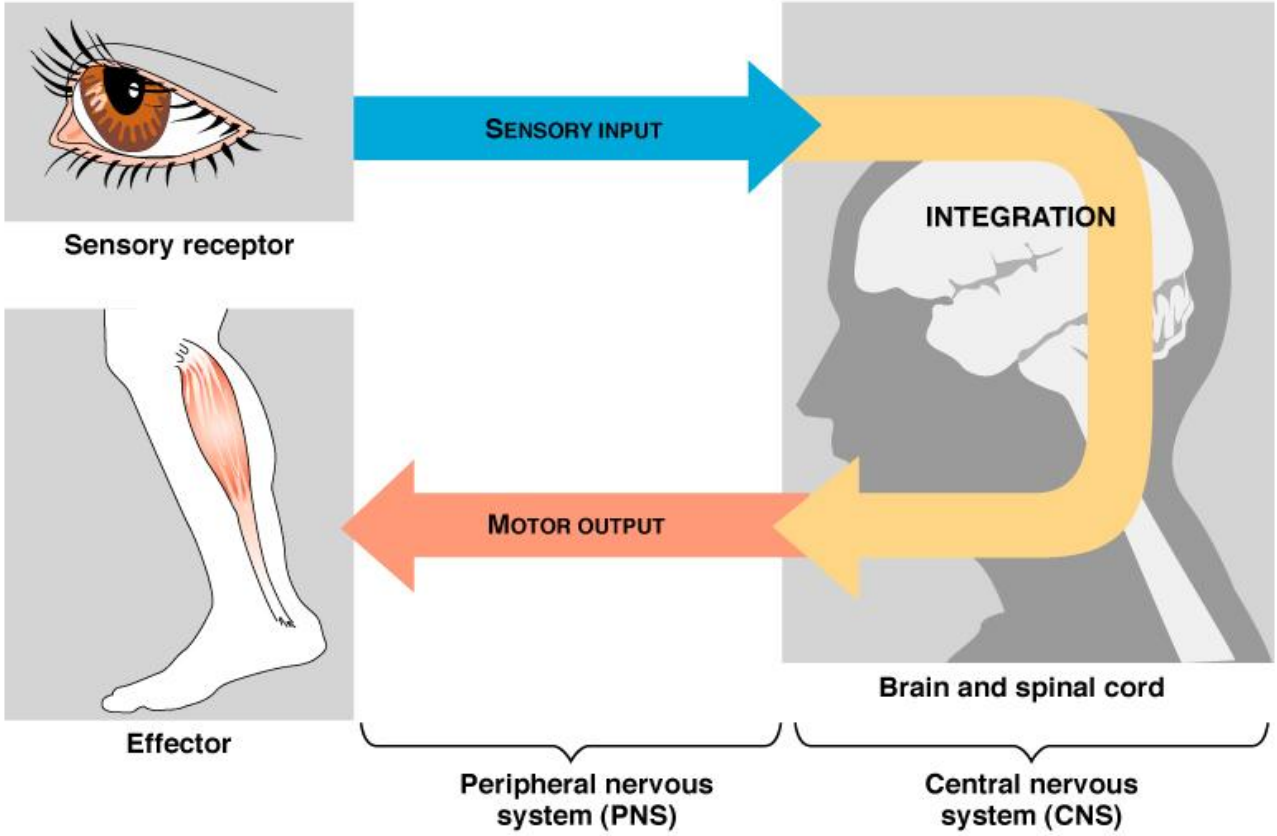
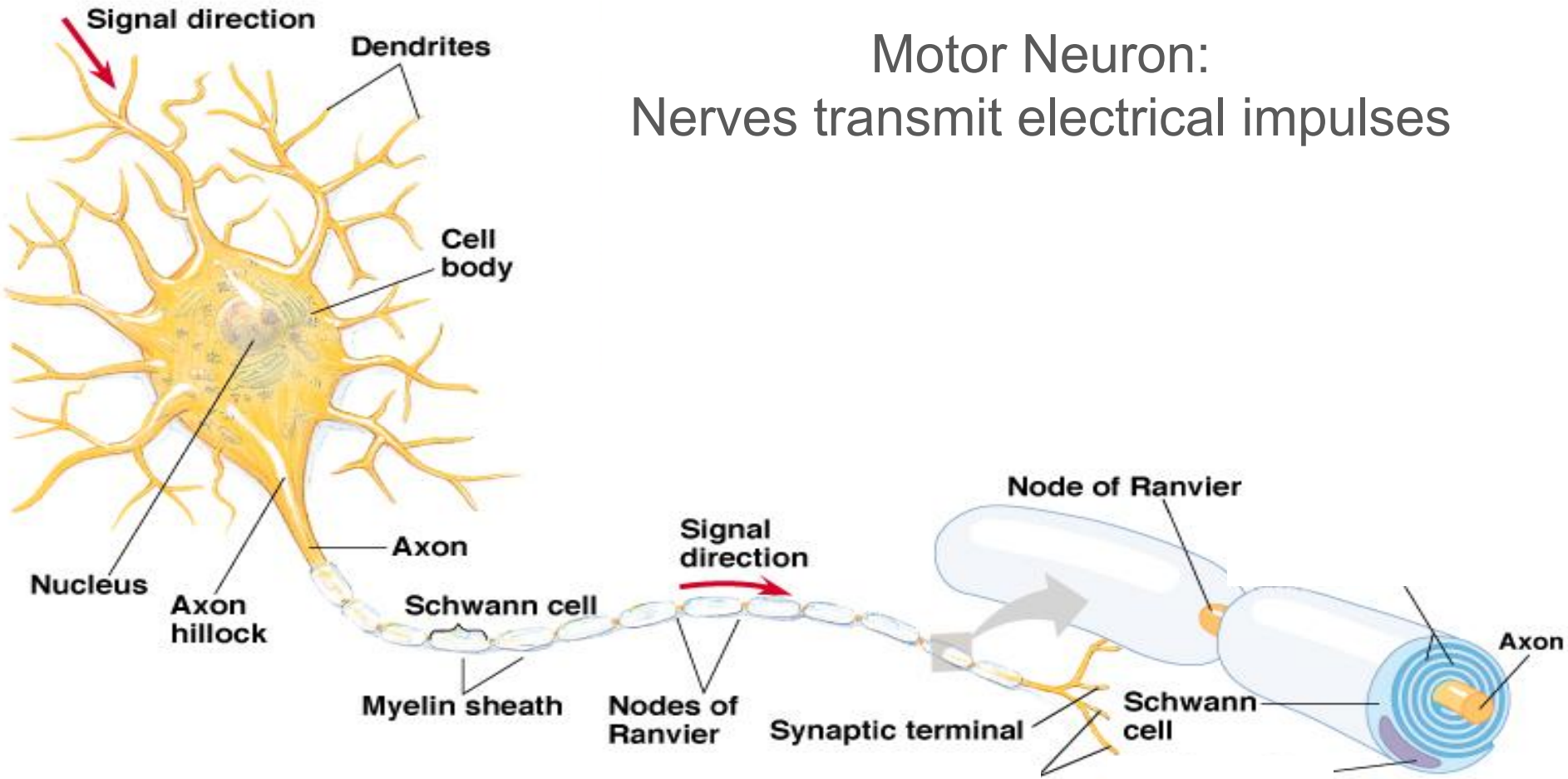
Human Body Systems

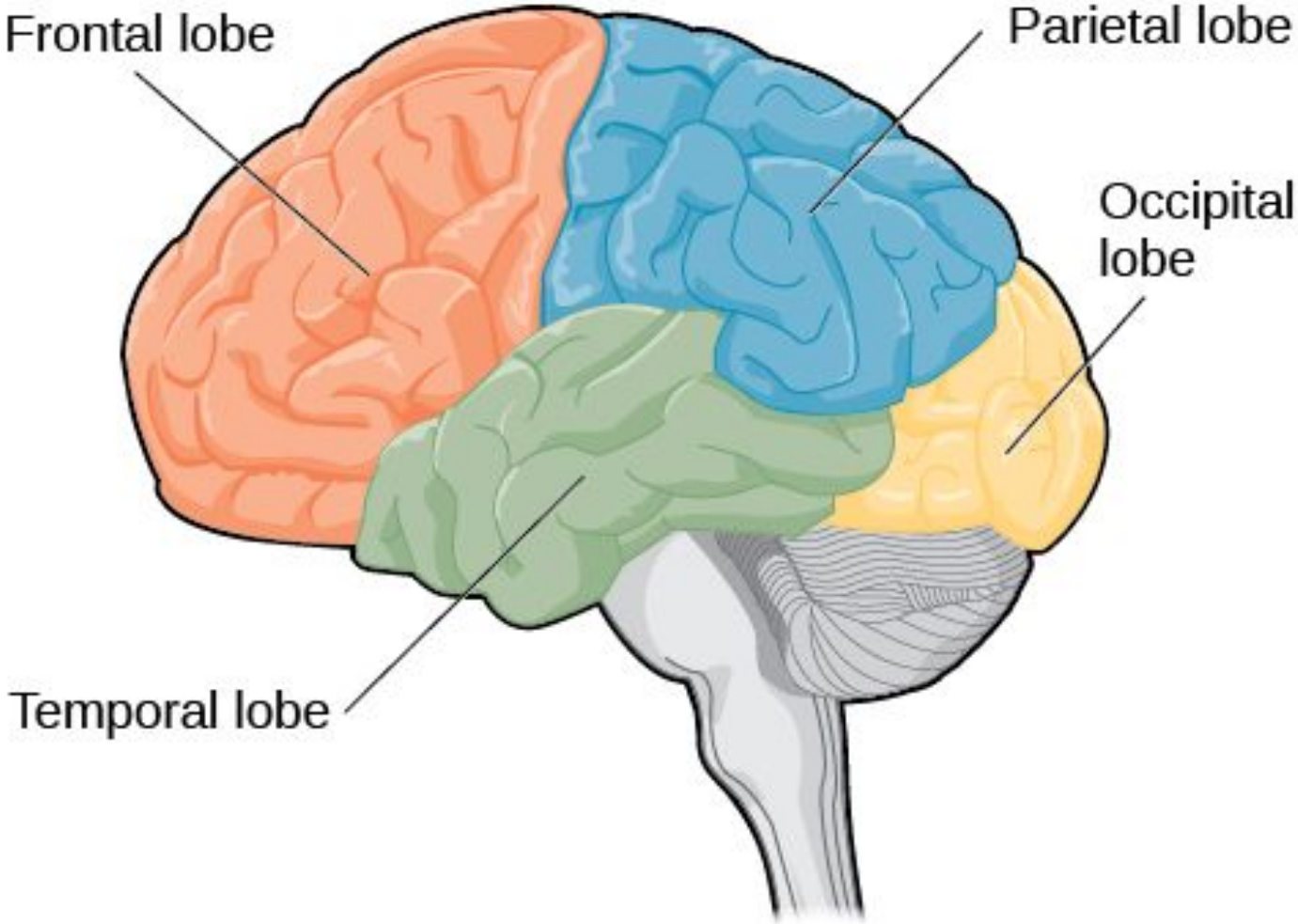
Unit 9

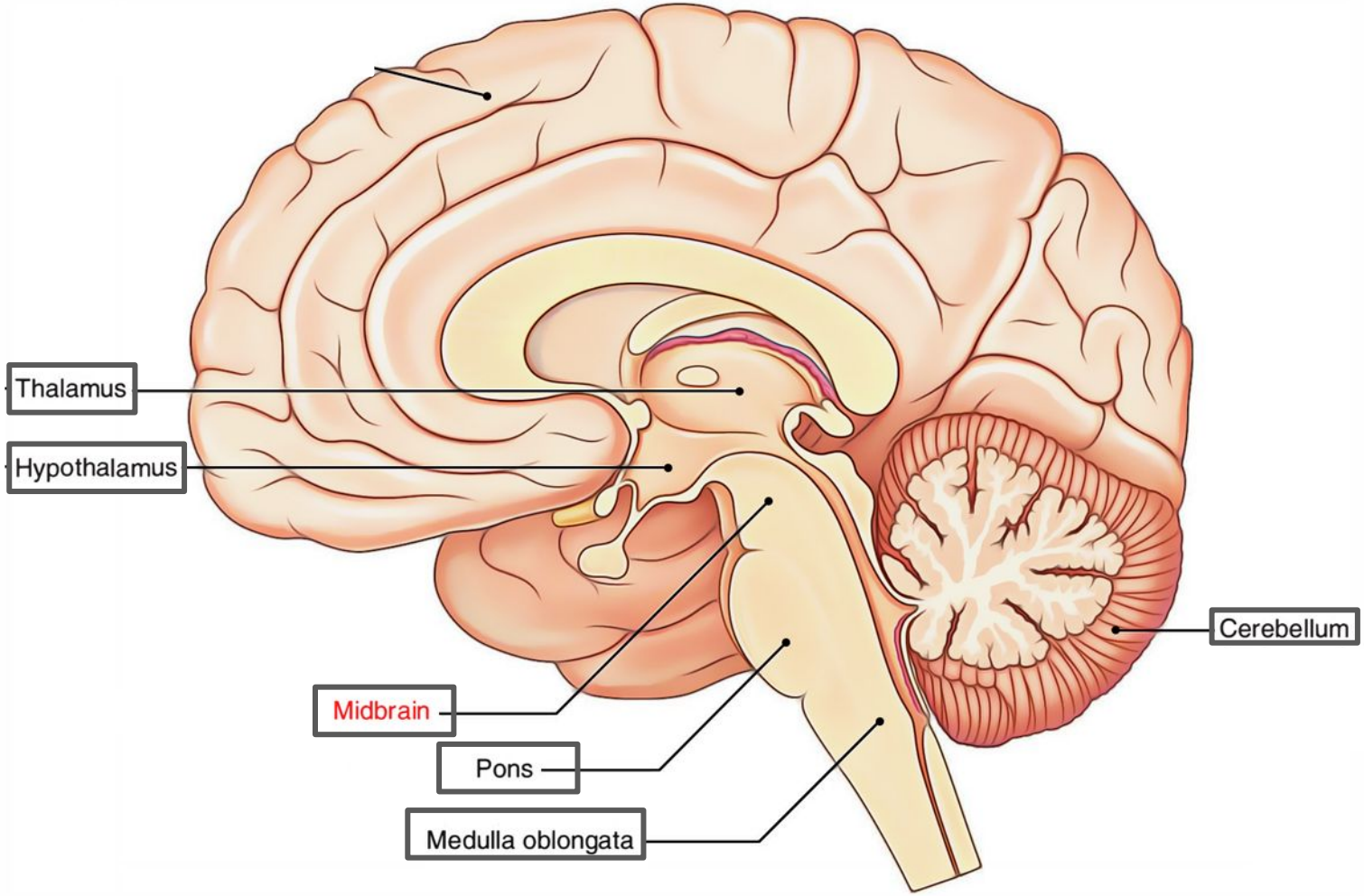
Nervous System



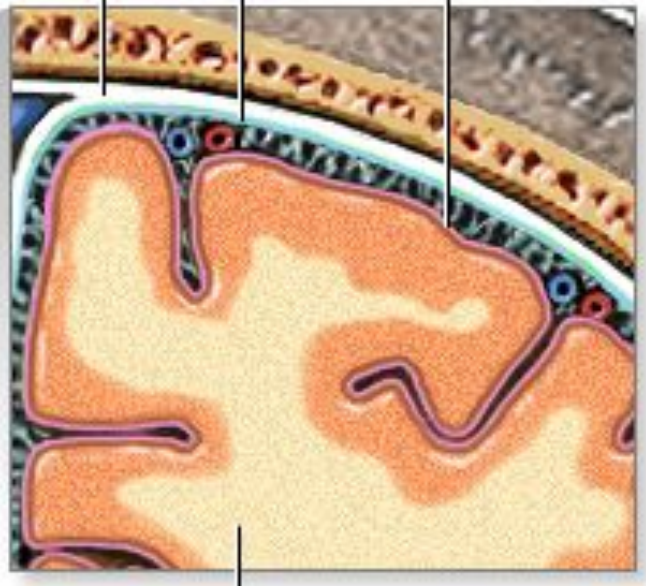
Motor Neuron:
Nerves transmit electrical impulses




Frontal lobe
Parietal lobe
Occipital lobe
Temporal lobe


Thalamus
Hypothalamus
Midbrain
Pons
Medulla oblongata
Cerebellum

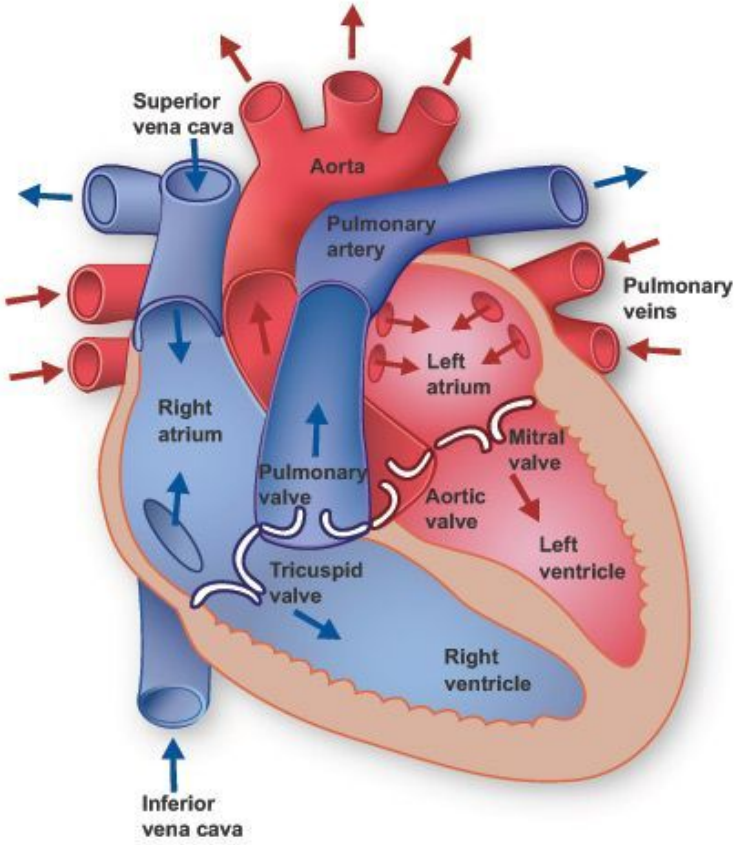
The meninges are the membranes covering the brain and spinal cord

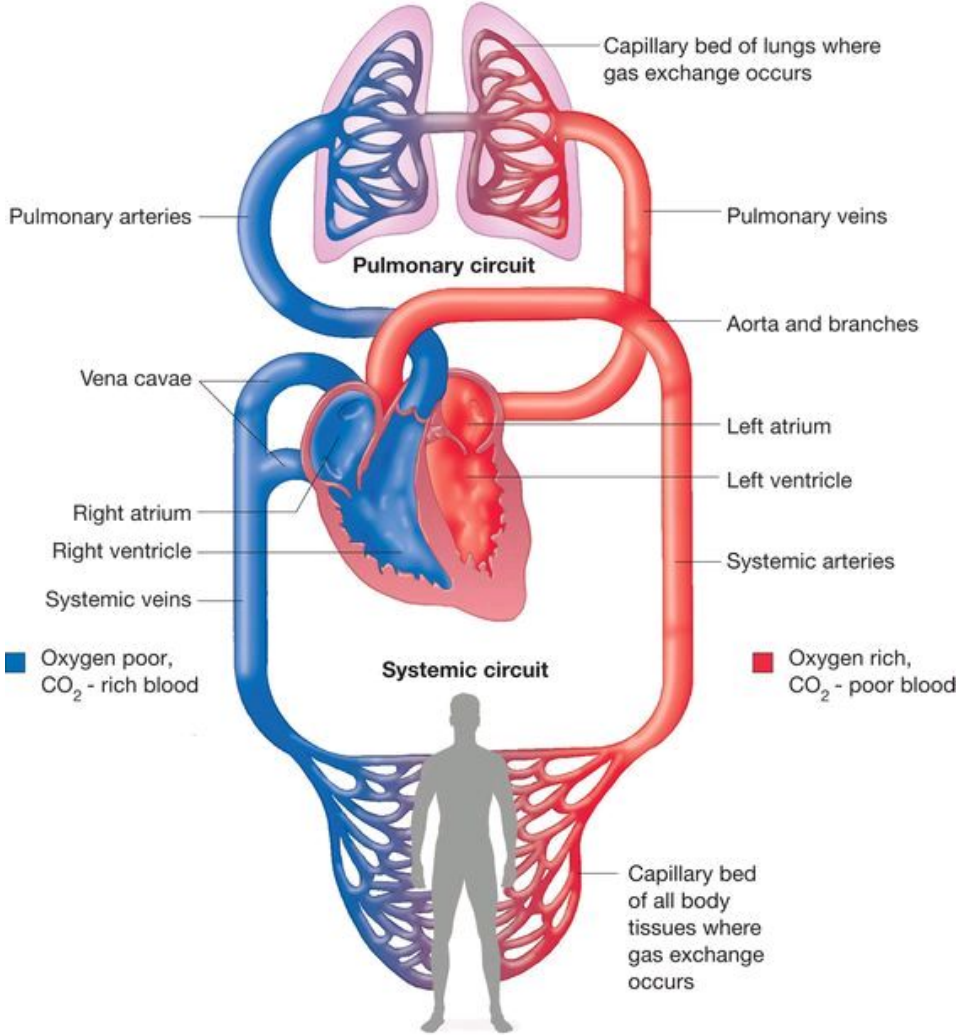


Functions of Parts of the Brain

- **Medulla oblongata:** controls involuntary and homeostatic activities such as swallowing, breathing, and heart activity.
- **Cerebellum:** coordinates motor control, such as movement and balance.
- **Hypothalamus:** maintains homeostasis, coordinating the nervous and endocrine systems, secreting hormones of the posterior pituitary, and releasing factors regulating the anterior pituitary.
- **Pituitary gland:** the posterior lobe stores and releases hormones produced by the hypothalamus and the anterior lobe, and produces and secretes hormones regulating many body functions.
- **Cerebral hemispheres:** act as the integrating center for higher order functions such as thinking, memory and emotions.

Cardiovascular System





Factors affecting blood flow

Blood pressure- faster heart rate leads to higher blood pressure

Blood volume- greater volume leads to the heart working harder to pump blood throughout the body

Resistance- greater resistance leads to slower blood flow.

Viscosity- greater viscosity (thicker like syrup) leads to slower blood flow.

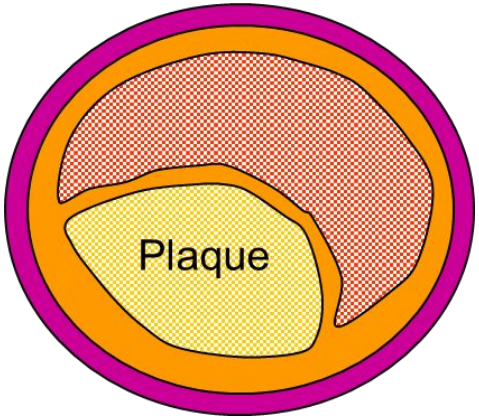
Exercise- increases heart rate and, therefore, blood flow while you are exercising.

Cardiovascular Disease

Arterial buildup from bad diet, smoking, sedentary lifestyle, and family history can cause plaque to form.

If the plaque ruptures, it forms a coronary thrombosis and blocks the coronary artery, it can cause the heart to beat in an uncoordinated way (fibrillation) and result in a heart attack.

It can also block the arteries to the brain (stroke) or lungs (embolism).



Immune System

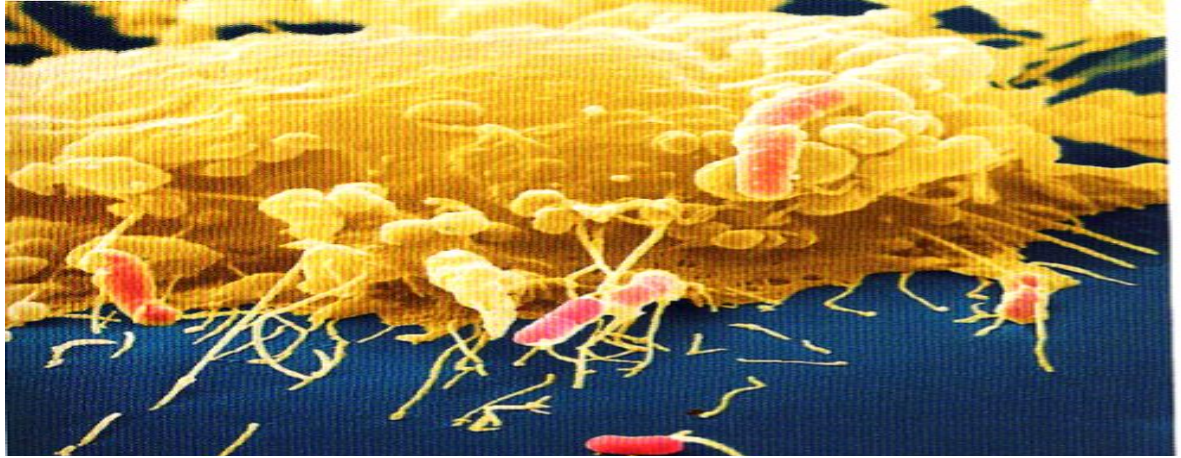
- Diseases can be caused by infections, genetics/ behavior, or from environmental factors.
- The immune system contributes to homeostasis by fighting and preventing disease to keep the internal environment maintained.
- Three lines of “defense” against disease.
- Non-specific are not targeting anything particular, just trying to keep anything out that does not belong. First two lines.
- Specific creates special proteins (antibodies) to target particular things (antigens).
- Vaccines & antibiotics are to prevent & treat disease, respectively.

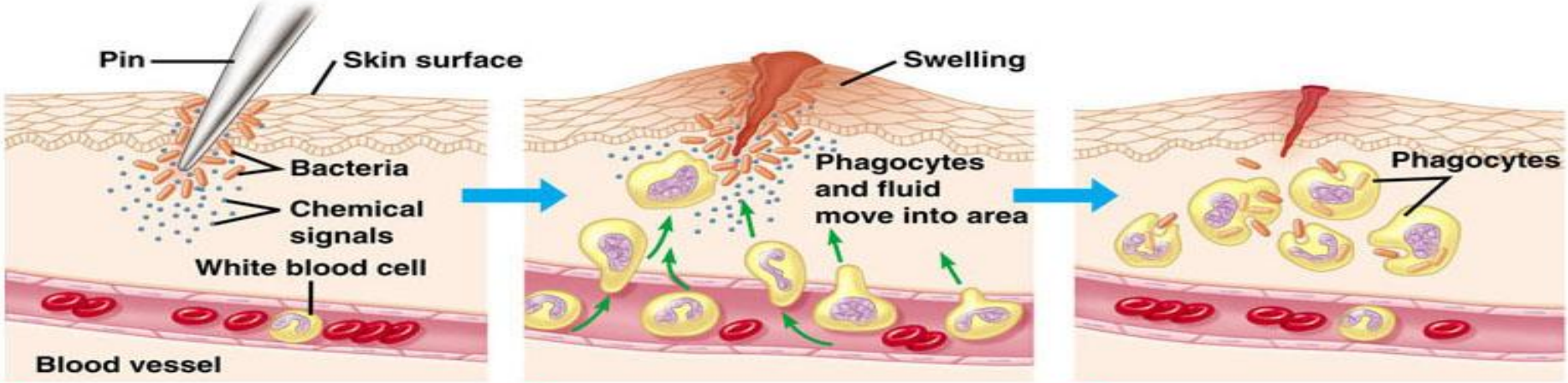
Skin & Mucus Barriers (First Line of Defense)

- Skin is a good **non-specific** barrier against disease for three reasons:
  1. Skin is tough.
  2. Secretes acidic oils that prevent growth of most bacteria.
  3. Outer layer (epidermis) is mostly dead cells preventing contact with live cells.
- Mucus membranes in trachea, nose, urethra, & vagina block **non-specific** pathogens in three ways:
  1. Produce a sticky mucus that traps pathogens.
  2. Some of these membranes cilia that help move trapped pathogens up & out of trachea.
  3. Cells that secrete mucus also secrete an enzyme (lysozyme) that chemically damage pathogens.

Phagocytes (Second Line of Defense)

- Once pathogens have entered the blood, phagocytes (a type of leukocyte/ white blood cell) recognize whether the cell is ‘self’ or ‘not-self’ by proteins on the surface.
- If it is determined to be ‘self’ it is left alone. If it is ‘not-self’, it is engulfed by phagocytosis.
- These cells contain lysosomes to chemically digest what has been engulfed.
- This is called **non-specific** because identity of the pathogen has not been established, merely determined as ‘non-self’.





1 Tissue injury; release of chemical signals such as histamine

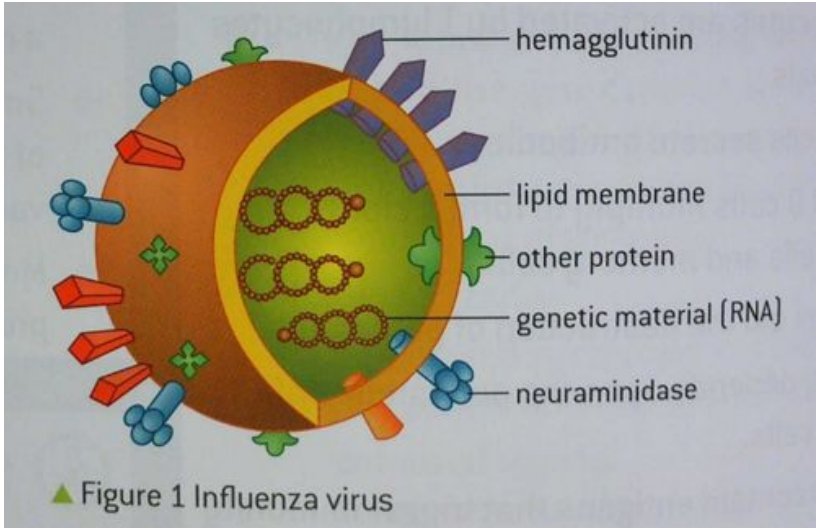
2 Dilation and increased leakiness of local blood vessels; migration of phagocytes to the area

3 Phagocytes (macrophages and neutrophils) consume bacteria and cell debris; tissue heals

Antibodies (Third Line of Defense)

- Antibody- protein molecules that we produce in response to a **specific** type of antigen.
- Antigen- any unique, 'non-self' molecule on the surface of cells that causes an antibody response. Commonly proteins on pathogens

Most pathogens have several different antigens on their surface and trigger the production of many different types of antibodies

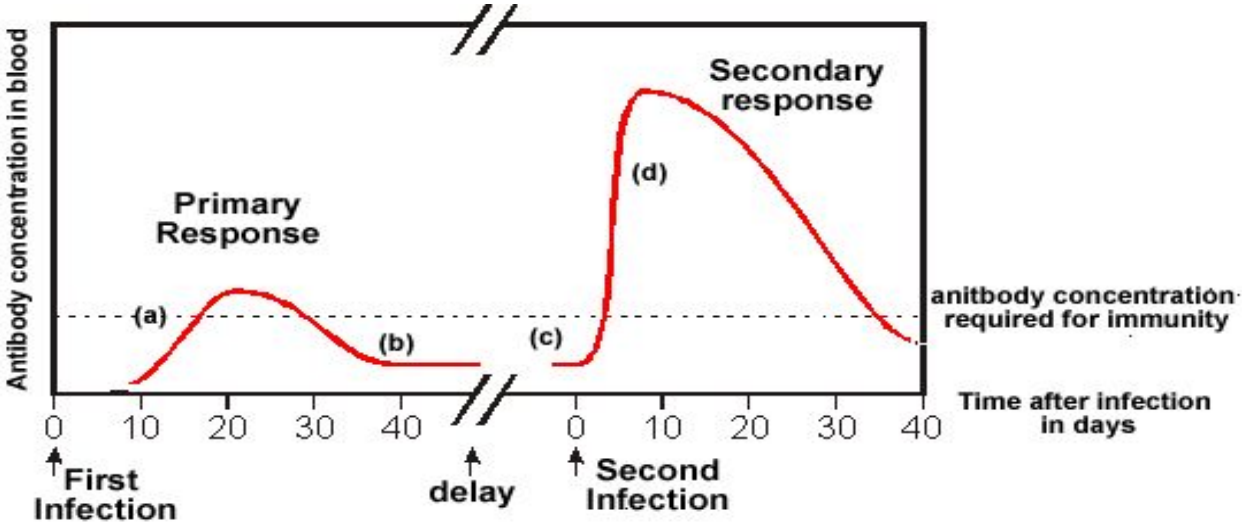


▲ Figure 1 Influenza virus

Cells Involved in Antibody Production	Function
Helper T Cells	Identify the antigen and activate B cells to divide
B Cells	Divide by mitosis to make plasma cells and B memory cells
Plasma Cells	Make and secrete antibodies into blood plasma
B Memory Cells	Rapid cloning into plasma cells when challenged by second exposure to same antigen. Long term immunity.

Vaccines

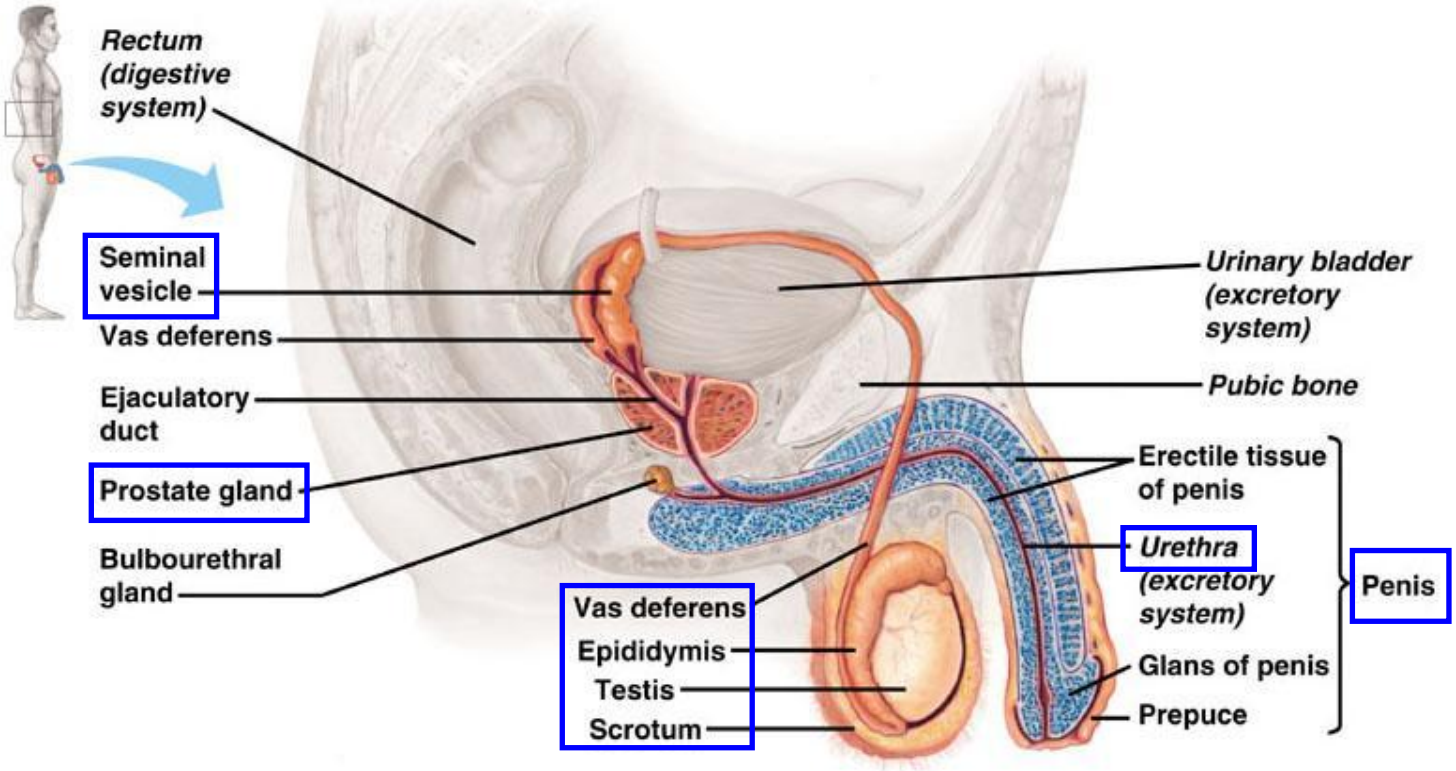
- Vaccines (immunization) use modified pathogens (antigen) which are dead or weakened.
- These vaccines carry the antigen and therefore stimulate production of antibodies and B memory cells without developing the disease symptoms or signs.
- Now the B memory cells are present in case you come across the real disease. You will make many antibodies quickly and prevent illness.



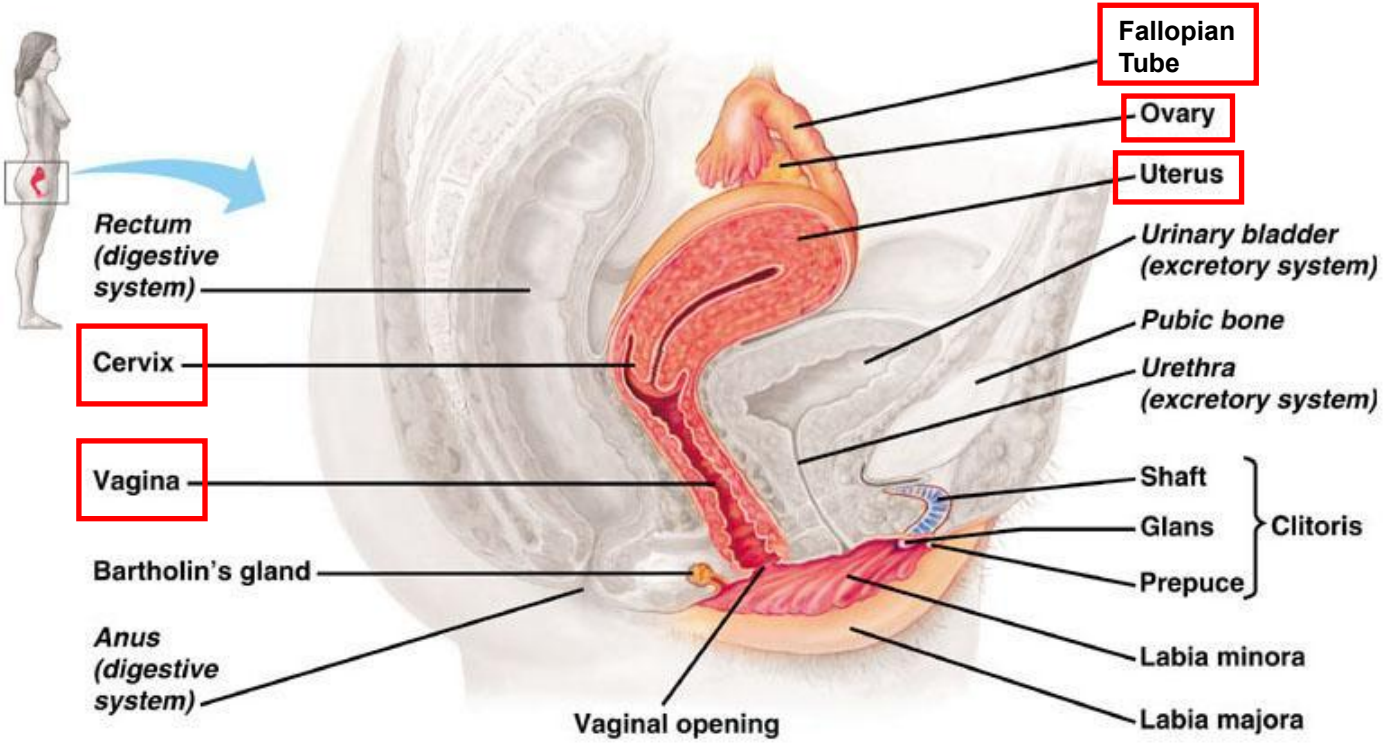
Antibiotic Effects

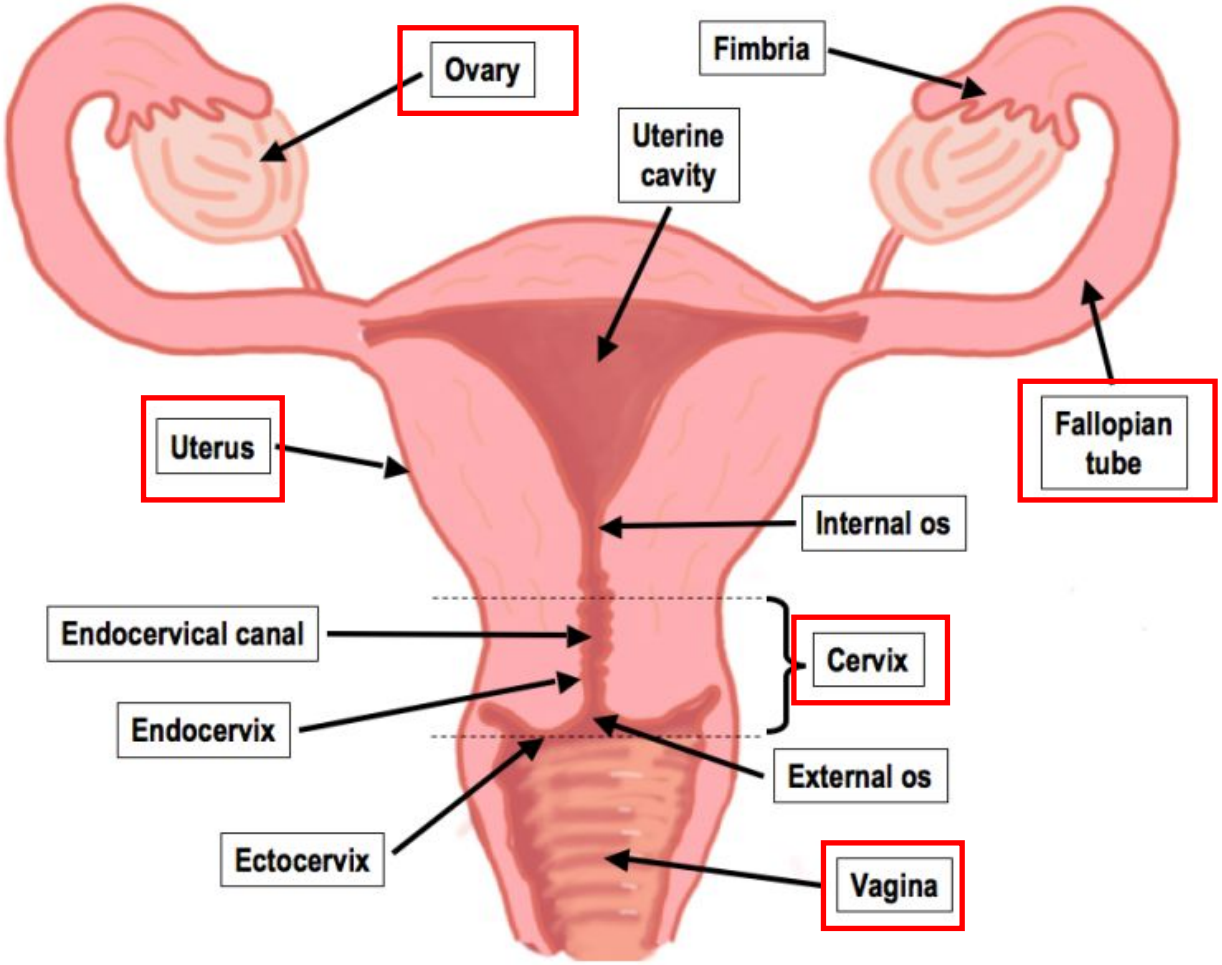
- **Antibiotics are used to treat bacterial diseases, but not viral ones. They work to block certain metabolic pathways of prokaryotic (bacteria) cells.** They may inhibit protein synthesis or prevent a new cell wall from forming however, due to differences in cell types, have no effect on eukaryotic cells of humans.
- **Viruses have no metabolic pathways so they rely on host cells to carry-out processes.**
- Therefore, antibiotics damage or kill prokaryotic cells (bacteria), but do not have an effect on eukaryotic cells or the virus that may have infected them.
- It is strongly recommended to complete the full course of treatment of antibiotics to prevent bacteria time to mutate and populations evolve resistance to the antibiotics.

Reproductive System

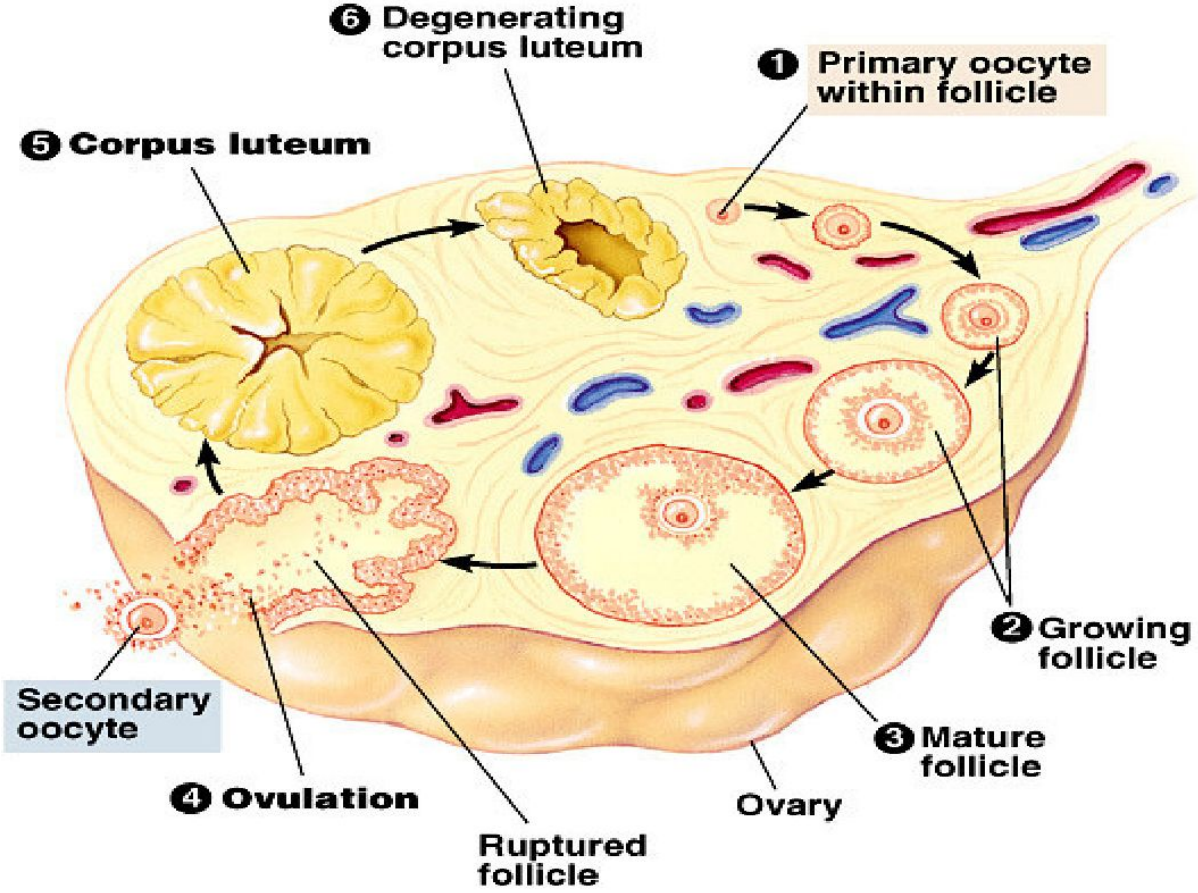


Structure	Function
Scrotum	Sac that contains the testes and epididymis where sperm are made and stored, respectively
Testes	Made up of tubules that make sperm for reproduction
Epididymis	Part of the scrotum where sperm mature and are stored until moved to vas deferens
Vas Deferens	Tube that carries sperm to the urethra. Several glands are attached to it and contribute contents of semen
Seminal Vesicle	Adds fluid to semen (70%); fluid is alkaline & contains fructose for cell respiration of sperm
Prostate Gland	Secretes fluid that to semen; where the vas deferens & urethra meet
Urethra	Tube from which sperm leaves the body in semen during ejaculation.
Penis	Inserts sperm into the vagina


Fallopian Tube
Ovary
Uterus
Urinary bladder (excretory system)
Pubic bone
Urethra (excretory system)
Shaft
Glans
Prepuce
Clitoris
Labia minora
Labia majora
Rectum (digestive system)
Cervix
Vagina
Bartholin's gland
Anus (digestive system)
Vaginal opening


Ovary
Fimbria
Uterine cavity
Uterus
Fallopian tube
Internal os
Endocervical canal
Cervix
Endocervix
External os
Ectocervix
Vagina

Structure	Function
Ovary	Releases an egg each month through ovulation
Fallopian tube/ oviduct	Carries egg from the ovary to the cervix; where fertilization occurs
Uterus	Site of implantation of blastocyst to become an embryo
Cervix	Opening to the cervix; dilates during birth
Vagina	Receives sperm from the penis



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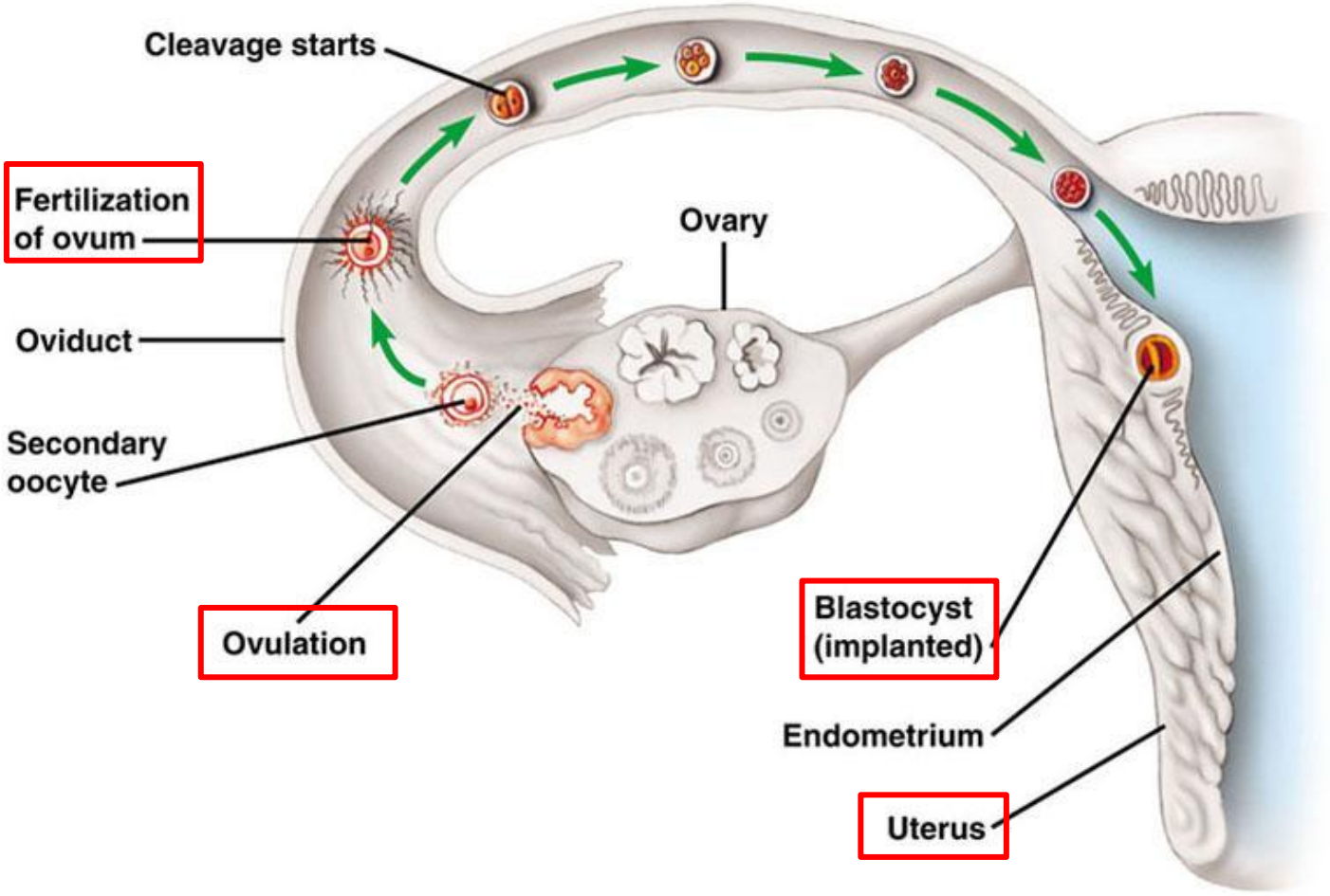
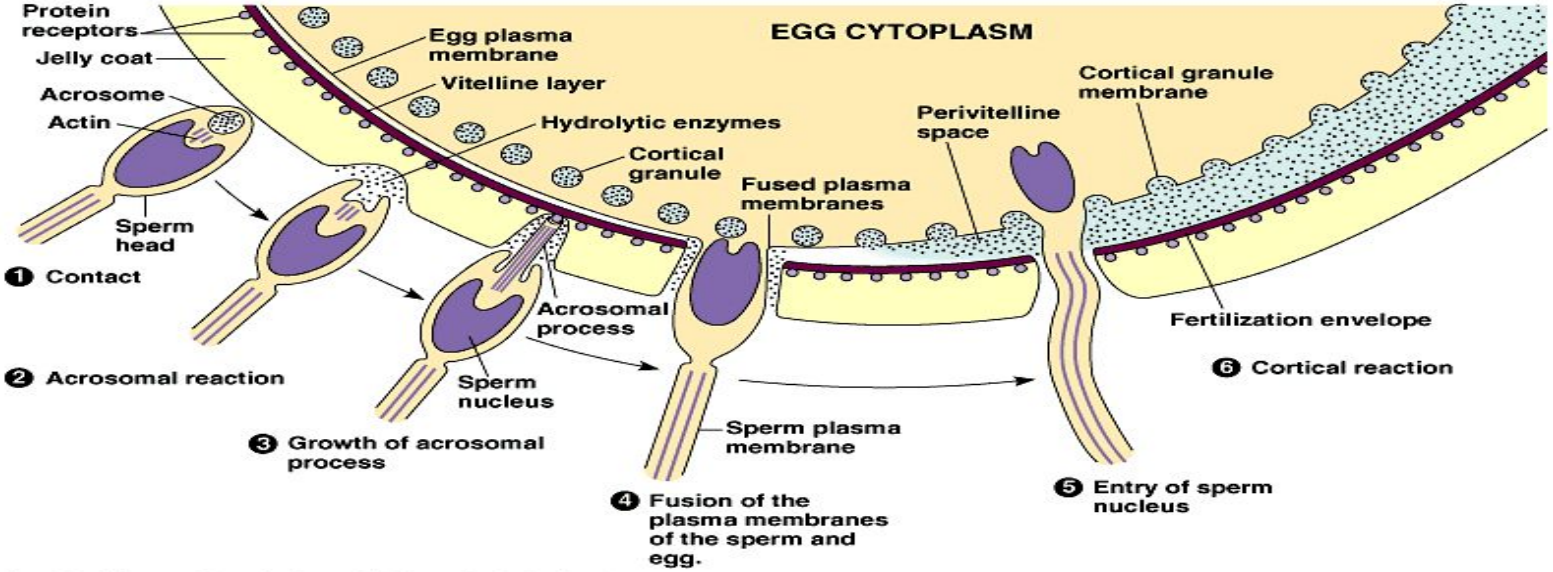
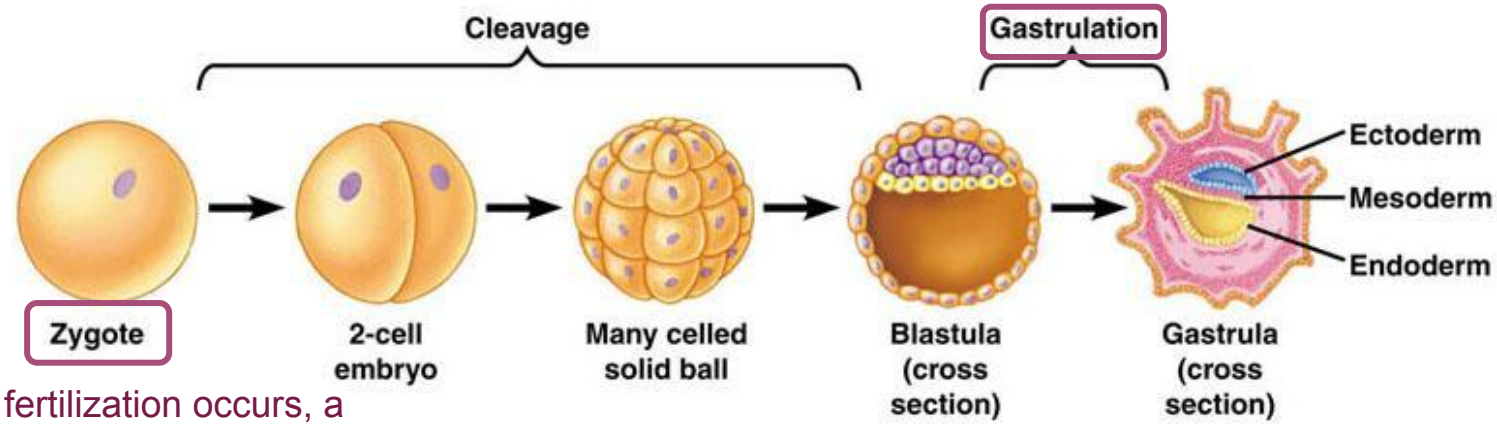

Cleavage starts
Fertilization of ovum
Oviduct
Secondary oocyte
Ovulation
Ovary
Blastocyst (implanted)
Endometrium
Uterus

Fertilization

1. Sperm enters oviduct and swims toward egg.
2. Sperm are attracted to the egg.
3. Sperm release hydrolytic enzymes penetrating the egg
4. Membrane of egg and sperm fuse to form a zygote.
5. The outside of the egg hardens and prevents polyspermy (multiple sperm).





Once fertilization occurs, a zygote is formed. It is only a zygote immediately after fertilization and then it becomes a morula, blastocyst, then embryo about 10-12 days after fertilization

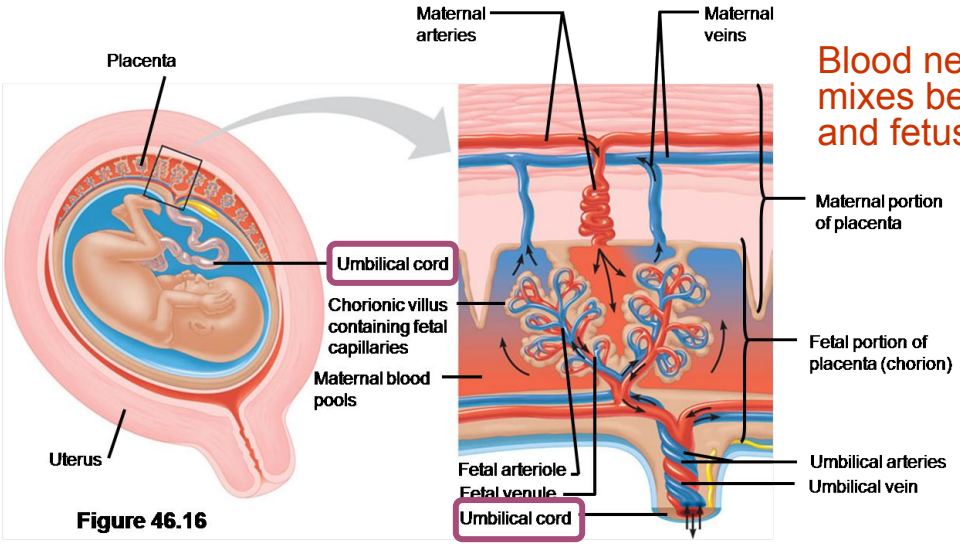
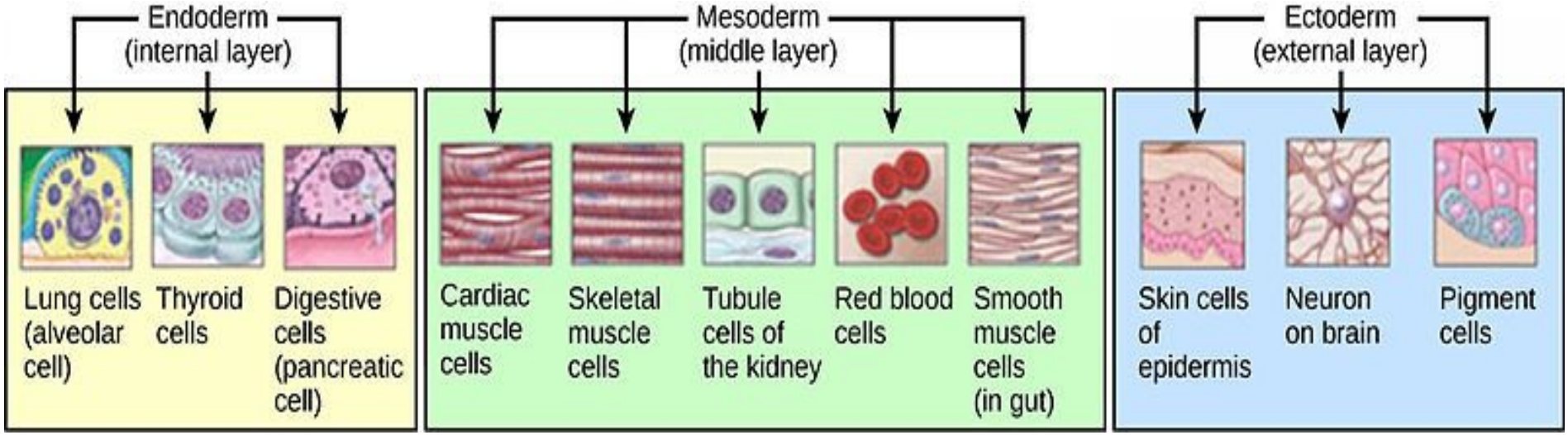


Figure 46.16

Blood never actually mixes between mother and fetus.


Endoderm
(internal layer)
Lung cells (alveolar cell)
Thyroid cells
Digestive cells (pancreatic cell)
Mesoderm
(middle layer)
Cardiac muscle cells
Skeletal muscle cells
Tubule cells of the kidney
Red blood cells
Smooth muscle cells (in gut)
Ectoderm
(external layer)
Skin cells of epidermis
Neuron on brain
Pigment cells

Placenta (site of exchange)

- Structure:
  - composed of fetal and maternal tissue
  - fetal blood through capillaries
  - maternal blood flows through intervillous space
- Functions:
  - Oxygen, antibodies, hormones, and glucose from mother to fetus
  - removal of waste products (urea & CO_2) from fetus to mother

Umbilical Cord

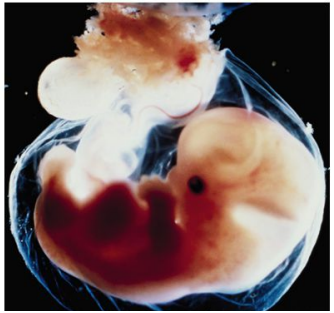
- Structure & Function:
  - Attaches the placenta to the fetus in order to receive nutrients, etc. from mother.

The **Amniotic Sac** holds amniotic fluid & the fetus. The **Amniotic Fluid** is to support & protect the developing fetus. Side note: it's mostly urine from the fetus.

Pregnancy by Trimester

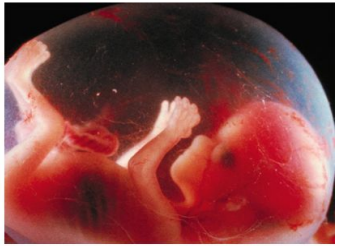
Fetal Development

- First trimester (weeks 1-12):
  - Body plan & early development
    - Heartbeat detected after week 5
    - Arms and legs begin to develop
    - Heart, brain, pancreas, kidneys, liver begin to form
    - Eyelids form then fuse for iris to develop
    - Hair, fingernails, and toenails develop
    - External sex orga sex of fetus (at er trimester)



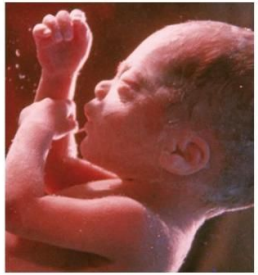
Fetal Development

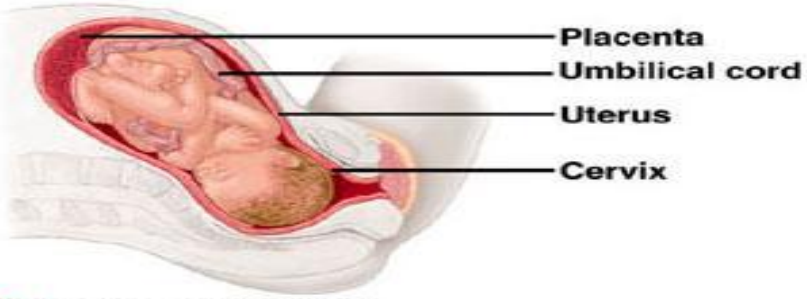
- Second trimester (weeks 13-27):
  - Fetus more active & developed
    - Most joints and bones have started to form
    - Skin is protected by fine air and waxy substance
    - Sleep cycles more regular
    - Eyes open & blink
    - Eyebrows/eyelashes form
    - Fetus breathes amniotic fluid (strengthens lungs)
    - First movements felt by mother



Fetal Development

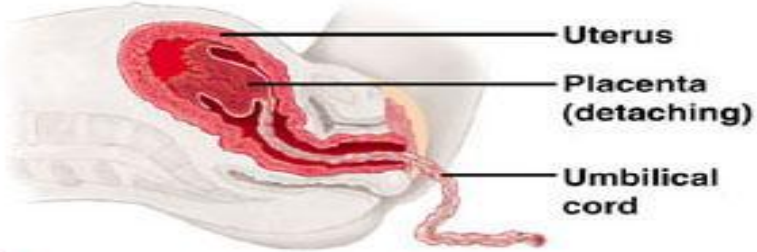
- Third trimester (weeks 28-40):
  - All organs fully form
    - Fetus responds to light & sound (from outside uterus)
    - Fetus has periods of dreaming
    - Fine body hair thins, scalp hair grows in
    - Bones grow & harden
    - Synapses between neurons form in huge numbers
    - Lungs complete development
    - Fetus turns head-down (ready to exit)





1 Dilation of the cervix

2 Expulsion: delivery of the infant



3 Delivery of the placenta