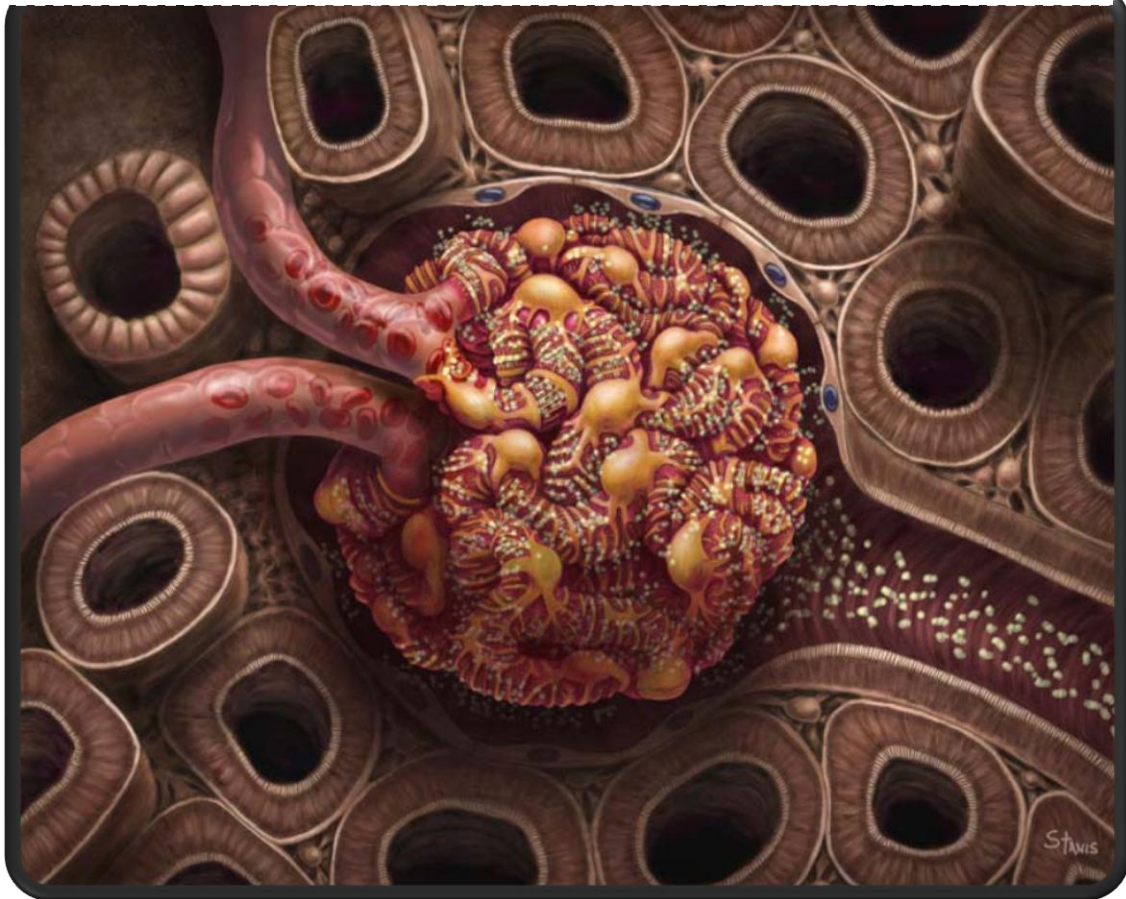


Physiology Team 431



Team leaders

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- Abdullah Al-Towim
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DIURESIS PRACTICAL

objectives

1. To be able to discuss the mechanisms by which the body:
 - a. Conserves fluids and sodium if neither food nor water is taken.
 - b. Excretes more water when extracellular fluids are diluted by the ingestion of water.
 - c. Slowly eliminates sodium and water when the extracellular fluid volume is increased without altering its osmolality.
 - d. Excretes large quantities of both water and sodium after taking Lasix tablet.

Most important points :

- **look for the graphs in this file (especially the one which is about urine flow) and you have to memorise the orders with each graph.**
- **you have to know how to calculate total sodium excretion and sodium excretion rate.**

**Several students have volunteered
to take an active part in this
practical class**

Let us see what happen with them



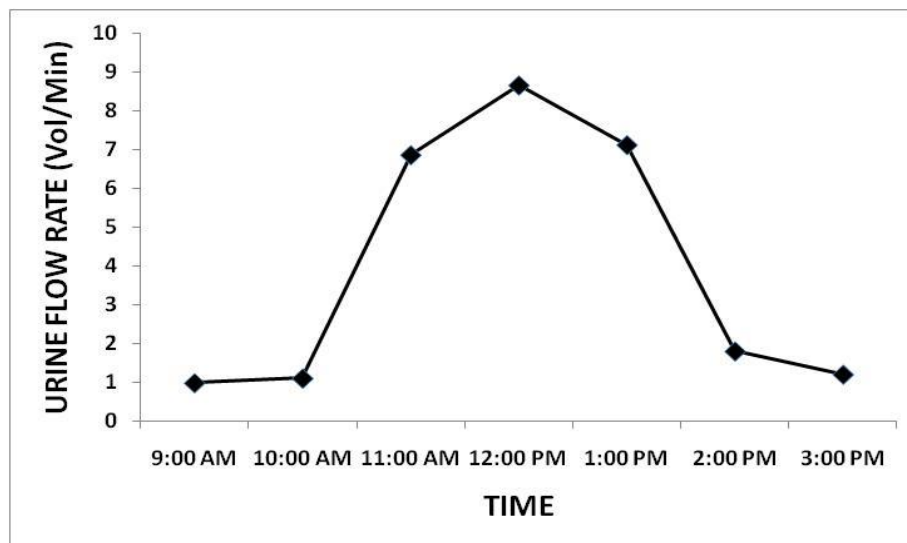
first subject dinking 1 litter of water

pre-experimental sample → before drinking 1 litter of water the subject asked to urinate .

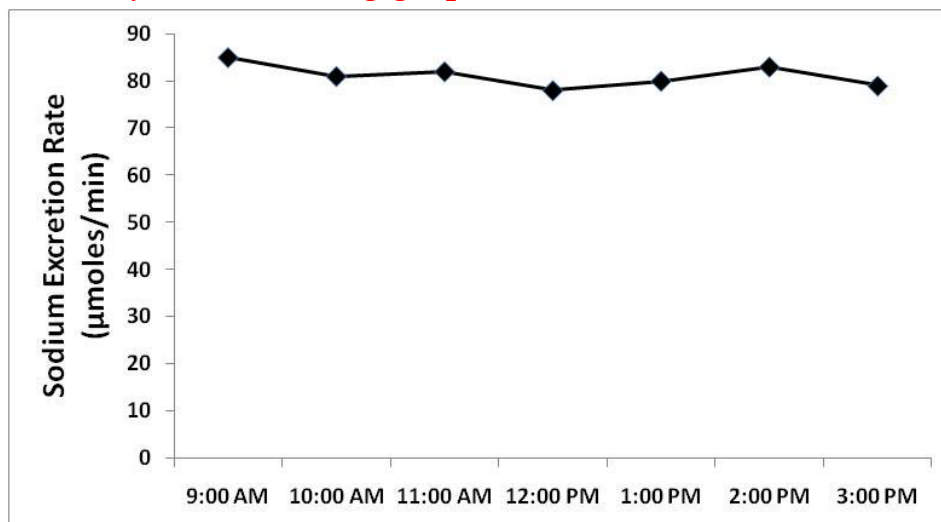
post-experimental sample → after drinking 1 litter of water the subject asked to urinate every half an hour

We will find in the subject that urine volume will be about the same in the first post-experimental sample as of the pre-experimental sample, **but then will increase dramatically in the subsequent samples and will again decrease back to the level of pre-experimental sample in the last sample.**

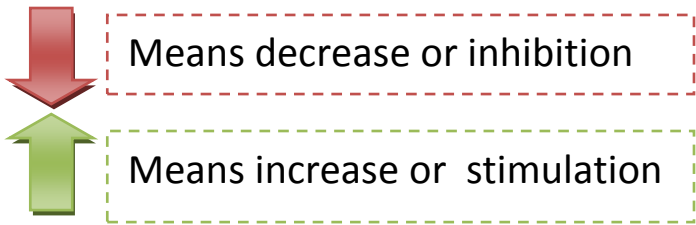
It means that the healthy kidneys get rid of this 1 liter of water ingested by the subject in 3 hours and the mechanism starts after 30 minutes, as shown by the following graph:



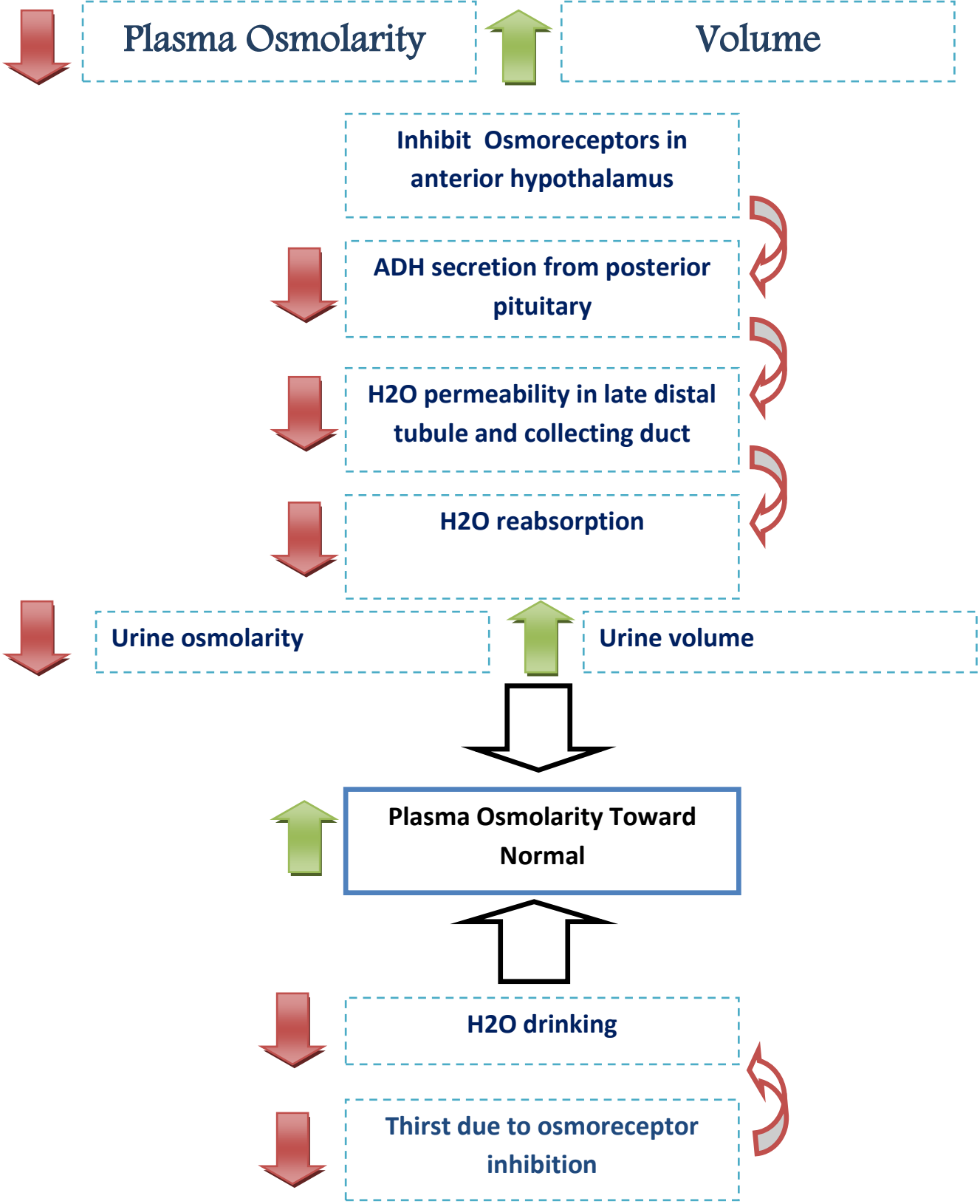
However sodium excretion in this subject will remain constant as shown by the following graph:



It is basic knowledge and not included in our exam as DR sitalbanat said

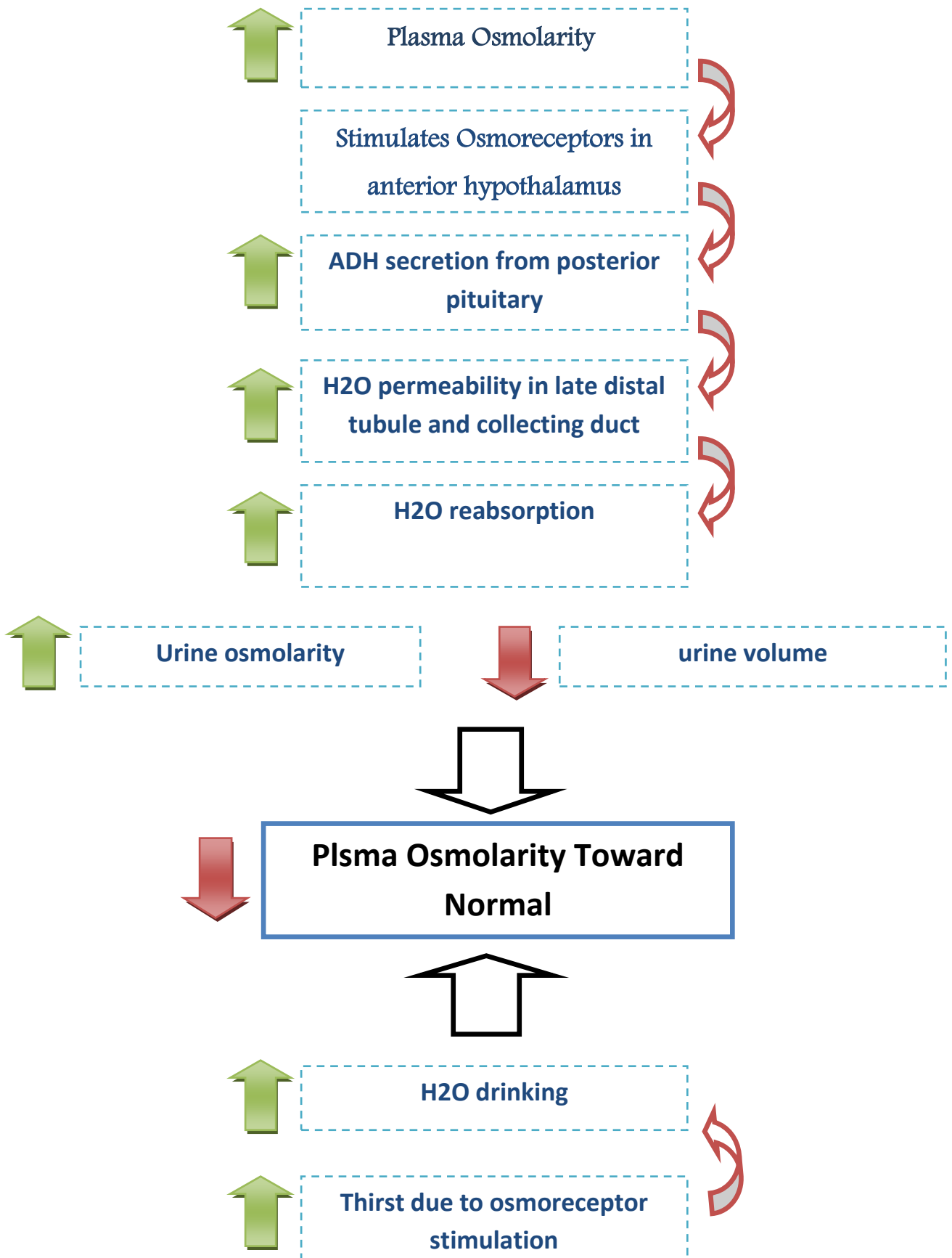


The mechanism :



Second subject taking no fluids

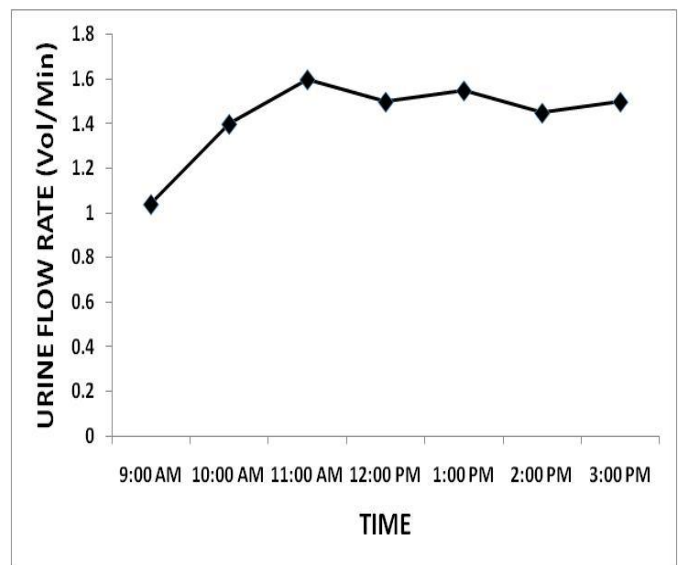
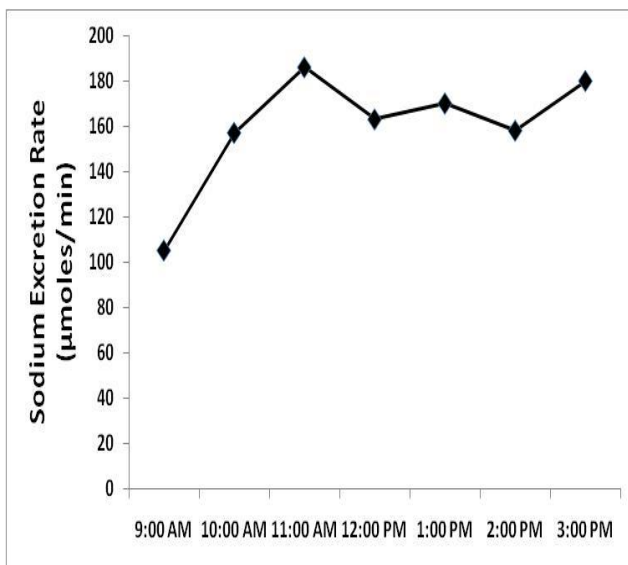
It is basic knowledge and not included in our exam as DR sitalbanat said



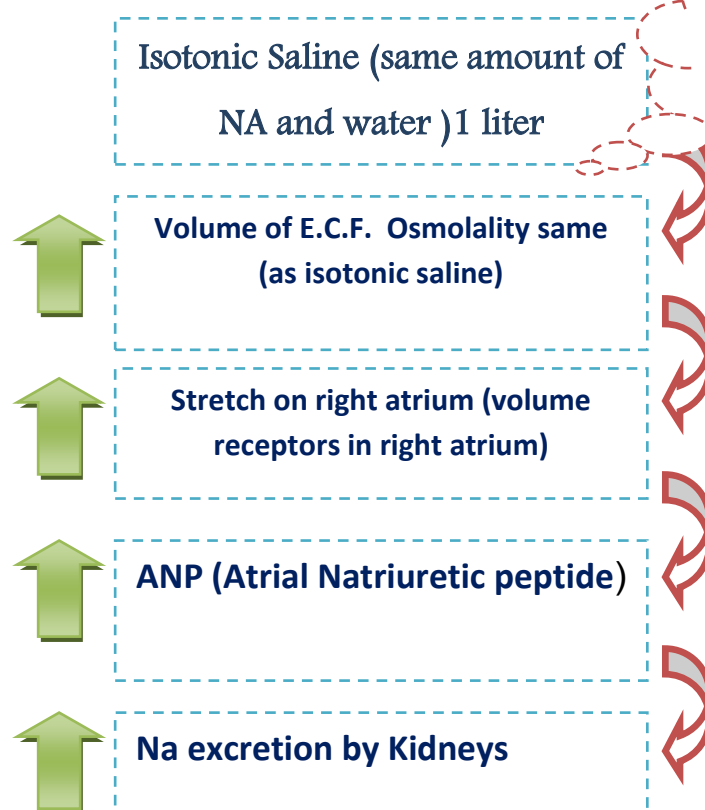
Third Subject drinking 1 liter of isotonic saline

We will find in this subject that **urine volume and osmolality will remain slightly increased** in the post-experimental sample as compared to pre-experimental sample. It means that the kidneys are trying to get rid of this extra sodium chloride and water that has been ingested by this subject, but slowly. As a matter of fact, it will take 24 hours to excrete 1 liter of isotonic saline ingested by him.

You can see the slightly increased urine volume and sodium excretion in the following graphs:



The mechanism

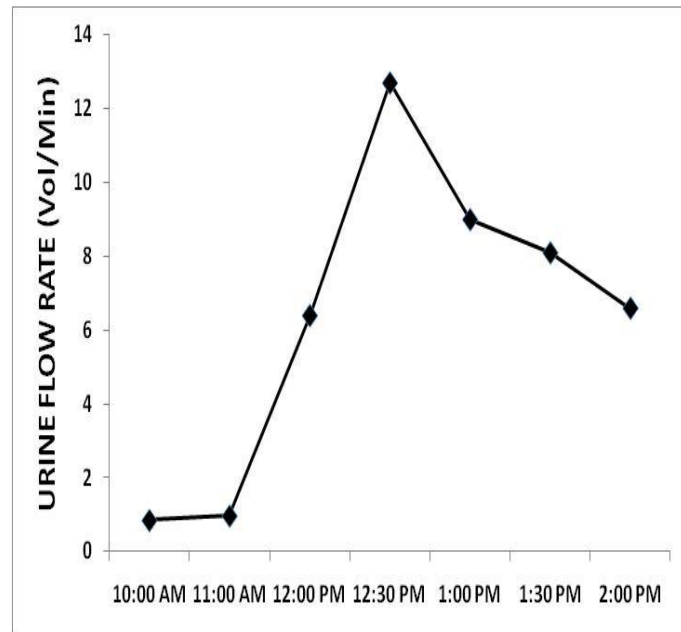
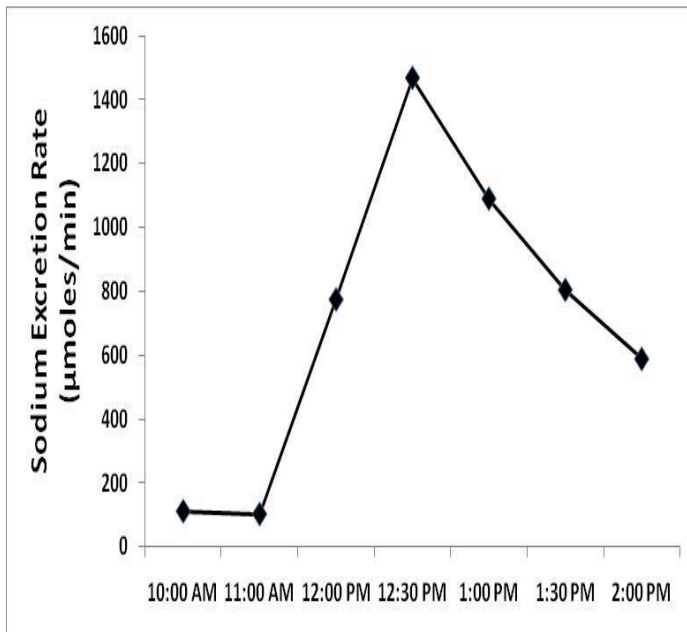


It is basic knowledge and not included in our exam as DR sitalbanat said

Fourth subject taking 1 tablet of lasix

We will find in the subject that urine volume and osmolality dramatically increased after 1 hour of taking Lasix tablet and remained increased for further duration of experiment. What we know about the effect of Lasix is that it usually starts 1-2 hours after ingesting it and lasts for 4-6 hours.

That means volume and Na excretion dramatically increased after 1 hour and remained increased for 4-6 hours You can see the changes in urine volume and sodium excretion in this subject taking Lasix tablet in the following graphs:



The mechanism

It is basic knowledge and not included in our exam as DR sitalbanat said

1 tab of Lasix (furosemide) (40mg) with 25ml of water

Action starts 1-2 hours and lasts for 4-6 hours (1/2 life of furosemide is 6hr)

Acts on thick ascending limb of loop of Henle and blocks the Na-K-2Cl co-transport (called loop diuretic)

Na excretion in urine and water excretion (osmotic drag)



The following is a sample table that we fill out during these experiments:

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 (μ moles/min)	85.6	71.5	80	93.3	64	60	66.7

- The sample no.1 is the pre-experimental sample and the remaining samples are post-experimental samples.
- Urine flow rate is obtained by applying the following equation**

$$\text{urine flow rate} = \frac{\text{Volume of urine}}{\text{time}}$$

- Total sodium excretion is obtained by applying following equation:**

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

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

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

$$\text{Sodium excretion rate} = \frac{87 \times 118}{120} = 85.6 \mu\text{moles/m}$$

$$\text{total sodium excretion} = \frac{87 \times 118}{1000} = 10.3 \text{mmol}$$

$$\text{urine flow rate} = \frac{118}{120} = 0.98 \text{ml/min}$$

Calculations for sample 1

This page for knowledge and for practicing to calculate total sodium excretion and rate also to calculate urine flow rate

SAMPLE NO.	1	2	3	4	5	6	7
COLLECTION TIME - mins	120	30	30	30	30	30	30
VOLUME (ml)	118	33	206	260	214	54	36
VOLUME/MINUTE (ml/min)	0.98	1.10	6.87	8.67	7.13	1.8	1.2
[Na ⁺] (mM)	87	56	12	9	10	25	53
TOTAL SODIUM EXCRETION - mmoles	10.3	1.8	2.5	2.3	2.1	1.4	1.9
SODIUM EXCRETION (μmoles/min)	85.6	61.6	82.4	78	71.3	45	63.6

H₂O

SAMPLE NO.	1	2	3	4	5	6	7
COLLECTION TIME - mins	120	30	30	30	30	30	30
VOLUME (ml)	125	39	50	42	47	32	45
VOLUME/MINUTE (ml/min)	1.04	1.30	1.67	1.40	1.57	1.07	1.50
[Na ⁺] (mM)	101	98	112	109	120	137	127
TOTAL SODIUM EXCRETION - mmoles	12.6	3.8	5.6	4.6	5.6	4.4	5.7
SODIUM EXCRETION (μmoles/min)	105.2	127.4	186.7	152.6	188.0	146.1	190.5

SALINE

Sample No.	1	2	3	4	5	6	7
COLLECTION TIME - mins	120	60	42	18	30	30	
VOLUME (ml)	102	58	269	230	270	125	
VOLUME/MINUTE (ml/min)	0.85	0.97	6.4	12.7	9.0	4.2	
[Na ⁺] (Conc) (mM)	132	107	121	115	121	117	
TOTAL SODIUM EXCRETION - mmoles	13.5	6.2	32.5	26.4	32.6	14.6	
SODIUM EXCRETION (μmoles/min) rate	112.2	103	774	1467	1089	487.5	

Lasix

$$\frac{132 \times 102}{1000}$$

$$\rightarrow \frac{Na^+ (conc) \times Vol}{1000}$$

$$\rightarrow \frac{Vol \times conc Na^+}{time}$$

$$\frac{102 \times 132}{120}$$

2 HOURS BEFORE TAKING LASIX

3 HOURS AFTER TAKING LASIX

DIURESIS EXPERIMENT