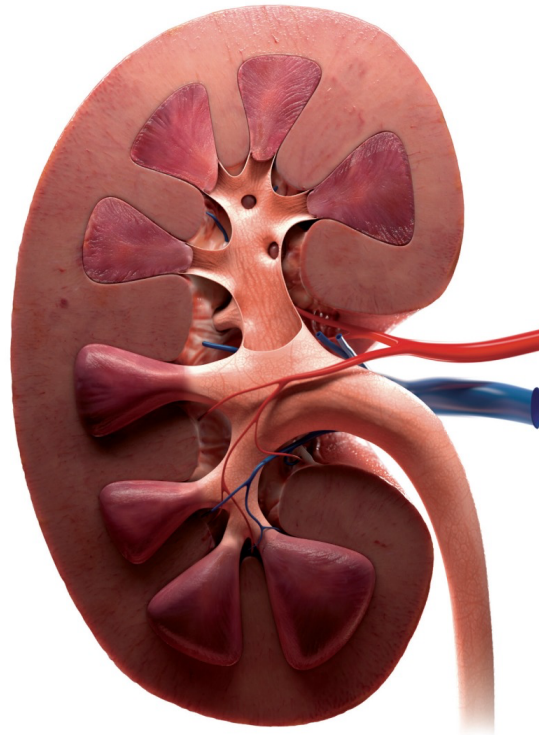




03d – HOMEOSTASIS

Osmoregulation & Blood Pressure



Altering Metabolism



3.3.3 Hormones can alter the **metabolism** of target cells, tissues, or organs.

- ☑ Describe the role of **antidiuretic** hormone (ADH) in **osmoregulation**.
- ☑ Discuss **links** between osmoregulation, blood volume, and blood pressure.

Diuretic: a substance that causes increased urine production (... loss of water)

Antidiuretic: a substance that causes decreases urine production (... keep water)



Blood Volume and Pressure

(water makes the difference)

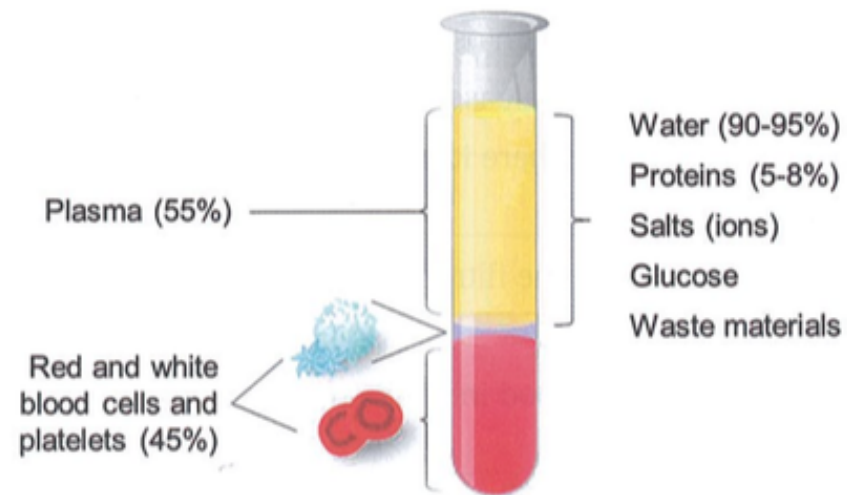


Figure 3.26: Composition of human blood.

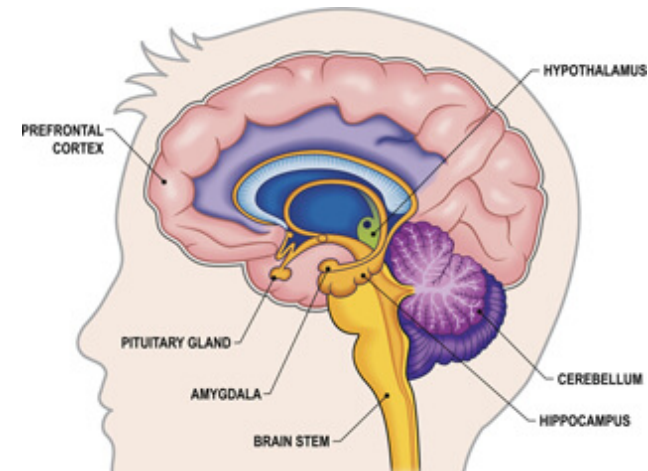
Osmolarity of the Blood

Osmolarity: the concentration of a solution (ie. blood)

Osmolarity	Water concentration	Causes
High	Low	<ul style="list-style-type: none">• Water loss/deprivation/dehydration• High level of sugar and salt in the blood.• Diarrhoea.
Low	High	<ul style="list-style-type: none">• Excessive water/fluid ingestion.• Low level of sugar and salt in the blood.• Syndrome of inappropriate antidiuretic hormone secretion (SIADH).

ADH (from pituitary gland):
production, secretion and activity is regulated
by changes in blood osmolarity

Sensor? Hypothalamus



Blood Volume and Pressure

(water makes the difference)

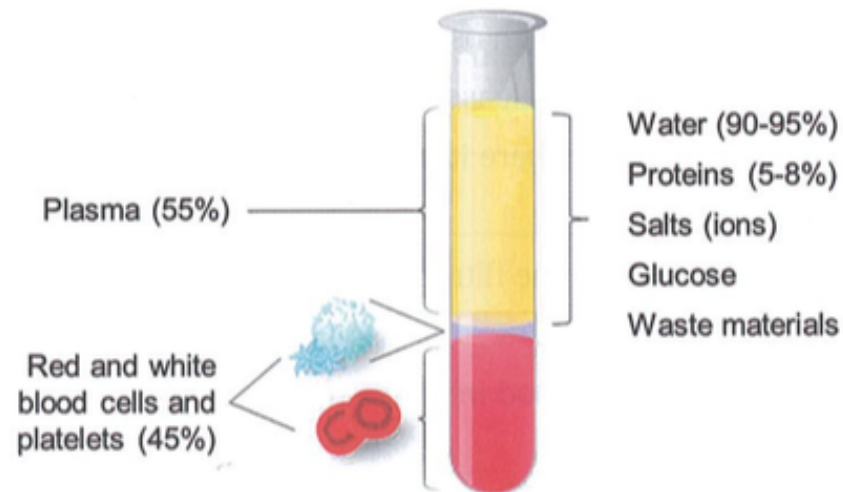
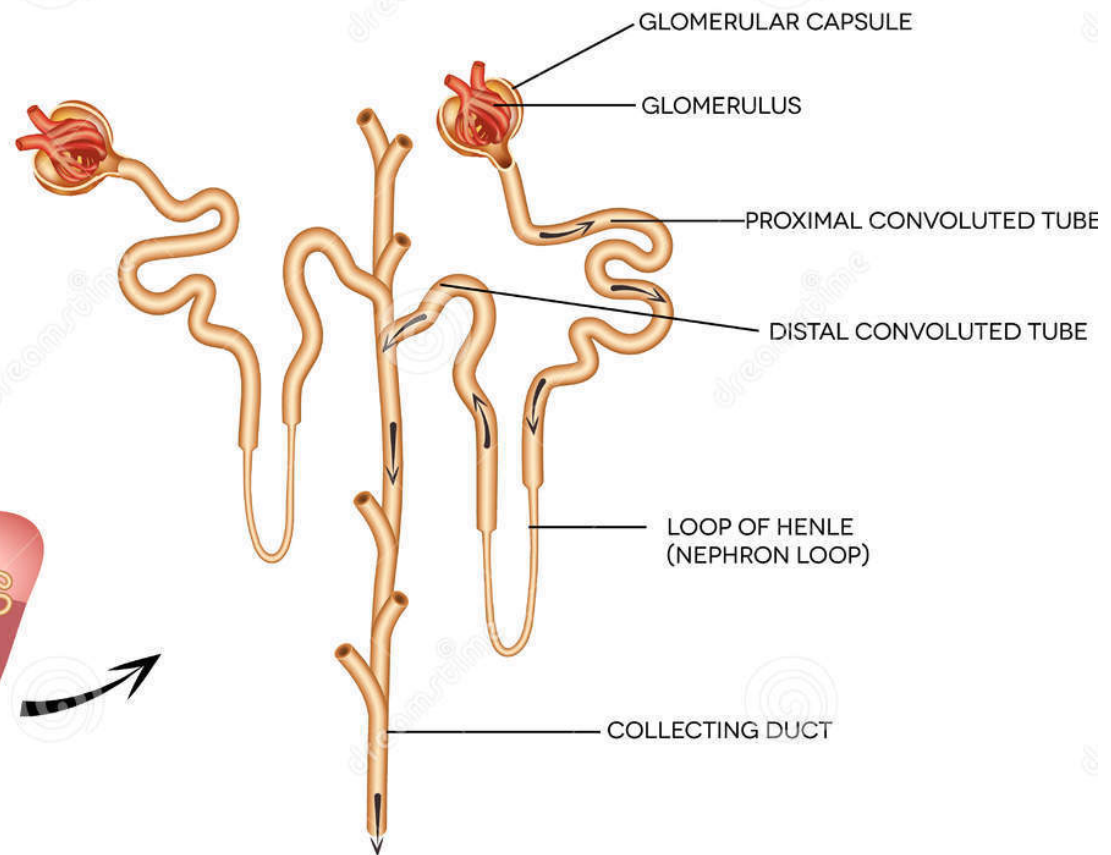
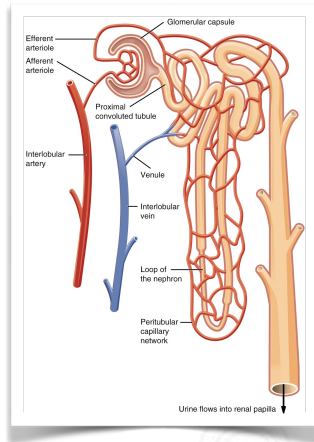


Figure 3.26: Composition of human blood.

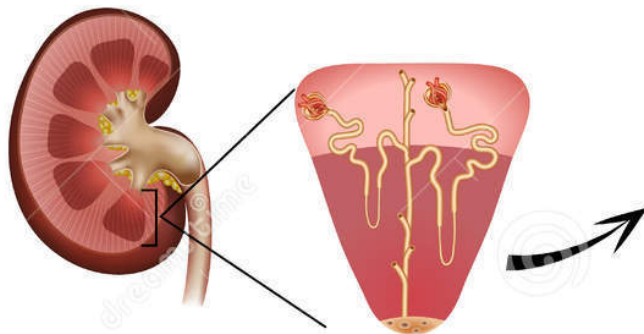
Property	Effect of water diffusing into blood	Effect of water diffusing out of blood
Osmolarity	Decreases	Increases
Blood volume	Increases	Decreases
Blood pressure	Increases	Decreases

Nephron of Kidney

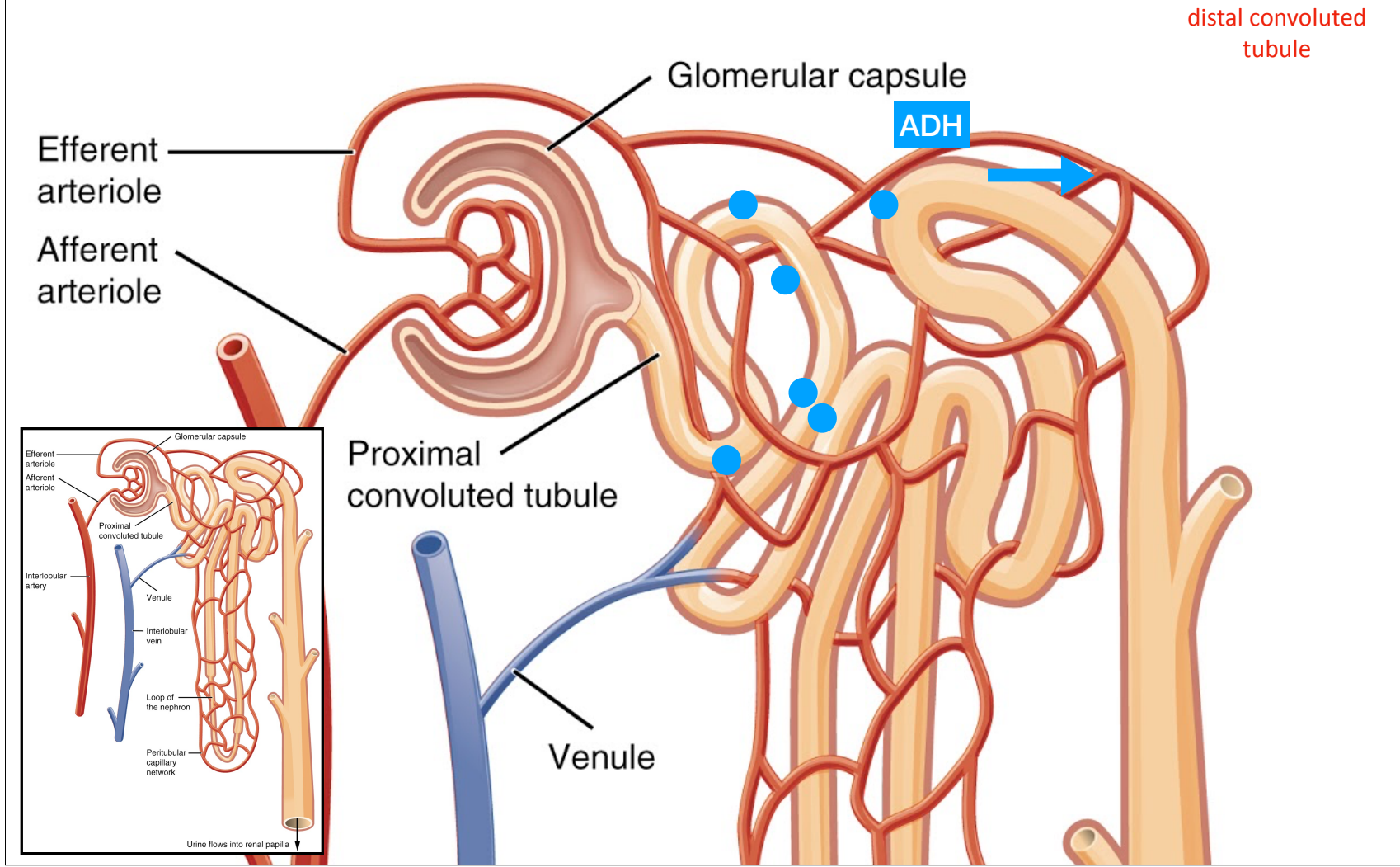
NEPHRON = function unit of kidney that forms urine by filtering waste/water from blood; 1,000,000 per kidney



KIDNEY



Action of ADH on Nephrons



What Happens?

Hypothalamus osmoreceptors:

detects high osmolarity (low water in blood)

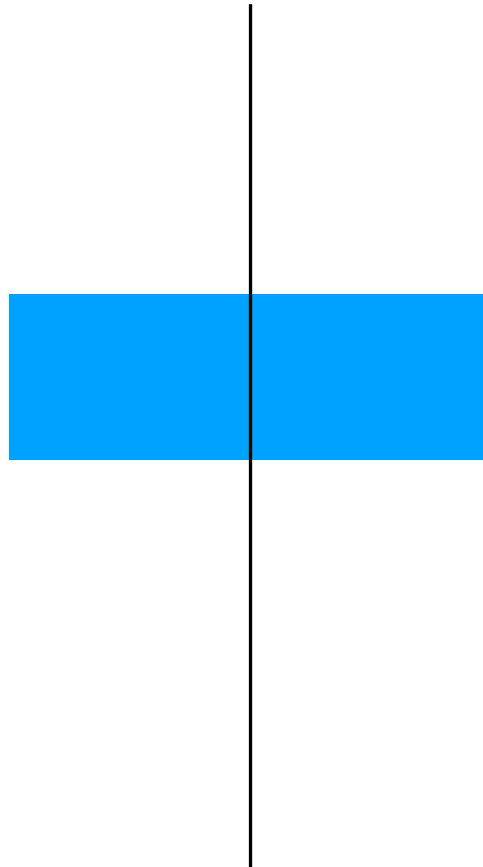
1. **Secretion of ADH into blood circulatory system (from pituitary)**
2. **ADH targets cells on distal convoluted tubule of nephron**
3. **Cells increase permeability and allow water to go from tubule back into blood (reabsorbed and ∴ conserved).**
4. **Blood water levels increase (lower osmolarity)... inhibits further ADH production.**

Hypothalamus osmoreceptors:

detects low osmolarity (high water in blood)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

too much water in blood



too little water in blood

Negative Feedback

The role of ADH in the regulation of osmolarity is summarised in Figure 3.25.

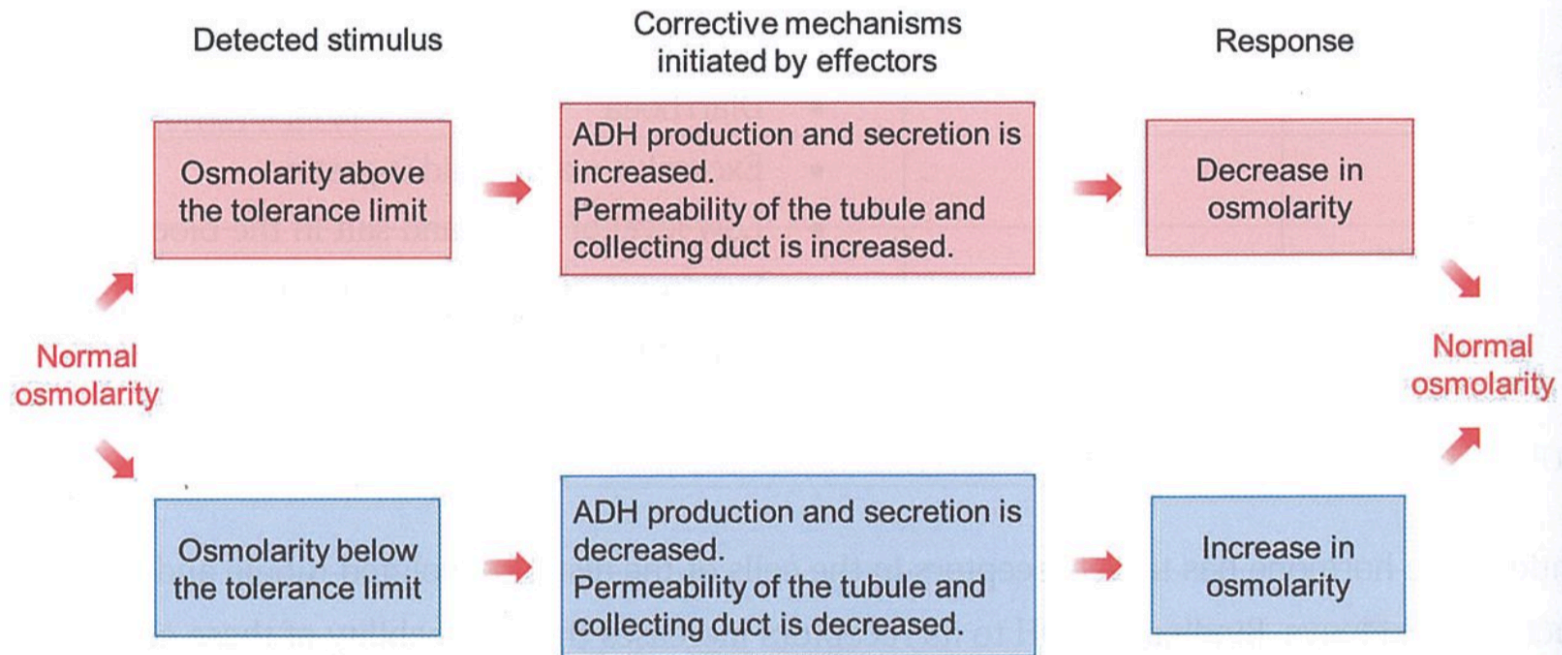


Figure 3.25: Negative feedback (osmolarity)

What Happens?

When you ingest a diuretic...

- 1.
- 2.
- 3.
- 4.
- 5.



What Happens to You One Hour After Downing a Can of Coke



1 **FIRST 10 MINUTES**

10 teaspoons of sugar hit your system. (100% of your recommended daily intake.) You don't immediately vomit from the overwhelming sweetness because phosphoric acid cuts the flavor allowing you to keep it down.

2 **20 MINUTES**

Your blood sugar spikes, causing an insulin burst. Your liver responds to this by turning any sugar it can get its hands on into fat. (There's plenty of that at this particular moment)

3 **40 MINUTES**

Caffeine absorption is complete. Your pupils dilate, your blood pressure rises, as a response your liver dumps more sugar into your bloodstream. The adenosine receptors in your brain are now blocked preventing drowsiness.

4 **45 MINUTES**

Your body ups your dopamine production stimulating the pleasure centers of your brain. This is physically the same way heroin works, by the way.

5 **60 MINUTES**

The phosphoric acid binds calcium, magnesium and zinc in your lower intestine, providing a further boost in metabolism. This is compounded by high doses of sugar and artificial sweeteners also increasing the urinary excretion of calcium.

6 **60 MINUTES**

The caffeine's diuretic properties come into play. (It makes you have to pee.) It is now assured that you'll evacuate the bonded calcium, magnesium and zinc that was headed to your bones as well as sodium, electrolyte and water.

7 **60 MINUTES**

As the rave inside of you dies down you'll start to have a sugar crash. You may become irritable and/or sluggish. You've also now, literally, urinated away all the water that was in the Coke. But not before infusing it with valuable nutrients your body could have used for things like even having the ability to hydrate your system or build strong bones and teeth.

Source: the renegade pharmacist.

Blood Pressure

What happens when your blood pressure **drops**?

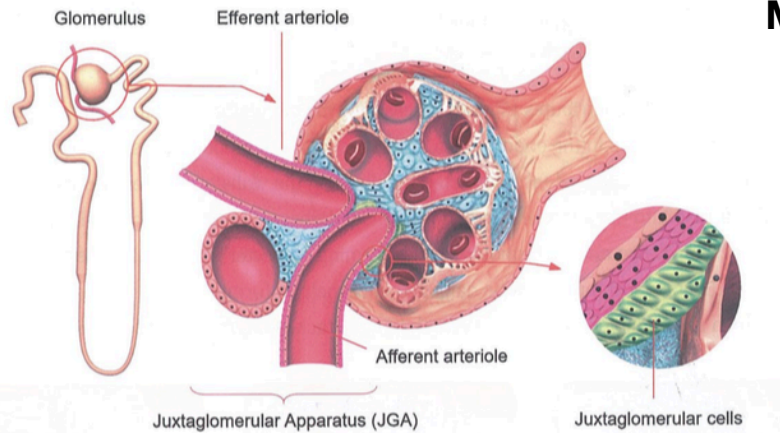


Figure 3.27: Juxtaglomerular cells in the human kidney.

Mechanoreceptors (detect pressure)
in JGA of Nephron

if your blood pressure is **dropping**

JGA makes renin
(peptide hormone)

Liver makes...

angiotensin
(peptide hormone)

Adrenal glands make...

aldosterone

Nephron

- * allow re-absorption of salt and water into blood
- * = up blood **volume**
- * = up blood **pressure**

Blood vessels

- * constrict
- * = up blood **pressure**