- **Body fluids:**
    - Intracellular:
    - Extracellular: interstitial and plasma

- Distribution of electrolytes is similar in plasma and interstitial fluids and inside the cells. The difference in distribution is negligible.
- In the interstitial fluid, there are virtually no proteins. If there are any proteins (albumin for example), they pass to the lymphatic system.
- **The major differences between intracellular and extracellular compartments:**
    - Potassium
    - Sulfate
    - Phosphate
    - Proteins
- Sodium maintains the positivity of the cell, and it is kept outside

- **Water is distributed in:**
    - Blood
    - Kidneys
    - Adipse tissue
    - Muscles 42%
    - Skin
    - Skeleton
- **Water in 70 Kg Man:**
    - 5 liters blood
    - 22 liters in muscles
    - 9 liters skin
- There are differences between males and females. The prime difference is between the ages 18-40 mainly due to differences in estrogen levels. Higher estrogen levels make the body fattier. Thus, women have more fat content, and less water content. This difference is negligible during childhood and in old age.

- **Blood or plasma osmolality:** 290 mMol/Kg

- **How much of that is for Sodium, potassium and Chloride?**
    - 280 and the rest are for proteins, glucose and nonionic substances.
- There is always a water balance. There is a balance between water input and water output.

- Water intake: (2.6 liters)
    - 1 liter water
    - 1.2 liters from food
    - 400 ml from other resources
- The output is mainly in urine:
    - 1.5 liters urine
    - lungs 500
    - skin 450 ml
    - 150 ml through feces.
- The water intake should equal the water output. How is this maintained?
    - Through mechanisms that the body employs in cases of hyper and hypovolemia.
    - In the case of hypervolemia, the body needs to excrete water. In this condition, ADH is inhibited. We don't need to retain water. We also need to excrete sodium. This is mediated through the effects of ANP (atrial natriuretic peptide). This is how we maintain blood volume
    - In case of hypovolemia, low pressure is detected by cells in kidneys. In the kidneys, rennin is produced. Renin is eventually transformed into angiotensin 2, the famous hormone. It maintains normal blood pressure.
        - **Angiotensin 2 functions:**
            1) Stimulates thirst
            2) Constricts blood vessels
            3) Stimulates ADH to absorb water
            4) Stimulates aldosterone to absorb sodium
            5) This increases blood volume and it returns back to normal. If this system doesn't work, we take medications.
- Mechanisms of the body, sometimes, fail to operate properly so dehydration occurs.
- **There are three types of dehydration:**
    1) Equal loss of fluids and electrolytes: isotonic dehydration
    2) Excessive fluid loss, less electrolyte loss: hypertonic dehydration
    3) Excessive electrolyte loss, less water loss: hypotonic dehydration
- **Dehydration occurs because of:**
    1) Deficiency of absorption of water through GIT
    2) Excessive loss from copious sweating, prolonged vomiting, diarrhea and excessive diuresis
    3) Drainage from wounds or burns
- **Charecterstics of dehydration:**
    1) A shrunken appearance of the face and body
    2) The skin loses its elasticity and becomes hard and leathery
    3) There is a rapid loss of body weight

4) When the deficiency reaches such a degree that the water is no longer sufficient for removal of heat of metabolism, fever may occur.
5) As the condition worsens, circulatory failure develops
6) Anuria results
7) Acid products are retained leading to acidosis
8) Cerebral disturbances, excitement, delirium and coma terminate the episode

- **Water intoxication:**
    - Because of excessive water intake. Alcoholics, when short on alcohol, drink water until they become drunk. The problem here is in the distribution. The water starts flooding the cells, and this causes disorientation.
    - Excessive water intake may produce the syndrome of water intoxication in which cellular function is disturbed by the dilution of the cellular electrolytes. Disorientation, convulsions, and coma may result, as well as gastrointestinal dysfunction, muscular weakness, and abnormal cardiac rhythms.

- **Lymphatic system:**
    - The pressure inside the blood vessels at the arterial end is 32; the plasma proteins pressure is about 28.
    - Venous end the blood pressure is 16; protein pressure does not change. Here there is filtration. Plasma and some protein pass into the interstitial spaces. At the end, there is osmosis and return of proteins. But, sometimes, some of the plasma proteins remain in the interstitial fluid and become lymph which is part of the lymphatic system. This is the mechanism of forming lymph in the lymphatic system
- The lymphatic system is an accessory route, through which fluids can pass from the interstitial space to the blood. Lymph is a tissue fluid. Lymphatic vessels drain into venous blood via the thoracic and right lymphatic ducts.
- It contains clotting factors and clots on standing in vitro.
- In most locations, there are lymphocytes. The lymphocytes screen the blood and remove any bacteria or foreign bodies.
- The fats are absorbed through the lymphatic system
- Lymphocytes enter the circulation, principally, through the lymphatics, and there are appreciable number so lymphocytes in thoracic duct lymph.
- There are proteins in the lymph, mainly in the liver.
- The lymphatic system consists of lymph capillaries, lymph vessels, lymphatic ducts, and lymph nodes.
- **Related organs:**
    - Spleen
    - Tonsils

- Thymus

- **Tissues that lack lymphatic capillaries:**
  - Avascular tissues
  - Central nervous system
  - Bone marrow
  - A portion of the spleen

- **How does the lymph flow?**
  - There are forces which include contraction of skeletal muscles, pressure changes due to the action of breathing muscles, and contraction of smooth muscles in the walls of larger lymphatic vessels.
- **Functions:**
  1) Return of excess filtered fluid
  2) Defense against diseases through lymphocytes
  3) Transport of absorbed fat
  4) Return of filtered proteins
- Sometimes, fluids accumulate in the lymph system and this is called edema.
- **Causes of edema:**
  1) High capillary pressure
  2) Low protein pressure
  3) Lymphatic blockage
  4) Increased capillary permeability