

# HLSC 2P95 Final Exam Review

## Lecture 1 (Intro, organ systems, epithelial tissue)

### Types of Anatomy

- **Microscopic anatomy:** Cannot be seen without magnification (cytology, histology)
- **Macroscopic anatomy:** Can be seen without magnification
  - Surface (morphology)
  - Regional (specific area)
  - Systemic (organ systems)

### Levels of Organization

Chemical/molecular → Cell → Tissue → Organ → Organ-system

### Organ Systems

- **Integumentary:** Protection from environment, controls temperature.
- **Skeletal:** Support/protection, mineral storage, blood formation.
- **Muscular:** Support, movement, produce heat.
- **Nervous:** Responds to stimuli, orders organ systems.
- **Endocrine:** Directs long-term changes.
- **Cardiovascular:** Transports cells, nutrients & wastes.
- **Lymphatic:** Fights infection.
- **Respiratory:** Exchanges and delivers air to body.
- **Digestive:** Processes and absorbs food.
- **Urinary:** Eliminates waste
- **Reproductive:** Produce sex cells & hormones.

### Body Cavities

- **Ventral** (protection, organ movement with no friction)
  - **Thoracic** (chest)
    - **Left/right pleural** (surrounds lungs)
    - **Mediastinum** (trachea, esophagus)
      - **Pericardial** (surrounds heart)
  - **Abdominopelvic** (abs)
    - **Abdominal** (digestive organs)
    - **Pelvic** (bladder & reproductive organs)

## **Epithelial tissue**

Sheet of cells, covers interior/exterior surfaces.

I.e. skin, digestive system, CVS, respiratory system

**Cellularity:** cells are close together

**Polarity:** apical surface (top), contains cilia

- Basal surface ("base")

Avascular, regenerates

Simple: protected areas

Stratified: found in mechanical/chemical stresses

## **Lecture 2 (Connective tissue, bones, cartilage, joints)**

### **Connective tissue**

Structural framework of body, stores energy, defends body from microorganisms

**3 types:**

- **Connective Tissue Proper:**
  - o **Loose:** framework
  - o **Dense:** densely packed
- **Fluid:**
  - o **Blood:** CVS
  - o **Lymph:** Lymph system
- **Supporting:**
  - o **Cartilage:** rubbery
  - o **Bone:** crystalline

**F - Fixed cells = Fibroblast**

**W - Wandering cells = white blood cells (neutrophil/eosinophil)**

### **Cartilage**

#### **1. Appositional Growth**

- a. Cells → chondroblasts
- b. Chondroblasts secrete matrix
- c. Chondroblast → chondrocyte

## 2. Interstitial Growth

- a. Chondrocytes divide
- b. Daughter cells secrete matrix, cells create cartilage

### 3 Types:

- **Hyaline:** Stiff, reduces friction. (i.e. costal cartilage)
- **Elastic:** Returns to original shape, provides support (i.e. ear lobe)
- **Fibrous:** Resists compression, prevents bone-to-bone contact (i.e. pads of knee)

## **Bones**

**Osteoblast:** immature bone cells, produce osteoids.

**Osteocyte:** mature bone cells

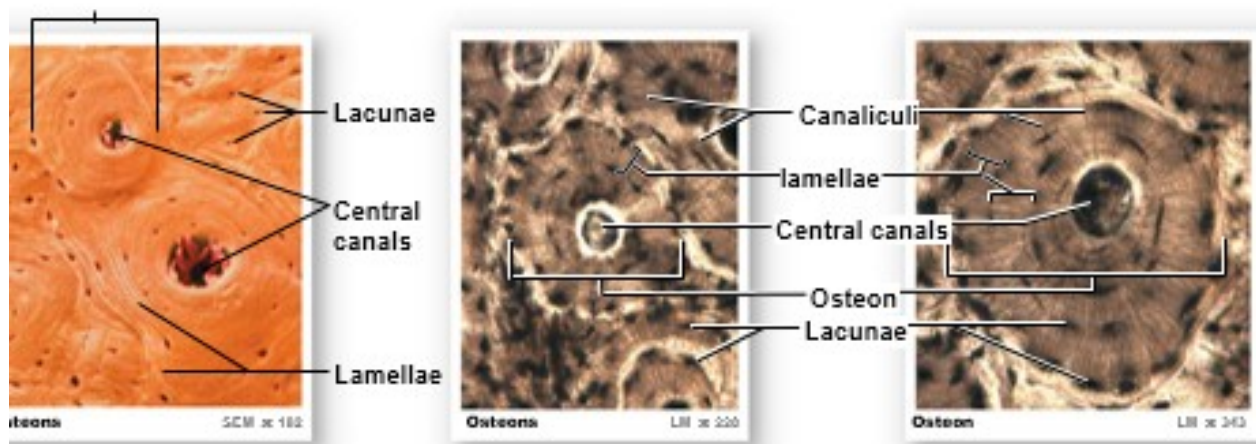
**Osteoclast:** breaks down bone cells

**Osteoprogenitor:** bone stem cell

### 2 Types:

- **Compact:** Dense & solid, forms walls of bone, contains **osteons** (functional unit of bone)
- **Spongy:** Lightweight, surrounds bone marrow, forms **trabeculae** (open network)

## **Osteon \*\*\* Know this slide**



## **Bone Growth**

**Ossification:** Replaces tissue with bone

**Osteogenesis:** bone formation

**Calcification:** puts  $\text{Ca}^{2+}$  in bone

**Intramembranous Ossification** (Think of the apple sauce “MOTTS” minus one “T”)

**1. Mesenchymal cells → osteoblasts**

- a. Osteoblasts secrete osteoid
- b. Osteoid hardens = ossification centre

**2. Osteoblasts → osteocytes & formation of spicules**

- a. Osteoblasts surround osteoid = osteocyte
- b. Ossification centre grows = spicules

**3. Trapping Blood vessels**

- a. Blood vessels grow, spicules surround & trap them.

**4. Spongy bone formation**

- a. Osteoblasts create bony plates
- b. Bony plates fuse together

**Endochondrial Ossification** (Think of a penis, it enlarges, blood vessels grow, blood supply increases, and it's a spongy bone)

**1. Chondrocytes enlarge**

- a. Matrix begins to calcify
- b. Chondrocytes die

**2. Blood vessels grow**

- a. Osteoblasts → periosteum
- b. Bone collar forms

**3. Blood Supply Increases**

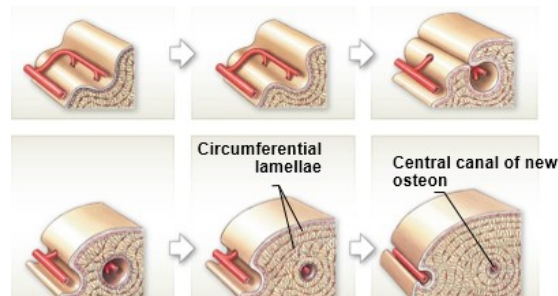
- a. Osteoblasts move to the centre
- b. Calcified matrix replaced by spongy bone

**4. Shaft fills with spongy bone**

- a. Shaft becomes thicker
- b. Osteoclasts make medullary cavity

Further growth:

- **Longitudinal** (length): Epiphyseal plate opens, fills up with spongy bone, pushes plates away, epiphyseal plates close.
- **Appositional** (diameter): Ridges create a pocket for blood vessel, ridges trap the blood vessel, bone grows inwards creating osteon, circumferential lamellae forms (more layers of bone form).



## Factors affecting bone growth

**Nutrition:** calcium, magnesium, vitamins

**Hormones:** parathyroid, calcitonin, estrogen

## Joints

**Synarthrosis:** no movement

- **Fibrous:** Sutures, gomphosis (“gums” of teeth)
- **Cartilaginous:** synchondrosis (“Syn” for synarthrosis, “chond” has a “C” like cartilaginous)
- **Bony fusion:** synostosis (“Bony” = osto)

**Amphiarthrosis:** little movement

- **Fibrous:** syndesmosis (syndesmosis has a “M” like amphiarthrosis)
- **Cartilaginous:** symphysis (symphysis has a “M” like amphiarthrosis)

**Diarthrosis:** free movement

- **Synovial**



## Lecture 3 (Muscle tissue, contraction)

1. **Excitability:** can respond to stimuli
2. **Contractility:** can shorten and exert a pull or tension (contract = shorten)
3. **Extensibility:** can contract over a range of resting lengths (Extend = length)
4. **Elasticity:** can rebound to its original length

**3 types:**

**Skeletal:** striated, voluntary, does not reproduce, repairs by myosatellite cells, multiple nuclei

**Cardiac:** striated, involuntary, heart muscle, has intercalated discs, does not regenerate, one nuclei

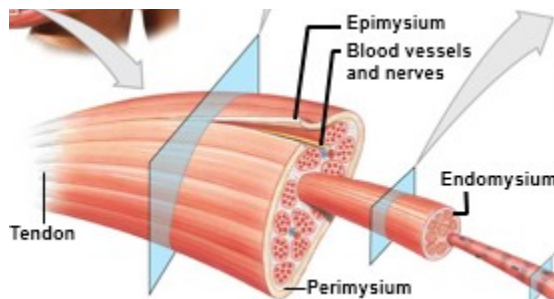
**Smooth:** non-striated, involuntary, spindle-shaped, can regenerate, one central nucleus

**Gross anatomy:** Connective tissue, muscle, muscle fascicle, muscle fiber

**Microanatomy:** Muscle fiber, myofibril, sarcomeres, myofilaments

### **Connective tissue**

- **Epimysium:** surrounds entire muscle
- **Perimysium:** divides muscle into fascicles
- **Endomysium:** surrounds muscle fibers



### **Muscle fiber**

30-40 cm in length

Multiple nuclei

Muscle fibers run parallel to each other

### **Myofibrils**

Organized bundles of contractile protein surrounded by SR (sarcoplasmic reticulum)

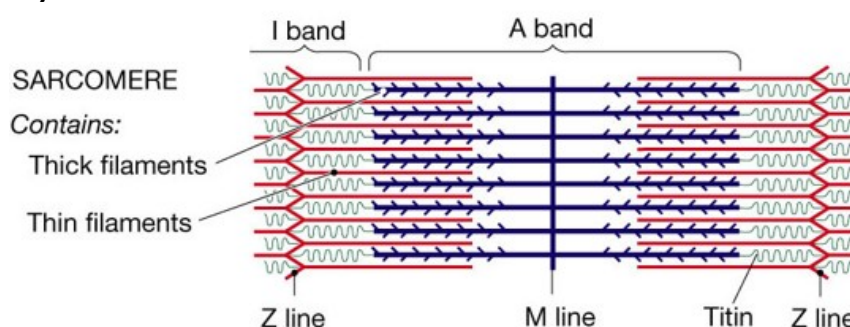
Where force generation takes place

### **Sarcomere**

Smallest unit of skeletal muscle

**Actin**-thin filament

**Myosin**-thick filament



**M-line:** middle of A-band, myosin filaments are held together

**Z-disc:** middle of I-band, actin filaments are held together

**I-band:** Only actin filaments (light region)

**H-zone:** middle of A-band, only myosin filaments

**A-band:** Actin and myosin filaments overlap (dark region)

### **Summary**

Skeletal muscle > muscle fascicles > muscle fibers > myofibrils > sarcomeres > myofilaments > actin and myosin

### **Contraction**

Presence of  $\text{Ca}^{2+}$  & ATP = actin filaments slide together = contraction

#### **Sliding filament Theory:**

- H & I-bands get smaller
- Z-lines move closer
- Myosin does not move
- Actin moves together
- Titin limits length of sarcomere

**Contraction Phase:** (Easier to remember 3 things, so chunk it up R.M., A.M., P.A.)

1. **Rigor State** (myosin bound to actin = cross-bridge)
2. **Myosin Release** (ATP binds to myosin and breaks cross-bridge)
3. **ATP Hydrolysis** (ATP breaks down, myosin head goes into “cocked” position)
4. **Myosin Reattaches** (Myosin head binds to actin = forms cross-bridge)
5. **Power stroke** ( $\text{P}_i$  is released, myosin head pulls actin)
6. **ADP release** (ADP is released, goes back to rigor state)

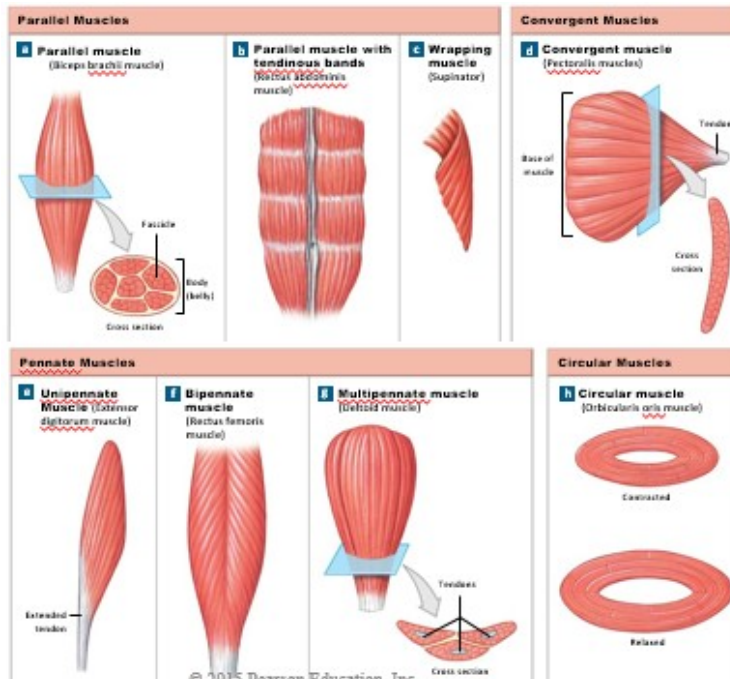
\* Requires  $\text{Ca}^{2+}$  for myosin to bind to actin in rigor state

**Excitation Phase:** (Remember “Insecure Assholes Causes Castles to Crash”)

1. Impulse travels down axon (of nerve)
2. Acetylcholine is released
3. Causes action potential & release of  $\text{Ca}^{2+}$  from SR
4.  $\text{Ca}^{2+}$  binds to actin

## 5. Contraction begins

Triad = SR and T-tubules



**Paralell:** Biceps brachii

**Paralell with tendinous bands:**  
Rectus Abdominis

**Wrapping:** Supinator

**Convergent:** Pectorialis major

**Unipennate:** Extensor digitorum

**Bipennate:** Rectus femoris

**Multipennate:** Deltoid

**Circular:** Orbicularis oris

### Types of fibers:

**Type 1** = Aerobic

**Type 2** = Anaerobic (larger than aerobic)

### Classes of Levers

**First Class:** Fulcrum in the middle (I.e. Neck looking down)

**Second Class:** Resistance in the middle (I.e. plantar flexion)

**Third Class:** Force in the middle (I.e. bicep curl)

## Lecture 4 Cardiovascular System

**Cardiovascular system:** transports nutrients, gases, hormones, ions, waste, & leukocytes, & stabilizes pH

Blood = ~8% of body weight

Terminology: **Hypovolemic:** low blood volume

**Normovolemic:** normal blood volume

**Hypervolemic:** high blood volume



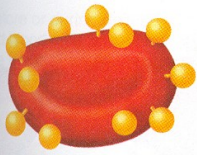

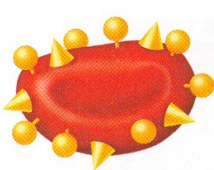

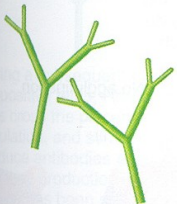

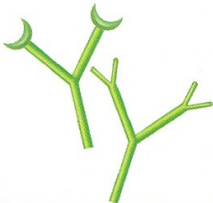
### Average blood volume:

- Males: 4-6 L
- Females: 4-5 L

### Average pH: 7.35-7.45

### Blood composition:

- Plasma: ~55%
- White blood cells: <1%
- Red blood cells: ~45%

Antigen A 	Antigen B 	Antigens A and B 	Neither antigen A nor B 
Anti-B antibody 	Anti-A antibody 	Neither Anti-A nor Anti-B antibodies	Anti-A and Anti-B antibodies 
<b>Type A</b> Red blood cells with type A surface antigens and plasma with anti-B antibodies	<b>Type B</b> Red blood cells with type B surface antigens and plasma with anti-A antibodies	<b>Type AB</b> Red blood cells with both type A and type B surface antigens, and neither anti-A nor anti-B plasma antibodies	<b>Type O</b> Red blood cells with neither type A nor type B surface antigens, but both anti-A and anti-B plasma antibodies

Wrong blood type leads to "agglutination" (blockage of small blood vessels)

Universal donor = O negative

Universal recipient = AB positive

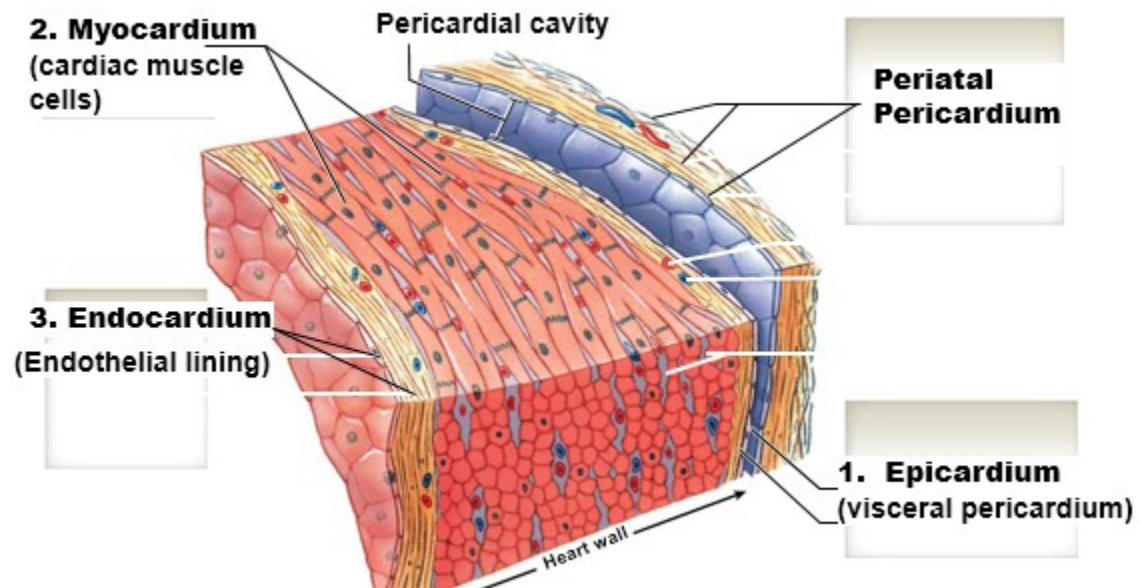
Rhogam binds to D-antigen in fetus during pregnancy so Mom doesn't trigger anti-D antibodies and killing baby

### Heart

~100 000 beats per day

Pumps ~ 1.5 million gallons of blood per year

## Structure of Heart wall



4 Chambers of the heart (Left/right atriums & ventricles) are separated by:

- **Interatrial groove**: separates atria
- **Coronary sulcus**: separates atria and ventricles
- **Anterior/posterior interventricular sulcus**: separates ventricles

## Coronary Blood Vessels & branches

### Arteries

They are opposites but LCA has circumflex

#### **Right coronary artery (RCA):**

- Right marginal branch
- Posterior interventricular branch

#### **Left coronary artery (LCA):**

- Left marginal branch
- Anterior interventricular branch
- Circumflex branch

### Veins

- Great cardiac vein (delivers blood to coronary sinus)
- Middle cardiac vein (delivers blood to coronary sinus)
- Coronary sinus
- Posterior vein of left ventricle
- Small cardiac vein

- Anterior cardiac vein

### **Ventricles of Heart** (right vs left)

<u>Right ventricle</u>	<u>Left Ventricle</u>
Thinner wall	Thicker wall
Weaker contraction	Stronger contraction
Has moderator band	6-7x more powerful than right ventricle

### **Cardiac cycle**

1. Atrial systole begins (forces blood to ventricles)
2. Atrial systole ends, atrial diastole begins
3. Ventricular systole 1<sup>st</sup> phase (AV valves close)
4. Ventricular systole 2<sup>nd</sup> phase (Pressure increases, Semilunar valves open)
5. Ventricular diastole-early (Ventricles relax, cusps close, blood flows to atria)
6. Ventricular diastole-late (All chambers relax, AV valves open, ventricles fill passively)

## **Lecture 5 Respiratory System**

**Respiratory system:** exchanges gas between air and blood, protects from dehydration, invading pathogens, produces sound, regulates blood volume, BP and body fluid pH.

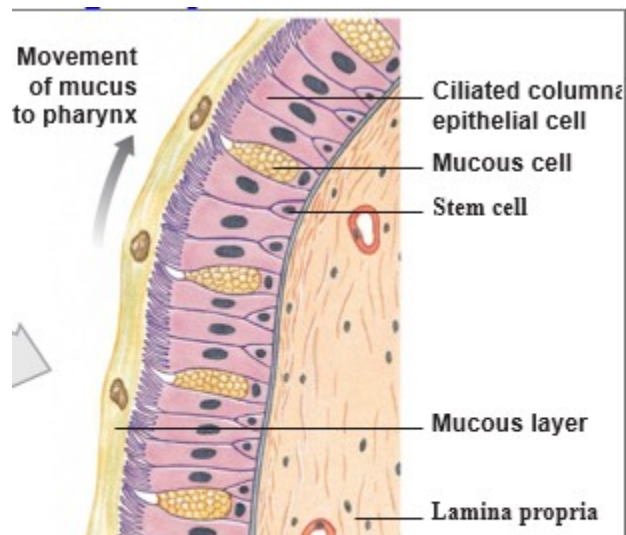
**Upper respiratory:** Nose, nasal cavity, sinuses & pharynx

**Lower respiratory:** Larynx, trachea, bronchi, bronchioles, & alveoli

\*Remember that anything below larynx is lower

**Respiratory epithelial cells** have **cilia** to push mucus up and away from lungs.

Smokers have the cilia damaged and needs to cough to remove the mucus.

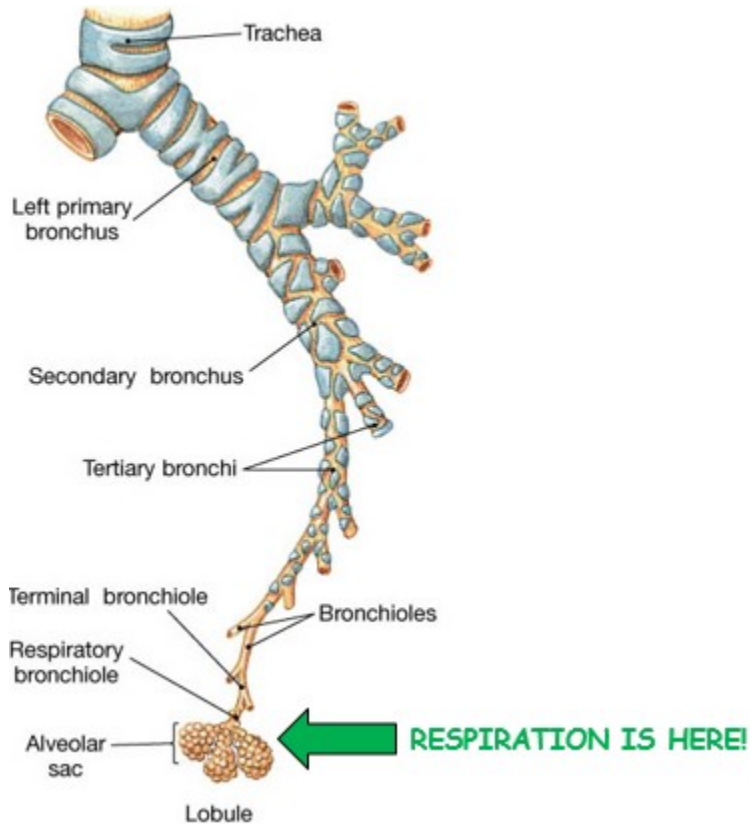


### **Trachea**

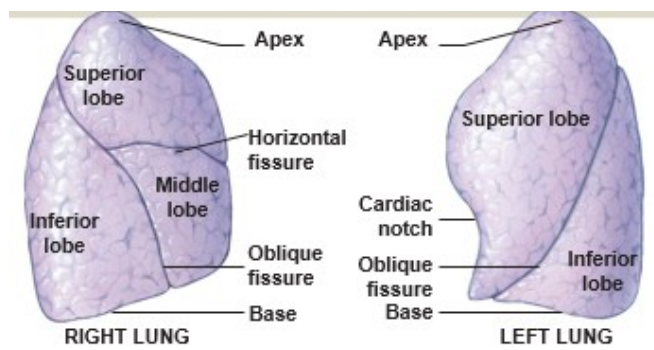
11 cm long, 2.5 cm diameter

The **carina** splits the trachea into 2 branches (bronchi)

### Levels of bronchi



### Lungs



### Major Differences of lungs (left vs right)

<b>Right Lung</b>	<b>Left Lung</b>
Has a middle lobe & horizontal fissure	Has a cardiac notch
Shorter and wider	Longer and skinnier
3 secondary bronchi, 10 tertiary bronchi	2 secondary bronchi, 9 tertiary bronchi

Lungs have a “sack” (**pleural membrane**)

**Pleural fluid** reduces friction during inhalation & exhalation

**Lungs have opposite blood system from body:**

- **Pulmonary veins** are red = oxygenated for the heart
- **Pulmonary arteries** are blue = deoxygenated from the heart

**2 Types of pneumocytes:**

- **Pneumocyte type 1:** allows for gas exchange
- **Pneumocyte type 2:** is larger and produces surfactant (oily substance)

There is about 150 million alveoli

**Muscles of respiration:**

**Inhalation:** external intercostals, diaphragm, pectoral, serratus, & scalene muscles

**Exhalation:** internal intercostals, transverse thoracis, rectus abdominis

\* Just be aware of the definitions

## RESPIRATORY FUNCTION

		♂	♀
<b>TOTAL LUNG CAPACITY</b> [mL · s]		5900	4400
<b>VITAL CAPACITY</b>	max oxygen a person can expel from the lungs after a max inhalation	4700	3400
<b>INSPIRATORY RESERVE</b>	max amount of air that can be inspired after a normal inspiration	3000	2100
<b>TIDAL VOLUME</b>	normal volume of air displaced between normal inhalation and exhalation	500	500
<b>EXPIRATORY RESERVE</b>	additional air that can be expired after normal expiration	1200	800
<b>RESIDUAL VOLUME</b>	amount of air left in the lungs after a forced exhalation	1200	1000

## Lecture 6 The Nervous System (Brain)

### Lobes of the brain:

- **Frontal lobe:** voluntary control of skeletal muscles
- **Occipital lobe:** Vision
- **Parietal lobe:** Touch, pain, taste, temperature
- **Temporal lobe:** Hearing, and smell

### Cerebrum vs cerebellum

**Cerebrum:** Thoughts, intellectual functions, memory, muscle contractions

**Cerebellum:** Motor functions

### Diencephalon and more

- **Diencephalon**
  - **Thalamus:** processes sensory info
  - **Hypothalamus:** controls emotion & hormones
- **Mesencephalon:** processes visual and sound data, reflexes, consciousness
- **Pons:** relays sensory info to thalamus
- **Medulla Oblongata:** relays sensory info to thalamus, regulates organ systems

### White matter vs Gray matter (brain)

**Gray matter** is made up of **cell bodies**

**White matter** is made up of **axons**

Dura matter (hard) → arachnoid matter (middle) → Pia matter (thin)

\*Cerebrospinal fluid (CSF) drains into the sinuses which drains to jugular vein

Ependymal cells help produce CSF (~500 mL/day) in the choroid plexus

### Cranial Nerves

1. **Olfactory:** Sensory, smell
2. **Optic:** Sensory, vision
3. **Oculomotor:** Motor, eye movement
4. **Trochlear:** Motor, eye movement
5. **Trigeminal:** Sensory & motor, biting & chewing
6. **Abducens:** Motor, eye movements, lateral movements
7. **Facial:** Sensory & motor, taste & facial expression

8. **Vestibulocochlear:** Sensory, balance & hearing

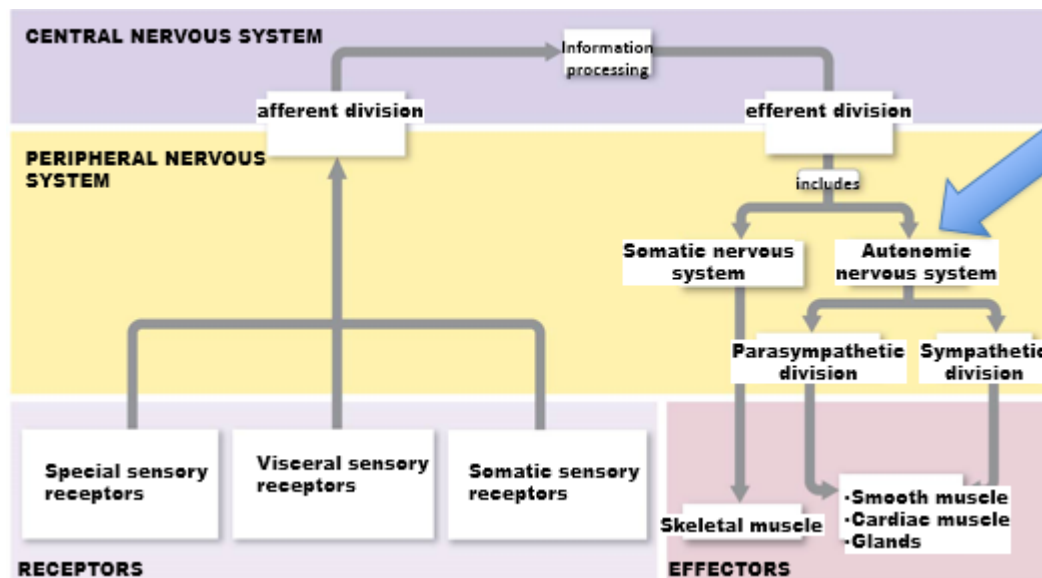
9. **Glossopharyngeal:** Sensory & motor, carries afferent (sensory) and efferent (motor) info.

10. **Vagus:** Sensory & motor, PSNS control of organ systems (i.e. CVS, digestive system)

11. **Accessory:** Motor, controls neck & back muscles

12. **Hypoglossal:** Motor, tongue movement

### **Nervous system Chart**



### **Somatic vs Autonomic**

<b>Somatic</b>	<b>Autonomic</b>
Single neuron between CNS & muscle	Two neurons between CNS & organ
Innervates ONLY skeletal muscle	Innervates smooth/cardiac muscles & glands
Leads ONLY to excitation	Can be excitatory or inhibitory
Voluntary	involuntary
Myelinated axons	Pre-ganglionic axon myelinated


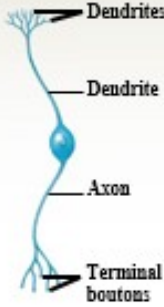

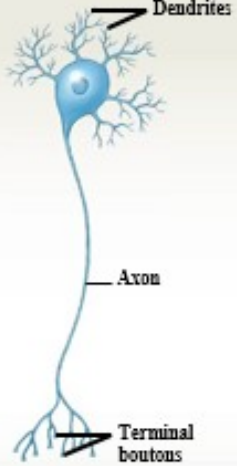
\* PSNS originates from cervical and sacral regions, post-ganglion is short, pre-ganglion is long.

\* SNS originates from thoracic and lumbar regions, post-ganglion is long, pre-ganglion is short.

## **Lecture 7 The Nervous System (Spinal Chord)**



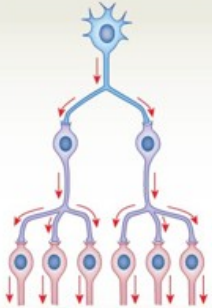
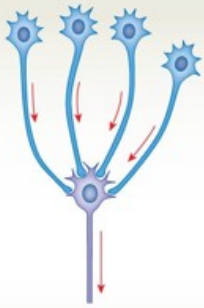

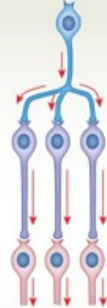
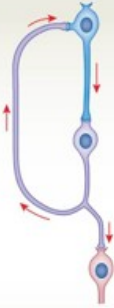
## Neuron classification

Anaxonic Neuron	Bipolar Neuron	Pseudounipolar neuron	Multipolar Neuron
			
<b>a</b> Anaxonic neurons have more than two processes, but axons cannot be distinguished from dendrites.	<b>b</b> Bipolar neurons have two processes separated by the cell body.	<b>c</b> Pseudounipolar neurons have a single elongate process with the cell body situated to one side.	<b>d</b> Multipolar neurons have a single axon and multiple dendrites.

**Neurons:** transfers info in the nervous system, contains soma, axon, dendrites

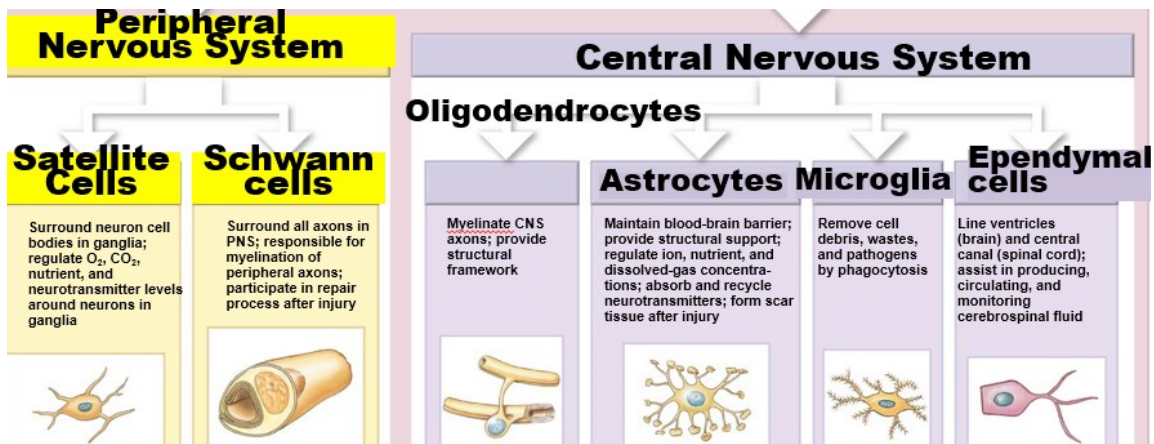
**Neuroglia:** cells that protects neuron

## Neuronal Organization circuits

		Serial processing	Parallel processing	
Divergence	Convergence			Reverberation
				
<b>a</b> Divergence; a mechanism for spreading stimulation to multiple neurons or neuronal pools in the CNS	<b>b</b> Convergence; a mechanism providing input to a single neuron from multiple sources	<b>c</b> Serial processing; neurons or pools work in a sequential manner	<b>d</b> Parallel processing; individual neurons or neuronal pools process information simultaneously	<b>e</b> Reverberation; a feedback mechanism that may be excitatory or inhibitory

## Classification of Neuroglia





**CNS neuroglia:**

**White matter** = myelinated axons

**Grey matter** = unmyelinated axons

### Central Nervous system

Brain can work with or without the spinal cord.

Spinal cord is the same, it can work without the brain.

### Spinal Cord

45 cm in length

Has 31 spinal segments/nerves

- 8 cervical
- 12 thoracic
- 5 lumbar
- 5 sacral
- 1 coccygeal

Each segment has dorsal root, dorsal root ganglia, ventral root, and spinal nerve.

**Spinal meninges** provide protection/shock absorption

### Reflexes

**Reflex:** immediate involuntary motor response

### Reflex Arc

1. Activation of sensory receptor
2. Relay info to CNS
3. Info processing
4. Activation of motor neuron
5. Response by effector

## **Lecture 8 The Digestive System**

**Peristalsis:** moves bolus in a wave like motion

**Segmentation:** churns and fragments digestive materials

### **Salivary Glands**

**Parotid** (cheeks): Largest, Drains to parotid duct

**Sublingual** (under tongue): Drains to sublingual ducts

**Submandibular** (under mandible): Drains to submandibular ducts

### **Pharynx**

Passage for food, liquid, & air

**Pharyngeal muscles:** (“Palantini” for palatal, “pharyngeus” for elevators)

- **Pharyngeal constrictors**
- **Laryngeal elevators**
  - Palatopharyngeus
  - Stylopharyngeus
- **Palatal** (Raises soft palate)
  - Tensor veli palantini
  - Levator veli palantini

### **Stomach**

Stores ingested food, produces chyme

**Regions of stomach:** fundus, cardia, body, and pylorus

Has pylorus and cardiac sphincters

### **Small intestine**

~20 ft long, 1.5-2.5 in diameter

#### **Regions of S.I.:**

- **Duodenum:** 10 in long, receives bile and enzymes
- **Jejunum:** 8 ft long, most digestion and absorption occurs here
- **Ileum:** 12 ft long, controls flow of materials to cecum.

**Plicae:** has microvilli and absorbs nutrients

**Intestinal crypts:** contains enteroendocrine cells that produce hormones/enzymes

\***Main differences between regions of S.I.:** Duodenum & jejunum has plicae, ileum has Peyer's patches

#### **Large Intestine**

~5 ft long, 3 in diameter

Reabsorbs water & absorbs vitamins

Stores shit

#### **Flow order of shit**

1. Shit leaves ileum, enters cecum
2. Shit goes up ascending colon
3. Around hepatic flexure
4. Across transverse colon
5. Around splenic flexure
6. Down descending colon
7. Around sigmoid flexure
8. In sigmoid colon
9. Into rectum

**Haustra:** pouches that allow expansion

**Taeniae coli:** long muscles that help peristalsis

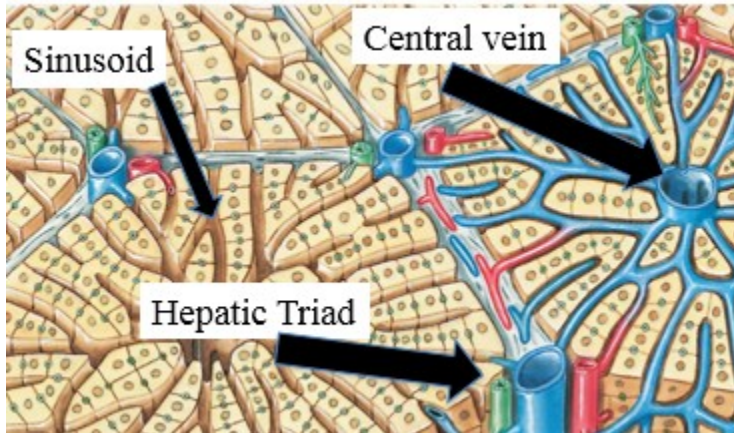
**Omental appendices:** "Flaps" of sacs of fat in intestine

#### **Liver**

Largest visceral organ in body

Regulates blood, metabolism, and stores bile

**Liver lobule:** functional unit of liver



**Gallbladder**

Has 3 regions: fundus, body, neck

Cystic duct leads to common bile duct

Stores & modifies bile

**Pancreas**

Consists of Head, body, tail, pancreatic duct (delivers secretions to duodenum)

**Acinar cells:** produces digestive enzymes (i.e. lipases, carbohydrases, nucleases, proteinases)

**Pancreatic islets:** produces hormones (i.e. insulin, glucagon, somatostatin)

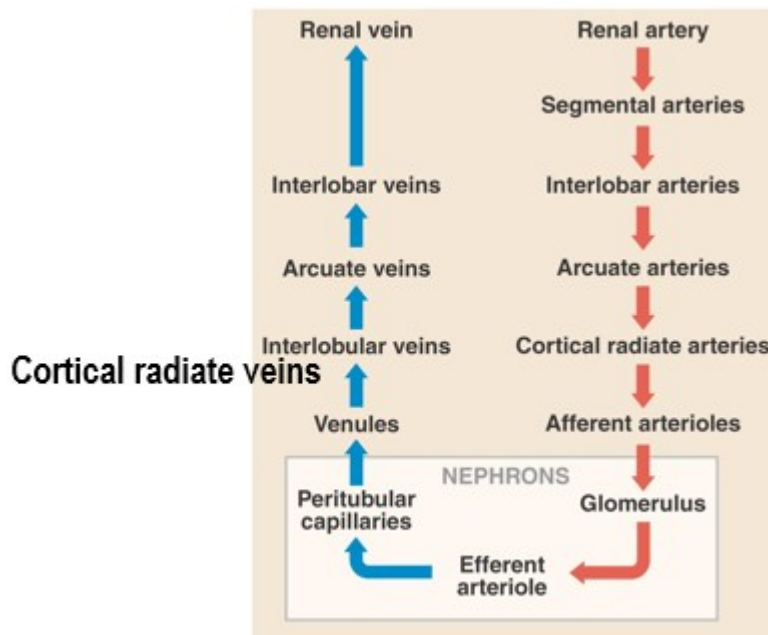
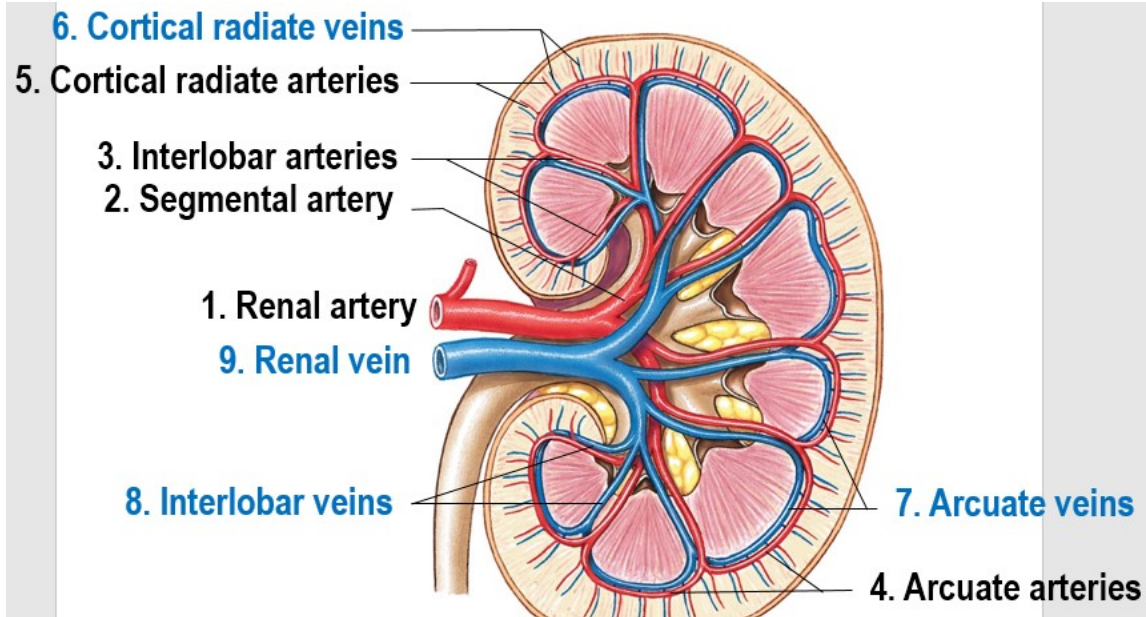
## Lecture 9 The Urinary System

Regulates ion concentration, BP, stabilize blood pH, prevents dehydration.

**Kidney**

Produces urine

**Blood Supply of Kidney**



## The Nephron

Functional unit of kidney

Reabsorbs organic material, 80% of water, secretes waste into filtrate.

2 Types:

**Cortical:** Short nephron loop, 85% of nephrons are cortical

**Juxtamedullary:** Long nephron loops, 15% of nephrons are juxtamedullary

## Renal Corpuscle

~200um diameter

Produces glomerular filtrate (protein free solution)

Consists of:

- **Glomerular capsule**
  - **Parietal layer:** lining of proximal convoluted tubule (PCT)
  - **Visceral layer:** podocytes
- **Glomerulus**

Filtration layers:

- **Capillary endothelium:** Has holes too small for blood cells
- **Basal lamina:** restricts large proteins, allows small proteins, ions, & nutrients
- **Glomerular epithelium:** allows water, ions, small organic molecules

### Juxtaglomerular complex

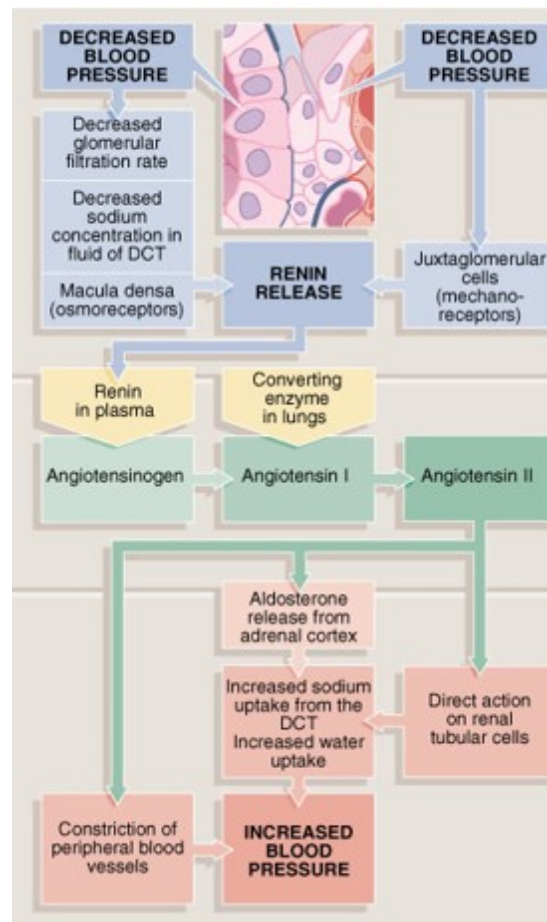
Types of cells:

- **Macula densa:** monitors electrolyte concentration
- **Juxtaglomerular:** secretes hormones
- **Mesangial:** provides support for arteries

Produces 2 hormones:

- **Renin:** regulates BP
- **Erythropoietin:** produces red blood cells

### Angiotensin system ----->



### Proximal Convoluted Tubule (PCT)

**Reabsorbs:** plasma proteins, all organic nutrients, 60% sodium/chloride ions, and other ions

### **Nephron Loop**

**Descending:** water enters bloodstream

**Ascending:** pumps ions out of loop

### **Distal Convolved Tubule (DCT)**

Secretes ions and acids, reabsorbs water, sodium/calcium ions

### **Collecting System**

Piss from **DCT** empties into **collecting duct**

**Travels** through **papillary duct, minor calyx, major calyx**

**Exits** kidneys through **ureter, urinary bladder, urethra**

### **Ureter**

Exits kidney into urinary bladder in the **trigone area**

### **Urinary bladder** (Males vs females)

**Males:** between rectum and pubis symphysis

**Females:** Inferior to uterus

### **Urethra** (Males vs Females)

**Males:** 18-20 cm, has prostatic, membranous, and spongy urethra

**Females:** 3-5 cm, external urethral orifice near anterior wall of vagina

\*Holding our piss is voluntary, we lose control as we age and/or spinal cord injuries.

## **Lecture 10 The Reproductive System**

Male gametes = sperm

Female gametes = ova

Ovum + sperm → fertilization = zygote

### **Testes**

5 cm long, 3 cm wide, 2.5 cm thick, 10-15 g

Hangs outside the body in the scrotum, which is 2°F cooler

Before birth, testes are in the abdominal cavity

### **Muscles of scrotum**

1. **Dartos:** Contracts, causes wrinkling
2. **Cremaster:** Contracts, pulls sac closer to body

\*Interstitial cells produce and release testosterone

**Spermatogenesis:** formation of sperm cells

**Spermatogonia:** stem cells that become sperm cells

### **Nurse cells**

Supports spermatogenesis, spermiogenesis (provides nutrients)

Secretes inhibin (controls rate of sperm formation), androgen-binding protein

\*acrosomal (head of sperm) contains enzymes for fertilization

### **Male Reproductive Tract**

Consists of Epididymis, Ductus deferens, & urethra

### **Accessory glands**

- **Seminal Glands:** ~ 60% semen volume
  - Produces seminal fluid & contents empty to ductus deferens
- **Prostate Gland:** ~ 20-30% semen volume
  - Weakly acidic, secretes seminalplasmin to prevent UTIs, contents empty to prostatic urethra
- **Bulbo-urethra glands:** ~5% semen volume
  - Secretes alkaline mucus and lubes penis, contents empty to spongy urethra

### **Ovarian Cycle**

1. Follicle-stimulating hormone begins cycle
2. Primary follicles → secondary follicles
3. Secondary follicles → tertiary follicles (~10-14 days)
4. Ovulation (Peak estrogen levels)
5. Formation of corpus luteum



\*No pregnancy corpus luteum becomes corpus albicans

## **Uterus**

Protects embryo

Pear-shaped, 7.5 cm long, 5 cm diameter, 30-40g

**3 layers:**

- **Endometrium:**
  - o **Functional Layer:** contains uterine glands, closest to uterine cavity
  - o **Basilar Layer:** closest to myometrium
- **Myometrium**
- **Perimetrium**

## **Uterine cycle**

Menstrual cycle (28 days)

- 1. Proliferation Phase:** endometrial lining thickens, prepares for egg implant
- 2. Secretory Phase:** endometrial glands enlarge, ready for egg implant
- 3. Menses:** decrease progesterin/estrogen, constricts blood vessels, loses endometrial cells (period)

## **Vagina**

Receives the penis ^^, holds sperm, serves as a passageway for birth

~7.5-9 cm long (not big enough ^^)

## **External Genitalia**

**Vulva:** THE ENTIRE GENITALIA AREA

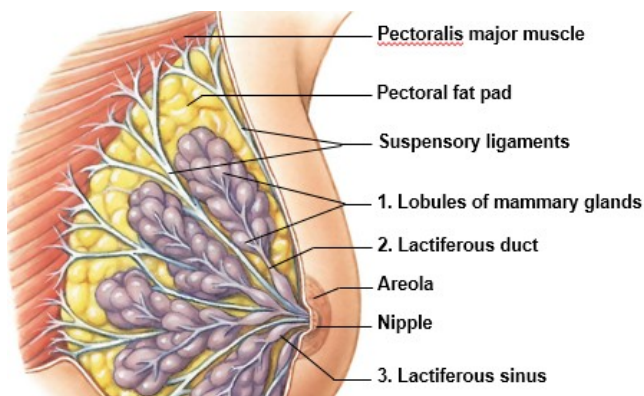
**Vestibule:** Opening of vagina, surrounded by the labia minora

**Clitoris:** Contains erectile tissue

**Prepuce:** skin surrounding the clitoris

**Labia majora and mons pubis:** Lateral and superior edges of the vestibule

**Hymen (when present):** elastic epithelial fold



## **Mammary glands**