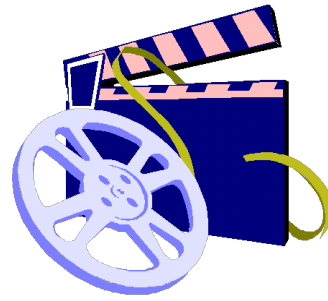
Directions: Fill in the blanks

1. The outermost layer of skin is the _____.
2. New cells that form deep in the epidermis gradually move upward to the surface of the skin, where after about _____, the cells die.
3. The inner layer of the skin is the _____.
4. Perspiration reaches the surface of the skin through openings called _____.

Directions: Label the following diagram



Focus Questions: Muscular and Integumentary Systems



1. What are the three main functions of the muscular system?
2. What are the three types of muscles?
3. What type of movement is produced by the cardiac and smooth muscles?
4. What type of muscle accounts for the majority of the body's total muscle?
5. What is the skeletal muscle also known as?
6. When does body movement occur?
7. When do muscles contract?
8. What is the difference between isotonic and isometric contraction?
9. What are three essential ingredients for muscle functioning for exercise?
10. Where is the cardiac muscle located on the heart? What does it look like?
11. Name three places where smooth muscle is located.
12. What is the average body temperature?
13. Why is skin essential?
14. How much does all your skin weigh?
15. Which hand grows nails the fastest?
16. What is the function of hair?

SPORTS INJURIES

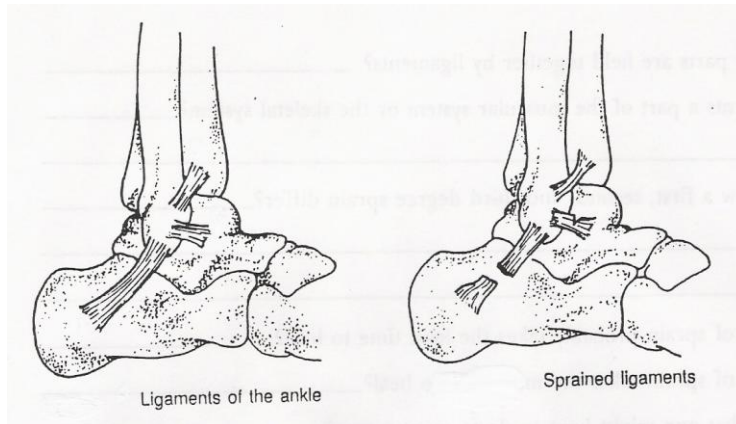
Directions: Label the following first-degree, second-degree and third-degree sprains.

Remember:

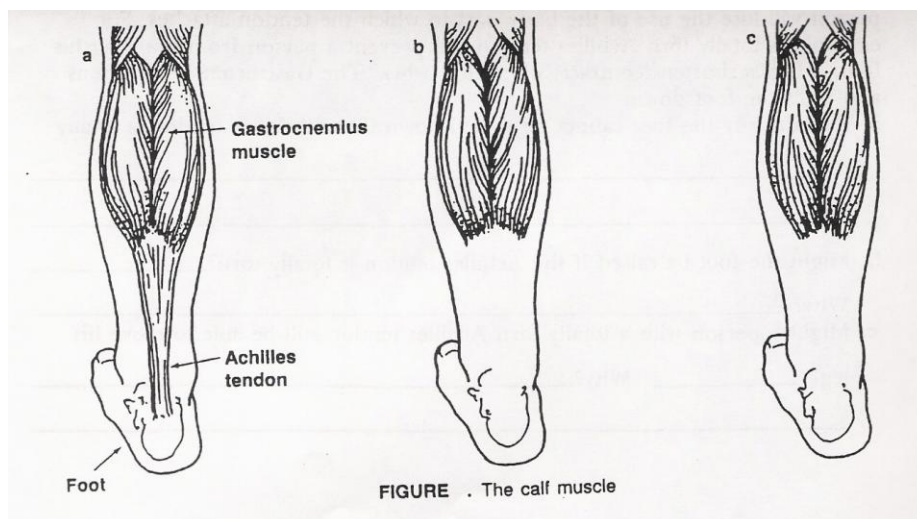
1st Degree Sprain = ligaments are stretched

2nd Degree Sprain = ligaments are partly torn

3rd Degree Sprain = ligaments are torn completely



Directions: Examine the next figure. The first is a view of the back of a person's leg and the calf muscle, the Gastrocnemius, in its normal state. The second shows a completely torn Achilles tendon. Draw an arrow pointing to the torn area and label it. Complete the third by drawing an example of tendonitis of the Achilles tendon. Tendonitis is a soreness of the tendon. It is caused by small tears which occur along the tendon. Draw an arrow pointing to the tears you drew and label them.



Questions:

1. What body parts are held together by ligaments? _____

2. Are ligaments a part of the muscular system or the skeletal system? Why?

3. Explain how a first, second, and third degree sprain differ?

4. What type of sprain probably takes the least time to heal? _____
5. What type of sprain takes the most time to heal? _____
6. Describe what one might have to do to cause a sprain.

7. What body parts are connected by tendons? _____
8. Are tendons a part of the muscular system or the skeletal system? Why?

9. Explain how tendons differ from ligaments.

10. Describe what one might have to do to cause a tendon to totally tear or develop tendonitis.

11. A totally torn tendon is a serious problem for an athlete or anyone else. A person will lose the use of the body part to which the tendon attaches. For example, a totally torn Achilles tendon will prevent the person from lowering his foot. Muscles shorten (contract) when they work. The Gastrocnemius shortens and pulls the foot down.
 - a. Explain why the foot cannot be pulled down if the Achilles tendon is totally torn.

 - b. Might the foot be raised if the Achilles tendon is totally torn? Why?

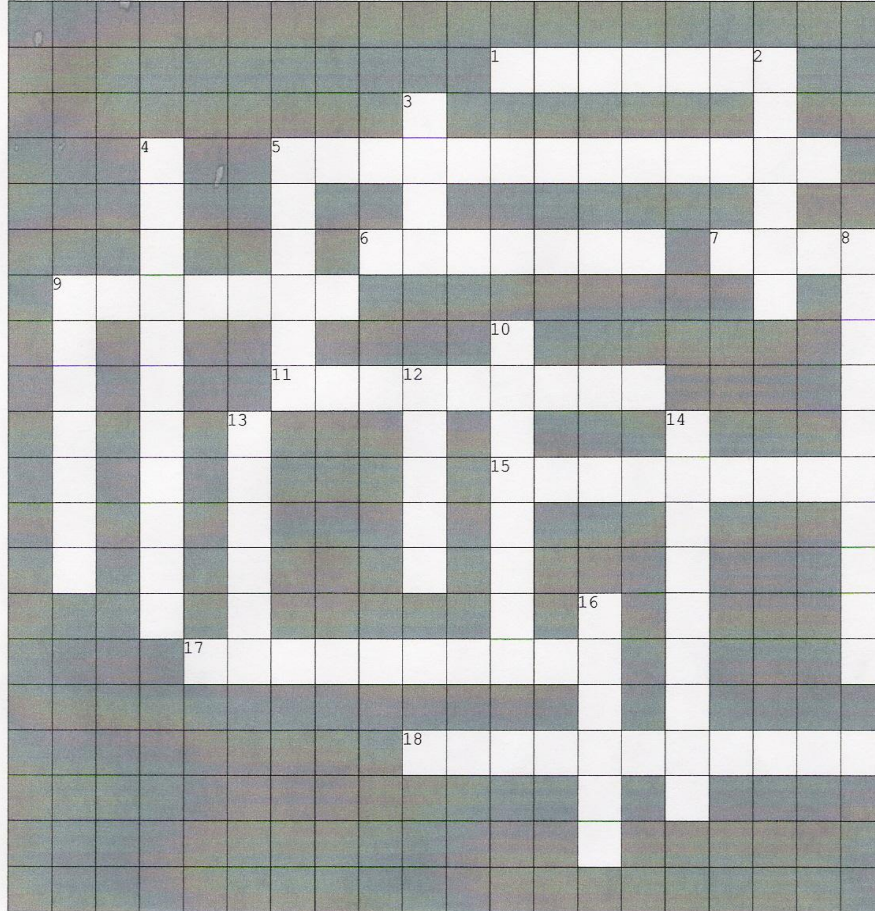
 - c. Might a person with a totally torn Achilles tendon still be able to move his leg? Why?



Skin Movie Focus Questions

1. Name 2 layers of the skin and their functions.
2. Where is the thickest and thinnest layer?
3. Why does the skin become red when you get hot?
4. Where do people with paler skin typically live?
5. What is a tan (not just change in color)?
6. Why do people tan?
7. What is a tan protecting us from?
8. What does the skin look like when it is damaged from the sunlight?
9. What does UV light do to skin cells?
10. Who is most likely to get melanoma (skin cancer)?
11. How can cancer be avoided?
12. What does SPF stand for?

CHAPTER 13 CROSSWORD



ACROSS

- 1 TISSUE THAT HOLDS MUSCLES TO BONES
- 5 COVERING SYSTEM
- 6 THE SUBSTANCE BURNED FOR ENERGY IN THE HUMAN BODY
- 7 TREATMENT FOR SPRAINS
- 9 MINERAL THAT IS STORED IN BONES
- 11 SYSTEM THAT PRODUCES HORMONES
- 15 TISSUE THAT CUSHIONS AND PROTECTS BONES
- 17 COVERING MEMBRANE OF A BONE
- 18 MAINTAINING INTERNAL CHEMICAL BALANCE

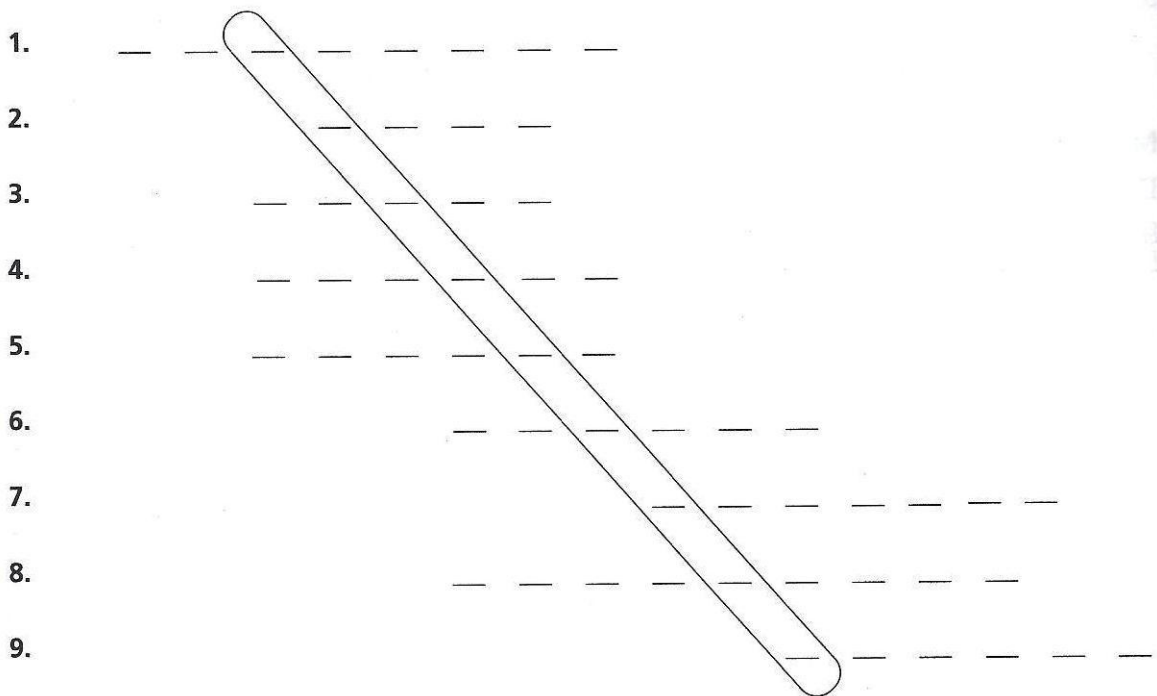
DOWN

- 2 WHEN LIGAMENTS ARE STRETCHED OR TORN
- 3 BASIC UNIT OF STRUCTURE AND FUNCTION IN THE HUMAN BODY
- 4 WHEN A BONE IS FORCED OUT OF ITS JOINT
- 5 SYSTEM THAT PROTECTS YOU FROM DISEASE
- 8 COVERING TISSUE
- 9 TYPE OF MUSCLE THAT POWERS THE HEART
- 10 A BREAK IN A BONE
- 12 A GROUP OF DIFFERENT TISSUES WORKING TOGETHER TO PERFORM A FUNCTION
- 13 A GROUP OF SIMILAR CELLS WORKING TOGETHER
- 14 TISSUE THAT HOLDS BONES TOGETHER
- 16 TYPE OF MUSCLE THAT POWERS INTERNAL ORGANS

KEY TERMS

Directions: Identify the clue words based on the descriptions. Use those clues to reveal the hidden word.

1. Muscles attached to the bones of the skeleton are _____ muscles.
2. An opening in the dermis through which perspiration reaches the surface of the skin
3. A place in the body where two bones come together
4. A strong connective tissue that attaches muscle to bone
5. A disease in which some cells in the body divide uncontrollably
6. A soft connective tissue found in the spaces in bone
7. A pigment that gives skin its color
8. A connective tissue that makes up the skeleton and that is more flexible than bone
9. _____ bone has many small spaces within it



What is the function of the mystery word? _____

LAB: Bones, Muscles, and Skin

Pre-Lab Discussion:

Have you ever seen a picture of a jellyfish? The body of the animal has no rigid shape because it has no bones. Think of what your body would be like without bones. Bones provide the structure needed for you to stand upright and to hold this paper. Bones work closely with muscles to allow your body to move. Muscles also keep important parts of your body, such as your heart, working. In Part A of the following investigation, you will examine bone and muscles cells to see how their structures relate to what they do.

Of course, you can't see your bones and muscles. They are covered by the largest organ in your body- your skin. What does the skin do? One of its many purposes is to protect the inside of your body against injury and disease. It also contains sense receptors that give you your sense of touch. In Part B of this investigation, you will examine one important function of the sense of touch- the ability to distinguish different temperatures.

1. What are the three types of muscles? Explain how they differ.
2. Name three functions of bones and three functions of skin.

Problem:

How are the three types of muscle cells and bones alike, and how do they differ? How does your body sense differences in temperature?

Materials:

Prepared slides of:

- Smooth muscle
- Skeletal muscle
- Cardiac muscle
- Cross-section of compact human bone
- Microscope
- 3 transparent plastic cups
- Cold water
- Room-temperature water
- Paper towel
- Stop watch

PROCEDURE:

Part A: Observing Muscle and Bone

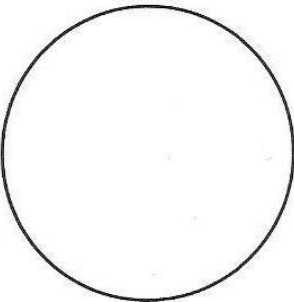
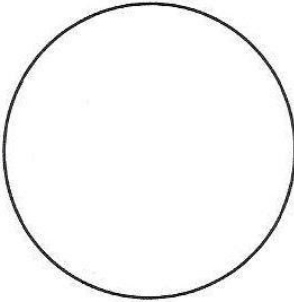
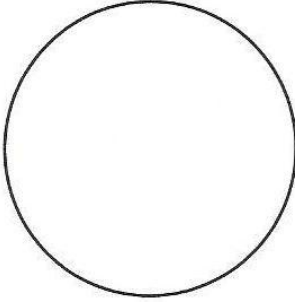
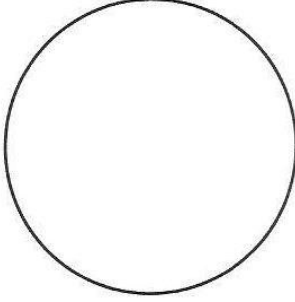
1. Using the microscope, first on low power, examine a prepared slide of skeletal muscle. Look for nuclei in the cells.
2. In Part A Observations, sketch the skeletal muscle tissue that you see. Note the magnification you use to view it. Label details of the cells such as striations (stripes) and nuclei.

- Using the microscope, first on low power and then on high power, examine a prepared slide of cardiac muscle. Look for nuclei in the cells.
- In Observations, sketch the cardiac muscle tissue you see. Note the magnification you use to view it. Label details of the cells
- Using the microscope, first on low power and then on high power, examine a prepared slide of smooth muscle. Look for nuclei in the cells.
- In Observations, sketch the smooth muscle tissue that you see. Note the magnification you use to view it. Label details of the cells.
- Using the microscope, first on low power and then on high power, examine a prepared slide of compact bone. Look for cells and structural features.
- In Observations, sketch the bone tissue that you see. Note the magnification you use to view it. Label the details of the structures.

Part B: Examining Sense of Touch

- Place a cup of cold water and a cup of room temperature water on two or three paper towels in front of you. Put your index finger in the cold water for about 5 seconds.
- Remove your finger from the cold water, and put it in the room-temperature water. Immediately tell your partner how the water feels. For this step and each of the following steps, have your partner record all your observations in the Data Table.
- Leave your finger in the room-temperature water. Describe how the water feels after a few minutes.
- While one finger is still in the water, put your index finger from your other hand into the same cup.
- Remove both fingers from the water. Put your original finger into the cold water and leave it there for about 20 seconds. Then move it into the room-temperature water. Leave your finger in the cup for a few minutes.
- Put your other index finger into the room-temperature water. Compare how the water feels now to how it felt in Step 3.
- Remove both fingers from the water.

**Observations
Part A**

<i>Smooth Muscle</i>	<i>Skeletal Muscle</i>	<i>Cardiac Muscle</i>	<i>Compact Bone</i>
			
<i>Magnification:</i> _____	<i>Magnification:</i> _____	<i>Magnification:</i> _____	<i>Magnification:</i> _____

Part B

STEP	What to Observe	Observations
2	How did the water feel when you first put your finger in the room-temperature water?	
3	How did the water feel when you left your finger in the room-temperature water?	
4	How did the water feel to your other finger when you put it in the room-temperature water?	
5	How did the water feel when you first put your finger in the room temperature water this second time?	
6	How did the water feel when you left your finger in the room-temperature water this second time?	
7	How does the water feel now compared to how it felt in Step 5?	

Analyze and conclude:

1. What structure can you clearly see in the muscle cells that you cannot see in the bone? Describe this structure.
2. What is the main structural difference between cardiac and skeletal muscle?
3. Did the sensors in your fingers respond in the same manner to the room-temperature water? Explain.
4. Can you infer that striations, or stripes, have anything to do with whether a muscle is voluntary or involuntary? Explain.
5. You looked at a cross-section of a bone. Describe how you could model the interior structure of an entire bone.
6. Suppose one person have been outdoors on a hot day and another person has been in an air-conditioned room. They both go into an area that is at room temperature. Use your results from Part B to explain the temperatures sensed by both people in the new location.