.8Renal Regulation of Body Fluid

Color index

- Important
- Extra Information

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Contents

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To function properly, **cells must be bathed in extracellular fluid with relatively CONSTANT concentration of electrolytes and other solutes .**

The total concentration of of solutes in the extracellular fluid = **Osmolarity**

The normal osmalarity of ECF = 290 mOsm/L

DETERMINED BY

Amount of solutes divided by the volume of ECF

ECF Na concentration and osmolarity are regulated by **ECF water**

Total body water is controlled by

Fluid Intake

Fluid Output)Renal Excretion(

Factors determine Thirst

Factors determine GF & TR

OSMORECEPTORS-ADH , HORMONAL AND NUEROAL

Normal Plasma Na = 140 – 145 mEq/L
Normal osmolarity ≅ 300 mOsm/L

Changes in plasma osmolarity can lead to a cascade of events to return it back to normal

ECF = ExtraCellular Fluid
GF = Glomerular Filtration
TR = Tubular Reabsorption

BUT FIRST LET US RECALL THE NORMAL DISTRIBUTION OF OUR BODY FLUIDS

Body Fluids → To stay in a state of fluid balance

Input = Output

EVEN THOUGH THEY'RE EQUAL THE REASON WE DRINK WATER IS TO WASH OUT TOXINS AND STAY IN BALANCE(

1: بخار

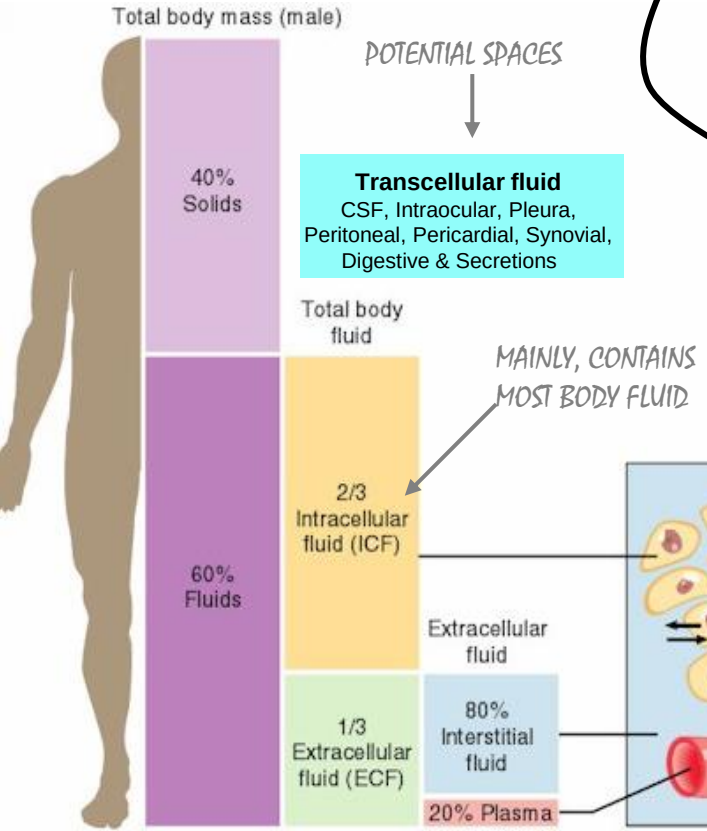
Input = 1500 ml/day

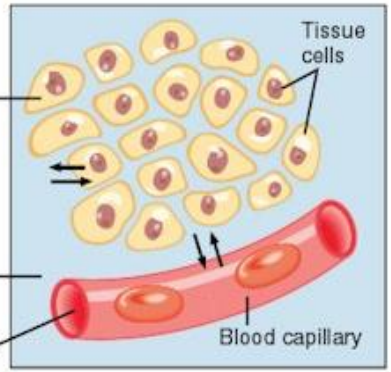
(SOMETIMES IT CAN BE 2000 ML/DAY (

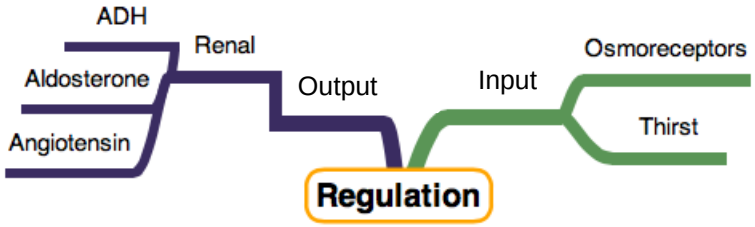
Due to H_2O & fluid consumption.

Output = 1500 ml/day

Due to Urination, Respiration: water vapour[1], Sweating, Stool, Metabolism



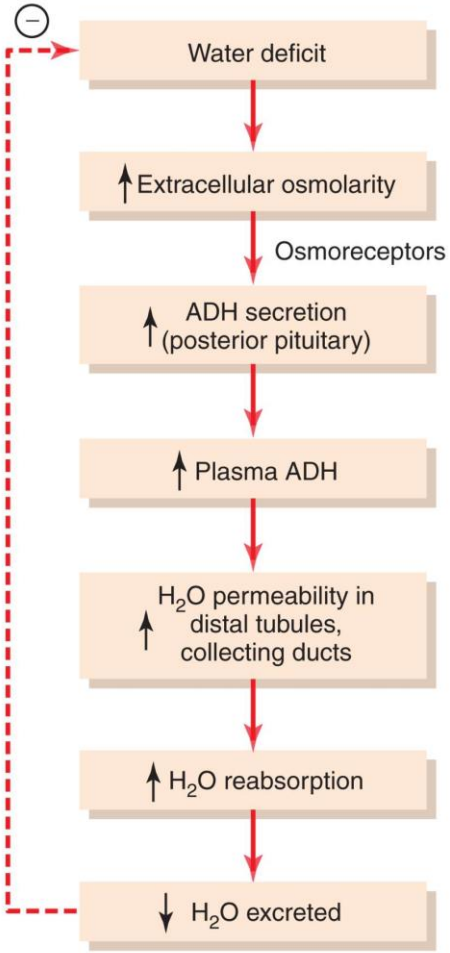




Osmoreceptor-ADH Feedback

Increase in Extracellular Fluid Osmolarity

1. **Osmotreceptor cells** located in the anterior hypothalamus near the supraoptic nuclei **shrink**
2. Sending nerve signals to additional nerve cells in the supraoptic nuclei
3. Shrinkage of the osmoreceptor cells causes them to fire
4. These action potentials conducted to the posterior pituitary
5. **Stimulate the release of ADH**
   - ✧ **Reabsorption of water**
   - ✧ **Excrete a small volume of concentrated urine**



Antidiuretic Hormone (ADH(

Factors influencing its release:

- ✧ Osmolality
- ✧ Haemodynamic factors
- ✧ Nausea → stimulates
- ✧ Atrial natriuretic peptide (ANP) → inhibits
- ✧ Angiotensin II → stimulates

Main physiological factors

Osmolality

Osmoreceptors in hypothalamus, outside blood-brain barrier.

↑osmolality ⇒ ADH release

"set point "

285 – 280 ~mOsm/kg H2O

Blood volume

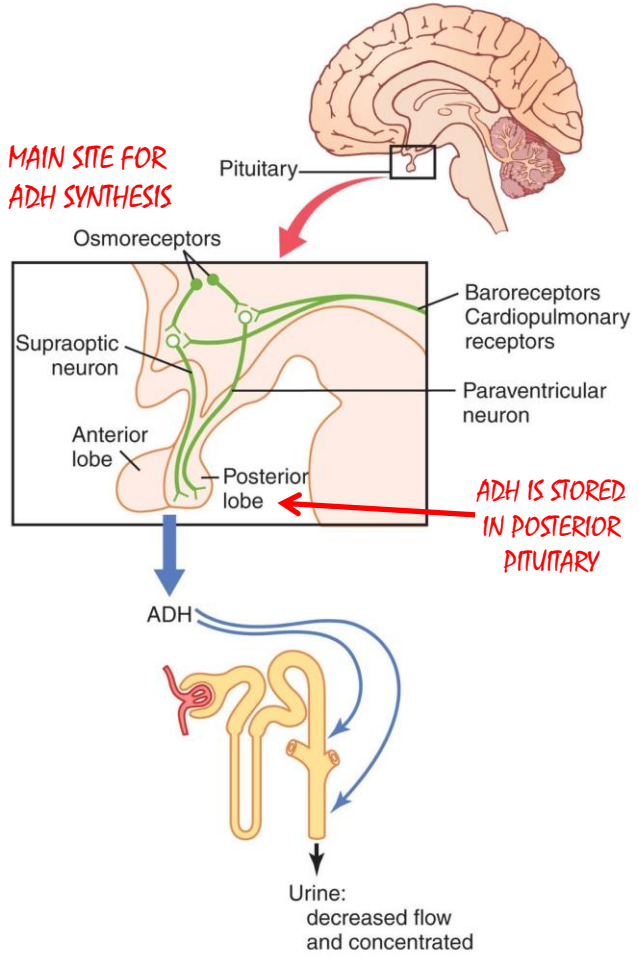
↓blood volume ⇒ ADH release

less sensitive than osmolality

need 5 – 10% ↓ blood volume

As would be expected changes in blood volume affect osmolality

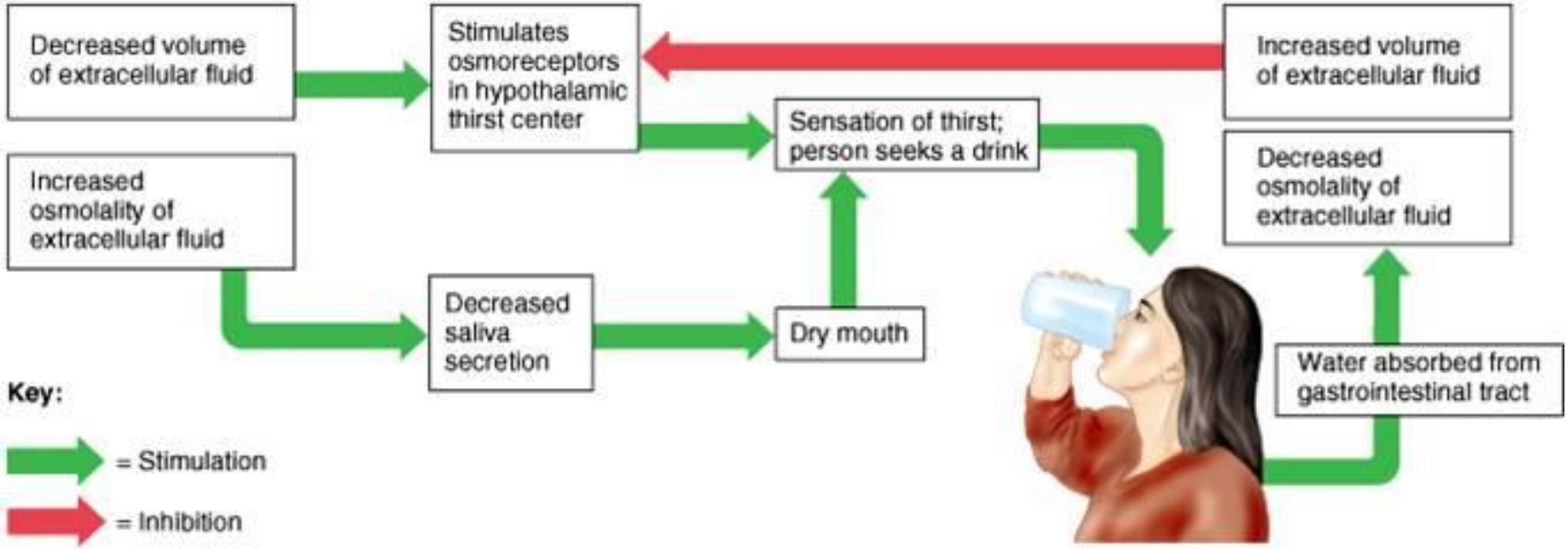
↓volume/BP ⇒ ↓ set point



Osmotic VS Non-Osmotic Stimuli

Stimuli	Effect on ADH secretion
Osmotic stimuli	↑ or ↓ depending on the change od omolarity (RAPID RESPONSE(
Changes in serum osmolarity	
Non-Osmotic Stimuli	
Hemodynamic changes associated with low effective arterial blood volume	↑
Drinking especially drinking cooler fluids	↓
Nausea	↑
Hypoglycemia	↑
Renin angiotensin system (Ang II(	↑
Hypoxia and hypercapnia	↑
Arterial Baroreceptors reflex	
Chemoreceptors reflex	

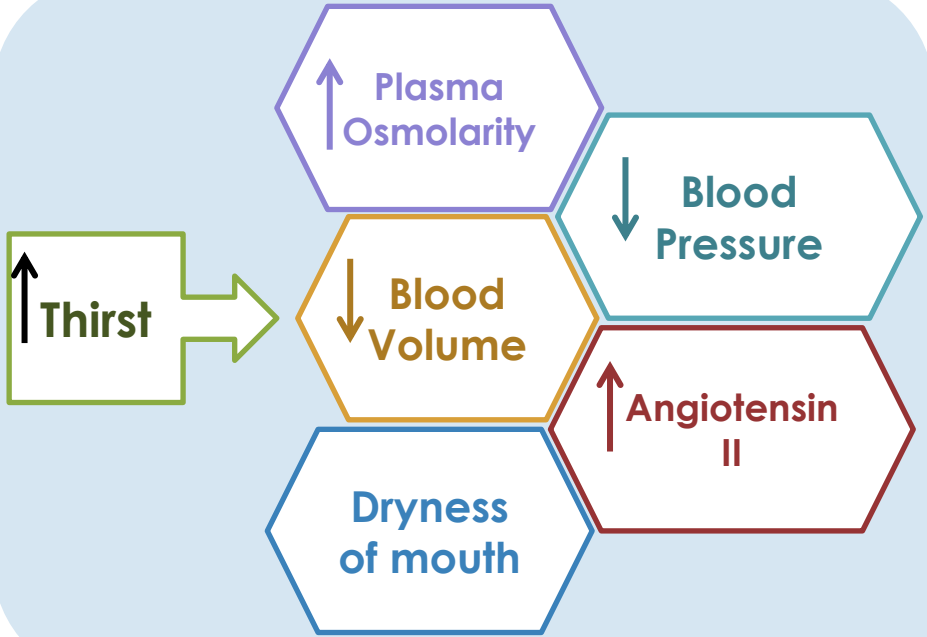
Thirst Mechanism



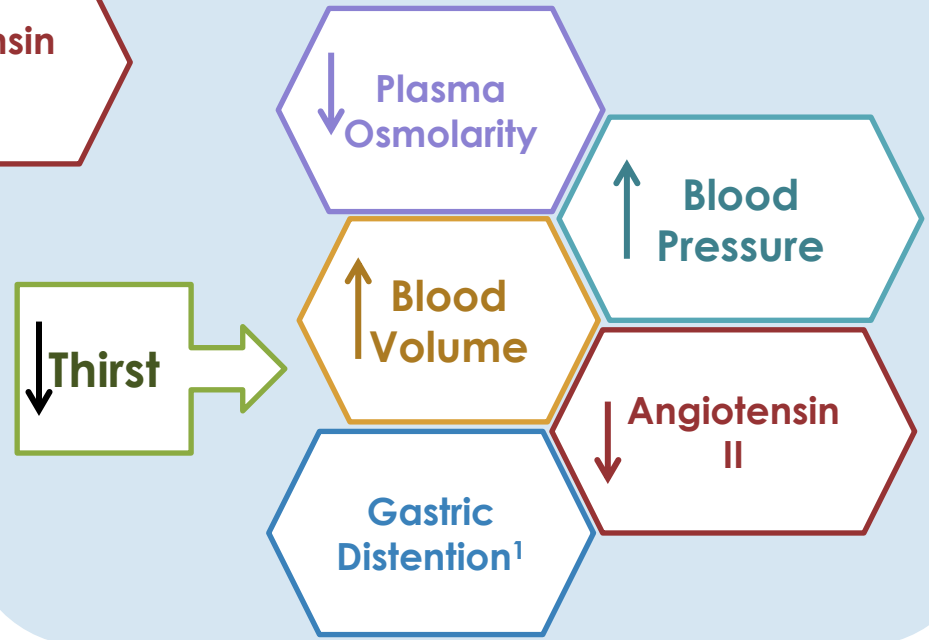
To stay in balance water intake = water loss
Fluid intake is regulated by thirst mechanism

The desire to thirst is completely satisfied when:
Plasma, osmolarity, Blood volume, Or both return to normal

Thirst Stimuli



Increase Thirst	Decrease Thirst
↑ Plasma osmolarity	↓ Plasma osmolarity
↓ Blood volume	↑ Blood volume
↓ Blood pressure	↑ Blood pressure
↑ Angiotensin II	↓ Angiotensin II
Dryness of mouth	Gastric distention

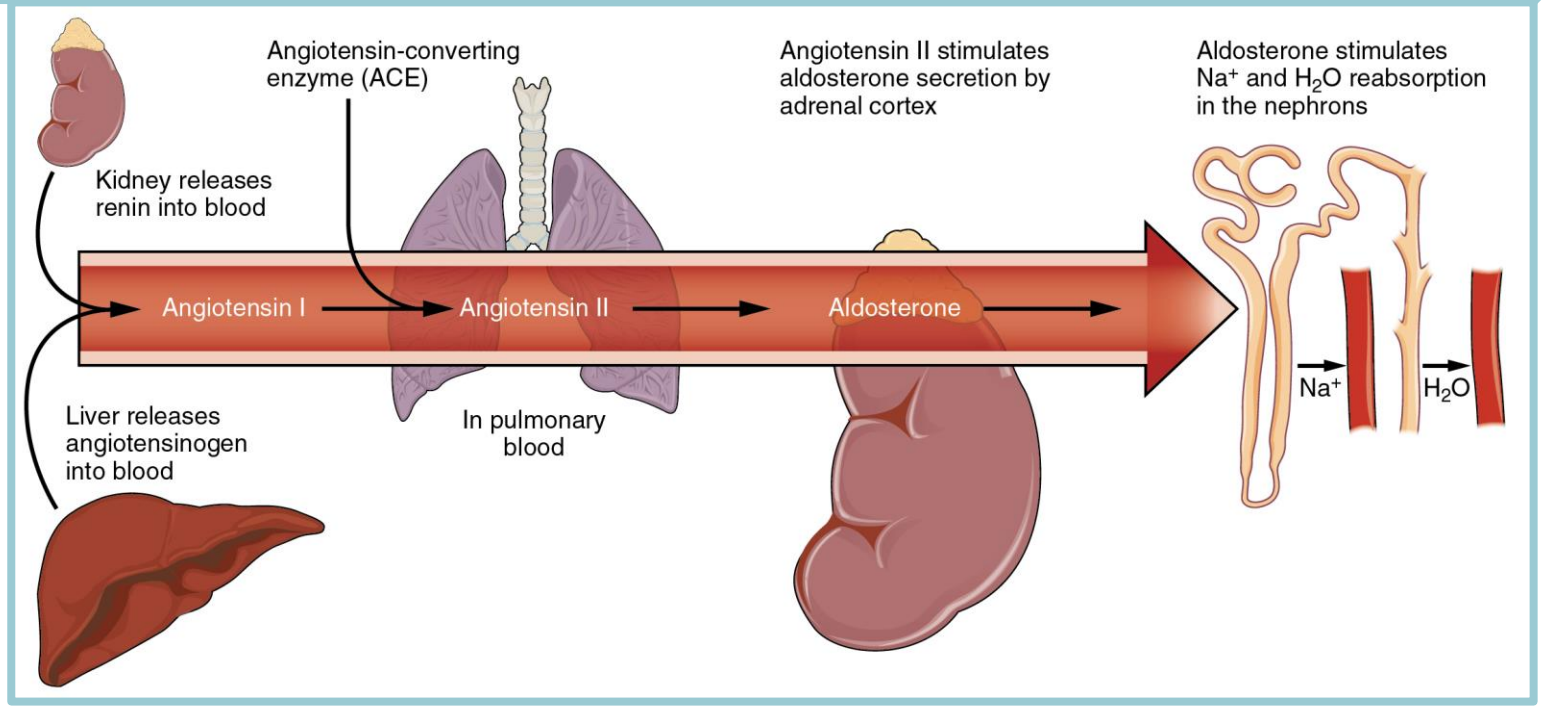


1: is bloating of the stomach when air is pumped into it

Role of Ang II & Aldosterone

- They do not normally play a major role in controlling ECF osmolarity and Na+ concentration.

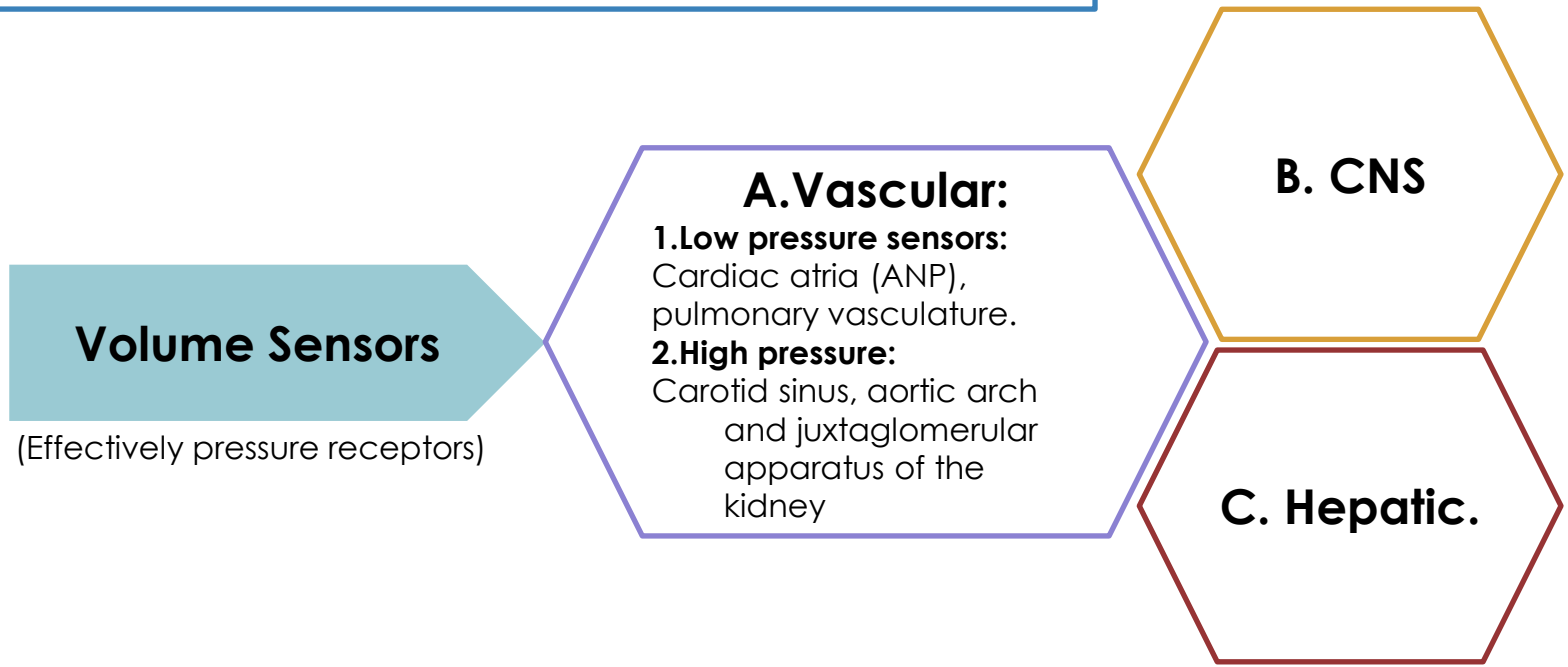
Their major role is to **absorb sodium through distal convoluted tubules**, leading to **greater extracellular fluid volume and sodium quantity.**



Regulation of Body Volume

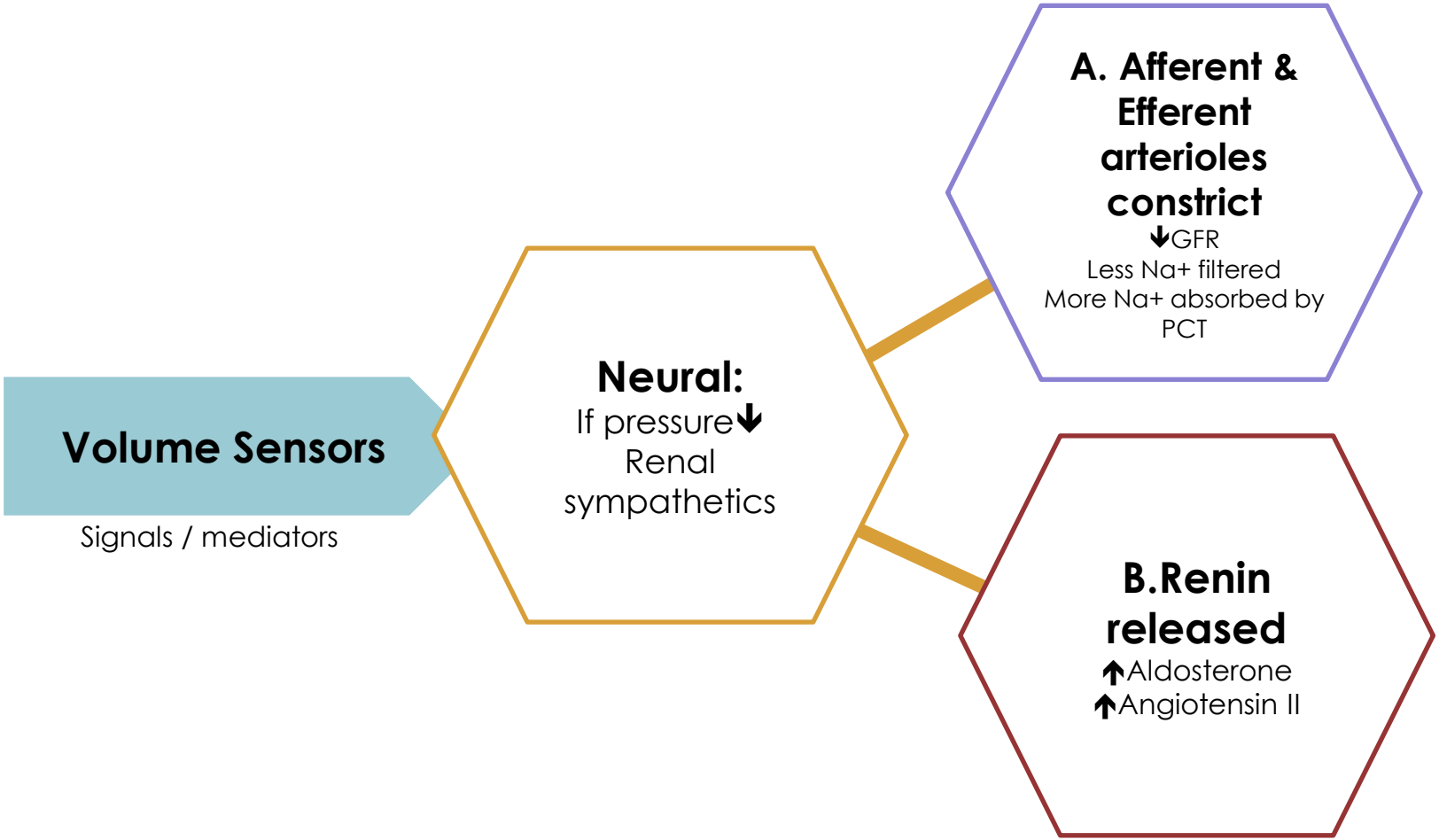
Control of circulating volume:

All down to **Na balance** I.e. absorption and excretion



Only in Males' Slides

Regulation of Body Volume cont.



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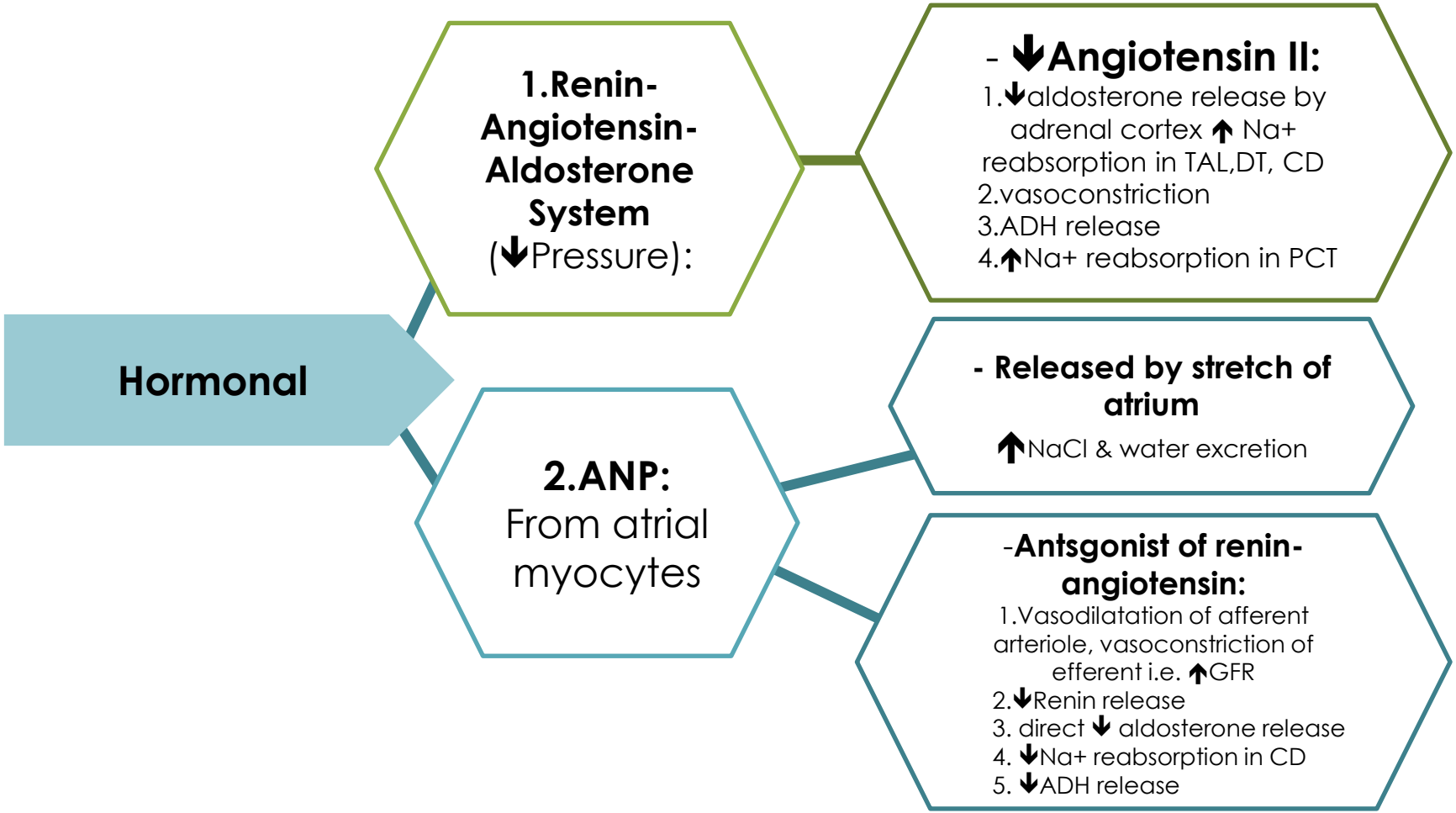
Regulation of Body Volume cont.



Only in Males' Slides

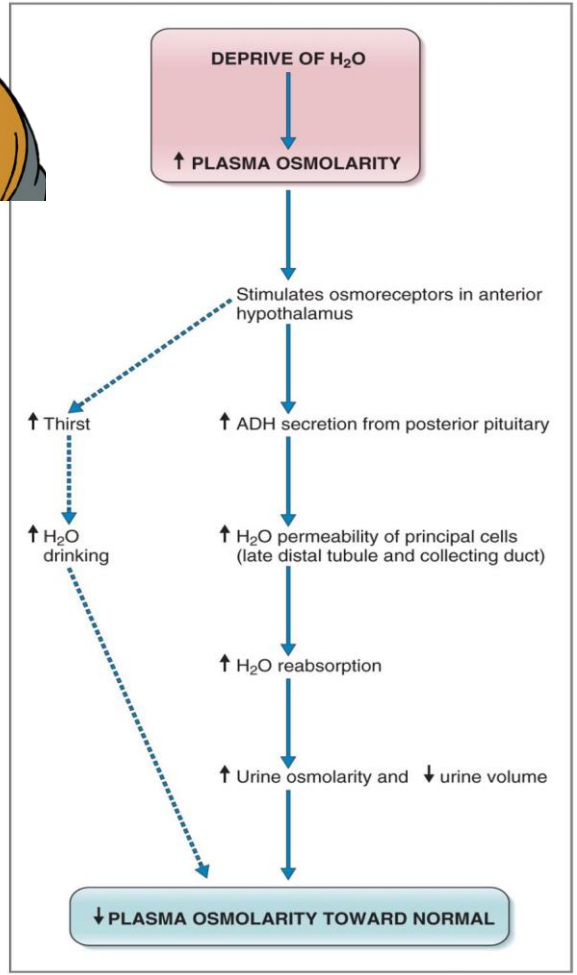
Water Deprivation VS Water Drinking

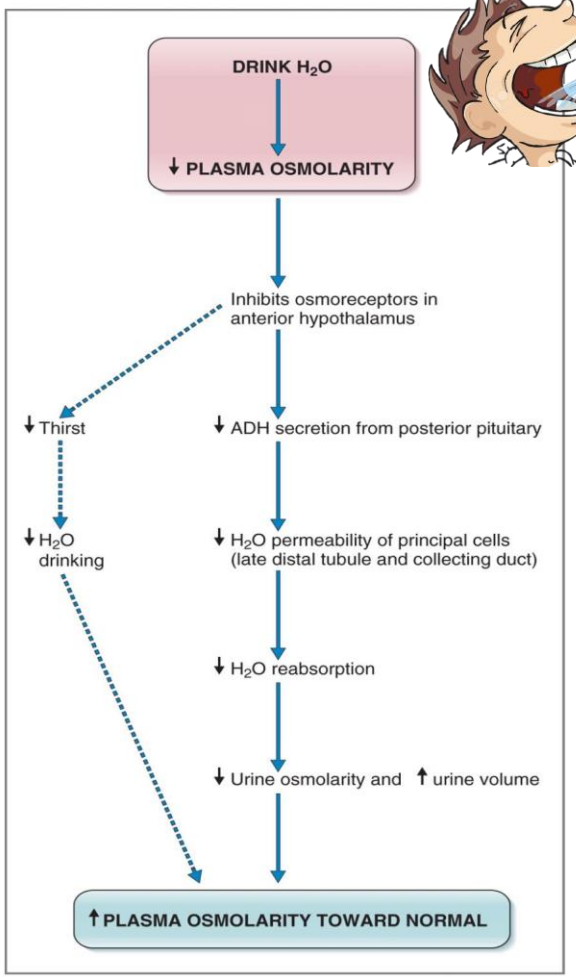
Person lost in desert, Exposed to hot weather, Excessive diarrhea..etc		**DrinkS 2 liters of fluids**	
1) Water is lost from the body. **2)** Plasma osmolarity increases. **3)** Stimulates osmorecepters in the anterior hypothalamus.		**1)** The added water will dilute body fluid. **2)** Plasma osmolarity decreases. **3)** Inhibits osmorecepters in the anterior hypothalamus.	
4) (+)ADH	**4)** (+)Thirst	**4)** (-)ADH	**4)** (-)Thirst
A) Posterior pituitary gland secretes ADH which circulate in blood to the kidneys. **B)** ↑ water permeability of the principles cells of LDCT & CD. **C)** ↑ water reabsorption means more water is return to the body fluids. **D)** Urine osmolarity increases & Urine volume decreases.	**A)**Drives water drinking behavior	**A)** Inhibition of posterior pituitary gland from secreting ADH, Levels of circulating ADH will decrease **B)** Less ADH is going to the kidney ↓water permeability of the principles cells of LDCT & CD. **C)** ↓ water reabsorption, the water that hasn't been reabsorbed will be excreted. **D)** Urine osmolarity decrease & Urine volume increases.	**A)**Suppress water drinking behavior
Plasma osmolarity return back to normal			

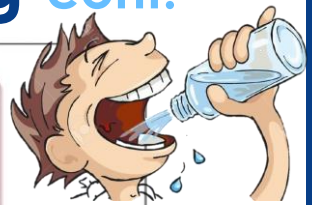
LDCT: Late Distal Convoluted tubules
CD: Collecting Ducts
(+): Stimulate
(-): Inhibit

Additional

Water Deprivation vs Water Drinking cont.







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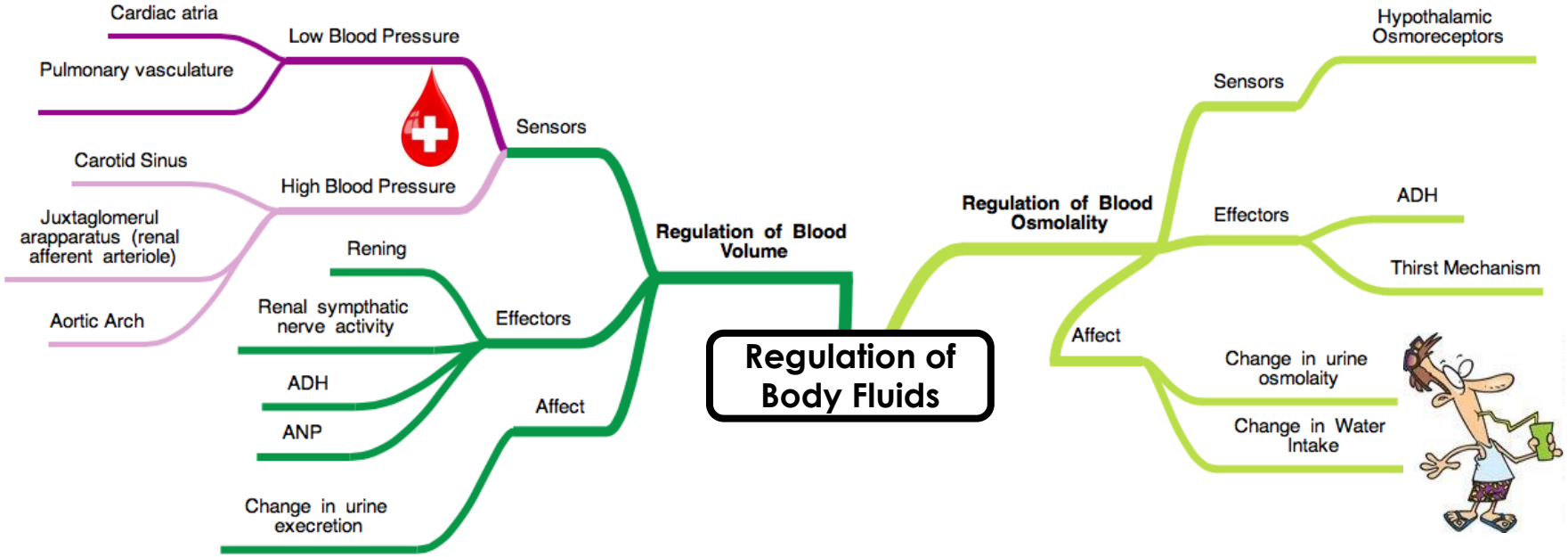

REGUULATION OF ADH SECRETION		CONTROL OF THIRST	
INCREASE ADH	DECREASE ADH	INCREASE THIRST	DECREASE THIRST
↑ Plasma osmolarity ↑ Blood Volume ↓ BP	↓ Plasma osmolarity ↑ Blood Volume ↑ BP	↑ Plasma Osmolarity ↓ Blood Volume ↓ BP ↑ Angiotensin II	↓ Plasma Osmolarity ↑ Blood Volume ↑ BP ↓ Angiotensin II

Summary

-1Osmolsrity of human body fluid equal:
A. 290 mOsm/L
B. 150 mOsm/L
C. 145 mOsm/L
D. 2500 mOsm/L

-2Decreased volume of extracellular fluid lead to:
A. Dilation of the renal arteries
B. Stimulation of osmoreceptors
C. Increase saliva secreation
D. Incease blood volume

-3Which one of the following doesn't lead to increase the thirst feeling:
A. Decreased ECF volume.
B. Decreased blood pressure.
C. Angiotensin II..
D. Gastric distention decreases thirst.

-4Which one of the following doesn't occur as a result of secreation of the ADH?
A. Increase blood volume
B. Increase arterial pressure
C. Decrease ECF osmolarity
D. Decrease fluid reabsorption

-5Which on of the following represent (the main place of ADH synthesis ,the place that stored in?(
A.Hypothalamic neurons in the supraoptic nuclei , posterior lobe of pituitary
B. Posterior lobe of pituitary , hypothalamic neurons in the suraoptic nuclei
C. Anterior lobe of pituitary , hypothalamic neurons in the suraoptic nuclei
D. Both of them in the anterior lobe of pituitary

-6 Which one of the following lead to decrease stimulation of the ADH?
A. Arterial baroreceptor reflex
B. Angiotensin II
C. Chemoreceptor reflex
D. Decrease ECF osmolarity

-7The mucosal lining the base of urinary bladder is..
A. Loosly attached and folded
B. There is no attachment in the base of the bladder
C. Smooth and frimly attached
D. Its not smooth and frimly attached

.1A
.2C
.3B
.4A
.5C
.6A
.7C

MCQs

-1Mention two hormones that take a place in regulation of fluid output?
ADH. , Angiotensin/Aldosterone.

-2How can the gastrointestinal tract take place in thirst mechanism?
By absorption the water that inter the body from the mouth in responses to the thirst mechanism

-3Mention the two things that Osmolality OF THE EXTRACELLULAR FLUID is determined by?
NaCl and water

-4Two ways of execrate fluid outside the body?
No regulation of the fluid input and it's a fatal mechanism

-5Mention two situations that lead to increase stimulates of the thirst center?
Increased osmolarity ECF, .Decreased ECF volume, .Decreased blood pressure., Angiotensin II. ,Dryness of the mouth.

-6What are the two things that should to return to the normal state to stop the thirst desire?
Plasma osmolarity, Blood volume

-7What is the result on the ADH secretion when the osmolarity of the ECF decreased?
Decrease the secreation of the ADH

-8Mention two mechanim that occar to regulate your body fluid when you're fasting?
Decrease saliva secretion ❾feel of thirst ❾increase H2O intake ❾Stimulate osmoreceptor in the hypothalamic thirst center ❾increase Secreation of the ADH ❾increase H_2O absorption

THANK YOU FOR CHECKING OUR WORK!

BEST OF LUCK

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