

## THE HUMAN BODY

### Chapter 24 SUPPORT AND MOVEMENT OF THE BODY

#### 24A - HUMAN SKIN THE **INTEGUMENTARY SYSTEM**

Approx. 1.9 square meters (about 18 sq. feet) of skin cover the body. Although the thickness varies, it averages about 1/8 of an inch (1-2 mm). Skin is the largest organ of the human body. The skin of an adult weights about 9 pounds (6% of the body weight). A piece of skin the size of a quarter contains:

- 1 yard of blood vessels
- 4 yards of nerves
- 25 nerve ends
- 100 sweat glands
- more than 3 million cells

This large but thin system serves the body in a number of varies ways.

#### FUNCTIONS OF THE SKIN:

(1) **PROTECTION** (a mechanical shield) - Your skin is one of your body's major defenses. The skin does not permit significant amounts of substances like water in or out of the body.

Bacteria, viruses, and many common chemicals that you constantly touch would be very harmful if they penetrated into the body. Skin is an effective barrier to most of them. Perspiration and oils secreted by the skin provide a form of chemical protection which is acidic and sometimes has enzymes that inhibit the growth of certain mircroorganisms.

(2) **SENSATION** (Communication) - nerve receptors for touch, pressure, temperature, and pain are in the skin. Communication between your body and the outside world. Your hair helps make you aware of things near your body.

(3) **HEAT CONTROL** - the amount of blood being carried to the surface of the skin is regulated to control the amount of heat lost to the atmosphere. Blood vessels in skin dilate when you need to cool off and constrict when you need to conserve heat. Also evaporation of sweat cools the body.

(4) **EXCRETION** (Secretion) - a small amount of body wastes is excreted with sweat.

*sweat glands* - move moisture to the surface to cool, also give off certain wastes to help keep the body clean

*oil glands (sebaceous)* - coat the skin with oils to keep it from drying out. Acne is an inflammation of sebaceous glands.

(5) **MANUFACTURE** - The skin produces small amounts of vitamin D. As little as 15-20 minutes of sunlight 2-3 days a week will produce sufficient vitamin D.

(6) **ABSORPTION** - the skin can absorb some chemicals, a few drugs, and a small amount of oxygen.

## The Layers of the Skin

- (1) **Epidermis:** the outermost layer of the skin  
has dead cells at the surface and living cells underneath  
contains nerve endings (example: pain receptors)  
the older cells of the epidermis fill with a waxy substance called **keratin** and die approximately every 25 days (faster for some people and in some areas of the body) a completely new epidermis covers the body
- (2) **Dermis:** the inner, much thicker layer of the skin  
contains: connective tissues  
blood vessels  
nerve receptors (cold, heat, touch, and pressure)  
sweat glands  
hair follicles  
oil (*sebaceous*) glands
- Subcutaneous layer:** not actually a part of the skin  
consists of loosely arranged fat cells and fibers  
the fat cells help to cushion and insulate you body  
the fibers attach the skin to the muscles under it

## Skin Color

Pink color of a person's skin is his blood showing through.  
Other colors are the results of pigments:

dark pigment - **melanin**

Melanin is produced by special cells (melanocytes) in the skin.

Freckles are clumps of cells that contain more melanin than the rest of the skin.

yellowish pigment - **carotene**

People with albinism do not have the ability to make melanin and thus cannot tan.

**Callus:** a thickened epidermis which helps protect the deeper layers of the skin.

**Blisters** are not a form of protection, but a response to injury. Friction causes layers of skin to separate and water collects in the space between the separated layers.

**Boils** are bacterial infections (the raised portion of skin is filled with pus).

**Burns** are classified by how deeply they penetrate the skin's surface.

**First degree** (superficial): involves only the epidermis  
**Second degree** (partial thickness): involves the epidermis and some of the dermis  
**Third degree** (full thickness): destroys the epidermis, dermis, and into the subcutaneous tissues

## THE SKELETAL SYSTEM

The human skeleton has about 206 separate bones.  
64 bones are in the hands and arms alone.  
Bones account for approximately 1/5 of the body's weight.  
Bones in your body are living organs that contain living bone cells (osteocyte) blood vessels, nerves, fat tissues, and blood-cell-forming tissues.

Functions of the skeleton:

- (1) Framework for Support and Movement  
The skeletal system serves as a framework for the support of the body.  
Bones serve as levers and with the muscular system produce movement.
- (2) Protection  
The skeletal system protects delicate organs such as the brain, spinal cord, heart, and lungs.  
**skull** - brain (eyes and inner ears)  
**ribs** - heart and lungs  
**vertebrae** - spinal cord
- (3) Storage of Minerals  
especially calcium and phosphorus
- (4) Production of Blood Cells  
bone marrow is involved in blood cell production

### Anatomy and Composition of a Bone

The bone's surface is covered with a layer of dense, white, fibrous tissue called the **periosteum**.

The periosteum is responsible for muscle attachment and for bone growth and repair.

The cavity (**shaft** - the long main part of a bone) in the middle of the bone is filled with bone marrow.

**bone marrow** - a soft tissue that produces blood cells; located in the **marrow cavity** of long bones and in the spaces of spongy bone

In young people this cavity is filled mostly with **red bone marrow**, a soft tissue that produces red blood cells and certain other blood cells. Makes approximately a billion new blood cells everyday.

**Yellow bone marrow** is fatty tissue that gradually replaces the red bone marrow as people grow older.

Cartilage plates are near the ends of long bones commonly called growth plates.

**ligaments** - tough, flexible bands of connective tissue that attach bones to other bones at joints  
(joined to the periosteum)

**tendons** - bands of connective tissue that connect muscles to bones  
(joined to the periosteum)

two main types of tissue make up the skeleton:

1. **Bone** - consists of living bone cells and the non-living material they secrete
2. **Cartilage** - a flexible supporting tissue  
blood vessels never pass through cartilage

**Osteon** (Haversian system) - a unit of bone tissue; composed of a central canal (use to be called Haversian canal) which housed a blood vessel, osteocytes (bone cells) and matrix (layers of nonliving material around it)

Bone fractures

**fracture** - the breaking of a bone or tissue  
fractures are classified according to the cause of the break & the nature.

types of fractures:

cause: **traumatic fracture** - if break is caused by an injury.  
**spontaneous fracture** - " " " " " " " " disease.

nature: **compound fracture** - if broken bone is exposed to the outside of the body by a break in the skin

**simple fracture** - if the broken bone remains protected by uninjured skin

**complete:** fracture line extends entirely through the bone

**incomplete:** fracture line extends partially through the bone

**comminuted:** bone is splintered

**greenstick:** one side of the bone is broken and other side is bent

**impacted:** one fragment is firmly forced into the other

Repair of bone fractures

Unlike most body tissues, bone heals with its own cells & not those of scar tissue.

treatment is 2 fold: 1) must be set in proper alignment  
2) immobilization

## Joints

**joint** - a connection between two or more bones or between

cartilage and bone

Joints are designed for specific functions and are classified into three groups according to the degree of movement:

- (1) **Freely Movable Joints**
  - ball and socket (free movement within a limited area)
  - hinge (bend in only one direction)
  - pivot (circular movement)
  - gliding (slide and twist)
- (2) **Slightly Movable Joints**
  - connect vertebrae
- (3) **Immovable Joints (fused joints)**
  - sutures - the interlocking margins of skull bones

Anatomy of a joint

**synovial membrane** - lines the inner surface of the joint cavity; secretes a lubricating fluid called **synovial fluid**, which acts as a shock absorber between the bones

**ligaments** - connect the bones of a joint

**tendons** - connects muscle to bone; often extend across the joint and strengthens it

**bursas** - a fluid-filled sac; lined with synovial membrane located between tendons, ligaments, & bones serve as cushions and reduce friction

#### Bone & Joint Diseases and Disorders

**Arthritis:** an inflammation of a joint, usually accompanied by pain. Arthritis frequently results in changes in the joint structure, greatly hampering movement

**Rheumatism:** a general term for various conditions that are characterized by soreness and stiffness of muscles and joints.

**Sprain:** a stretch injury to the ligaments of a joint. In severe sprains, the ligaments may be torn.

**Double-jointed:** results from abnormally long ligaments, which allow a joint to be easily dislocated.

#### The Muscular System

There are approximately 600 muscles.

Of all the many different kinds of cells in the human body, only muscle cells have the ability to shorten (contract) and lengthen (relax).

Functions of muscles:

- (1) movement
- (2) posture
- (3) heat production

The two key words that describe the muscular system are contraction and movement.

Contraction refers to the ability of a muscle tissue to shorten and thereby cause movement.

**Your muscles can move your body only by pulling, never by pushing.**

Some muscles you consciously control, and others you can't.

- **voluntary** - a muscle that can be controlled at will
- **involuntary** - muscles controlled automatically by the brain; controlled without conscious effort

Types of muscle tissue:

(distinguished by their location, microscopic appearance, and type of nervous control)

A. **Skeletal Muscle**

named for its location (usually attached to skeleton)  
*striated* (dark and light stripes in its cells)-appearance  
*voluntary* (controlled by conscious thought) - type of nervous control

B. **Visceral Muscle**

location: walls of internal organs, iris of the eye, sphincters

appearance: *nonstriated or smooth* (shorter, one nucleus, arranged loosely)

nervous control: *involuntary* (not directly controlled by conscious thought)

the term visceral refers to internal organs  
the name fits well because visceral muscles is located in the walls of internal organs such as the stomach, intestines, blood vessels, and urinary bladder  
visceral muscle is also located in the iris of the eye  
most of the **sphincters** (circular bundles of muscles that regulate the diameter of various tubular organs and openings) are visceral muscles; the muscular valves at both ends of the stomach are examples of sphincters

C. **Cardiac Muscle**

location: only in heart

appearance: *striated* (striations are not as regular and distinct as skeletal; muscle fibers are branched and joined together)

nervous control: *involuntary*

### Muscles Diseases and Disorders

**atrophy** - a great reduction in muscle fibers and possible replacement by fibrous tissue; commonly occurs when limbs are in casts or when nerve cells that supply

muscles are destroyed by injury or disease

**convulsions** - violent, involuntary contractions of an entire group of muscles; characteristic of epileptic seizures and drug withdrawals

**cramps** - painful, involuntary contractions in those muscles that have been used heavily and have suffered from fatigue

**muscular dystrophy** - a progressively crippling disease of unknown cause in which the muscles gradually weaken and atrophy

**paralysis** - inability to move a muscle or muscles; usually because of some nervous system failure

**shin splints** - a soreness on the front of the lower leg due to straining a muscle; often as a result of walking up and down hills

**spasm** - an involuntary contraction of shorter duration than a cramp and usually not as painful

**strain** - a stretching or tearing of muscles or tendons