

1st lecture
In
Anatomy & Physiology
For
1st Class
By
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Anatomy and Physiology

Anatomy

It is a descriptive science

- It describes the shape, structure, location, of the organs and systems in the body and also it describes the relation of each organ with others.

Division of the anatomy

Mainly we study two types of anatomy:

1. **Gross anatomy:** It needs naked eye to describe the organs.
2. **Histology (microscopic anatomy):** it needs microscope to describe the tissue and cells.

Physiology

- Physiology studies **the function** of cells, tissue, organs, and systems. i.e. what the organs do?
- In other wards it tell us how body organs work?

Why do we study both (anatomy and physiology)?

- Function cannot occur without structure.
- Functions are often dictated by shape.
- In order to understand the function we should know the structure and shape of the organ
- Example: the hands and feet both of them have the same structure (bones, joints, muscles, and skin) which make them to move but the shape of their bones, muscle, and also joints are differ. So the function of hands is differ from the feet.

Body fluids (water) and electrolytes

- Body contains many different elements example: Oxygen, Hydrogen, Carbon, Nitrogen, Potassium, Sodium,.....ect.
- Elements in the body are divided into two types (as in the table)

Elements in the body are divided into two types

Major elements (99.3% of total atoms)

- * Hydrogen "H" (63%)
- * Oxygen "O" (26%)
- * Carbon "C" (9%)
- * Nitrogen "N" (1%)

Minor elements (0.7% of total atoms)

Mineral elements:

- * Calcium "Ca"
- * Potassium "K"
- * Sodium "Na"
- * Magnesium "Mg"
- * Phosphorus "P"
- * Sulfur "S"
- * Chlorine "Cl"

Trace elements: less than 0.01 of total atoms

- * Iron "Fe"
- * Iodine "I"
- * Copper "Cu"
- * Zinc "Zn"
- * Manganese "Mn"
- * Cobalt "Co"
- * Chromium "Cr"
- * Selenium "Se"
- * Fluorine "F"
- * Silicon "Si" and others

Fluids Compartments

- Total body Fluids represents 60% of body weight.
- So person with 70 Kg has 42 liters of fluids.
- Man has more fluid than women because women relatively has more adipose tissue.
- Obese person has less fluid.

**Body
Fluids**
(70 Kg B.w.)

**Intracellular
Fluid (ICF)**
($2/3$ of all fluids = 28
Liters)

**Extracellular
fluids (ECF)**
($1/3$ of all fluids = 14
Liters)

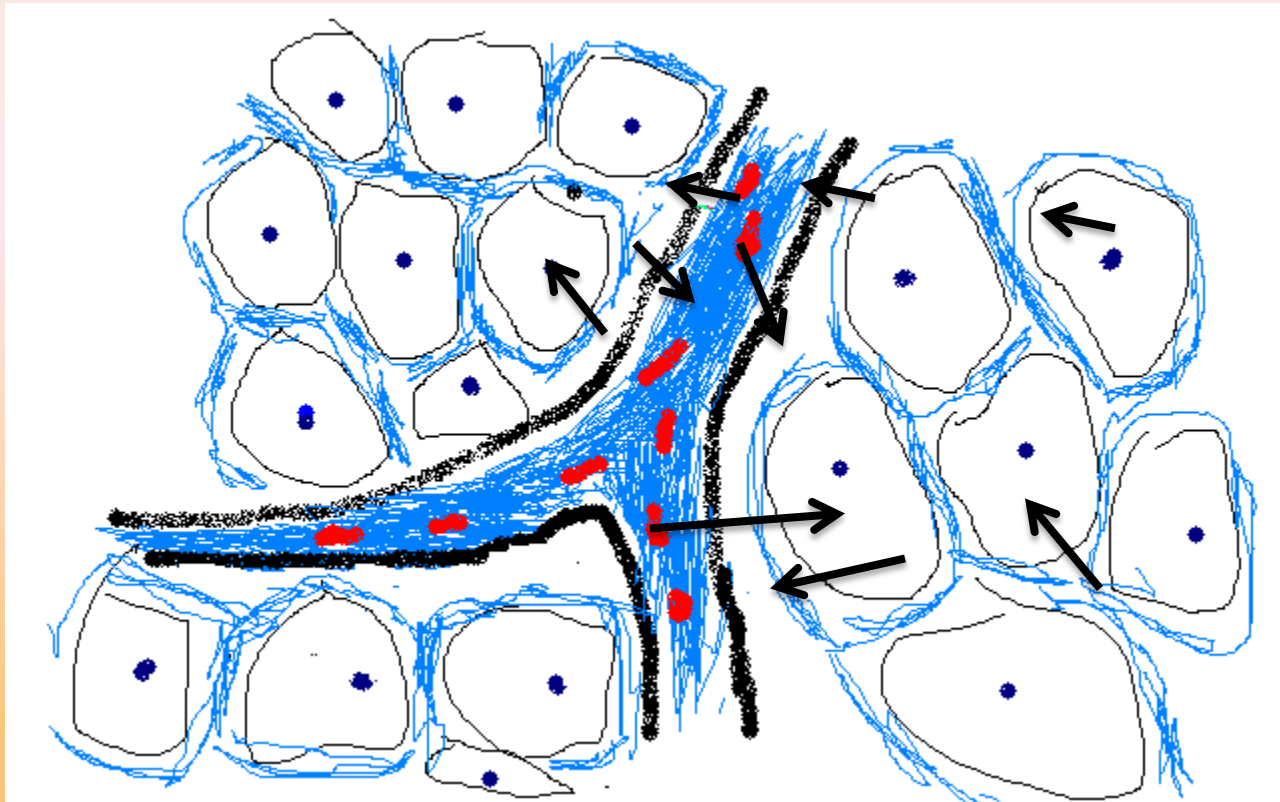
1. Plasma
(3.5 liters)

2. Interstitial fluids
(in space between
cell) (10.5 liters)

**3. Other
extracellular fluids:**

Lymph, Cerebral spinal
fluid, Serous fluids,
Gastrointestinal fluids,
Synovial fluids, and
others.

- Fluid transport among these compartments (blood plasma, interstitial space, tissue fluids, and cells)
- When there is increase in the plasma fluid moving out of plasma to the interstitial fluids
In case of **odema.**
- Movement of the fluids from interstitial tissue and cells to the plasma occurs in case of **dehydration.**



Electrolytes

- Chemicals with electrical charge are called **electrolytes**.
- Electrolytes with positive charge are called **cations** like: Na^+ , K^+ , Ca^{++} ect.
- Electrolytes with negative charge are called **Anions** like : Cl^- , HCO_3^-

Distribution of Electrolytes

Major intracellular Electrolytes	Major Extracellular Electrolytes
K⁺	Na⁺
Mg⁺⁺	Ca⁺⁺
PO₄⁻³	Cl⁻
Proteins (due to negative charged amino acids in protein)	HCO₃⁻

- In ECF the presence:
- Na^+ Cl^- , and HCO_3^- leads to form NaCl and NaHCO_3 .
- NaCl and NaHCO_3 act as buffers in plasma.
- Buffer acts to reduce acidity and alkalinity. i.e. it maintains the pH by removing or accepting hydrogen ions.
- Normal blood plasma pH is 7.4.

Distribution of Ions in the Body Compartments

Cations	ICF mEq/L	Interstitial Tissue fluid mEq/L	Blood Plasma mEq/L
Na⁺	10	147	142
K⁺	140	4.0	5.0
Ca⁺⁺	5	2.5	5.0
Mg⁺⁺	27	2.0	3.0
Anions			
HCO₃⁻	10	30	27
Cl⁻	25	114	103
PO₄⁻³	80	2.0	2
SO₄⁻²	20	1.0	1
Organic acids	-	7	6
Proteins	47	0	16

- The maintenance of normal volume and composition of the body fluids (intracellular and extracellular) is very important for life.
- Homeostasis should occurs in water, electrolytes, and acid-base

- Balance of water
- Balance of electrolytes
- Acid – Base balance

- the balance between the water get in the body and water get out of it is very important to keep the normal volume of body water.
- When the volume of water in the body decrease, two things will be occur
 - 1). the antidiuratic hormone (ADH) released from pituitary gland that lead to decrease water loss in urine.
 - 2). Feeling thirsty
- Increase in the body fluids leads to decrease ADH secretion and decrease thirsty.

Balance of water

Water get in daily (ml)		Water get out daily (ml)	
Drinking water	1200	Loss in urine	1200
Water from food	1000	Loss in feces	150
Metabolism	300	Sweating	
Total	2500	Evaporation at skin	750
		Evaporation at lung	400
		Total	2500

Electrolytes balance

- Decrease in the sodium leads to release aldosterone hormone from adrenal gland
- Aldosterone hormone prevents sodium loss by kidney. It acts on renal tubules to reabsorb sodium.

Acid base-balance

- Normal body fluid pH is 7.4
- Some molecules in the body fluids act as buffer
- Chemicals have ability to maintain pH are called buffers.
- In the buffer there are two types of compounds one of them decrease pH and the other increase pH.
- H_2CO_3 , H_2PO_4 , NH_4 and Proteins **decrease pH** because have ability to give H^+ .
- HCO_3 , HPO_4 and NH_3 **increase pH** because have ability to accept H^+ .

- Lungs and kidney play major role to maintain acid- base balance.
- Lungs remove CO₂ from circulation therefore increase pH.
- Many electrolyte excreted or absorbed by kidney which keep the blood buffer constant.