

5 Homeostasis II

- Very important
- Extra information
- Terms

You can't change the direction of the wind ,
but you can adjust your sails to reach your
destination !





Extracellular and Intracellular Fluids



- Ion fluxes are restricted and move selectively by active transport.
- Nutrients, respiratory gases, and wastes move Unidirectionally. (in one direction)
- Plasma is the only fluid that circulates throughout the body and links External and Internal Environments.
- Osmolalities of all body fluids are equal changes in solute concentrations are quickly followed by osmotic changes.

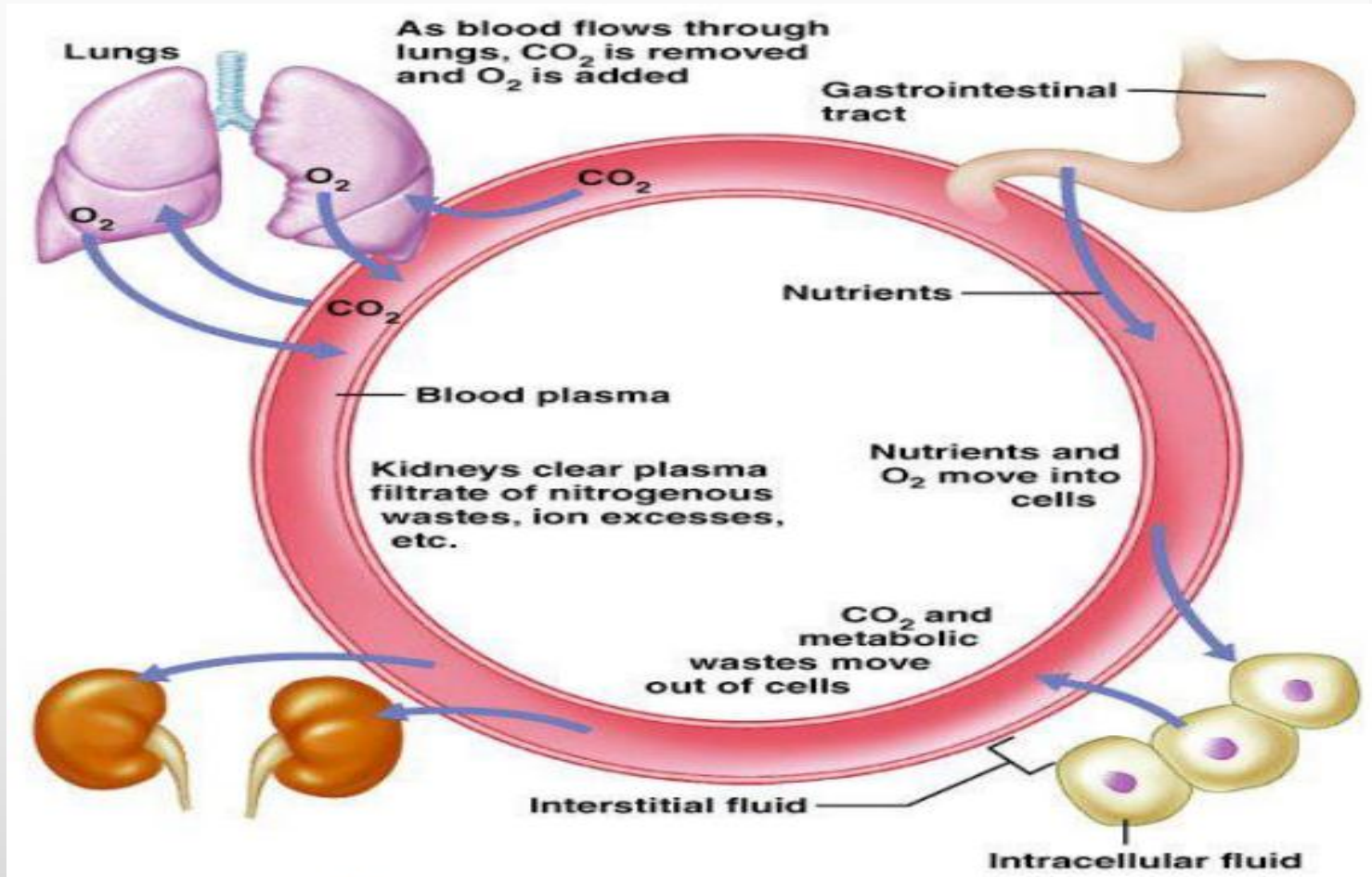
NOTE :

OsmolaLity :

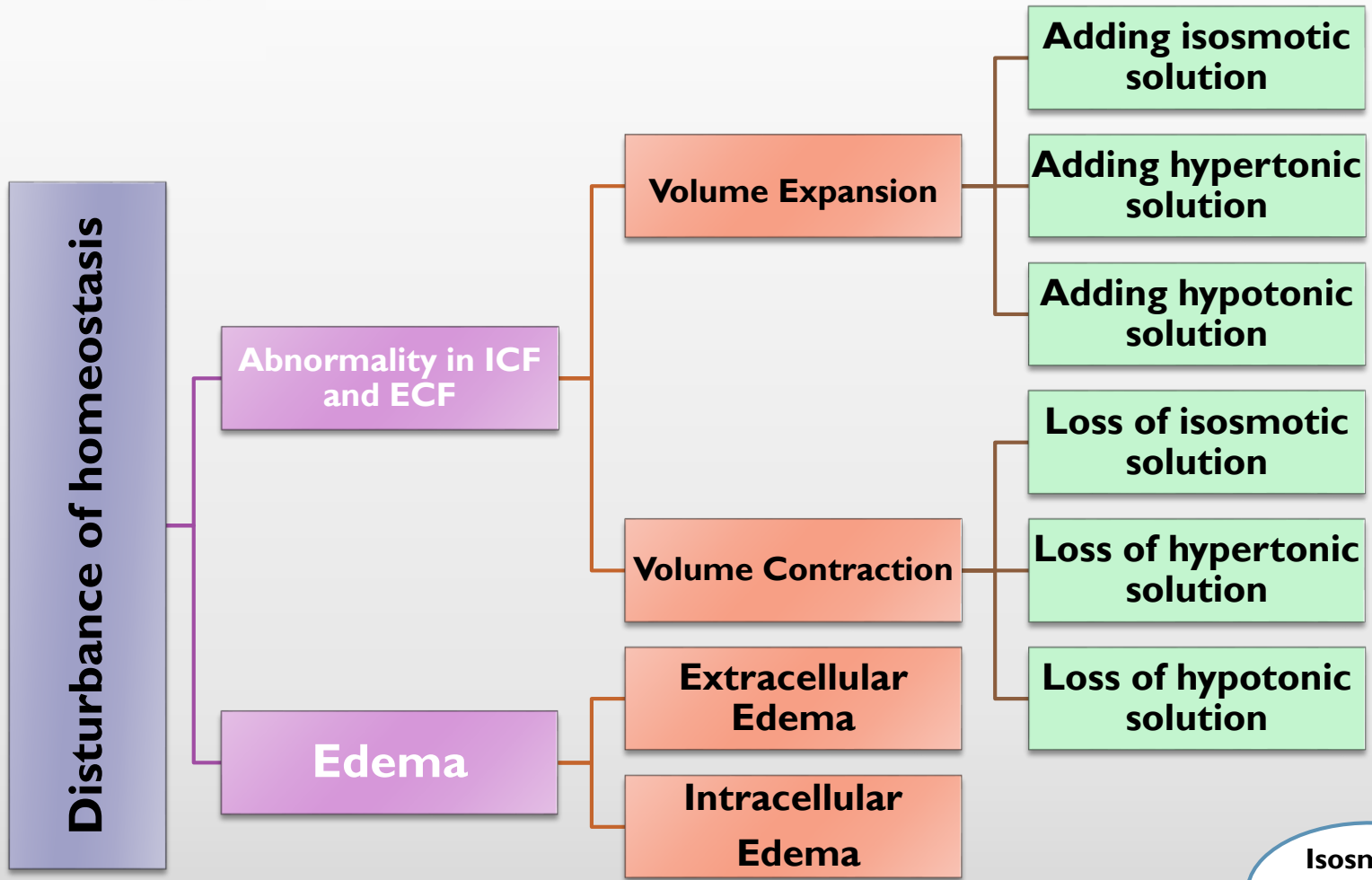
The concentration of a solution expressed in osmoles of solute particles per kilogram of solvent.

OsmolaRity :

the concentration of a solution in terms of osmoles of solutes per liter of solution.



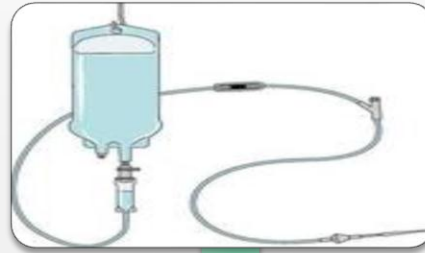
Continuous exchange of Body Fluids



Isosmotic
=
Isotonic

Volumes And Osmolarities of ECF and ICF In Abnormal States

Intravenous infusion (IV)



Dehydration



I'm thirsty

Abnormal sweating



Factors can
cause the
change in the
volume of
ECF and **ICF**

Volume contraction (removing)



Volume contraction “decrease in the ECF volume”

Loss of Isotonic solution

e.g. Diarrhea

- Stable osmolarity.
(osmolarity of fluid lost \approx osmolarity of ECF)
- Decrease in **ECF volume**. ↓
- Decrease in arterial pressure ↓

Loss of hypotonic solution

dehydration or
water
deprivation

- Increase **Osmolarity** in both
ECF and **ICF**. ↑
- Decrease **volume** in both **ECF**
and **ICF**. ↓

Loss of Hypertonic solution

e.g. Adrenal
Insufficiency

- Decrease **Na⁺** in the **ECF**. ↓
- Decrease **osmolarity** in both. ↓
- Decrease in **ECF volume**. ↓
- Increase in **ICF volume** ↑

Volume contraction (removing)

Loss of Isotonic solution

diarrhea means loss of fluid, and that fluid is isotonic fluid.
only loss of volume will occur, cause the osmolarity is the same in EFC & ICF
arterial pressure will decrease due decreasing in the volume of ECF

Loss of hypotonic solution

- water will move from ICF to ECF
- Loss of water in ECF
- Loss of water in the cell

Loss of Hypertonic solution

adrenal gland secrete aldosterone that is responsible about regulating Na and bring it back to ECF.
insufficiency in adrenal gland will leads to decrease aldosterone which leads to a low concentration of Na in ECF. therefore water will move from ECF to ICF due to the higher concentration of Na in ICF.

Very important !

Loss of **hypo**tonic solution
(dehydration or water deprivation)



Hyper-osmotic
dehydration

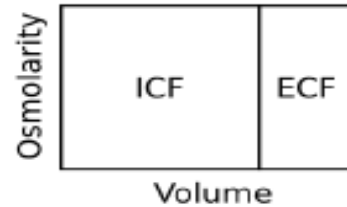
Loss of **Hyper**tonic solution
(Adrenal Insufficiency)



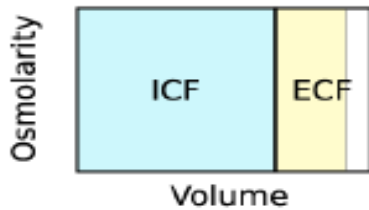
Hypo-osmotic
dehydration

Volume contraction (removing)

Normal



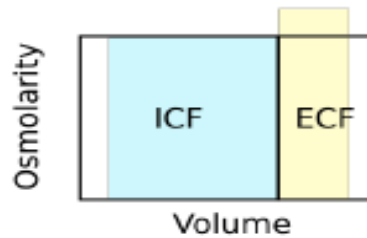
Secretory Diarrhea
Isoosmotic Volume-loss from ECF



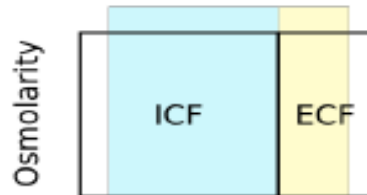
↓
Water flow:
None



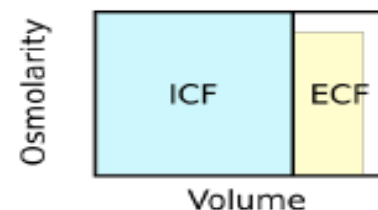
Diabetes Insipidus
Hyperosmotic Volume-loss from ECF



↓
Water flow:
ICF → ECF



Adrenocortical Insufficiency
Hypoosmotic Volume-loss from ECF



↓
Water flow:
ECF → ICF



Volume Expansion (Adding)

Volume Expansion

“Increase in the ECF volume”

Adding of isotonic solution

e.g. infusion of
isotonic NaCl

- No change in Osmolarity.
- Increase in ECF volume.↑
- Isosmotic “isotonic” expansion .

Adding of hypotonic Solution

e.g. syndrome of
inappropriate anti
diuretic
hormone(SIADH).

- Decrease in both ECF and ICF
Osmolarity.↓
- Increase in both ECF and ICF volume.↑

Adding of Hypertonic solution

e.g. high NaCl
intake

- Increase in both ECF and ICF
Osmolarity.↑
- Increase in ECF volume.↑
- Decrease in ICF volume.↓
- Hyperosmotic volume expansion.

Volume Expansion (Adding)

Adding of isotonic solution

When you add an isotonic NaCl solution, it only increases the volume of ECF but it does not change the osmolarity or the ICF volume.

Adding of hypotonic Solution

ADH controls water reabsorption, so if there is an excessive secretion of ADH it will cause increasing in both ECF and ICF volume and decreasing in both osmolarity

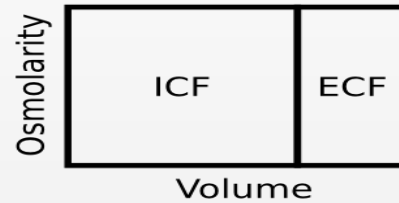
Adding of Hypertonic solution

An excessive NaCl intake causes increasing in both ECF and ICF osmolarity which will result a movement of water from ICF to ECF

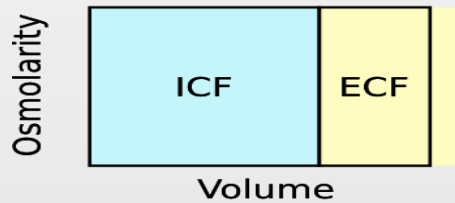
ADH = anti diuretic hormone

Volume Expansion (Adding)

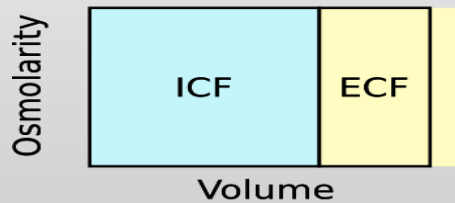
Normal



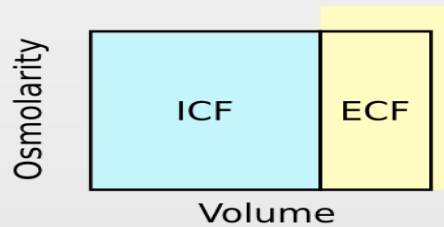
Isotonic Saline Infusion
Isoosmotic Volume-
addition to ECF



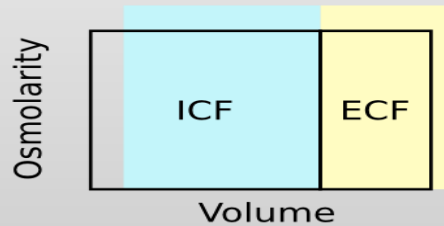
↓
Water flow:
None



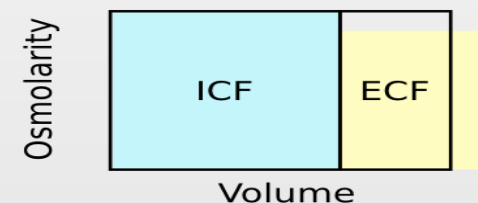
Hypertonic Saline Infusion
Hyperosmotic Volume-
addition to ECF



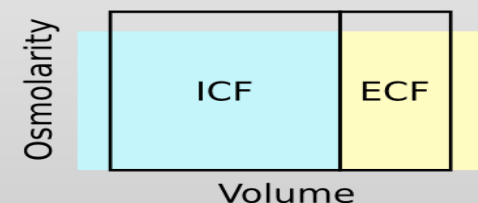
↓
Water flow:
ICF → ECF



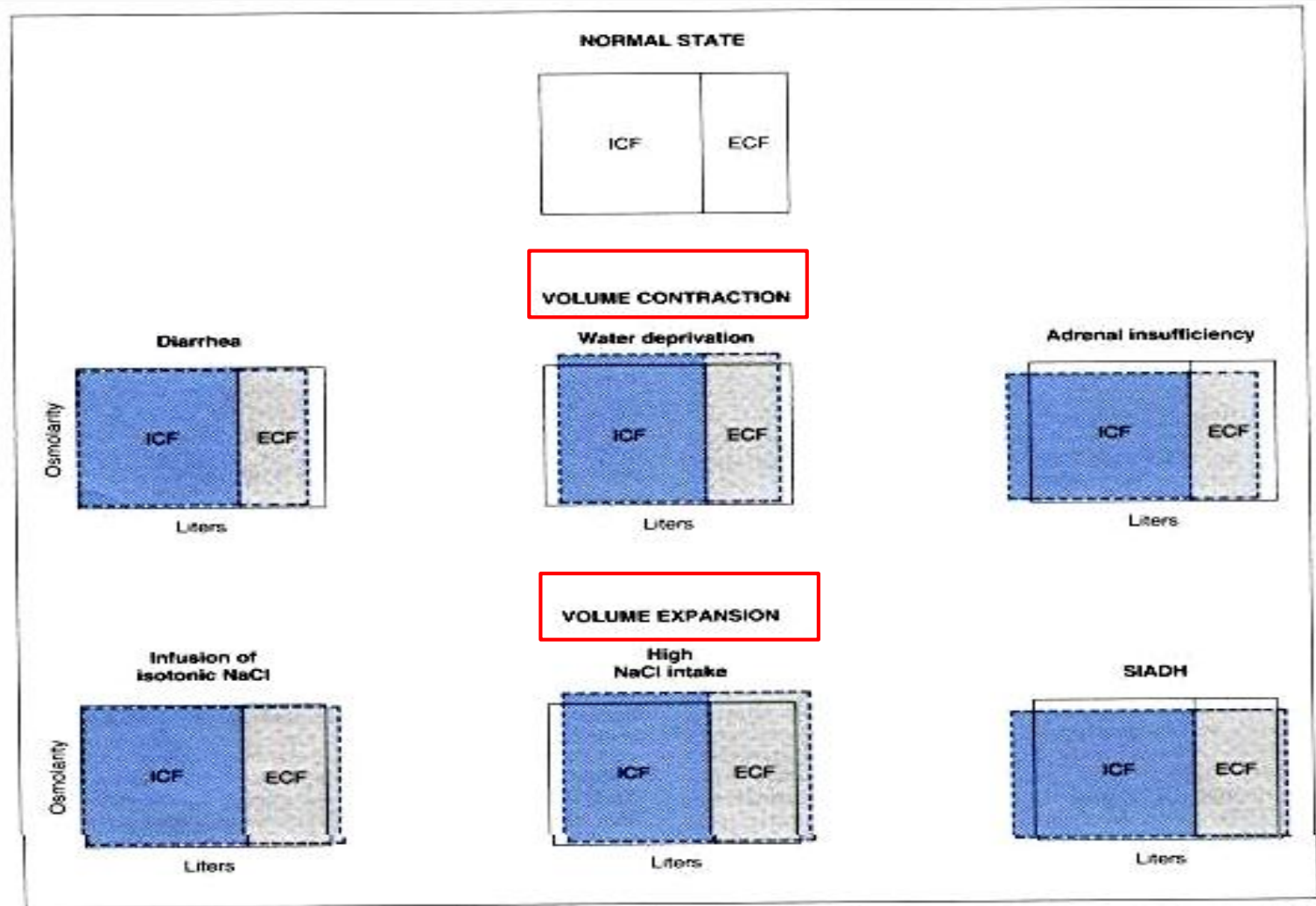
Glucose Infusion
Hyposmotic Volume-
addition to ECF



↓
Water flow:
ECF → ICF



		ECF		ICF	
		Volume	Osmolarity	Volume	Osmolarity
Volume contraction (Removing)	Isotonic solution (Diarrhea)	↓	-	-	-
	Hypotonic solution (Dehydration)	↓	↑	↓	↑
	Hypertonic solution (Adrenal insufficiency)	↓	↓	↑	↓
Volume expansion (Adding)	Isotonic solution (Infusion of isotonic NaCl)	↑	-	-	-
	Hypotonic solution (SIADH)	↑	↓	↑	↓
	Hypertonic solution (High NaCl intake)	↑	↑	↓	↑



Edema:

Excessive fluid in the body tissues.
Can be **Extracellular** or
Intracellular.

- It occurs mainly in the **ECF compartments**.
- The common clinical cause is **Excessive capillary fluid filtration**.



Types of Edema

Extracellular:

Heart failure

↑ **Capillary pressure**

↑ **Filtration**

Edema

Intracellular:

Inflammation of tissues

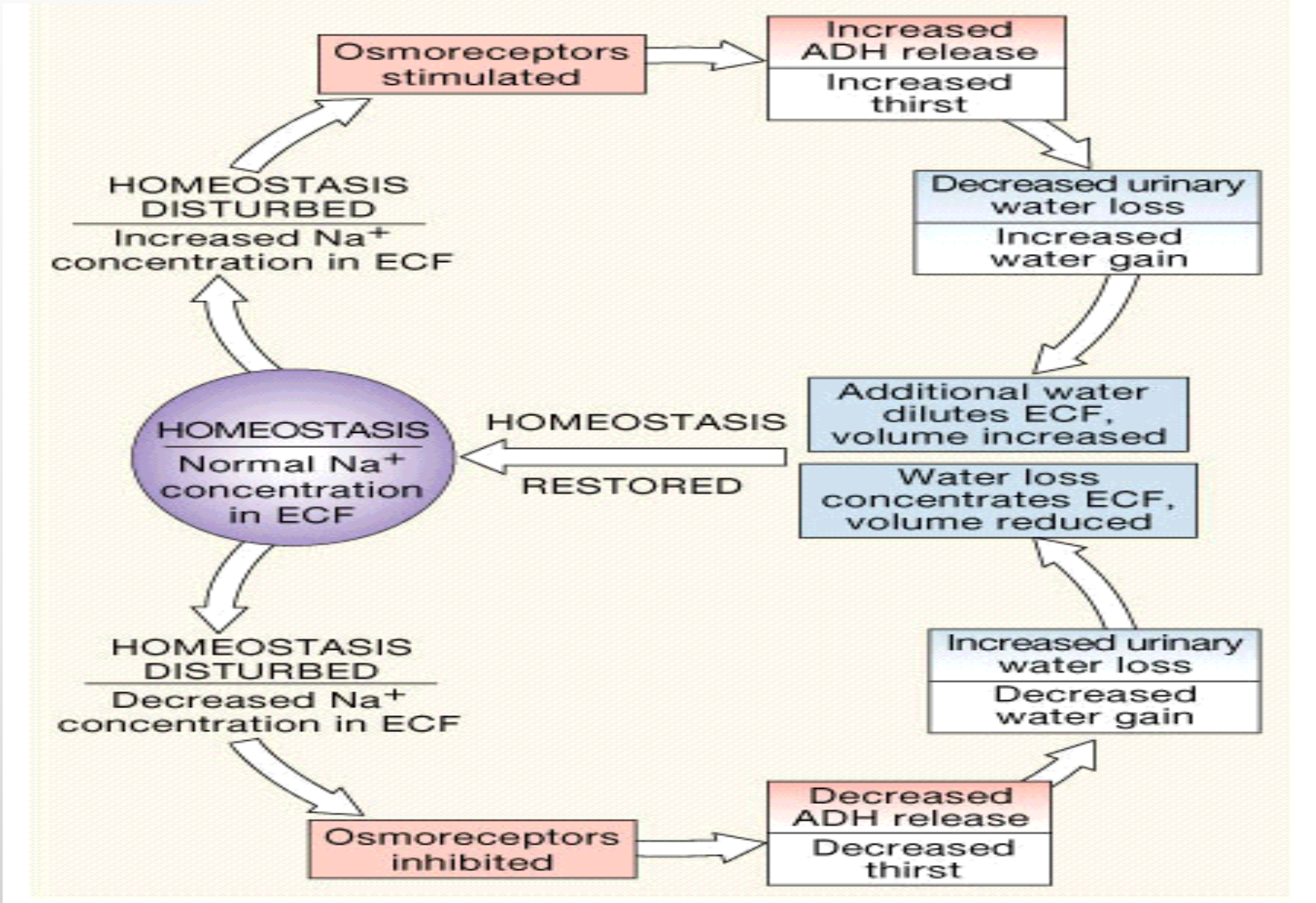
↑ **Membrane permeability**

Na inside cells

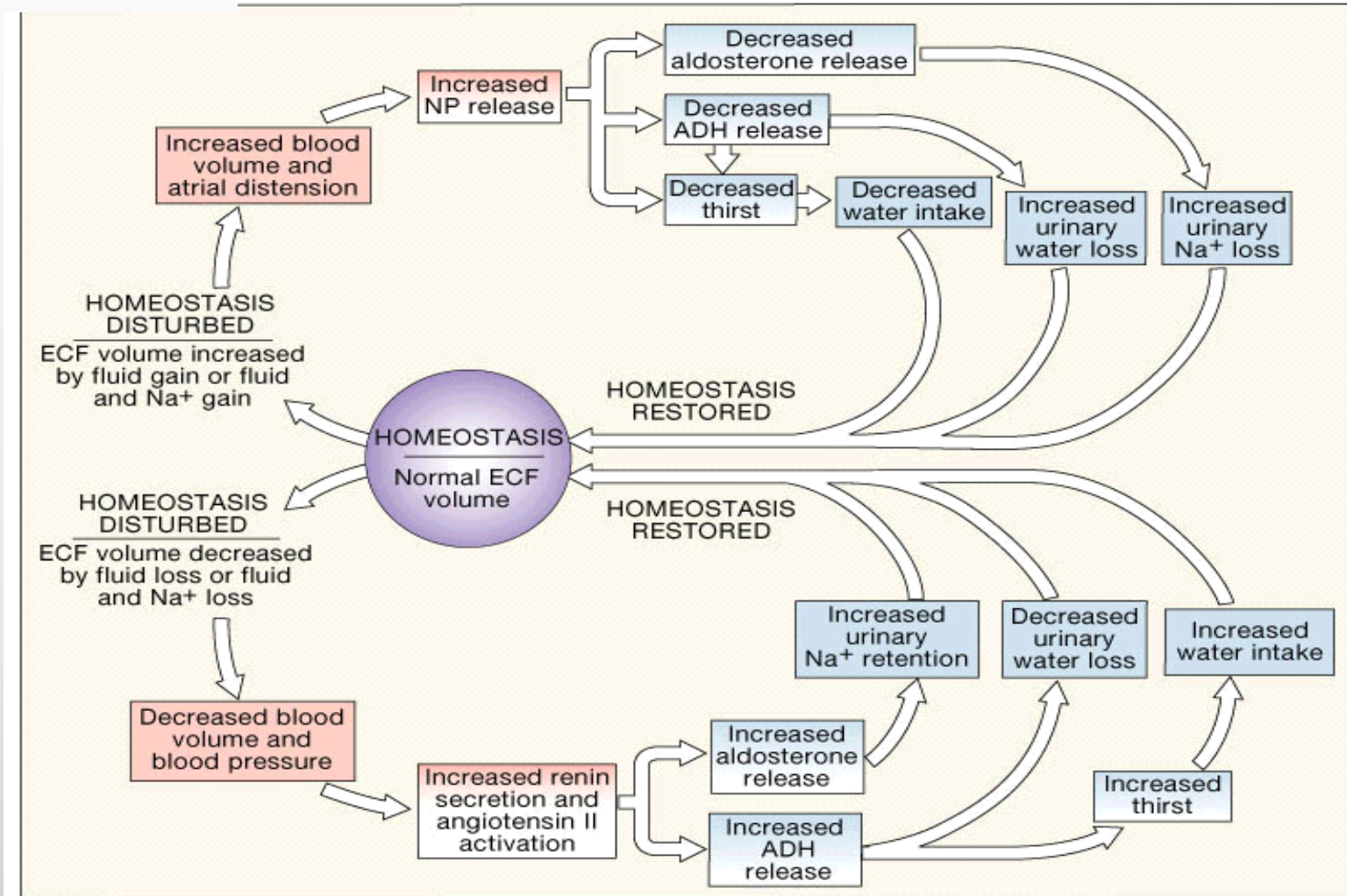
water

Edema

Helpful diagram



Helpful diagram



[click](#) here and check your understanding !

Videos :

- <https://www.youtube.com/watch?v=xN-IIIhPKjs>
<https://www.youtube.com/watch?v=Bvl5qHZf5Yg>
(To learn more about Edema)
- <https://www.youtube.com/watch?v=Z0XPMFL45oo>
(A comparisons between Aldosterone and ADH functions)
- <https://www.youtube.com/watch?v=sCeLdc677ws>
(Homeostasis of Extracellular Fluid)

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