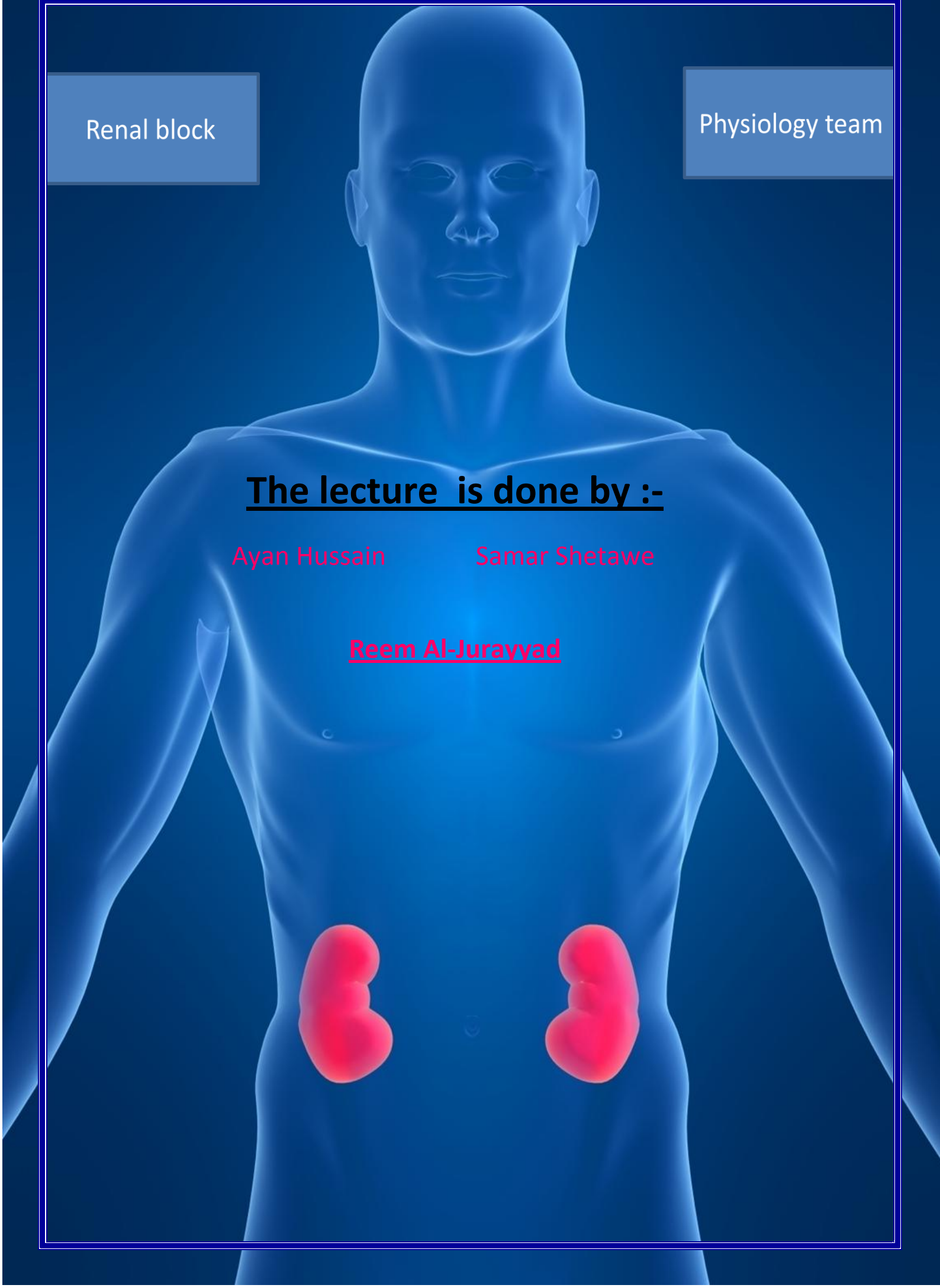
Renal block

Physiology team



The lecture is done by :-

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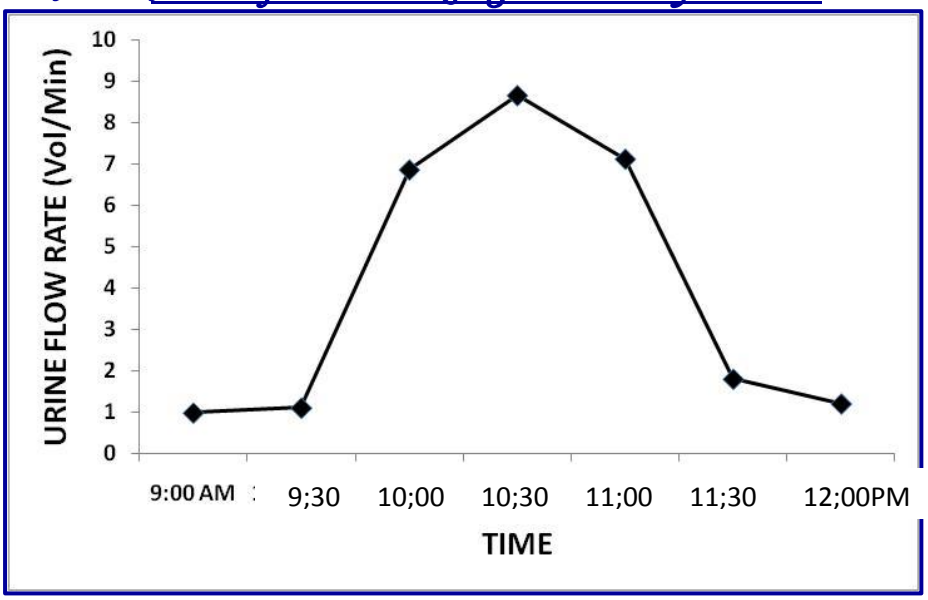
A- A subject drinking 1 liter of water

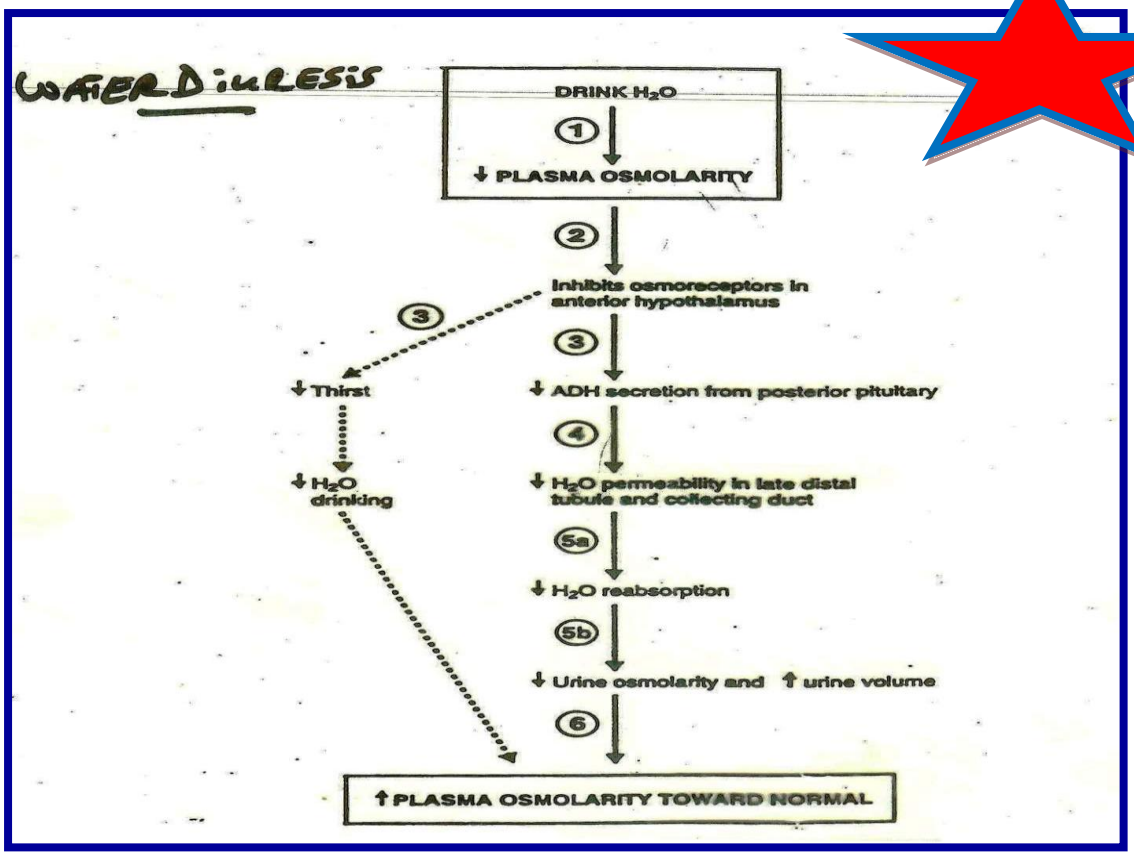


***Before drinking the 1 litter of water the subject should be asked to urinate (This sample will be pre-experimental sample).**

***After drinking the water the subject will be asked to urinate every half an hour (provide post-experimental samples).**

***We will find in these subjects that urine volume will be about the same in the first post-experimental sample as of the pre-experimental sample, but then it will increase dramatically (up to 6 or 8 ml) in the subsequent samples and will again decrease back to the level of pre-experimental sample in the last samples.**

***Healthy kidneys get rid of this 1 liter of water ingested by these volunteers in 3 hours and that will start after 30 minute.**



*The Mechanism;.

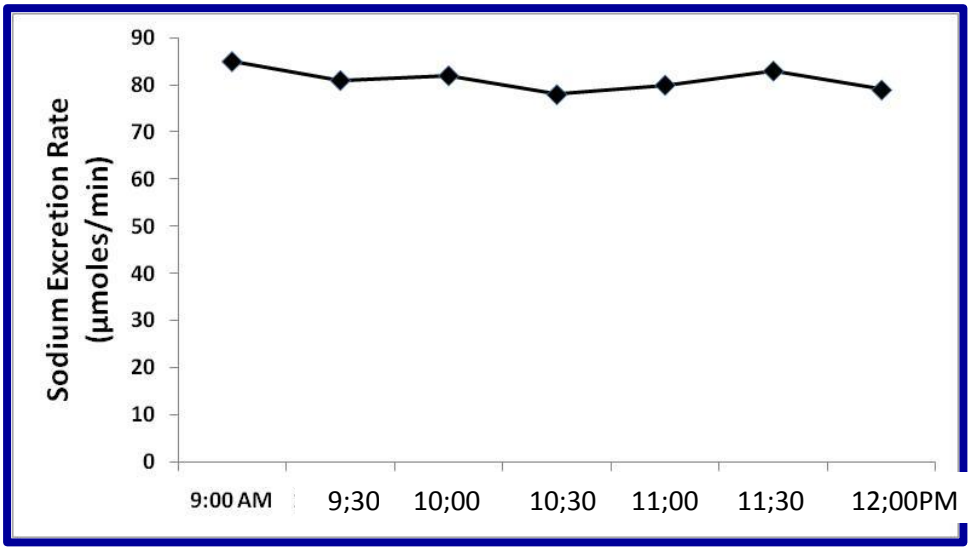
-When the subject drink a large amount of water the ECF osmolality decreases below the normal because the water is in excess; this will cause:

1.A special nerve cells called osmoreceptor cells, located in the anterior hypothalamus near the supraoptic nuclei will not send impulses to the pituitary gland.

2.NO ADH well be released .

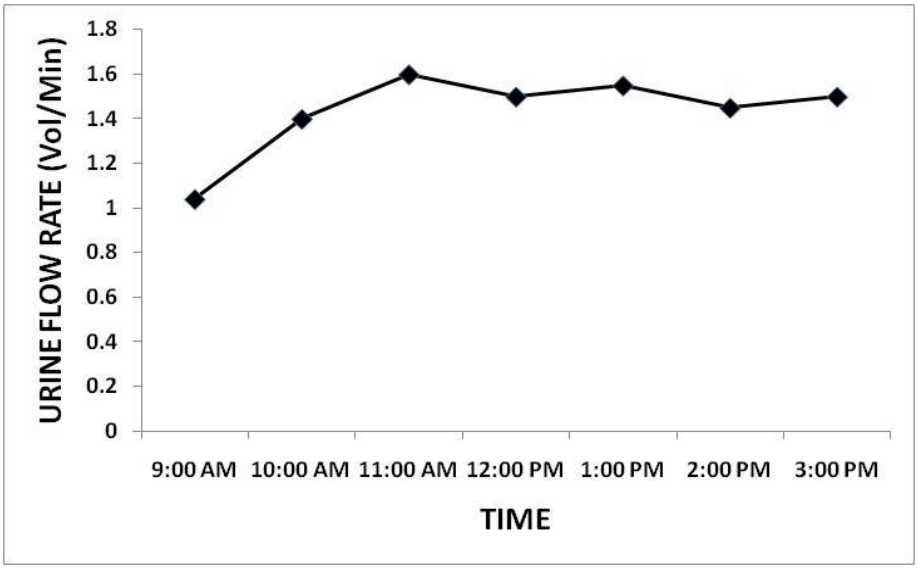
3.Decrease the water reabsorbtion from the late distal tubule and the collecting duct .

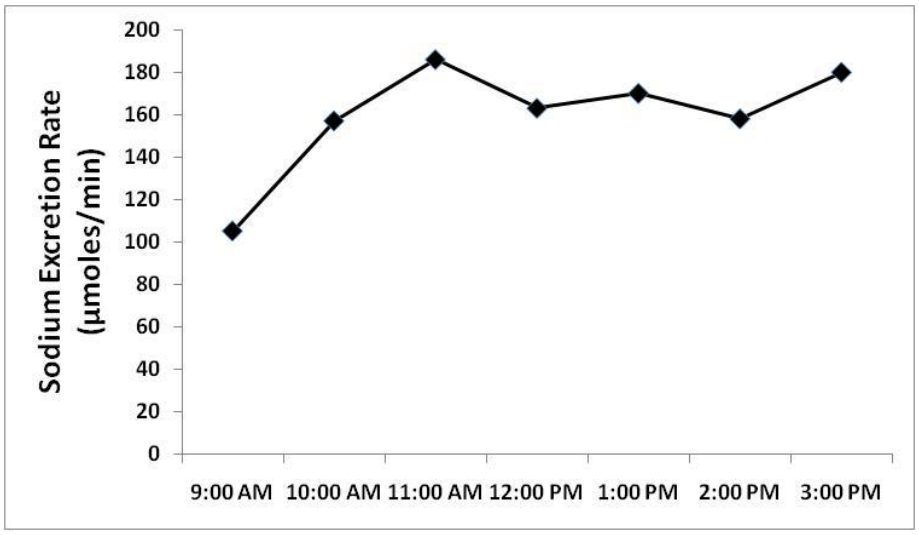
4.Urine osmolality decreases and the urine volume increases.



*** Sodium excretion in these volunteers will remain constant and that's because of inhibition of the ADH leading to excretion of water only in the urine and no changing in the sodium level.**

A subject drinking 1 liter of isotonic saline :-





What do u see in these charts ?!

We will find in these subjects that urine volume and Na^+ excretion will remain slightly increased in the post-experimental samples as compared to pre-experimental samples. It means that the kidneys are trying to get rid of this extra sodium chloride and water that has been ingested by these volunteers, but slowly. It will take 24 hours to excrete 1 liter of isotonic saline ingested by them. You can see the slightly increased urine volume and sodium excretion in the following graphs.

Isotonic Saline

DIURESIS EXPERIMENT

Isotonic Saline (0.9%) 1 litre

↓

↑ Volume of E.C.F.
Osmolality same (as Isotonic saline)

↓

↑ Stretch on Right atrium
(volume receptors in Right atrium)

↓

↑ ANP (Atrial Natriuretic Peptide)

↓

↑ Na^+ excretion by kidneys

ANP ACTION

↑ Blood flow to kidneys (due to relaxation of smooth muscles of blood vessels)

↑ GFR
↑ Na^+ loss in urine

↓ Aldosterone
↓ Na^+ reabsorption in DCT (↑ Na^+ loss in urine)

The mechanism:

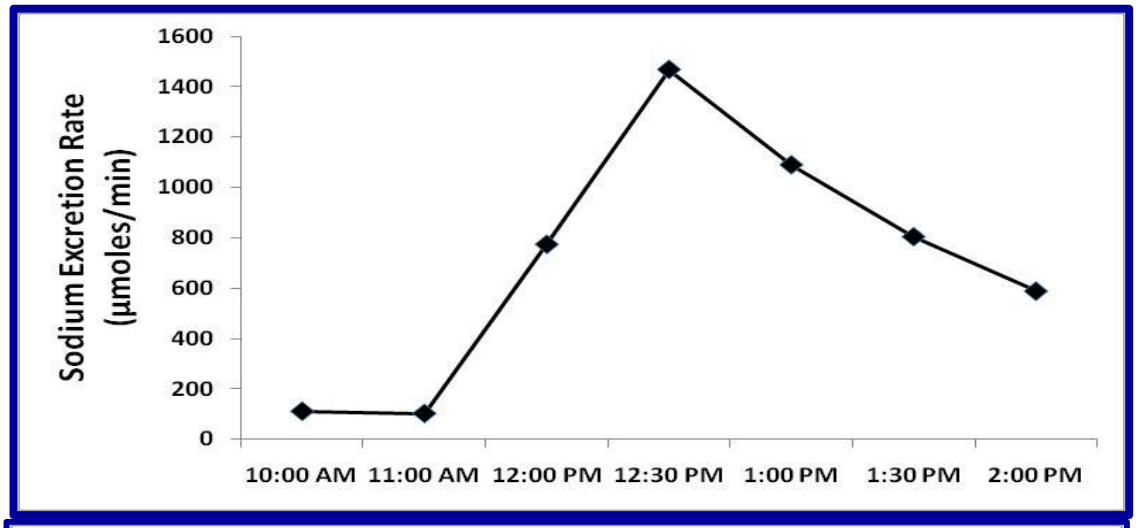
The subject take an isotonic saline (which means that you are taking the same amount of Na+ & water) thus his ECF osmolality will remain the same, but the ECF volume will increase and this will lead to several things :

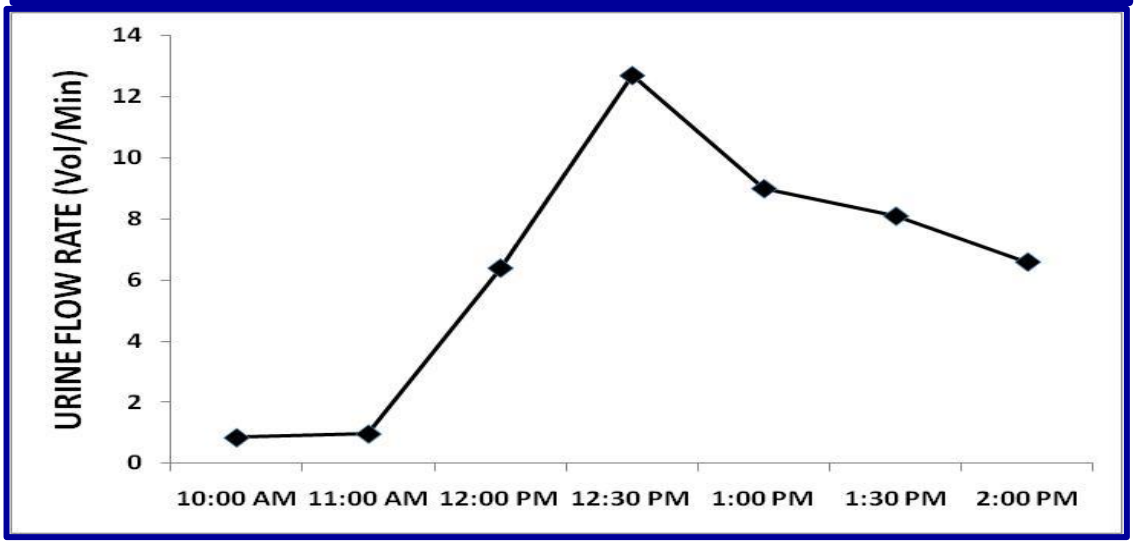
-As we know that ADH is stimulated by osomreceptors in the hypothalamus ONLY when the osmolality is high and is inhibited when the osmolality is low. When his osmolality remains the same these receptors will not be inhibited or stimulated so ADH level will not change.

-Due to this the fluid volume will increase leading to increase in the VR to the RA the RA will stretch and this will stimulate the ANP leading to increase in the GFR because of afferent dilation ⟶ increase in RBF ⟶ which lead to increase in urine volume & Na+ excretion

Note: **the ANP is not as fast as ADH and the kidney will take 24 hours to excrete 1 liter of isotonic saline.**

c. A subject who have taken 1 tablet of lasix;.



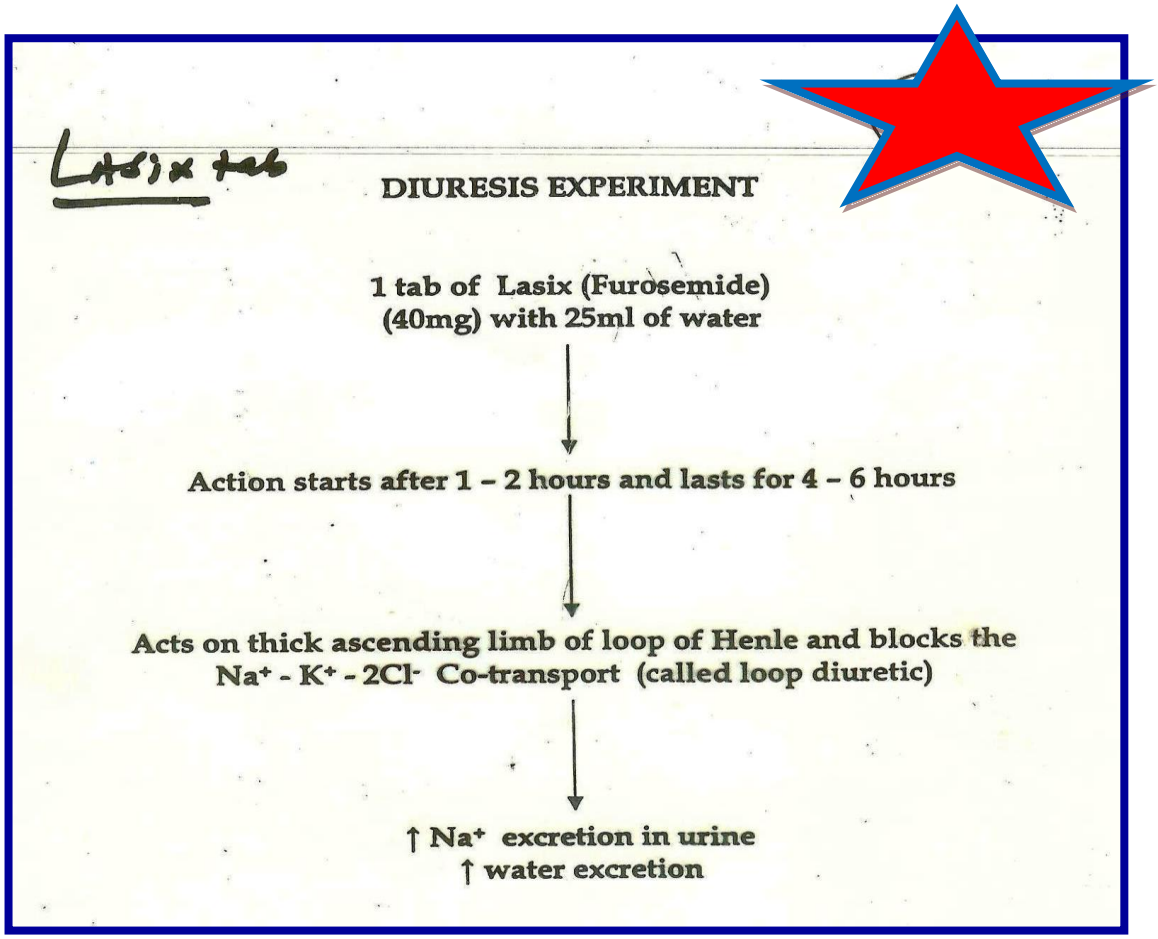


***When the subject has swallowed a Lasix (Furosemide) Tablet after giving a pre-experimental sample . They will give a post-experimental sample every one hour ,there will be no change in the graph during the first hour.**

*** it usually starts 1 to 2 hours after ingesting.**

***it lasts for 4-6 hours.**

***The volume and Na^+ excretion dramatically increased after 1 hour of taking Lasix tablet and remained increased for 4-6 hours .**

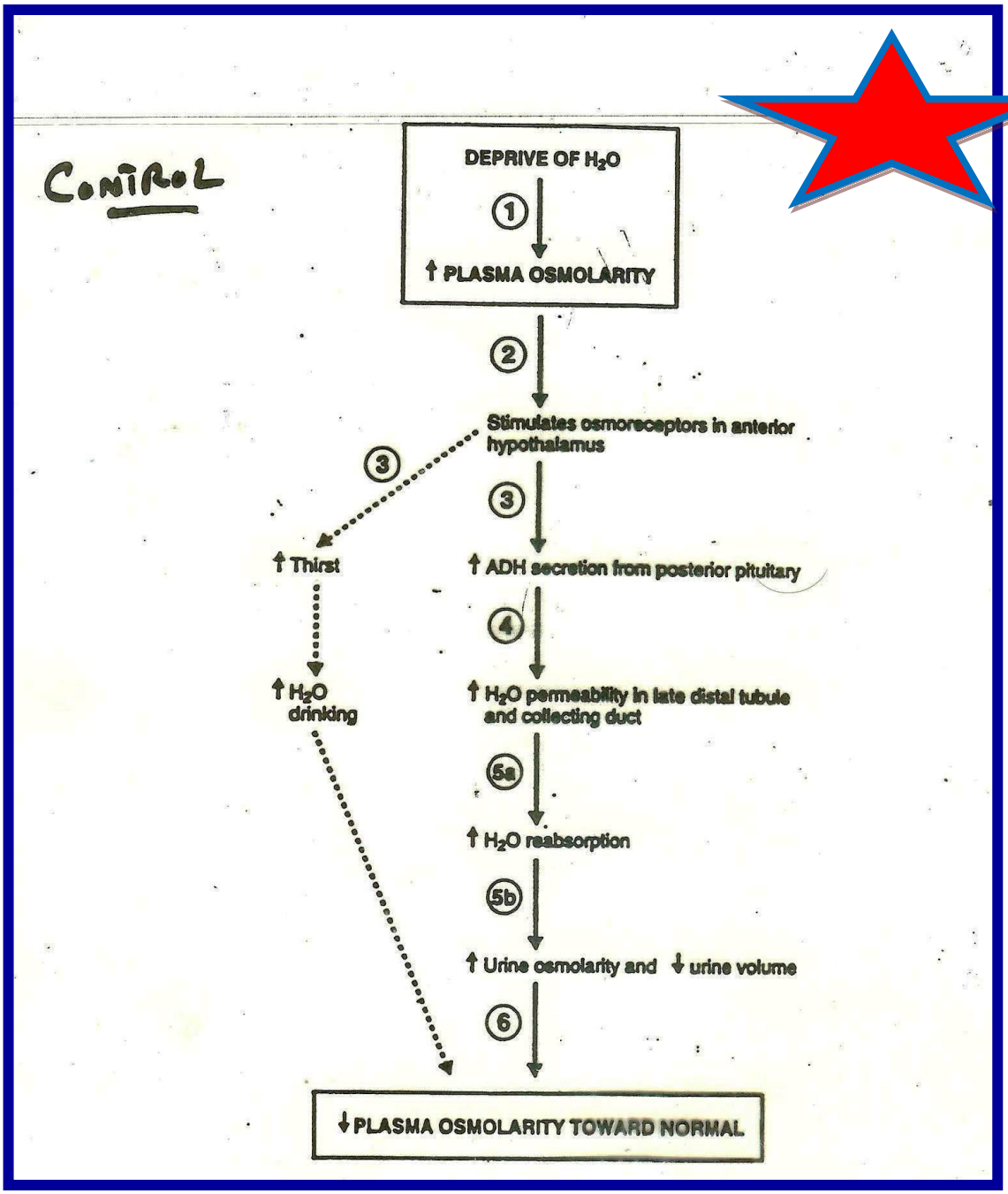


-The Mechanism :

LASIX :are one of the loop diuretics that works on the thick ascending limb of the loop of Henle by inhibiting the Na+\K+\2cl transporter thus reducing the reabsorption of Nacl so Na^+ will be excreted in urine and as lasix works as osmotic diuretics it will drag water with it causing diuresis.

D.THOSE ACTING AS CONTROLS (TAKING NO FLUIDS):

*The mechanism;.



you should know the mechanism of the normal control for urination

- Total sodium excretion is obtained by applying following equation:

$$\text{Sodium excretion} = \frac{\text{Sodium concentration x Volume of urine}}{1000}$$

- Sodium excretion rate is obtained by applying the following equation:

$$\text{Sodium excretion rate} = \frac{\text{Sodium concentration x Volume of urine}}{\text{Time}}$$

SAMPLE NO.	1	2	3	4	5	6	7
COLLECTION TIME (minutes)	120	30	30	30	30	30	30
VOLUME OF URINE (ml)	118	33	200	280	240	60	50
URINE FLOW RATE (ml / min)	0.98	1.1	6.66	9.33	8	2	1.66
SODIUM CONCENTRATION (mmoles/liter)	87	65	12	10	8	30	40
TOTAL SODIUM EXCRETION (mmoles)	10.3	2.2	2.4	2.8	1.9	1.8	2.00
SODIUM EXCRETION RATE (µmoles/min)	85.6	71.5	80	93.3	64	60	66.7

*from this table we can calculate the following for subject 1;.

-urine flow rate =volume of the urine/Time =118/120=0.98 ml / min

- SODIUM EXCRETION RATE=sodium concentration *urine volume/time=

87*118/120=85.6 µmoles/min

-total sodium excretion = sodium concentration *urine volume/1000 =

87*118/1000=10.3 mmoles.

Important things that u should know :-

1-The mechanism of each one .

2- The calculation especially the flow rate.

3- The graphs for water and Na+ cause they might bring the graph and ask this graph shows what?!

-answer >>>a subject taking lasix ,water,saline or controlled) or they might ask questions about the graph which is written under each graph but focus more on the water graphs.

Good luck ☺