

BMSN1601 – Anatomy – Part II (L11~L15)

Characteristic of an organism

Made of Cell	Growth and Development	Metabolism
Regulation (Maintain Homeostasis)	Reproduction	Responsiveness & Adaption

Definition of Anatomy & Physiology

☞ Anatomy is study of body structure, including the location, tissue types and associated structure

Surface Anatomy	Regional Anatomy	Systemic Anatomy
Cytology (Study of Cell)	Histology (Study of Tissue)	Radiographic anatomy (X-Ray)

☞ Physiology is study of body function, including the individual and cooperative functions of anatomical structure.

Composition of Cells

☞ 3 Main Parts: Cell Membrane, Cytoplasm with organelles, Nucleus

Water	> 70% of the cell mass
Organic Molecule	> 90% of the dry weight of cell
Inorganic Ion Presence in Water/Plasma	< 1% of the cell mass

Introduction of Primary Tissue – Epithelial Tissue

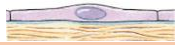


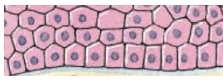


☞ Epithelial Tissue – (Specializations: Ciliated & Microvilli)

Covering epithelia	Cover Internal & External Surface
Glandular epithelia	Make & Secrete Substance

Function:

- ◆ Protection – Skin, Lining of Internal Organs
- ◆ Absorption – Intestines, Skin
- ◆ Filtration – Kidney
- ◆ Sensation – Sensors @ Skin
- ◆ Secretion – Hormones, Mucus, Sweat @ Skin

Location of Epithelial Tissue

Simple Squamous	Blood vessel, Air sacs	
Simple Cuboidal	Lines Kidney tubules, Glands	
Simple Columnar (Absorb, Mucus)	Lines most Digestive Organs	
Stratified Squamous	Outer layer of Skin, Mouth, Vagina	
Stratified Cuboidal (Secrete water/ion)	Sweat glands ducts	
Stratified Columnar (Secrete Mucus)	Epididymus, Mammary Glands, Larynx	

Characteristic:

Cells fit closely together	Polarity: apical and basal surfaces	Regenerate easily
Avascular (無血管) but has rich nerve supply	Attach via basal lamina to underlying connective tissue	The lateral surface is bound to other epithelial cells

Introduction of Primary Tissue – Connective Tissue

- Structure of Connective Tissue: Cells in Matrix / Vascularized (except cartilage) / Nerve Supply
- As a most abundant tissue in the Body

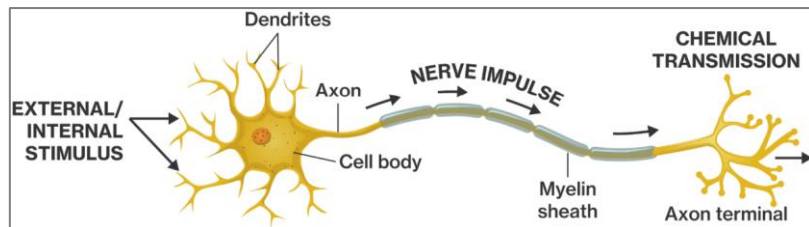
Adipose tissue	<ul style="list-style-type: none"> loose connective tissue with adipocytes (fat cells) matrix: gelatinous stores fat (energy) Insulation
Cartilage	<ul style="list-style-type: none"> matrix is rigid, non-vascular Presence with Chondrocyte (軟骨細胞) Protects ends of long bones
Osseous tissue (bone)	<ul style="list-style-type: none"> Hard tissue (Calcified Matrix) Presence with Osteocyte, Osteoblast Metabolically active
Ligament, tendon	<ul style="list-style-type: none"> Matrix: dense, regular arrangement of tightly packed protein fibers <ul style="list-style-type: none"> Collagen (膠原) Presence with fibroblast <ul style="list-style-type: none"> a cell in connective tissue which produces collagen and other fibers.
Blood	<ul style="list-style-type: none"> Fluid matrix: plasma Presence with red blood cell, white blood cell and platelet (血小板) Transports substances throughout the body

Introduction of Primary Tissue – Muscle Tissue

- Excitable, responds to stimulation → Contracts and relaxes to support movement

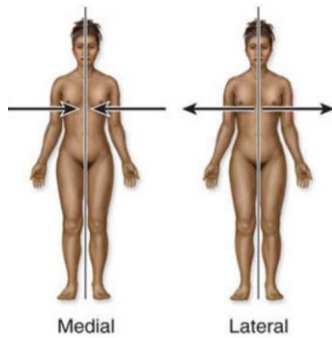
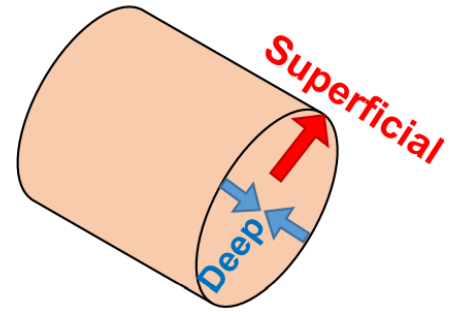
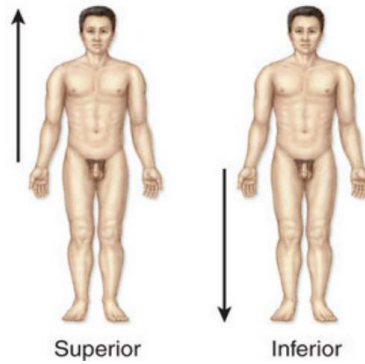
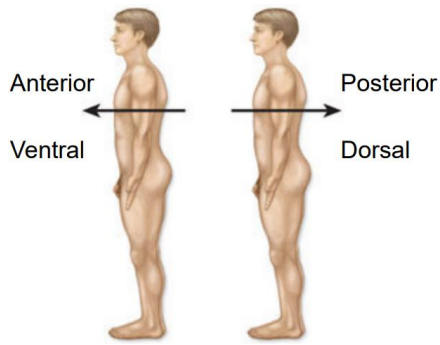
Skeletal Muscle	Smooth Muscle	Cardiac Muscle
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Introduction of Primary Tissue – Nervous Tissue @ Brain, Spinal Cord, Nerves

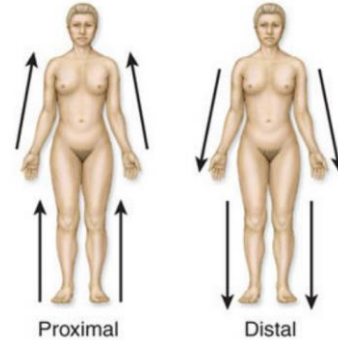


- Excitable
- Transmits and processes information between brain and other part of body
- Controls movement, reflexes, and receives sensory information

Directional terms of Anatomy

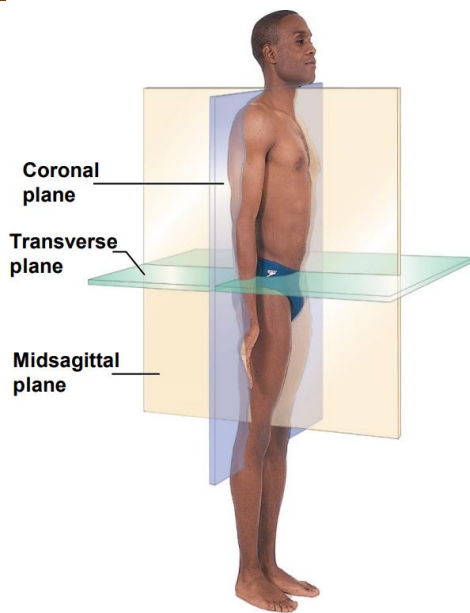


(Medial: Toward the Central Axis)
(Lateral: Away from the Central Axis)

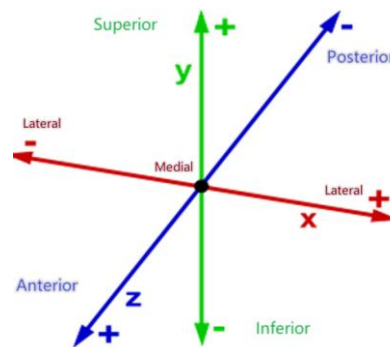


(Proximal: Toward the Joint)
(Distal: Away from Joint)

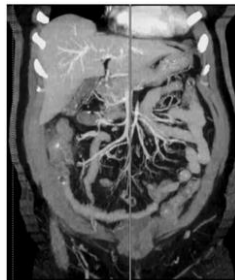
Body Planes



- ✎ Coronal (frontal) plane → Anterior and Posterior
- ✎ Transverse (horizontal) plane → Superior and Inferior
- ✎ Mid-sagittal (median) plane → (Equal left and right halves)
- ✎ Sagittal Plane → (Unequal left and right parts)



Sagittal



Coronal



Transverse

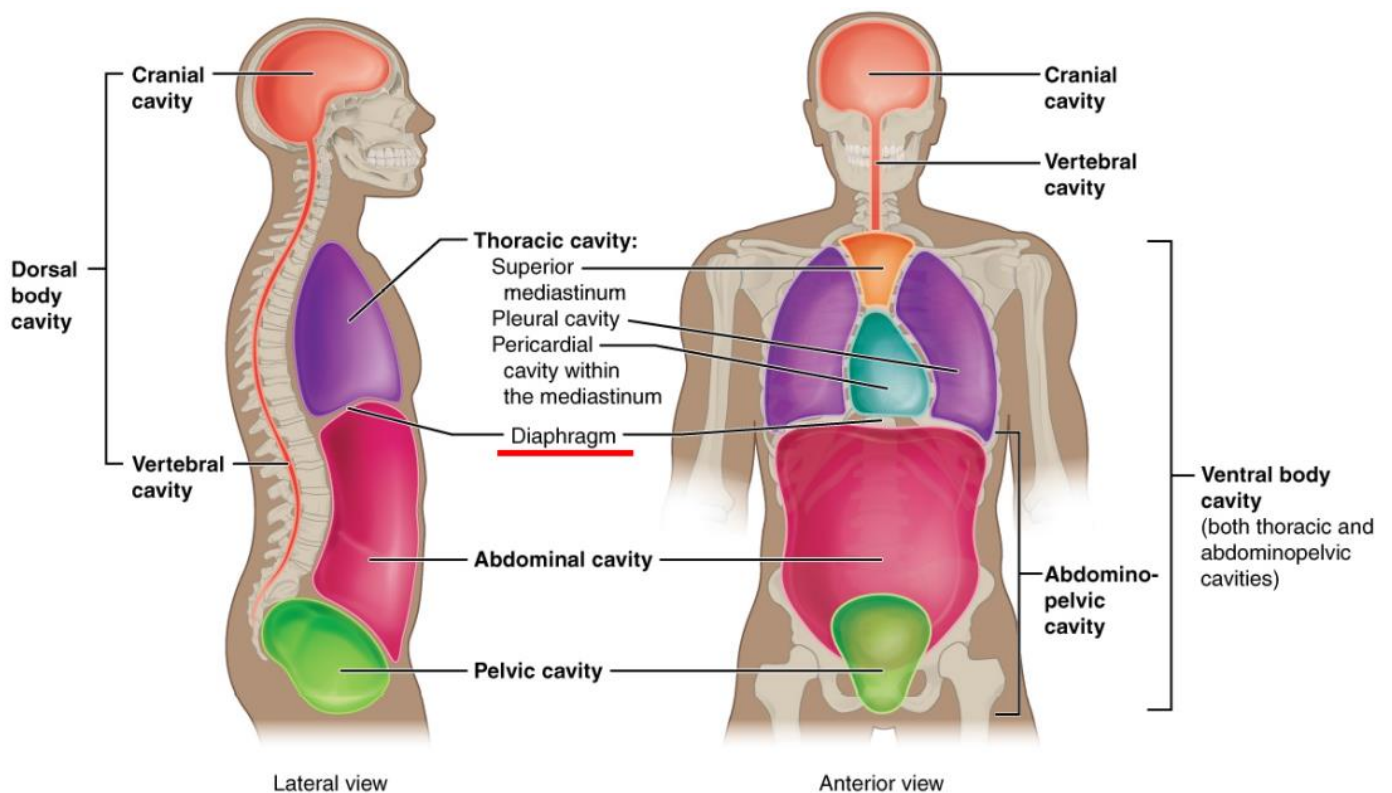
Body Cavity

Contain and protect delicate internal organs

Dorsal (posterior) cavity	Cranial	Brain formed by skull bones
	Vertebral	Spinal cord formed by vertebral column bones

Allows changes in size & shape of organs during their functions

Ventral (anterior) cavity	Thoracic	Lungs, heart, esophagus and trachea
	Abdominopelvic	Organs of digestion, liver, bladder and internal reproductive organ (Largest)



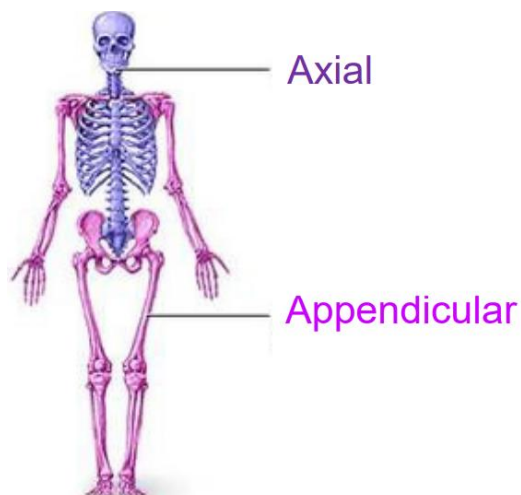
Regional anatomy

☞ Axial

- Head
- Neck
- Trunk

☞ Appendicular

- Upper Limbs (上四肢)
- Lower Limbs (下四肢)



Introduction to Circulatory System

☞ The circulatory system transports fluids throughout the body.

◆ Cardiovascular system (Blood Transportation Network)

→ **Generates and regulates blood pressure**

→ Pumps the blood through both pulmonary and systemic circuits

Pulmonary circuit: Carries deoxygenated blood from the heart to the lungs for gas exchange and returns oxygenated blood to the heart

To the Lung

Systemic Circuit: Carries oxygenated blood from the heart to supply the whole body (including the lungs and the heart themselves) and returns deoxygenated blood back to the heart

Supply Necessity

◆ Lymphatic system (Lymph Transportation Network)

→ **Maintain Fluid Balance** ⇒ Recover the fluid lost from blood capillaries

→ **Body Defense** ⇒ Guard against Pathogens

→ **Fat absorption via intestinal lacteals** ⇒ **Chyle** (lymph + lipids) is absorbed

Organization of Cardiovascular System

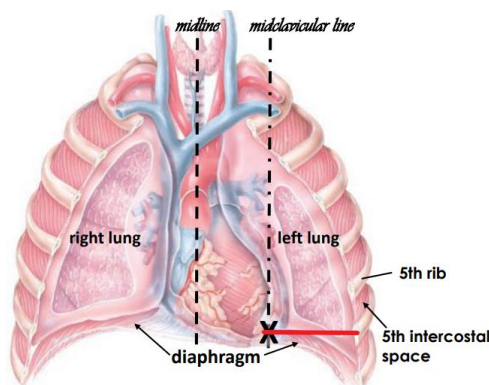
☞ Shape of the Heart

◆ Tilted and inverted pyramid, pointing toward inferior left

◆ The apex of the heart is the inferior blunt tip, sit on the diaphragm

◆ The base of the heart is the broad superior portion facing the thoracic vertebrae, made up of right and left atrium

☞ Location of the Heart



◆ In the mediastinum

◆ Superior to the diaphragm

◆ Posterior and to the left of the sternum (胸骨)

◆ Apex locates at the left midclavicular line of the 5th intercostal space

☞ Cardiac Muscle & Coronary Circulation

◆ Coronary arteries supply blood to the heart muscle.

■ Right & Left coronary artery

◆ Cardiac veins collect and return blood to the right atrium through the coronary sinus

■ Great & Middle & Small cardiac vein

☞ Conducting System of Heart

◆ Specialized cardiac conducting cells (e.g: sinoatrial node) initiate and conduct the electrical signals locally, ensure that the four heart chambers are coordinated with each other.

☞ Innervation (精神支配) of the Heart

◆ The heart is supplied by cardiac plexus (神經) formed of sympathetic and parasympathetic fibers, part of the autonomic nervous system

◆ Sympathetic stimulation: **Increase heart rate** & **Dilation of coronary arteries**

◆ Parasympathetic stimulation: **Decrease heart rate** & **Constriction of coronary arteries**

✂ Anatomy of the Heart

1. Heart Wall

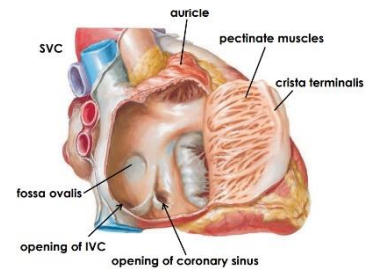
- ◆ Epicardium (visceral layer of serous pericardium): contains coronary vessels
 - As Lubrication
- ◆ Myocardium: thickest layer, formed by cardiac muscle cells
- ◆ Endocardium: lines the chambers of the heart by **a layer of simple epithelium**

2. Heart chambers

- ◆ Two Atria: Thin-walled, Upper Chambers → As receiving chambers
- ◆ Two Ventricles: Thick-walled, Lower Chambers → As Pumping Chambers

3. Right Atrium @ (forms the right border of the heart)

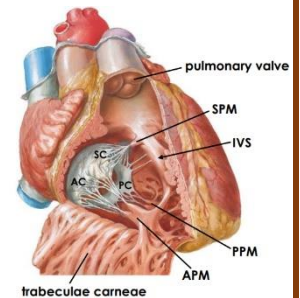
- ◆ A smooth wall posteriorly (後方) containing:
 - ❖ Opening of Superior vena cava (SVC)
 - ❖ Opening of Inferior vena cava (IVC)
 - ❖ Opening of the coronary sinus
- ◆ A rough, muscular wall, which formed by **pectinate muscles**, anteriorly
- ◆ **Crista terminalis** separating smooth and rough wall
- ◆ An oval, thumbprint-sized depression, called **fossa ovalis**, in the **interatrial septum**
- ◆ An ear-like **right auricle** projected superiorly and anteriorly



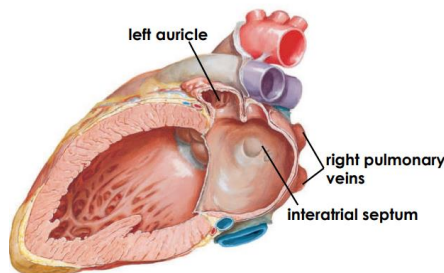
4. Right Ventricle @ (forms the anterior surface and the inferior border of the heart)

- ◆ Guarded by **tricuspid valve** at **right atrioventricular (AV) orifice**

anterior cusp (AC) posterior cusp (PC) septal cusp (SC)	} tendinous cords (chordae tendineae) }	anterior papillary muscle (APM) posterior papillary muscle (PPM) septal papillary muscle (SPM)
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- ◆ Separated from left ventricle by **interventricular septum (IVS)**
- ◆ Communicates with the pulmonary trunk through pulmonary valve (semilunar valve)
- ◆ Contains a rough, muscular wall (**trabeculae carneae**)



5. Left Atrium @ (forms most of the base of the heart.)

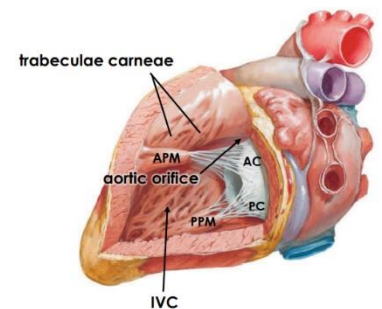


- ◆ A large smooth-walled part and a smaller muscular left auricle containing **pectinate muscles**
- ◆ Opening of four pulmonary veins
- ◆ Smooth-walled **interatrial septum**

6. Left Ventricle @ (forms most of the base of the heart)

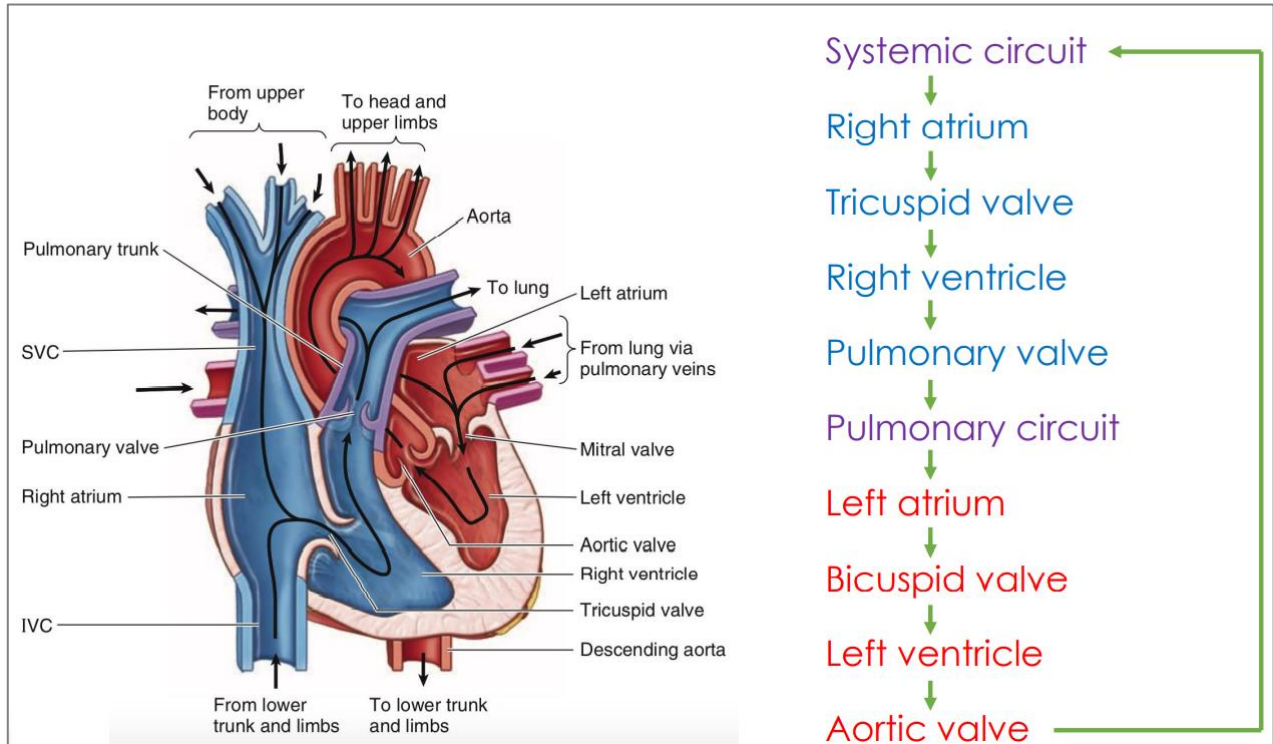
- ◆ Guarded by bicuspid valve at the left AV orifice

anterior cusp (AC) posterior cusp (PC)	} tendinous cords (chordae tendineae) }	anterior papillary muscle (APM) posterior papillary muscle (PPM)
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- ◆ Separated from right ventricle by IVS
- ◆ Communicates with the ascending aorta via aortic valve (semilunar valve) at aortic orifice
- ◆ Contains a thick, rough, muscular wall, **trabeculae carneae**

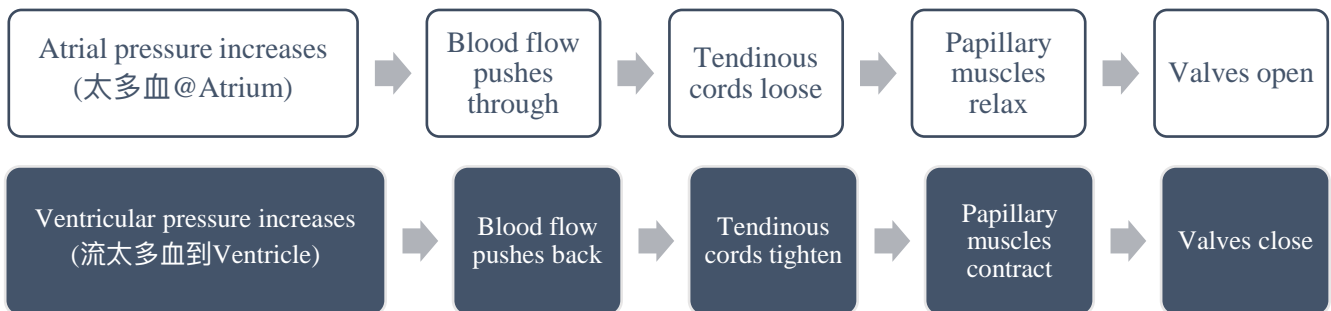
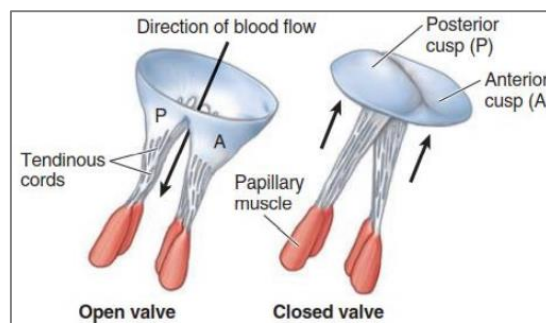


Blood Flow in Heart & Valves

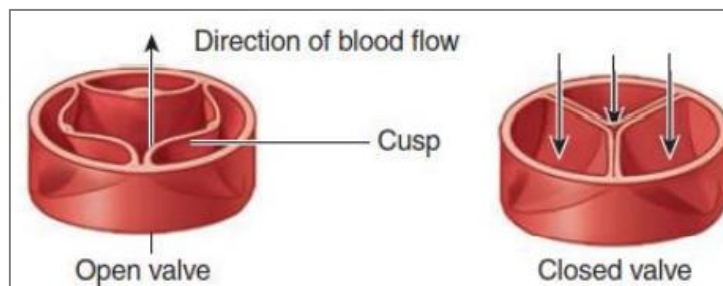
☞ Blood Flow in Heart



☞ Blood Flow Through Bicuspid/Tricuspid Valves



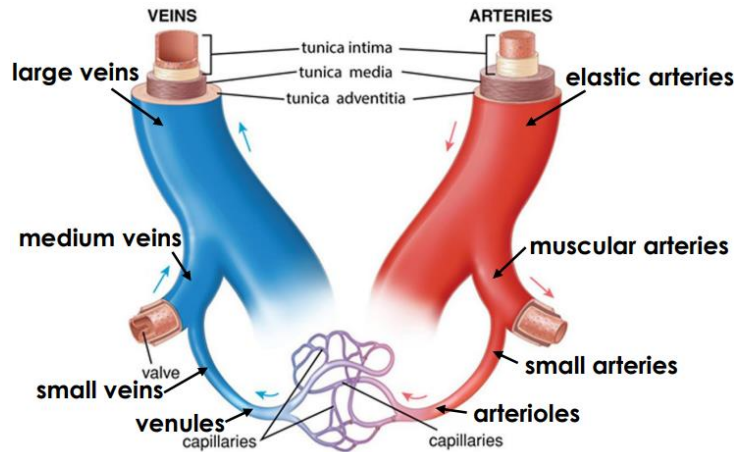
☞ Blood Flow in Semilunar Valves



- Ventricular pressure increases → blood flow pushes the cusps aside → valves open
- Ventricular pressure decreases → **reflux of blood enter pulmonary sinuses** → valves close

Structure of Blood Vessels

☞ The walls of arteries and veins are composed of 3 layers



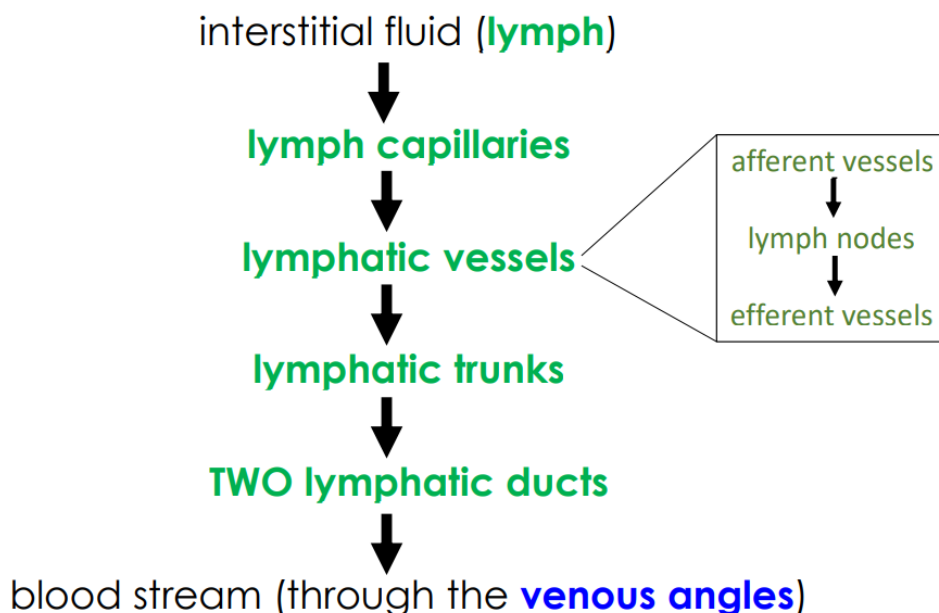
	Tunica intima	Tunica media	Tunica externa
Arteries	most elastic tissue	varies	relatively thick
Veins	very little tissue	thin layer	relatively thick
Capillaries	simple endothelial lining	absent	very delicate

- tunica intima: elastic tissues & endothelial lining
- tunica media: elastic fibers & smooth muscle
- tunica externa (adventitia): connective tissues

Major lymphatic tissue and organs

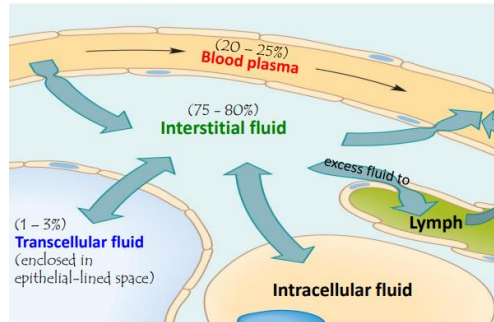
Primary Organs	Sites where lymphoid stem cells are divided and matured into immunocompetent T and B cells	☞ Thymus → (T cells) ☞ Bone marrow → (B cells)
Secondary organs	Immunocompetent (免疫活性) cells populate these tissues and initiate immune responses to foreign antigen	☞ lymph nodes / vessel ☞ spleen (脾胃) ☞ Tonsils

Lymphatic circulation



Body composition

intracellular fluid ($\frac{2}{3}$ of total body fluid)
 extracellular fluid ($\frac{1}{3}$) $\left\{ \begin{array}{l} \text{intravascular fluid (20–25\%)} \\ \text{interstitial fluid (75–80\%)} \\ \text{transcellular fluid (1–3\%)} \end{array} \right\}$ $\left. \begin{array}{l} \text{blood} \\ \text{lymph} \end{array} \right\}$



Body Composition: More Fat – Less Water

- Elderly have less body water than the young one
 - A decrease in lean body mass in favor of fat during aging,
- Women contains less water (%) than men.

Man	Women	Elderly
50-60%	~50%	45%-55%

Infusion solutions used for fluid imbalance

Isotonic	Hypertonic	Hypotonic
Maintain the homeostasis	Let Solute be more concentrated	Let Solute be less concentrated
Example: Bleeding Isotonic Saline	Example: Hyponatremia Hypertonic Saline	Example: Hypernatremia Hypotonic Saline



Definition of:

- Isotonic: solution has the osmolarity the same as that inside the cell & blood
- Hypertonic: solution has the osmolarity higher than that inside the cell & blood
- Hypotonic: solution has the osmolarity lower than that inside the cell & blood

Osmolarity v.s. Osmolality



Osmolality: number of all solute particles per unit weight

Osm/kg

(Weight does not change with environmental temperature) [熱脹冷縮]



Osmolarity: number of all solute particles per unit volume

Osm/L

Crystalloid VS Colloid infusion solution

- ☞ Crystalloid: Has solutes which can pass through cell membrane
 - Isotonic crystalloid solution: 0.9% saline, 5% dextrose (glucose)
- ☞ Colloid: Has solutes which are too big to pass through cell membrane
 - As volume or plasma expander
 - Example: Albumin (hypertonic [20%] or isotonic [4%]) for hypoalbuminemia (低蛋白血症) or hypovolemia (低血容量)

Introduction to Blood

Physical Characteristic:

- Sticky
- Opaque (Non-transparent)
- 8% of Body Weight → male: 5 – 6 L ; female: 4 – 5 L
 - ◆ 70 kg man, his blood: ~ 5.6 L (density ~1kg/L under 1atm)
- High Oxygen Level: scarlet red
- Low Oxygen Level: dark red
- pH: 7.4

Composition to Blood

- Plasma: ~55% of total volume
- Buffy coat (leukocyte, platelet) <1%
- **Erythrocytes** ~45% of total volume

Introduction to RBC/erythrocyte

Characteristic of RBC			
biconcave	no nucleus & no organelles	no mitochondria	Flexible
More surface area for gas exchange	More hemoglobin is packed inside cell	Does not consume Oxygen	Change shape when passing through capillaries

One Hemoglobin has Four Subunits → Four Heme Group → Each Heme Binds to One Oxygen molecule

Introduction to Leukocytes

Leukocytes: responsible for inflammation, phagocytosis, fever & adaptive immunity

Leukocytes				
Neutrophil	Lymphocyte e.g. B cell, T cell	Monocytes/macrophage	Eosinophil	Basophil

Neutrophil	<ul style="list-style-type: none"> Most abundant leukocyte in blood Bacterial slayer Phagocytic
Lymphocyte	<ul style="list-style-type: none"> non-phagocytic crucial to adaptive immunity found in lymphoid tissues [NOT BLOOD CIRCULATION]
Monocytes/macrophage	<ul style="list-style-type: none"> largest of all leukocyte various cellular targets <p>When entering tissue → macrophage → chief phagocytic & prefer to reside in tissue</p>
Eosinophil	<ul style="list-style-type: none"> phagocytic target parasitic worms <u>Induce allergies and asthma (哮喘) by stimulating basophils</u>
Basophil	<ul style="list-style-type: none"> Phagocytic release heparin to counteract (抵消) blood clotting release histamine (inflammatory chemicals) <ul style="list-style-type: none"> → induce vasodilation (血管扩张) & <u>Attract leukocytes to inflamed sites</u>

Introduction to Cardiovascular System

Function of Cardiovascular System:

- To transport O₂ for cellular respiration and remove excess CO₂
- To transport urea to kidney
- To transport nutrients
- To control the body temperature
- To transport hormone to target organs/tissue
- To deliver white blood cell & antibodies
- To deliver clotting factors & platelets

Component of Cardiovascular System

- Heart: functions as a pump to systemic & pulmonary circulations
- Arteries: carry blood away from heart
 - ◆ It carries oxygenated blood except pulmonary arteries & umbilical artery
- Veins: carry blood back to heart
 - ◆ It carries deoxygenated blood except pulmonary veins & umbilical vein
- Micro-circulation:
 - ◆ composed of arterioles, capillaries & venules which provide a region of material exchange in every organs

Recap: Blood Flow in Heart

right atrium	receives from <u>superior vena cava & inferior vena cava</u> ☞ SVC receive <u>venous blood</u> (deoxygenated blood) from <u>organs superior the diaphragm</u> ☞ IVC receive <u>venous blood</u> (deoxygenated blood) from <u>organs inferior the diaphragm</u>
right ventricle	push the deoxygenated blood to pulmonary arteries → lung
Left atrium	Receive the oxygenated blood from pulmonary veins
Left Ventricle	Push the oxygenated blood to systematic circuit
! : Blood in Ventricle mainly (80%) filled by ventricular relaxation → Only 20% of Blood is pumped by atria	
<u>ventricles relax that creates suctional force to draw atrial blood or even blood in vena cava</u>	

Recap: Blood Flow & Valves

atrioventricular valves @ Atria	close to prevent blood backflow <u>during ventricular contraction</u> (When Blood is ready to push to the Pulmonary Atria / Atria)
semilunar valves @ Ventricles	close to prevent blood backflow <u>during ventricular relaxation</u> (When Ventricle is ready to suck the blood from the atria)

Comparison between Pulmonary Circulation & Systemic Circulation

Pulmonary Circulation	Systemic Circulation
SP/DP: 24/10	SP/DP: 120/80
Lower Resistance	Higher Resistance
Deoxygenated Atrial Blood	Oxygenated Atrial Blood
Oxygenated Venous Blood	Deoxygenated Venous Blood
<u>vasodilation & vasoconstriction mainly depending on blood oxygenation</u>	<u>vasodilation & vasoconstriction mainly depending on hormone: adrenaline</u>
<u>Same Blood Flow</u>	
$Q = \frac{\Delta P}{R}$ Given that R is smaller and P is also smaller → Balanced → Same Blood Flow	

Introduction to Blood Circulation – Systemic Circuit

☞ Blood is supplied to every organ **in parallel**

■ Benefit of **In Parallel**:

- ◆ Same Arterial Composition
- ◆ Similar Arterial Pressure

☞ Characteristic of different type of blood vessel

Arteries	<ul style="list-style-type: none"> ☞ Muscular for high blood pressure ☞ Control the blood flow by vasoconstriction / vasodilation
Capillaries	☞ For Material Exchange
Veins	<ul style="list-style-type: none"> ☞ Less Muscular ☞ More Elastic ☞ More Distensible (~20x) → As reservoir to store 70% of the blood

☞ Recap: Pulse Pressure / Systolic Pressure / Diastolic Pressure

- Pulse Pressure = Systolic Pressure – Diastolic Pressure (Respond to the resistance of blood flow against the vessel)
 - ◆ (WSD) Wide Pulse Pressure: Increase in Systolic Pressure / Decrease in diastolic Pressure
 - ◆ (NDS) Narrow Pulse Pressure: Increase in Diastolic Pressure / Decrease in Systolic Pressure

Type of Pressure	The Normal Range of the Pressure
Systolic Pressure	~120mmHg
Diastolic Pressure	~80mmHg
Pulse Pressure	30~50 mmHg

Implimentation of the Pulse Pressure & Clinic Suituation

☞ **Aortic regurgitation**

- When **aortic valve** cannot close properly during **ventricular relaxation**
 - The Blood Flow Back to the Atria → DP is Decreased & Blood Flow is Decreased
 - As the Ventricular Contraction is No Change → No Change in SP
 - Pulse Pressure is Wider (Blood Pressure in the Aorta is Decreased)

Pulse Pressure ≠ Blood Pressure in the Aorta

- ! Pulse Pressure means the Pressure act on the blood by the heart (E.M.F)
- Blood Pressure means the Pressure against the blood vessel by the blood (Potential Difference)

Reference:

In aortic insufficiency, the three flaps of the aortic valve, called leaflets, do not close tightly, allowing blood to leak back into the heart. This causes a decrease in blood pressure in the aorta, an increase in pulse pressure, and a decreased forward flow of blood.

In normal situation, widen the pulse pressure should increase the blood flow, narrow pulse pressure should decrease the blood flow. However, under wide pulse pressure, blood flow will decrease if and only if there is Aortic Regurgitation.

Thus, it is not a must for the positive relationship between pulse pressure and blood flow. On the other hand, we can find out there must be something wrong if there is no positive relationship between pulse pressure and blood flow.

☞ **Aortic Stenosis** (can be spotted by palpatation of pulse)

- **Aortic Valve Cannot open Fully** → The Systolic Pressure is dropping (NDS)
 - The Pulse Pressure is dropping
 - The Blood Flow is decreased

Introduction to Anatomy of Respiratory System

Recap: Function of Respiratory System

- Gas Exchange、Olfaction (嗅覺)、Phonation (发声)

Recap: Anatomical Separation of Respiratory System

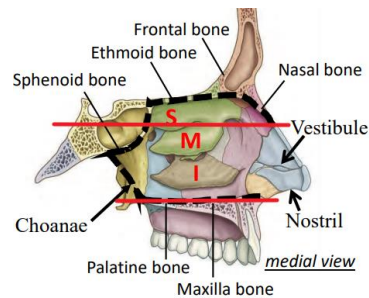
- The Respiratory Tract
- The Lungs
- The Muscle of respiration

Recap: Components of upper and lower respiratory tracts

The Components of upper respiratory tracts

The Nose

Nose	<ul style="list-style-type: none"> Support by bones Support by cartilages
Nasal Cavity	<ul style="list-style-type: none"> There are four boundaries of nasal cavity: <ul style="list-style-type: none"> ■ Roof ■ Floor ■ Medial Wall ■ Lateral Wall



Notes:

roof (nasal, frontal, ethmoid and sphenoid bones)

floor (maxilla bone and palatine bone)

medial wall (nasal septum)

Ethmoid Bone: superior(S) and middle(M) nasal conchae

Maxilla: inferior(I) nasal conchae

The Nasal Cavity

The Nasal conchae divide the nasal cavity into 4 Passages:

- ☞ Spheno-ethmoidal recess
- ☞ Superior Nasal meatus
- ☞ Middle Nasal Meatus
- ☞ Inferior Nasal Meatus

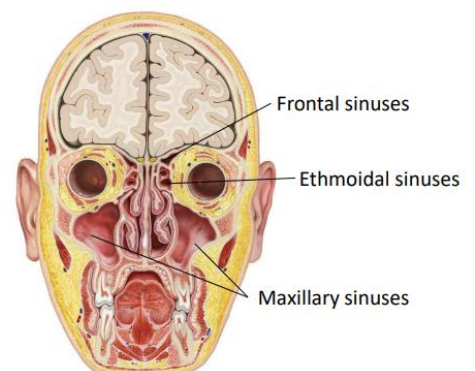
The Paranasal Sinus

There are four sinuses considered as the paranasal sinus:

- ☞ **maxillary sinuses**
- ☞ **frontal sinuses**
- ☞ **ethmoidal sinuses**
- ☞ **sphenoidal sinuses**

Notes: Do notice that the sinuses are double-sided,

In total, there are 4 pairs of sinuses



The Pharynx

The **muscular funnel-shaped structure** extending from choanae to the larynx

There are four pharynxes:

- ☞ nasopharynx
- ☞ oropharynx
- ☞ laryngopharynx

☞ The Components of Lower Tract of Respiratory System

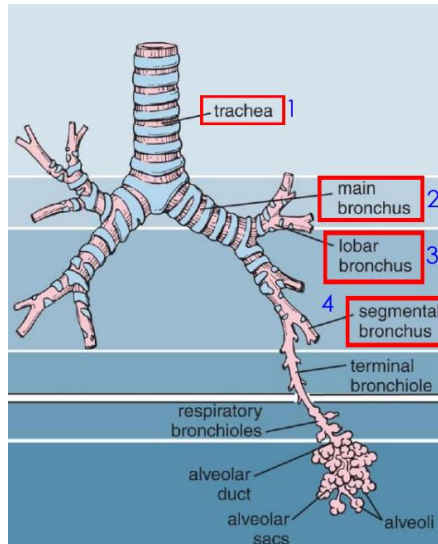
The Larynx

☞ The **hollow musculoligamentous structure** with **a cartilaginous framework (9 cartilages)** that connects to the trachea

☞ Functions:

- ◆ Respiration
- ◆ Phonation
- ◆ **Guard the air passage during depression of epiglottis (swallowing)**

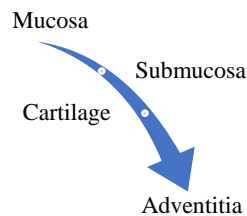
Tracheobronchial Tree



Trachea

☞ The trachea is **supported by C-shaped rings of hyaline cartilage**.

☞ the **wall of trachea has 4 layers: From Inner to Outermost**



1. Mucosa: consists epithelium **goblet cells and ciliated cells** → **Mucus-secreting Cell**
2. Submucosa: consists serous and mucous glands
3. Cartilage
4. Adventitia

Main bronchus

Lobar bronchus

Segmental bronchus

☞ **each supplies a bronchopulmonary segment**

Terminal bronchiole

Respiratory bronchioles

Alveolar duct

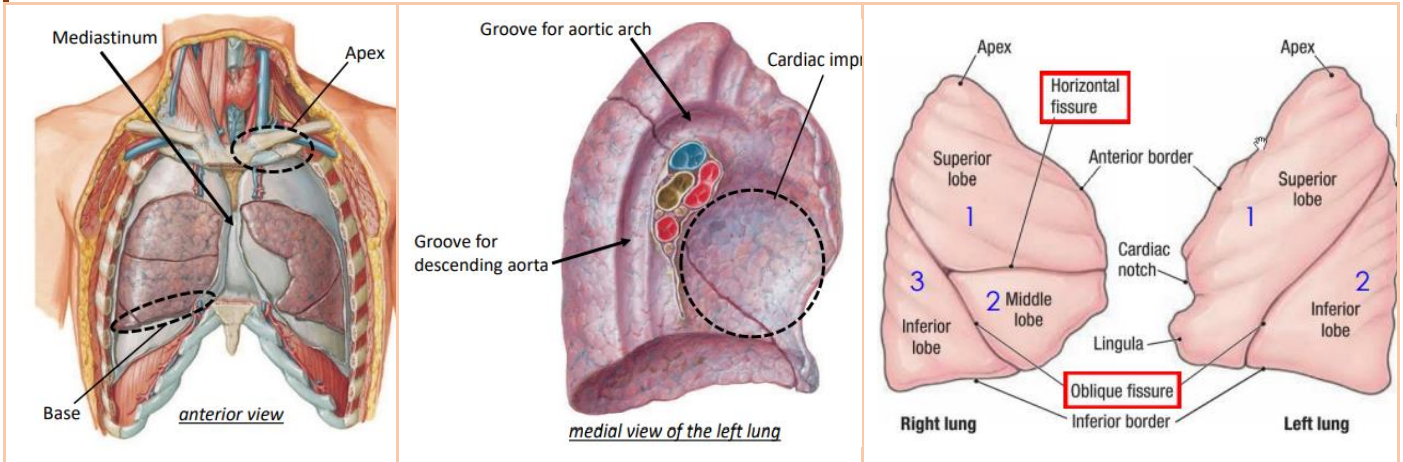
Alveolar sacs

Alveoli

☞ Functional Division of the Tracheobronchial Tress

- Conducting zone (lined by **respiratory epithelium** / **pseudostratified ciliated columnar epithelium**)
- Respiratory zone (lining gradually changes to **alveolar epithelium** / **simple squamous epithelium**)

Anatomy features of the Lung



- ☞ Apex
 - Superior the level of the 1st rib, ascending into the root of the neck
- ☞ Base
 - the concave inferior surface, resting on the diaphragm
- ☞ Cardiac impression
 - a depression at mediastinal area for accommodating the heart
- ☞ Groove for aortic arch/descending aorta
 - an arched furrow caused by the impression of aortic arch and descending aorta
- ☞ Fissures
 - horizontal fissure @ 4th rib
- ☞ Oblique fissure
 - Posterior to T4 vertebral
 - Anterior to 6th rib
- ☞ Lobes
 - superior and inferior to the Left Lung
 - superior, middle and inferior to the Right Lung

Lungs & Pulmonary artery / veins

☞ Each Lung Has:

One pulmonary artery:

Each pulmonary artery → secondary lobar arteries & tertiary segmental arteries running anteriorly along the corresponding bronchus.

Two pulmonary veins:

Pulmonary veins run independently of arteries and bronchi coursing between the adjacent bronchopulmonary segments.

Introduction to Innervation of the lungs

☞ The lungs are supplied by pulmonary plexus formed of sympathetic and parasympathetic fibers, part of the autonomic nervous system.

Sympathetic stimulation	<ul style="list-style-type: none"> ☞ dilates bronchi ☞ reduces secretion
Parasympathetic stimulation	<ul style="list-style-type: none"> ☞ constricts bronchi ☞ promotes bronchial secretion

Pleura and Pleural Cavity

- ☞ Each lung is enclosed in a pleural sac that consists of two continuous membranes:
 - **visceral pleura** / adherent to surfaces of the lungs
 - **parietal pleura** / adherent to the thoracic wall, mediastinum and diaphragm
- ☞ The potential space between the layers of pleura is **pleural cavity**, containing **serous pleural fluid**.
- ☞ **Costodiaphragmatic recesses** is the lowest area in pleural cavity

Thoracic cage

- ☞ The **thoracic skeleton** forms the **thoracic cage** → **protect the heart and lungs & provide attachment for muscles**

Introduction to the Hilum of the lung

- ☞ **The hilum of the lung** is the area where the structures **form the root**
 - which **connects the lung with the heart and trachea**

Pulmonary artery	Superior pulmonary veins inferior pulmonary veins	Main bronchus surrounded with bronchial vessels	lymphatic vessels Lymphatic nerves
The bronchial arteries supply the pleura near the hilum → provide oxygenated blood to lung tissues			

Introduction to the Intercostal space & Diaphragm

Intercostal neurovascular bundles are hidden in the costal groove

from superior to inferior:

intercostal Vein

intercostal Artery

intercostal Nerve

external intercostal muscle	internal intercostal muscle	innermost intercostal muscle
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Diaphragm is a musculotendinous structure innervated by phrenic nerve → As primary respiratory muscle		
right dome	left dome	central aponeurotic part

Introduction to Mechanism of Respiration

<p>Quiet inspiration</p> <p>→ develops a negative intrathoracic pressure</p>	<ul style="list-style-type: none"> ∞ Diaphragm contracts <ul style="list-style-type: none"> → increase the vertical diameter ∞ External intercostal muscles contract <ul style="list-style-type: none"> → increase the transverse → increase AP diameters
<p>Passive expiration</p> <p>→ passive recoil of the lungs</p>	<ul style="list-style-type: none"> ∞ diaphragm relaxes <ul style="list-style-type: none"> → decrease the vertical diameter ∞ external intercostal muscles relax <ul style="list-style-type: none"> → decrease the transverse → decrease AP diameters
<p>Forced (Active) inspiration</p> <p>→ allow additional increase in the AP and transverse diameters</p>	<ul style="list-style-type: none"> ∞ anterior and middle scalene muscles contract <ul style="list-style-type: none"> → lift the 1 st rib ∞ diaphragm and external intercostal muscles contract <ul style="list-style-type: none"> → increase the diameter ∞ pectoralis and sternocleidomastoid muscles (SCM) <ul style="list-style-type: none"> → raise the ribs and sternum
<p>Forced (Active) expiration</p> <p>→ allow further increased intrathoracic pressure</p>	<ul style="list-style-type: none"> ∞ internal and innermost intercostal muscles contract <ul style="list-style-type: none"> → depress ribs → decrease space in the thoracic cavity ∞ abdominal muscles contract <ul style="list-style-type: none"> → depress lower ribs → compress abdominal contents → push up respiratory diaphragm