

Human Anatomy and Body Systems



Levels of Organization

Remember, the human body is organized in several levels, from the simplest to the most complex. . .

Cells – the basic unit of life

Tissues – clusters of cells performing a similar function

Organs – made of tissues that perform one specific function

Organ Systems – groups of organs that perform a specific purpose in the human body

***The purpose of the 11 organ systems is for the human body to maintain **homeostasis**.

4- Cell types

muscle tissue

most abundant tissue

controls internal movement
digestion, blood through veins
external movement of body

epithelial tissue

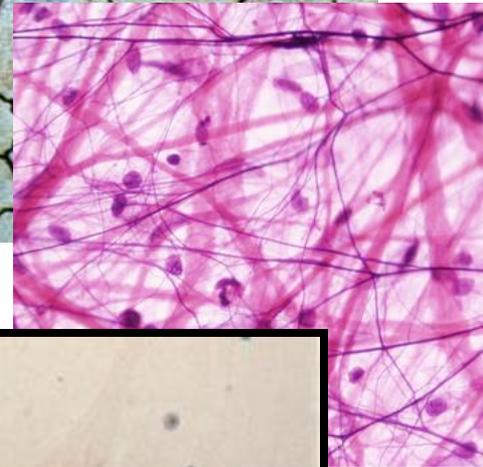
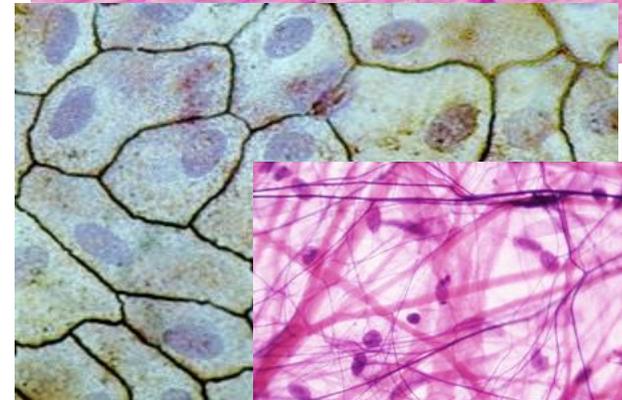
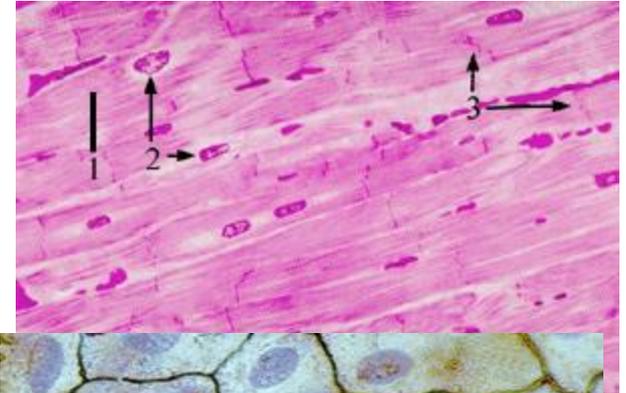
covering for body & organs
linings of organs & vessels

connective tissue

holds organs in place
ligaments, tendons, some
keep organs in place

nervous tissue

receives messages from body's
internal and external messages
analyze data & direct response



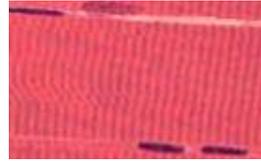
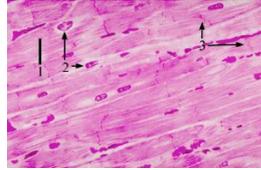
The 11 Human Body Systems

The 11 human body systems are as follows:

- nervous system
- respiratory system
- excretory system
- muscular system
- endocrine system
- lymphatic (immune) system
- integumentary system
- digestive system
- skeletal system
- circulatory system
- reproductive system

The Circulatory System

Purpose: to deliver oxygenated blood to the various cells and organ systems in your body so they can undergo cellular respiration

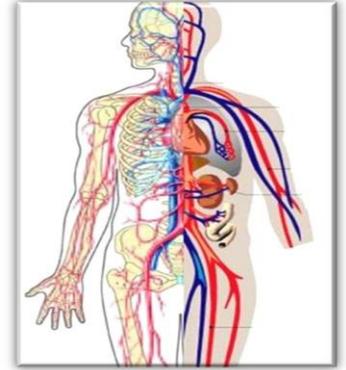


Cell type - Muscle

Major Organs and Their Functions

Heart – the major muscle of the circulatory system

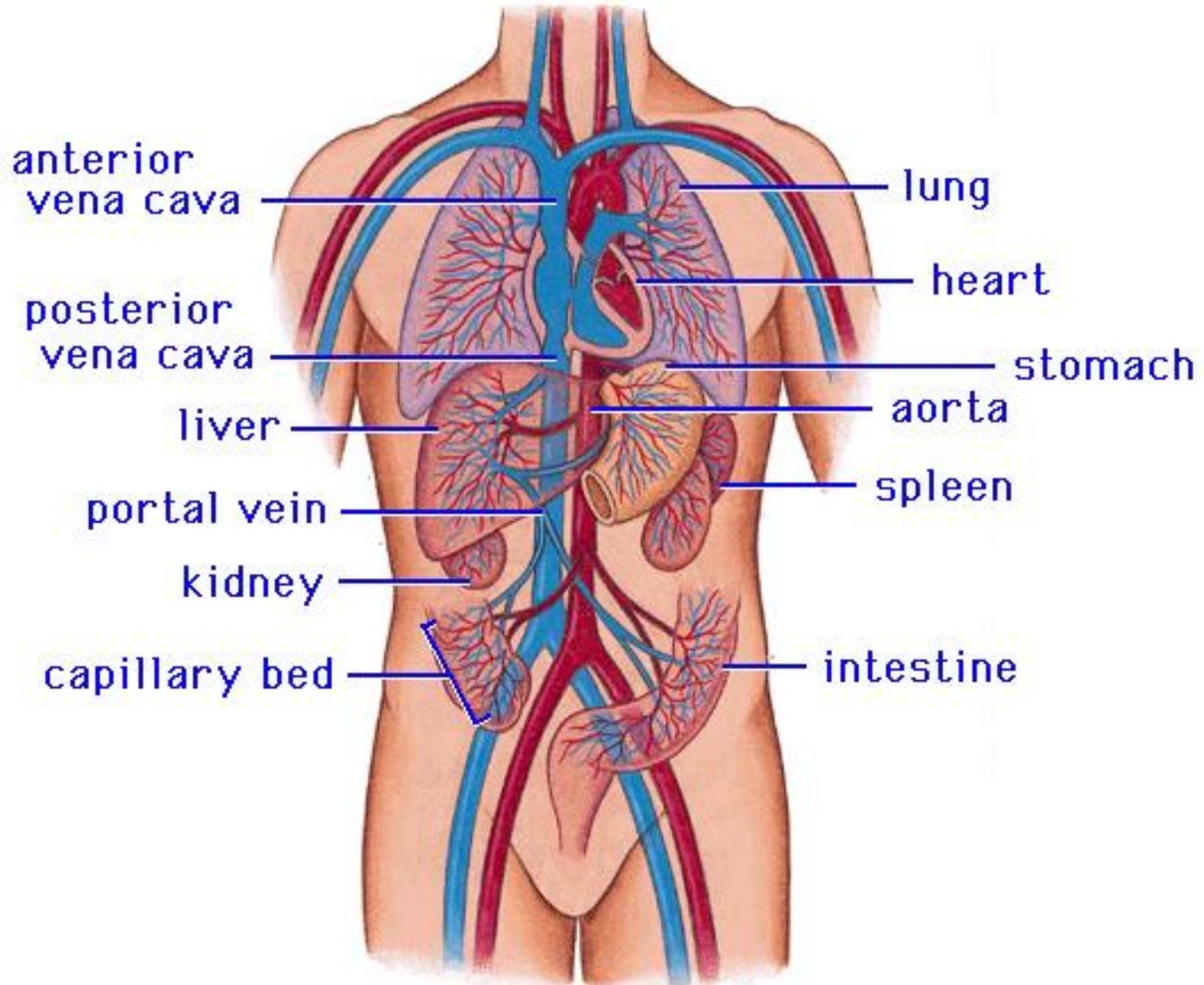
- pumps deoxygenated blood into the lungs, where it gets oxygenated, returned to the heart, and then pumped out through the aorta to the rest of the body
- valve regulate the flow of blood between the chambers



Organ system Interactions

- With lungs – exchange O_2 & CO_2
- With digestive system - pick up nutrients for transport throughout the body
- With excretory – blood is filtered to remove toxins and some water
- Nervous system – heart-beat regulation & blood pressure

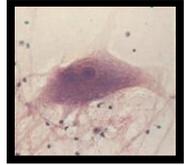
Image of the Circulatory System



The Nervous System

Purpose: to coordinate the body's response to changes in its internal and external environment

Cell type - Nerve



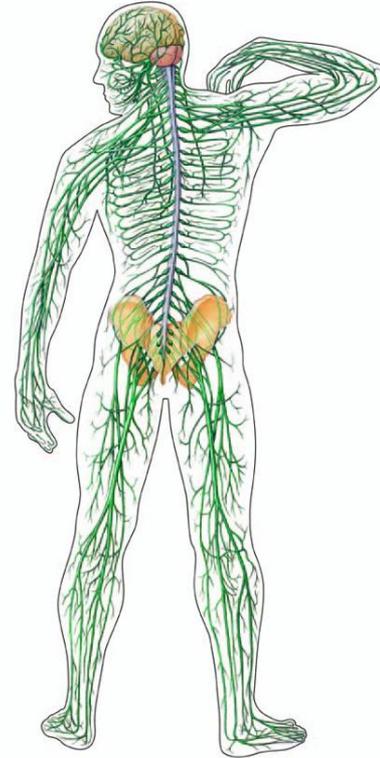
Major Organs and Their Functions

Brain – control center of the body, where all processes are relayed through
-- consists of cerebrum (controls thought and senses) and cerebellum (controls motor functions)

Spinal Cord – sends instructions from the brain to the rest of the body and vice versa

-- any organism with a major nerve cord is classified as a **chordate**

Nerves – conduct impulses to muscle cells throughout the body



Nerves – neurons clustered into bundles of fibers (axons)

- 3 types:
 1. Sensory – carry impulses from sense organs to brain and spinal cord.
 2. Motor – from brain or spinal to other organs.
 3. Interneuron – connects sensory and motor neurons.

Synapse – point at which a neuron can transfer an impulse to another cell.

Human Nervous System

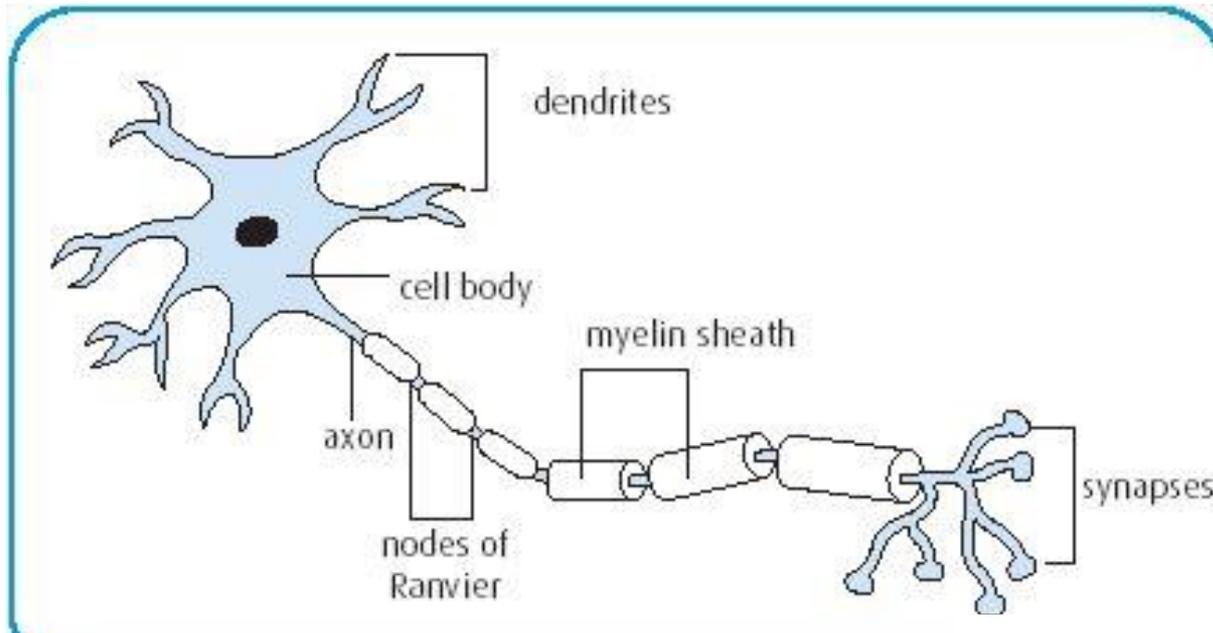
1. Central Nervous System (CNS) – the control center.

A. Brain – 100 billion cells neurons

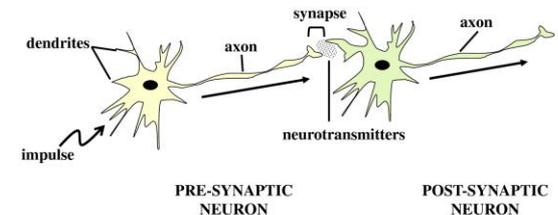
- a. Cerebrum – largest part, responsible for learning, intelligence, and judgment.
- b. Cerebellum – coordinates and balances actions of muscles. (Posture, movement, and balance.)
- c. Brainstem – regulates blood pressure, heart rate, breathing, and swallowing. (Thalamus, hypothalamus, midbrain, pons, and medulla oblongata.)

Nerves – conduct impulses to muscle cells throughout the body

Diagram of a Nerve Cell

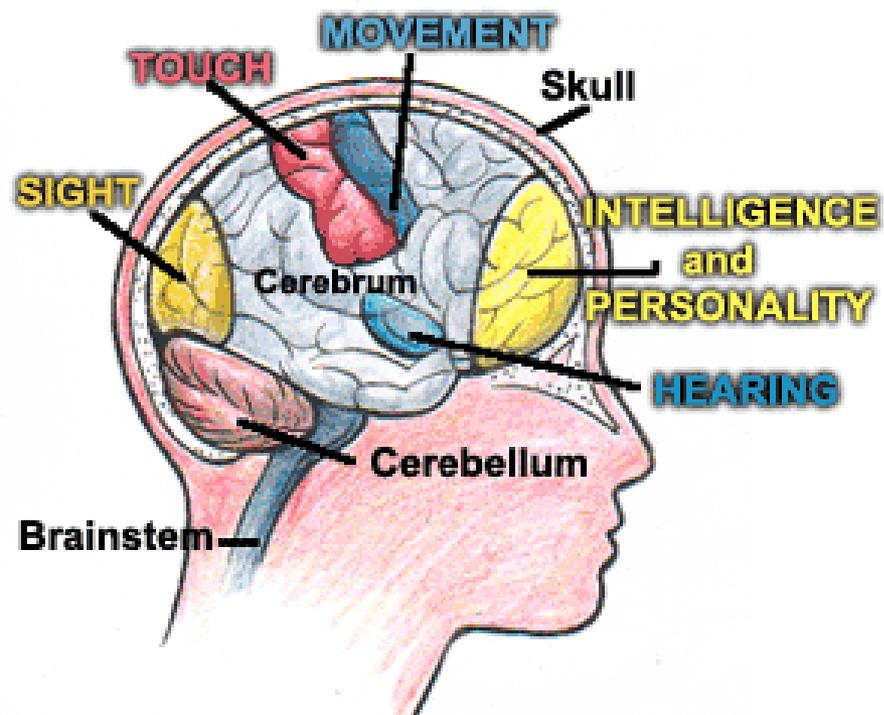
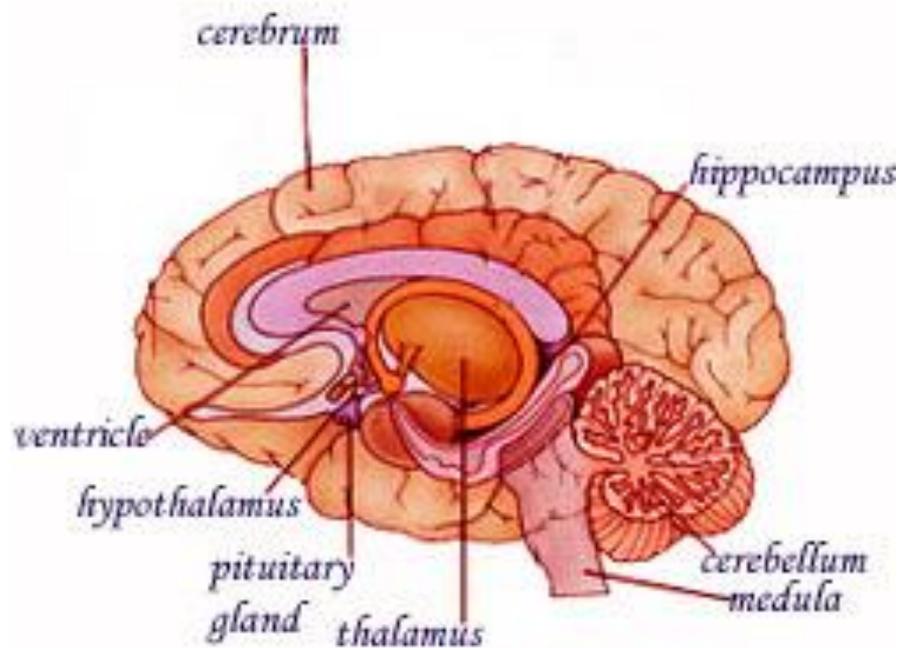


Anatomy of a Nerve Cell



Organ system Interactions

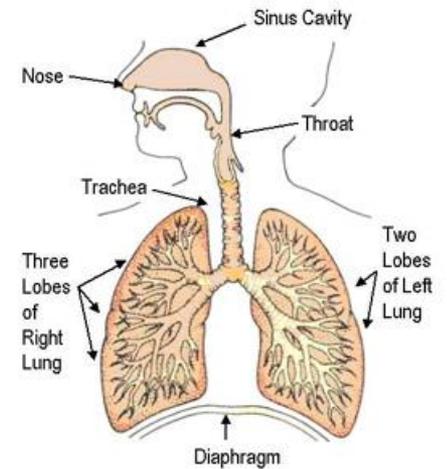
- Nervous system is interactive with all other systems in the body – you name it it's involved



The Respiratory System

Purpose: to provide the body with a fresh supply of oxygen for cellular respiration and remove the waste product carbon dioxide

Cell type: Epithelial



Major Organs and Their Functions

Nose – internal entry and exit point for air

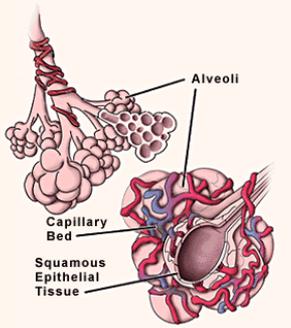
Pharynx – serves as a passage way for both air and food at the back of the throat

Larynx – your “voicebox”, as air passes over your vocal chords, you speak

Trachea – the “windpipe”, or what connects your pharynx to your lungs -- a piece of skin, called the **epiglottis**, covers the trachea when you swallow, preventing food from entering

Bronchi – the two large passageways that lead from the trachea to your lungs (one for each lung)

- the bronchi are further subdivided into bronchioles
- eventually, the further subdivisions lead to tiny air sacs called **alveoli**

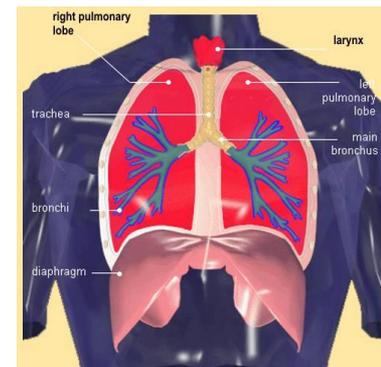


- alveoli are in clusters, like grapes
- capillaries surrounding each alveolus is where the exchange of gases with the blood occurs

Lungs – contain the alveoli, bronchi and connective tissue

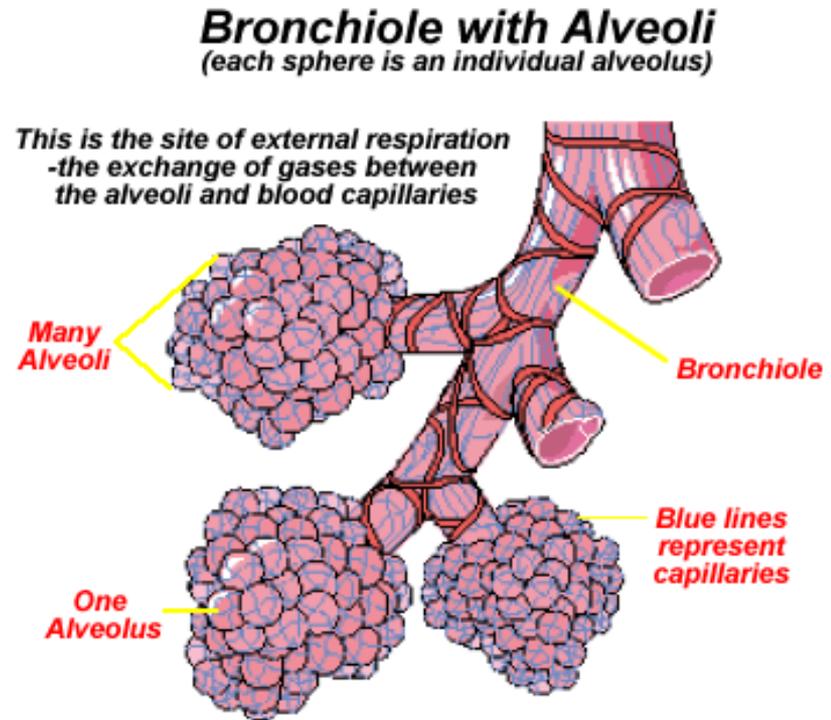
The **diaphragm** is the muscle that causes you to breath

- hiccups are involuntary contractions of the diaphragm



WHY ARE ALVEOLI SO IMPORTANT?

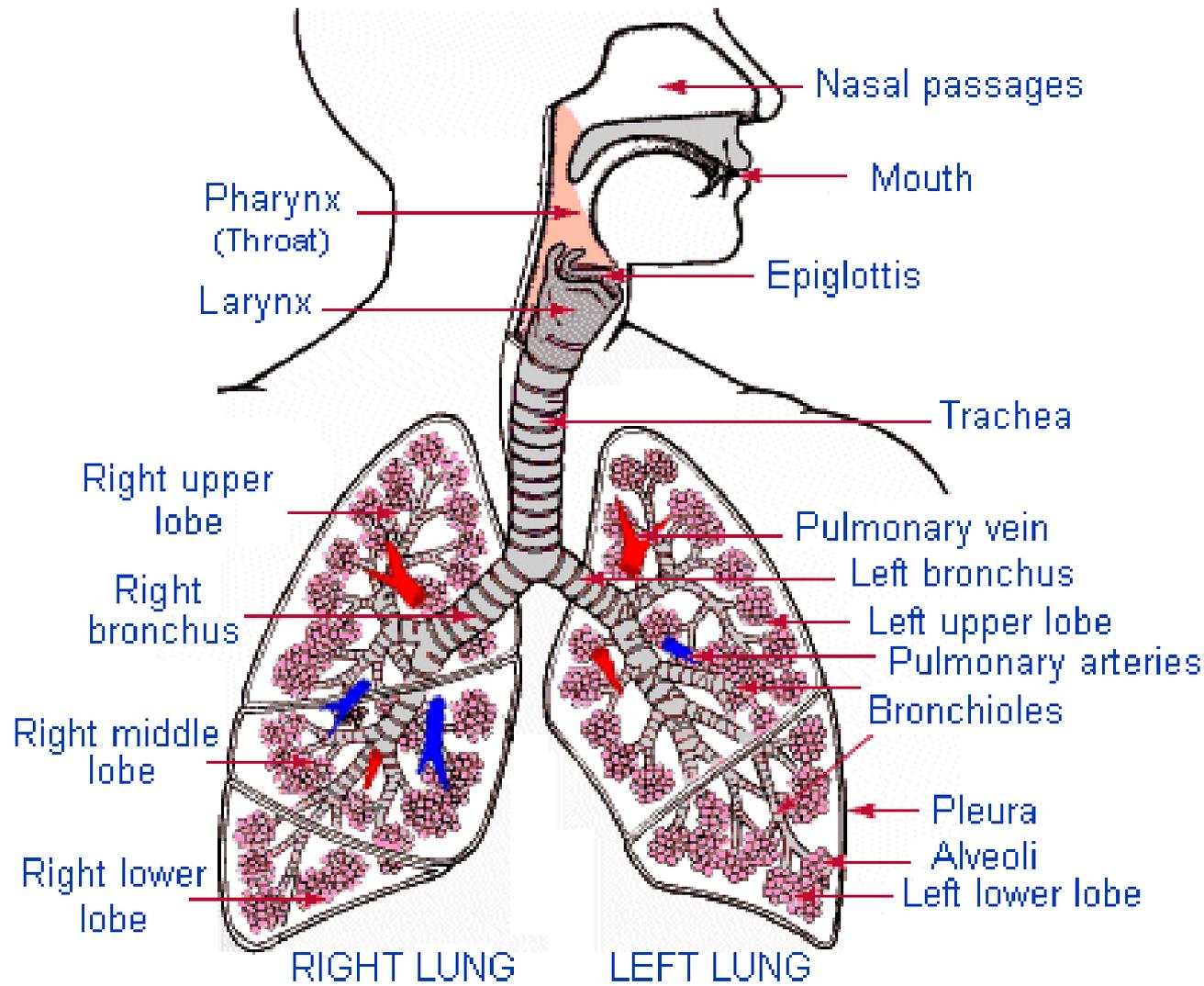
- Alveoli are the air sacs of the lungs.
- They have thin walls made of simple cells and are surrounded by blood capillaries.
- Gas exchange occurs in the alveoli.
 - Oxygen gas is in higher concentration in the alveoli than in the blood and so it diffuses into the blood through a layer of cells.
 - Carbon dioxide is in higher concentration in the blood than the alveoli and so it diffuses into the alveoli through a layer of cells.
- The surface of alveoli are covered in a thin lipoprotein layer and it prevents them from collapsing during exhalation.



Organ system Interactions

- The respiratory system directly interacts with the circulatory system
- Indirectly interacts with the immune system (lining of the nasal and bronchiol cavities/tubes)
- Nervous system (smell & taste) – regulation of breathing

Image of the Respiratory System



■ oxygen-rich blood
■ oxygen-poor blood

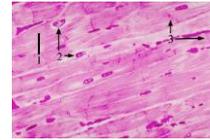
The Digestive System

Purpose: to convert food particles into simpler micromolecules that can be absorbed into the bloodstream and used by the body

Cell Type: epithelial



and muscle



Major Organs and their Functions:

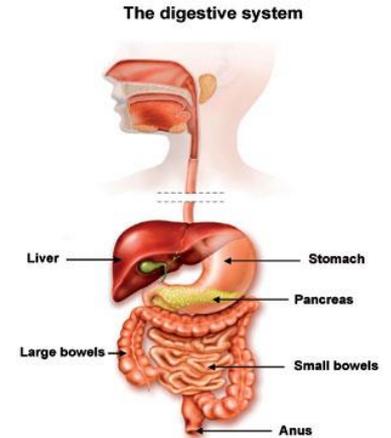
Mouth – to chew and grind up food

-- saliva also begins the chemical breakdown

Esophagus – pipe connecting mouth to stomach

Stomach – secretes an extraordinarily strong acid (pH = 2) that leads to breakdown of food

-- once the food is broken down in the stomach and mixed with digestive juices, it is called **chyme**



Pancreas – secretes digestive enzymes, produces the hormone **insulin** that regulates blood sugar levels

-- also help neutralize stomach acid

Liver – produces bile, which breaks down fats in foods

Gallbladder – pouch-like organ that stores **bile** for future use

Small Intestine – after digestion is complete, the chyme enters the small intestine where it is absorbed into the bloodstream

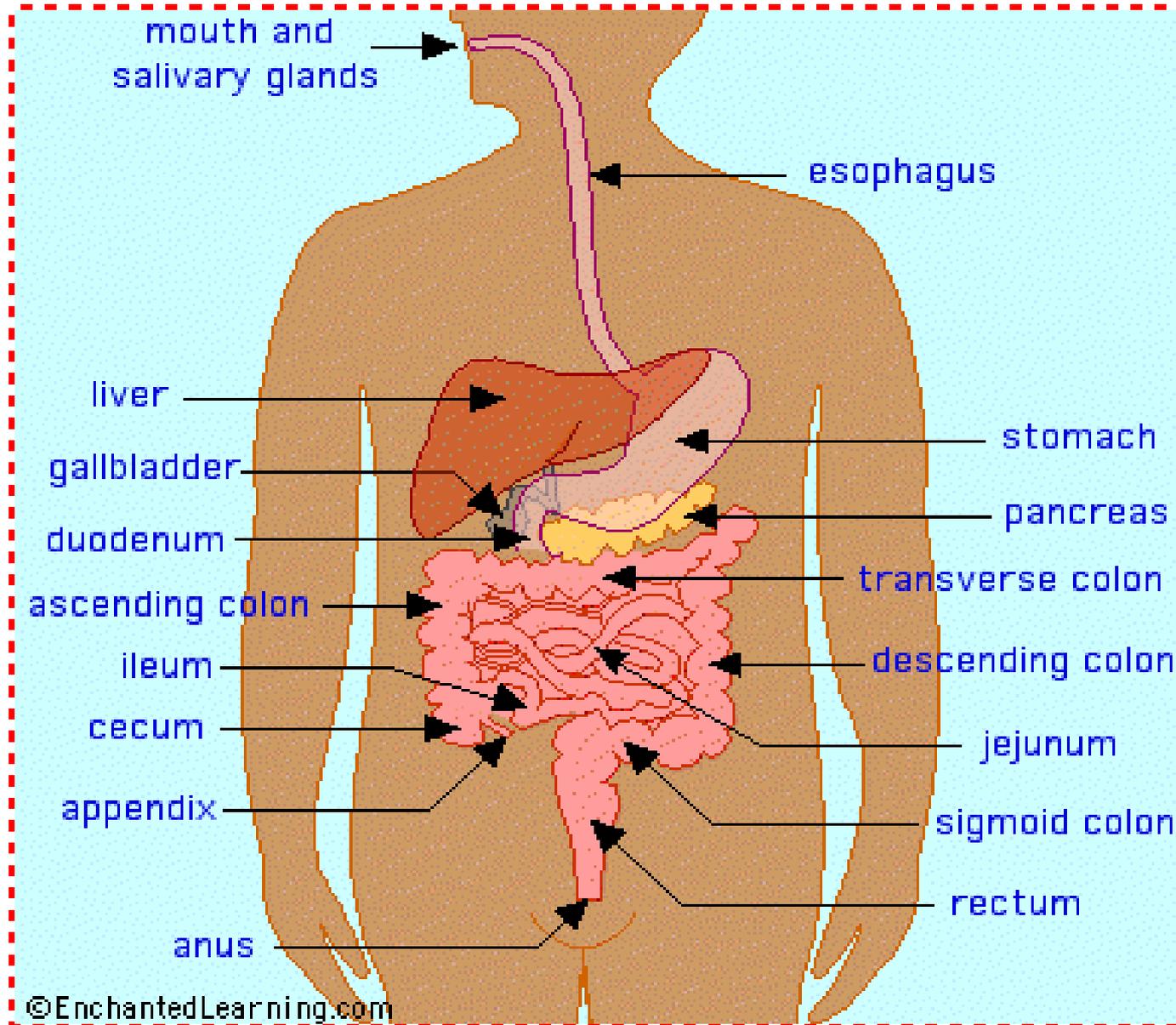
-- the chyme is propelled along by folded surfaces called **villi**, on the intestine

Large Intestine – removes water from the chyme and gets the waste ready for excretion

Organ system Interactions

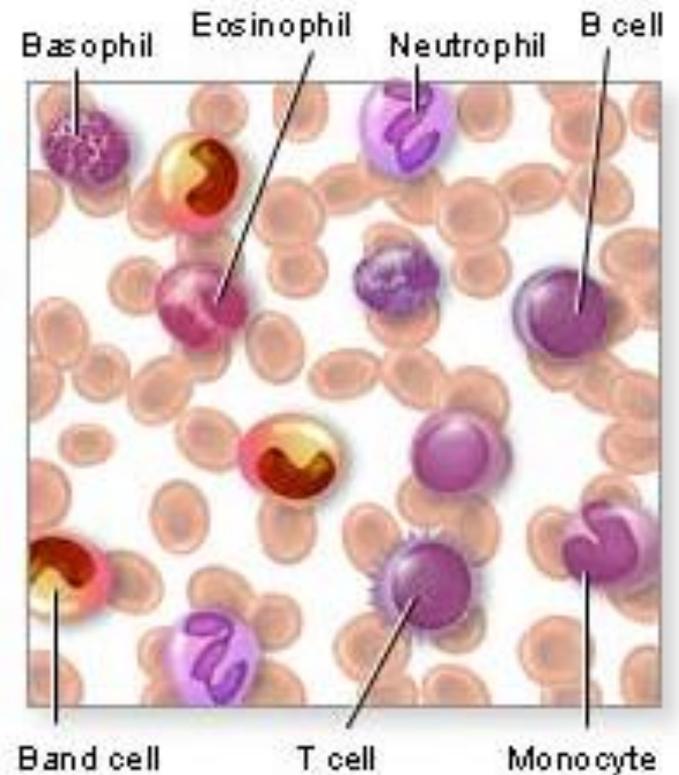
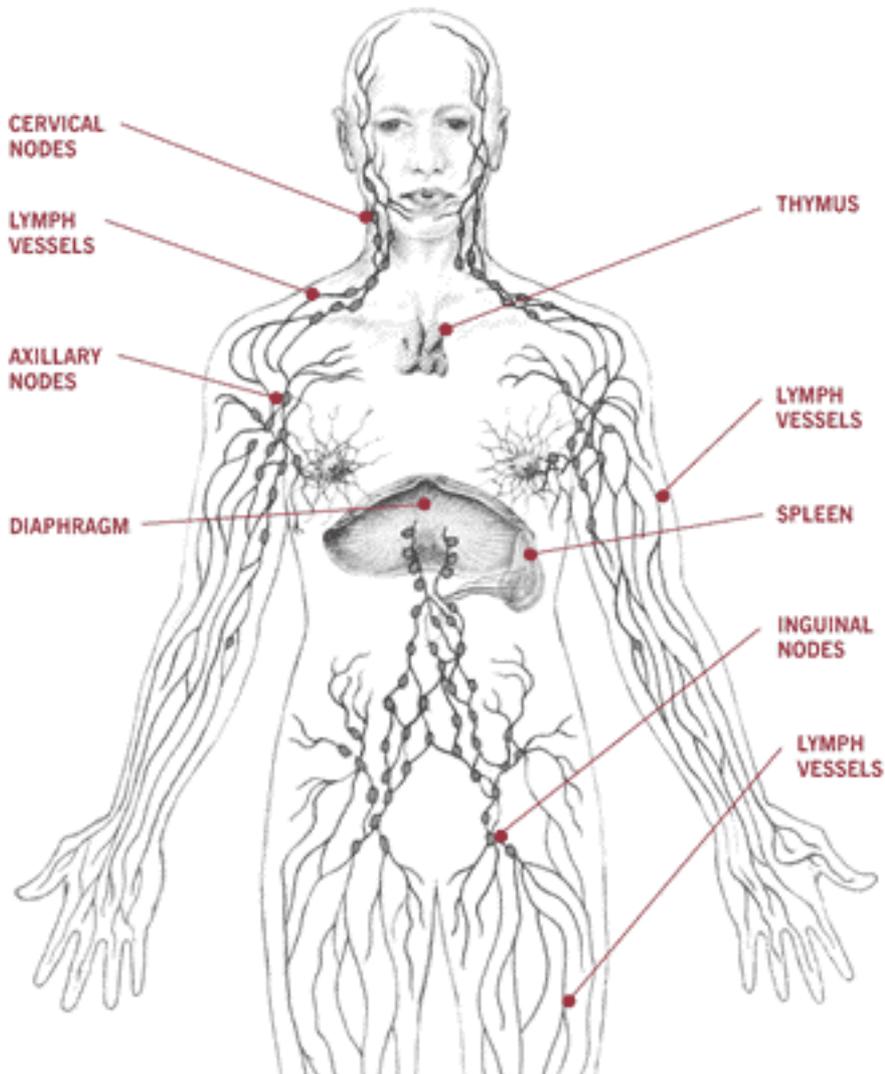
- Circulatory system – move nutrients to other parts of body
- Nervous system – regulation of peristaltic activity
- Endocrine system – hormones that regulate apatite and digestive enzyme release
- Excretory – removal of solid waste

The Digestive System



Organ system Interactions

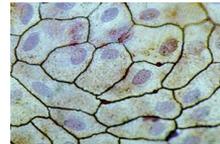
- Integumentary – first line of defense
- Respiratory – mucus membranes
- Circulatory – transport of antibodies & white blood cells
- Endocrine – chemical stimulus response
- Excretory & digestive – elimination of pathogens



White blood cells - travel in both the lymph system and the blood stream

Integumentary System

- Purpose: temperature regulation, waste removal, sensory info, and protection
- Largest organ of the body = skin which has two layers.
- Skin, Hair, Nails
- Cell type – epithelial



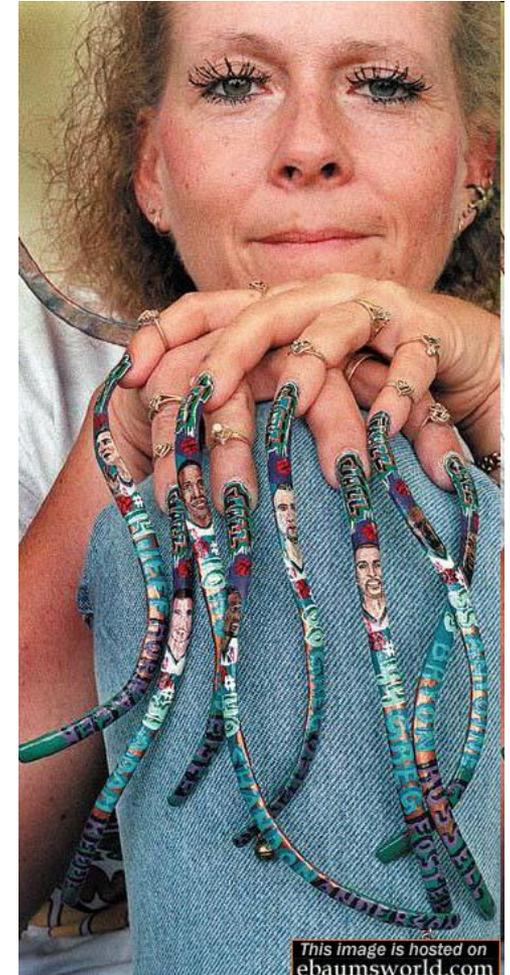
Hair Functions

- **Absorbs radiation from the sun that maybe harmful**
- **Reduces loss of heat**
- **Filters out dust and dirt**
- **Shows gender**
- **Sensitive to movement**



Nail Functions

- **Protects tips of fingers or toes**
- **Helps pick up small objects**
- **Enhances sensation of the finger by acting as a counterforce**
- **Scratching**



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The Epidermis

- Outermost layer of skin.
- Made of layers of epithelial cells.
- Outermost layer of cells are flattened, dead, and keratin filled.
- Keratin makes skin tough and waterproof.
- Skin is continually damaged, but replaces cells instead of repairing them.
- Layer of actively dividing cells at base of epidermis make new cells that move up to replace old ones on surface, producing keratin as they go.
- Epidermal cells contain melanin, a pigment that absorbs UV radiation.
- Melanin ranges from reddish brown to black



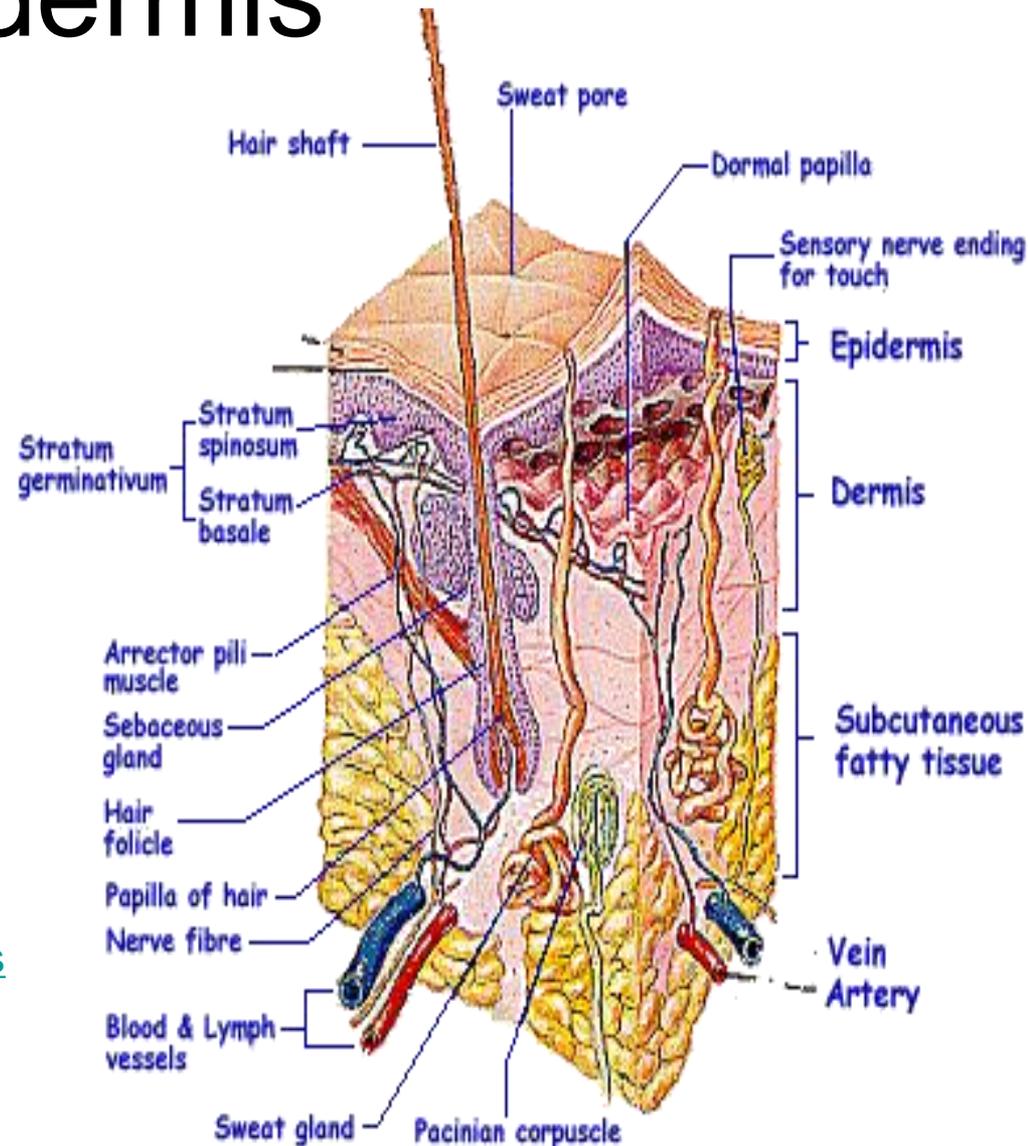
Epidermis

Outermost Layer:

- keratin - tough, flexible protein; found in hair and fingernails
- melanocytes - cells that produce melanin

Image from:

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Dermis

- Dermis - supports epidermis. Contains nerve endings, blood vessel, and smooth muscles.
- 2 types of glands
 - A) sweat glands - controlled by nervous system
 - B) sebaceous glands - produce oily secretions that helps keep the epidermis flexible and waterproof.

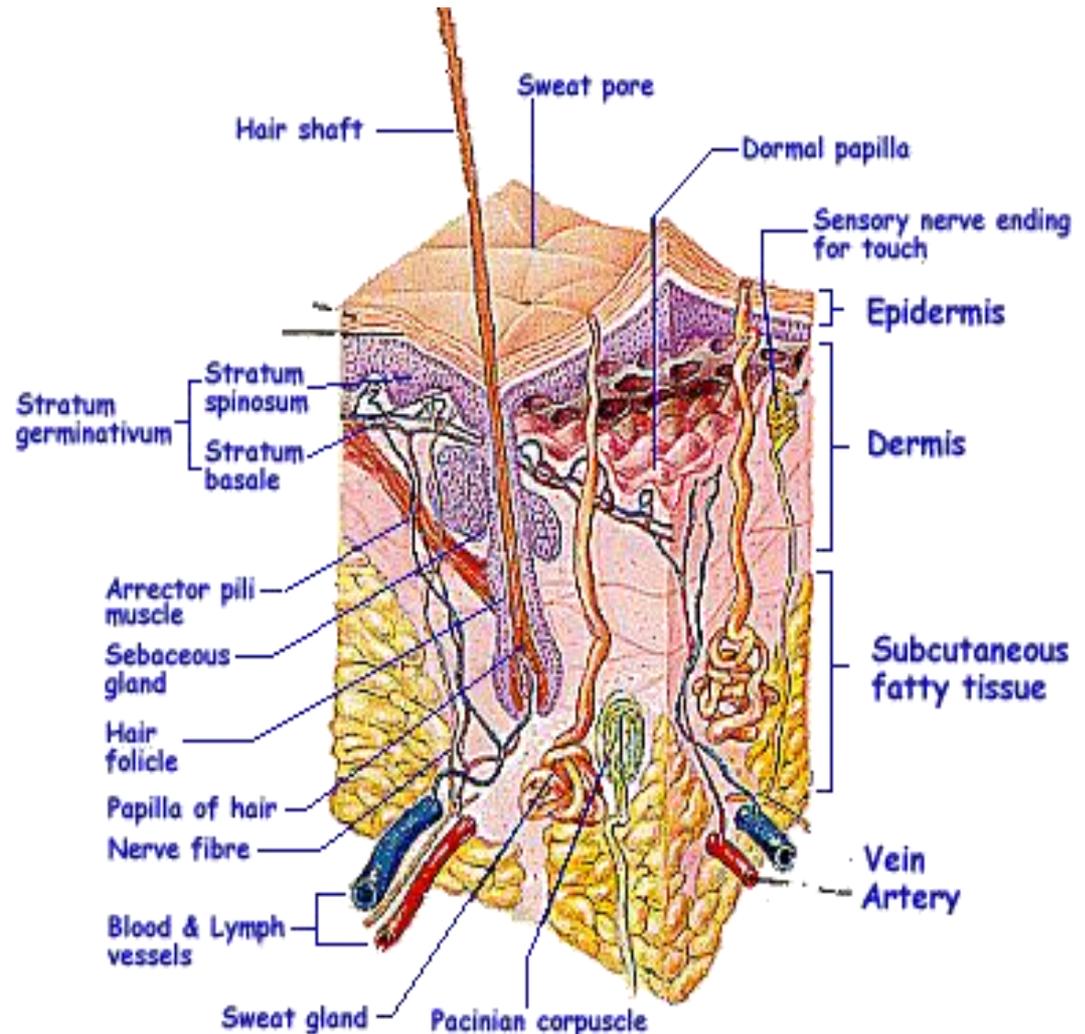


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Subcutaneous Tissue

- **Located beneath the Dermis.**
- **It's a layer of connective tissue made of fat.**
- **It's a shock absorber, insulator, and energy storage.**
- **Anchors skin to underlying organs.**
- **Thickness varies throughout the body.**



Organ system Interactions

- Immune system - first line of defense
- Circulatory system - brings nutrients and water
- Excretory system – sweat
- Nervous system – touch
- Endocrine – thermoregulation

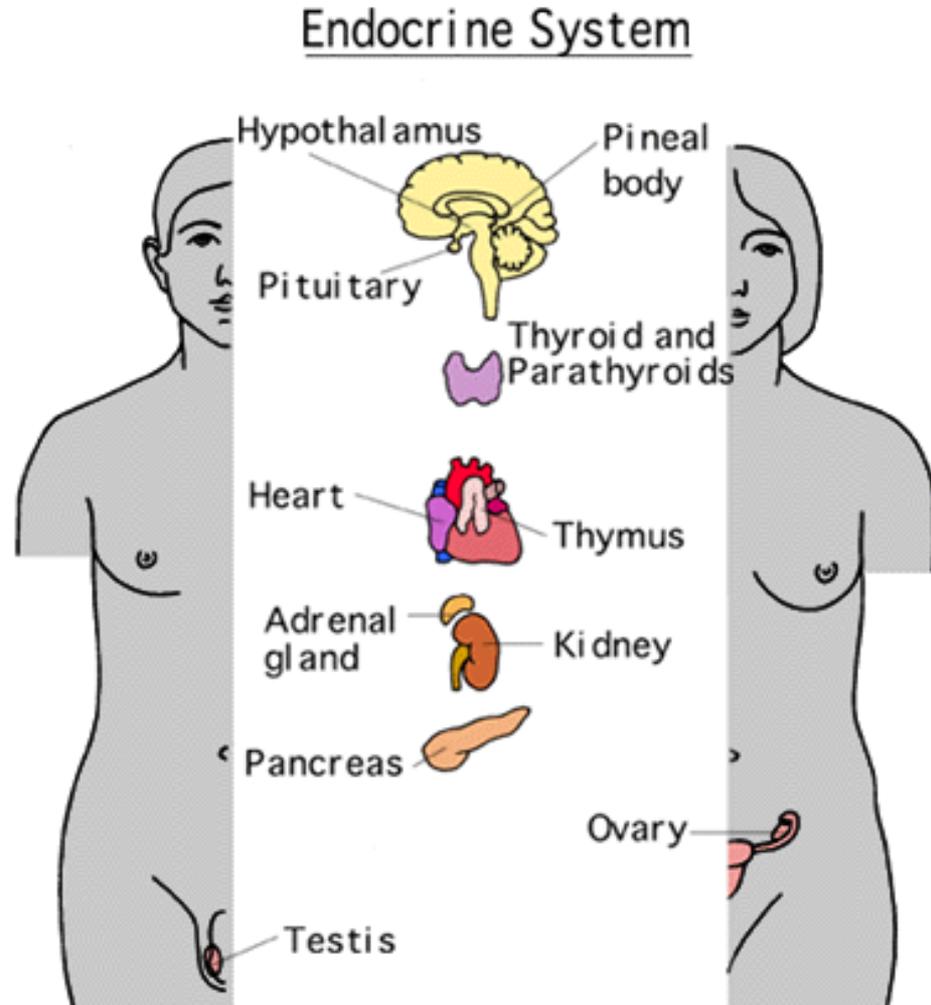
The Endocrine System

Purpose: to control growth, development, metabolism and reproduction through the production and secretion of hormones

Major Organs

- hypothalamus
- pituitary gland
- thyroid
- parathyroid
- adrenal glands
- pancreas
- testes
- ovaries

Cell type - epithelial

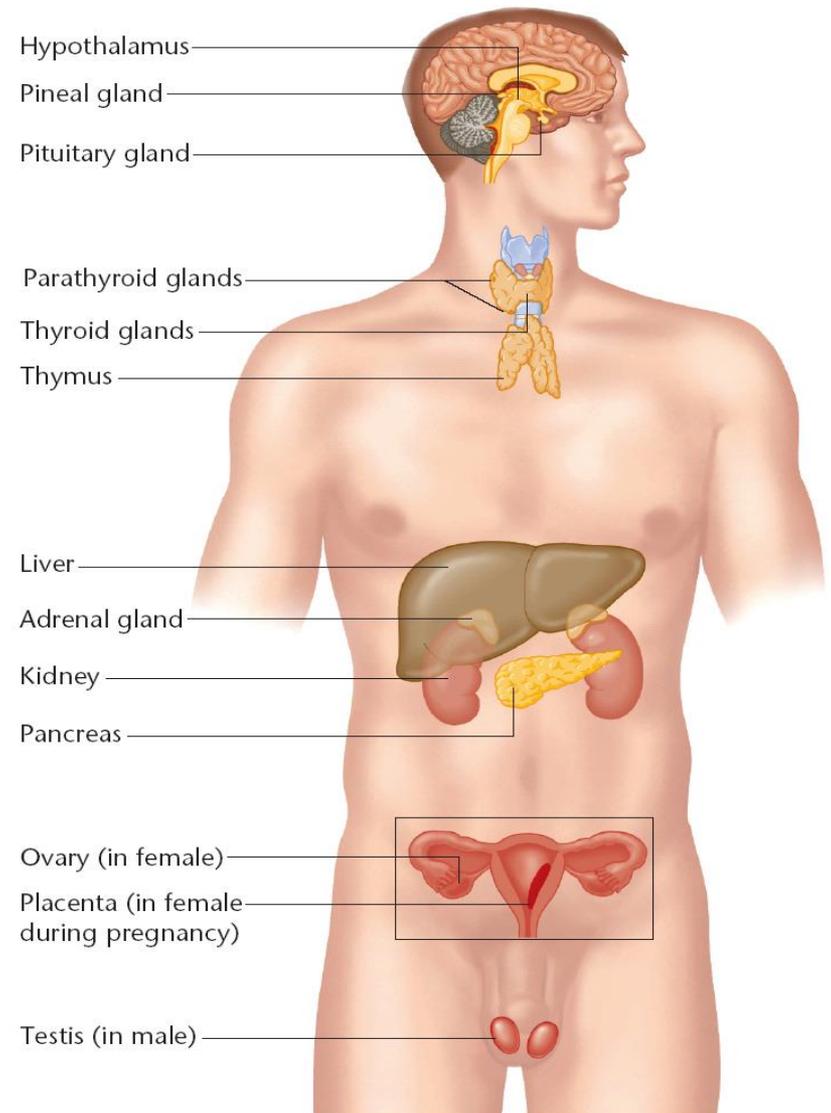


Endocrine System

- Controls all the metabolic activities of the body.
- Made up of a series of **glands** – organs which produce and release chemical messengers, generally into the bloodstream.
- The chemical messengers are called **hormones** and they affect the behavior of cells.
 - Only cells with receptors respond to hormones

Glands of the Endocrine System

- The major gland is the **pituitary gland** – produces many of the hormones that regulate the endocrine glands.
- The **hypothalamus** controls the pituitary gland.
- Thyroid, parathyroid, adrenal, pancreas, ovaries and testes.



Examples of Hormones

Endocrine Gland	Hormone	Effect on Target Cells
Thyroid	Thyroxine	Regulates metabolic rate of cells
Adrenal medulla	Adrenaline and noradrenaline	Prepare the body for “fight or flight” by increasing body activities
Pancreas – Islets of Langerhans	Insulin	Regulates the amount of sugar in bloodstream
Posterior pituitary	Oxytocin	Stimulates contractions of uterus during childbirth

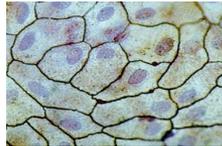
Organ system Interactions

- You name it – it interacts with it for regulation especially in conjunction with the nervous system and circulatory system

The Excretory System

Purpose: to rid the body of wastes, including excess water and salts

Cell Type: epithelial



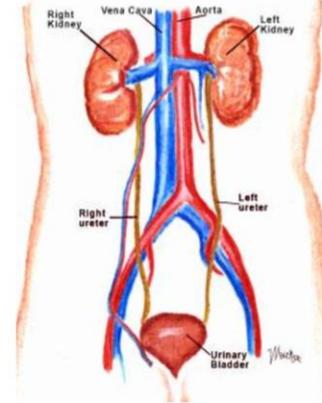
Major Organs and Their Functions

Kidneys – the main organs of the excretory system

-- waste-laden blood enters the kidney and the kidney **filters** out urea, excess water and other waste products, which eventually travel out of the kidney as urine

-- eventually they travel through the **ureter** to the urinary **bladder**

Rectum – solid (food) waste travels out of the body through the rectum



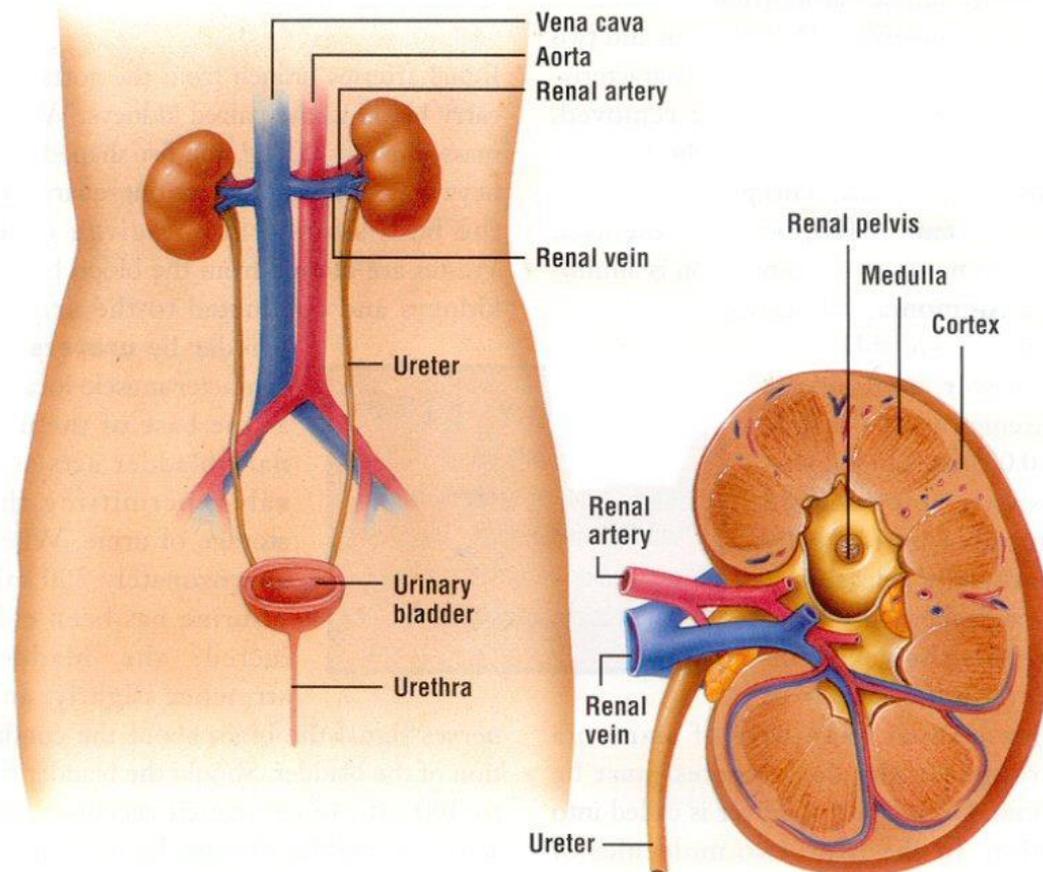
Organ system Interaction

- Circulatory system – filters blood
- Digestive system – removes undigested food
- Nervous system – response & regulation
- Endocrine system – response regulation

Skin – sweat glands remove excess water and salts from the body

Lungs – expel the waste gas carbon dioxide

The Excretory System



The Skeletal System

Purpose: to provide structure and support to the human body

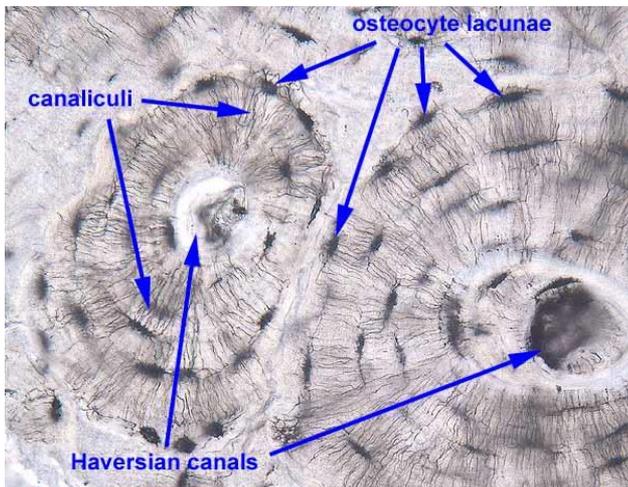
Bones are where new blood cells are generated (in the marrow), and require the mineral **calcium** for strength

Major Bones of the Human Body

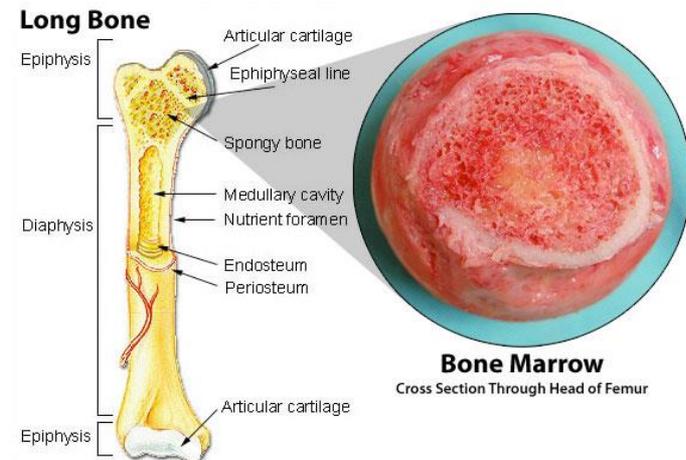
- femur (thigh bone)
- radius and ulna (lower arm)
- sternum (breastbone)
- fibula and tibia (calf)
- scapula (shoulder)
- coccyx (tail bone)
- humerus (upper arm)
- cranium (skull)
- clavicle (shoulder blade)
- vertebrae (back)
- pelvic bone
- phalanges (fingers/toes)

Skeletal System

- Types of cells:
 - osteocytes - cells that build and maintain bones
 - bone marrow - produce white and red blood cells



blood cells



What are joints, ligaments, tendons, and cartilage?

- ◎ **Joints** are where two bones meet and can withstand pressure.
- ◎ **Ligaments** are strong bands of connective tissue that hold joints together and prevent them from moving too far.
- ◎ **Tendons** are strips of dense connective tissue attached to bone.
- ◎ **Cartilage** is light weight, strong, flexible tissue.

Organ system Interaction

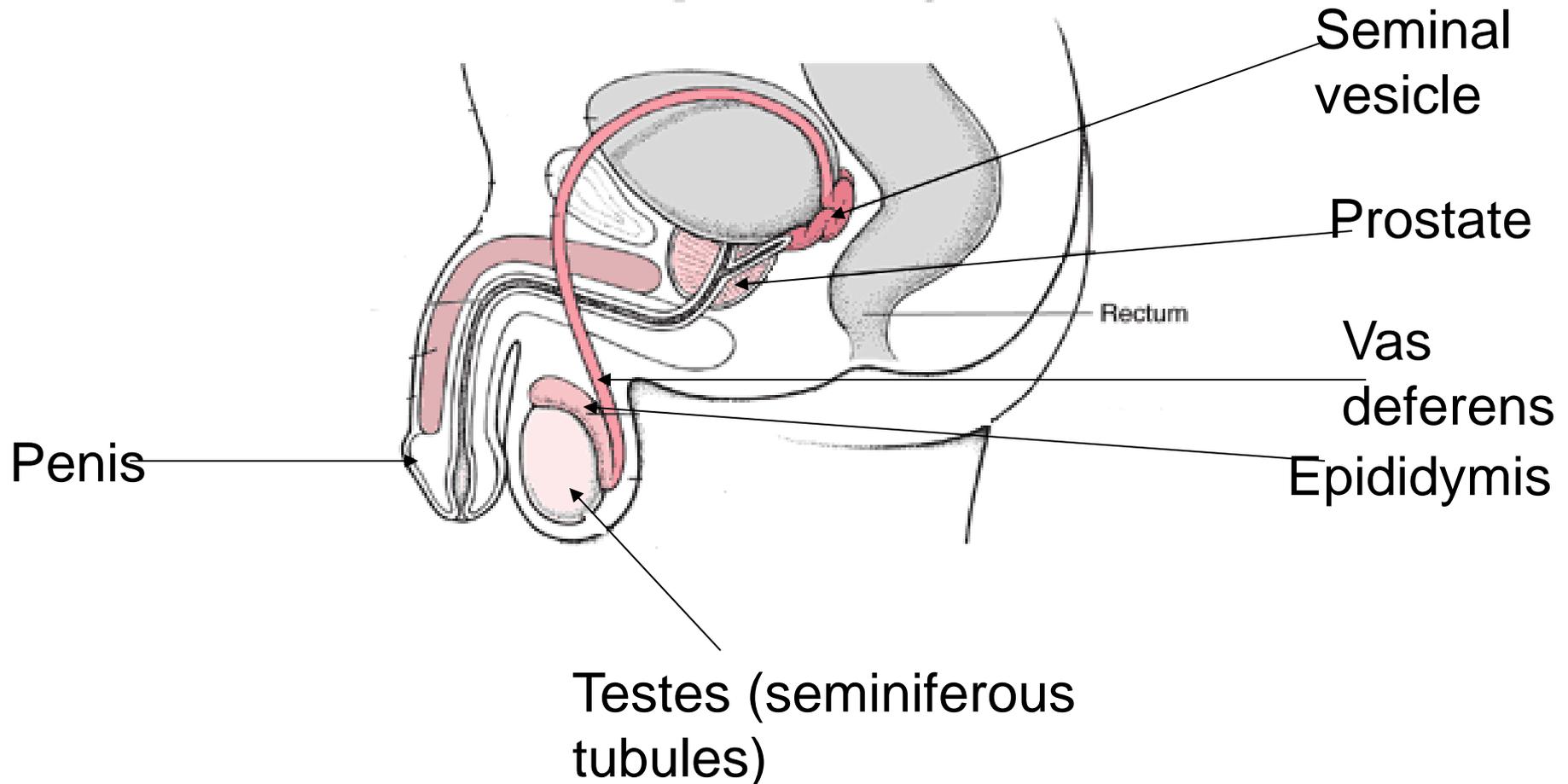
- Nervous system – movement
- Muscle system – movement
- Circulatory system – oxygen & nutrients
- Digestive system – digestion (stomach & peristaltic activity)
- Excretory - sweat

The Reproductive System

- Produces, matures, nourishes, and stores gametes.
 - For the first 6 weeks of development, male and female embryos are identical.
 - At the 7th week, if a Y chromosome is present, the testes develop and begin to produce androgens (hormones) that cause male physical characteristics and reproductive structures to develop.
- Cell type – epithelial

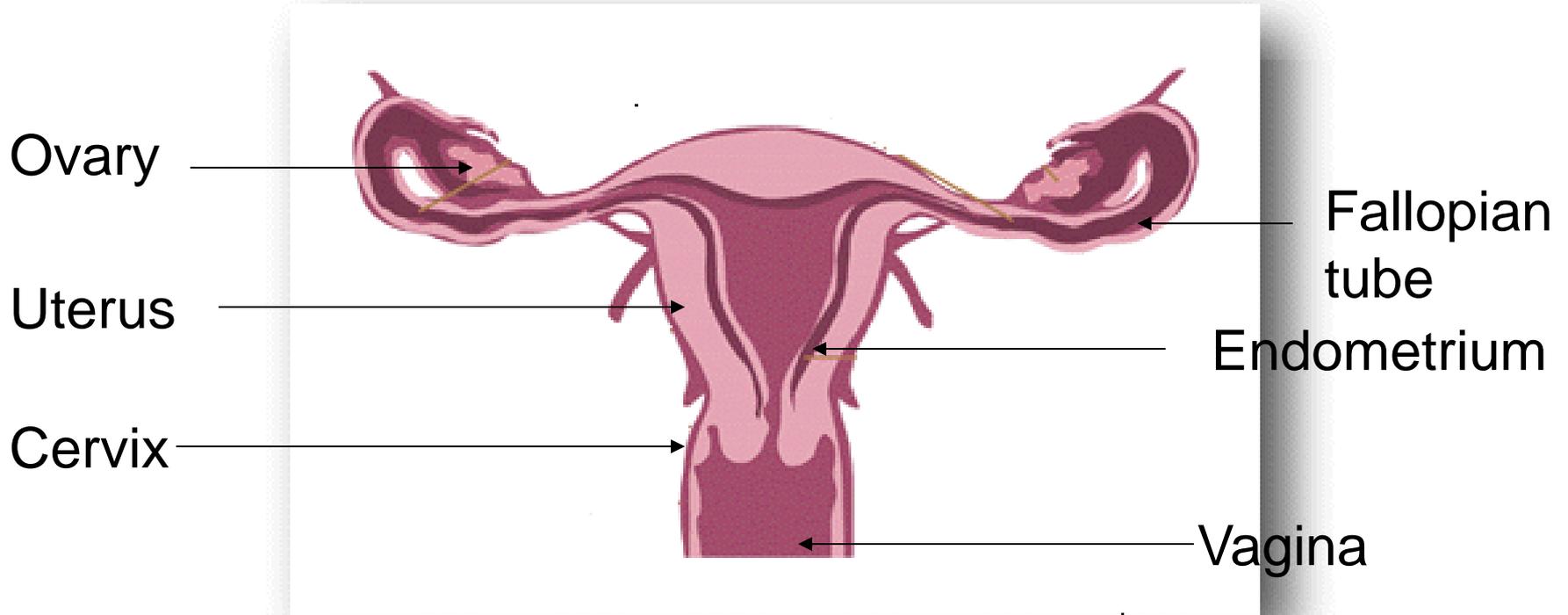
Male Reproductive System

www.merck.com



Female Reproductive System

www.sw.org/.../piid/331/ciid/764



Organ system Interaction

- Endocrine – hormones for gamete production & reproductive cycle
- Nervous system
- Circulatory system

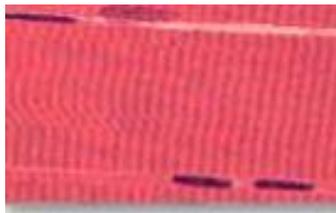
The Muscular System

Purpose: works with the skeletal and nervous system to produce movement, also helps to circulate blood through the human body

- muscle cells are fibrous
- muscle contractions can be voluntary or involuntary

makes up to 40 – 50% of the body mass

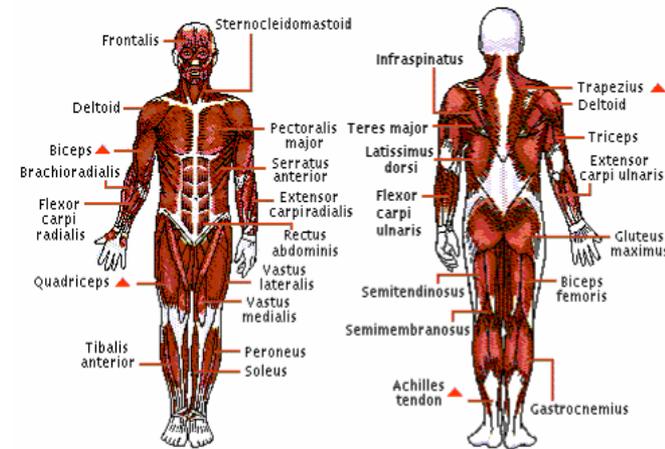
Cells -



Muscle tissue

Major Muscles in the Human Body

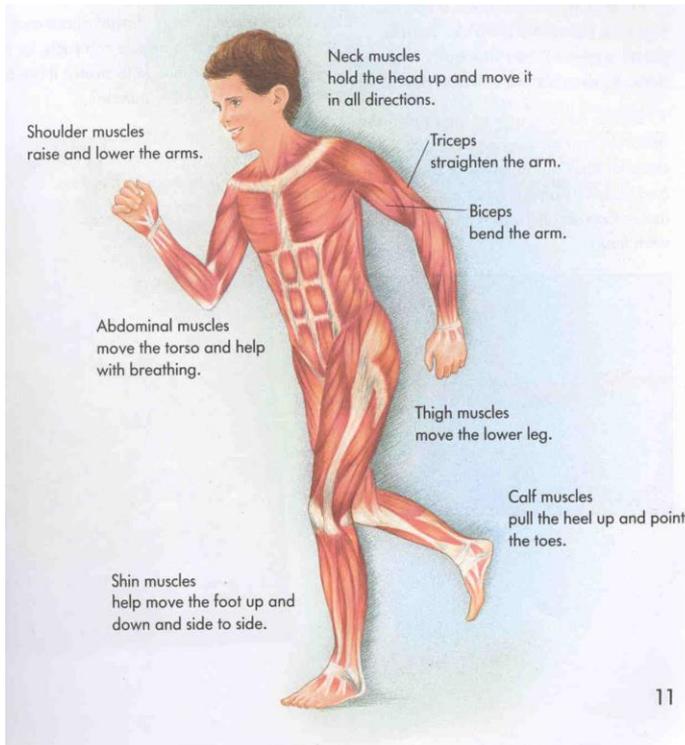
- biceps
- triceps
- deltoids
- glutes
- hamstrings



Muscular System

- Three types of muscles:
 - 1. skeletal - attached to bones, voluntary control, multinucleated, striated
 - 2. smooth - internal organs (except heart), one nucleus, nonstriated, involuntary control
 - 3. cardiac - heart, one nucleus, striated, involuntary control

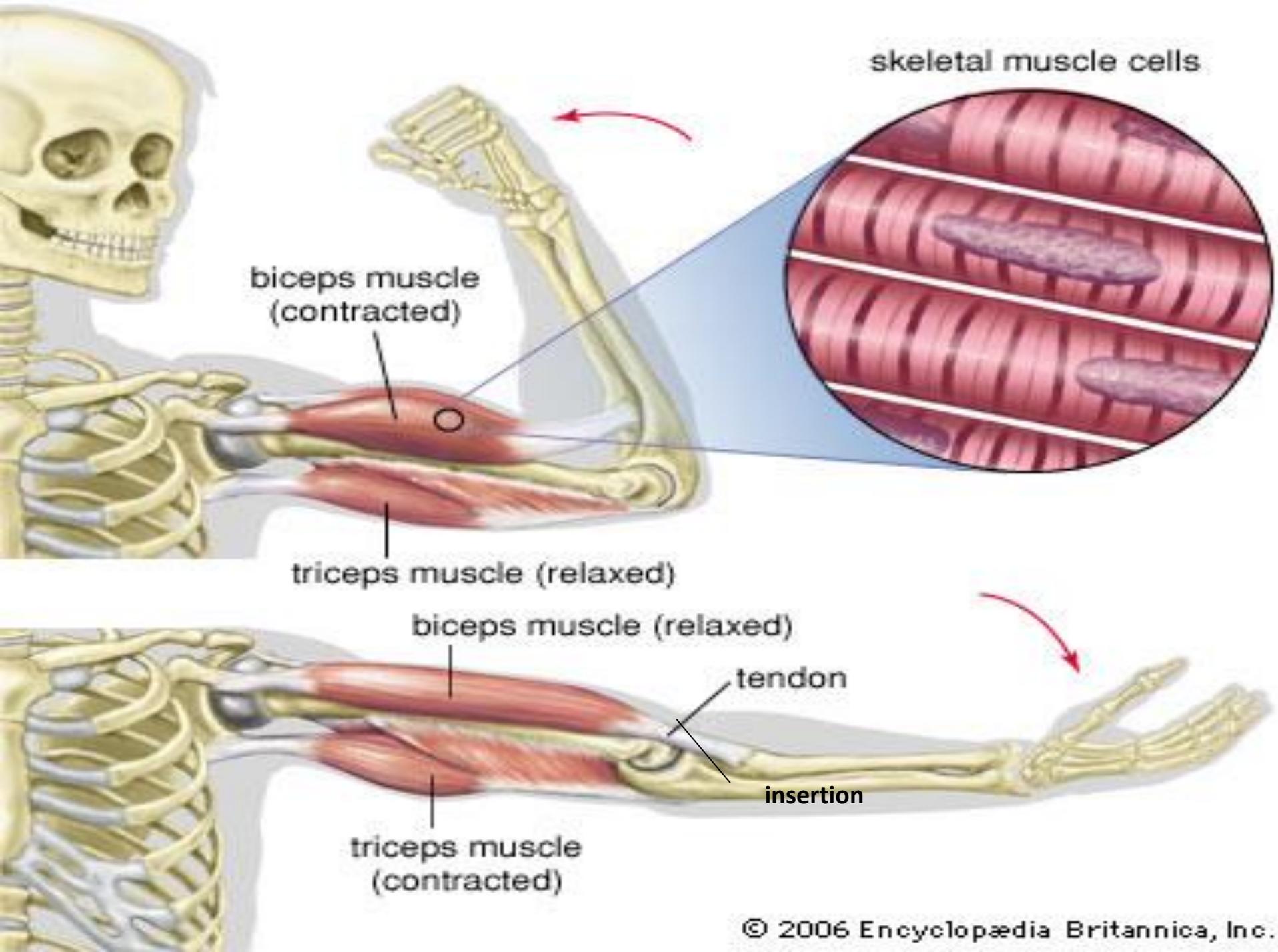
structure



- ❑ **tendons**- dense strips of connective tissue.
- ❑ **flexor**- muscles that cause a joint to bend.
- ❑ **Extensor**- muscles that cause the joint to straighten.
- ❑ **actin & myosin**- enable muscles to contract.
- ❑ **myofibrils**- a fiber found in straighten muscle cells and that is responsible of muscle contractions.
- ❑ **Sarcomere**- basic unit of contraction in skeletal and cardiac muscles.
- ❑ **Origin**- muscle pulls against origin.
- ❑ **Insertion**- bone that moves when muscle contracts.

Muscular System

- Muscles work in antagonistic pairs (opposite each other) and are always in a state of slight contraction.
- Muscles always pull, bones do not push them.
 - * flexor - decreases the angle of the joint (bends), examples are biceps and hamstrings
 - * extensor - opens a joint to normal position (extends), examples triceps and quadriceps
 - * abductor - moves bone away from midline of the body, like the deltoids
 - * adductor - moves bone towards the midline of the body, like the latissimus dorsi



Organ system Interaction

- Circulatory – heart
- Skeletal – movement
- Nervous – movement & vision (focus)
- Digestive – stomach & peristaltic activity
- Endocrine – release of some hormones a& enzymes