Hello, I'm Dr Alex Lathbridge and this is Bitesize Biology.

This the seventh episode in our eight-part series on homeostasis.

Today, we're going to talk about water and nitrogen balance.

In our series on The Cell, we looked at osmosis, the movement of water across a selectively permeable membrane from a region of higher concentration to a region of lower concentration. If that doesn't ring a bell, go back and listen because it's going to come up today.

Water and mineral salt levels need to be controlled, so that the concentration of water and salts is the same inside and outside the cells.

If the water concentration is too low outside of the cell, water leaves the cell by osmosis, meaning it might shrivel up.

If the water concentration outside the cell is too high outside of the cell, too much water enters the cell by osmosis and they swell up, and they might burst.

So maintaining a constant level of water and mineral salts in the blood is known as osmoregulation.

There are a few different ways that water leaves the body :

When we sweat, water leaves through the skin.

When we breathe out, or exhale, water leaves from the lungs, like when you breathe out on a window or into the air on a cold day, you can see water vapour.

Surprisingly, the lungs and skin have no control over how much water is lost.

It's down to the kidneys, they control water loss. They remove excess water, salt and urea from the blood to produce urine.

Urine is actually a really good marker for what's going on in your body. Because it's one of the routes by which the body gets rid of all the by-products that shouldn't really stay in your bloodstream.

So the general rule of hydration is that the lighter and clearer your urine, the better. If you don't drink enough water and get dehydrated, your urine can end up dark brown in colour. But this can also be affected by medication that you take, vitamins, alcohol, and diet.

Let's have a deeper look at the urinary system now. You need to know the different parts and what

they do, so grab a pen and write this down:

The urinary system is made up of the kidneys, the renal artery, the renal vein, and the bladder.

This is an example of an organ system.

The kidneys produce urine by filtration of the blood, selecting the useful substances that it wants to keep, and reabsorb.

So blood is transported to the kidney by the renal artery.

Once at the kidney, blood is filtered at high pressure and the kidney reabsorbs anything useful like glucose, salt ions, and water.

After the blood has been filtered in the kidneys, it returns to the circulatory system by the renal vein.

The kidneys produce urine which is taken from them to the bladder. The bladder stores urine until is expelled from the body (by peeing.)

Urine is made up of water, salts, and urea. Urea is the main waste product in urine, as it's not reabsorbed by the kidneys.

Urea is made by the liver when excess amino acids are broken down (don't worry, more about that later!)

Let's focus specifically on the kidneys now and look at the nephron.

You can think of nephrons like big, helpful sieves. They're responsible for "cleaning" the blood by removing urea, excess water and mineral ions.

There are three stages of how the kidney works to maintain water levels and produce urine:

Stage 1 is filtration. Blood containing waste products arrives at the nephron inside the kidney, where there are networks of capillaries (these are really small blood vessels.)

This means the blood travels under high pressure, which helps with the filtration.

Small molecules including urea, water, ions and glucose are filtered, or forced under high pressure, out of the blood and pass into the nephron.

Large molecules such as proteins are too big to fit through the small capillary walls and remain in the blood.

Stage 2 is selective reabsorption. Now that all the small essential molecules such as water, ions, and glucose have been filtered out of the blood, the kidneys must reabsorb molecules that are needed, whilst letting the molecules that aren't, to pass out in the urine.

The kidneys selectively reabsorb, back into the bloodstream, only the molecules that the body absolutely needs.

These reabsorbed molecules include glucose, just enough water to maintain the right water levels in the blood, and just enough ions to maintain the right levels of mineral ions in the blood. This filtered blood leaves the kidney via the renal vein.

Stage 3 is the formation of urine. The waste products, the molecules which are not selectively reabsorbed, travel along the nephron as urine. This then passes down to the bladder until it can be expelled.

Finally, we're going to talk about what urea is and how the body controls nitrogen levels.

As well as blood glucose and water levels, the body also needs to carefully maintain and control the levels of nitrogen.

When we eat, we digest lots of proteins. Long protein molecules are broken down into amino acids. This results in excess amino acids which need to be excreted safely.

Our bodies can't store proteins because of the nitrogen molecules in them. The rest of the protein is very useful, but the body can't deal with nitrogen so we have to get rid of it.

During digestion, excess proteins are broken down into amino acids, and then comes deamination.

This is where amino acids are further broken down to form ammonia.

Ammonia is the substance containing nitrogen and its toxic, so it gets immediately converted into urea, so it can be excreted safely.

So urea is actually a waste product made of nitrogen, resulting from this breakdown of proteins.

In the liver, amino acids are converted into ammonia, but as ammonia cannot be allowed to accumulate in the body, it is converted into urea.

Urea is released from the liver into the bloodstream and is carried to the kidneys where it can be filtered out, so the urea is passed out of the body in urine when we pee.

I'm Dr Alex Lathbridge and this is Bitesize Biology, listen now on BBC Sounds.