

## 11.1 Urinary System Anatomy

### What is it and what does it do?

- Every living organism produces waste that it needs to remove from the body. The urinary system is how the body removes the waste that it generates from each cell. This is different than the waste that is produced from the digestive system.
  
- The waste from the digestive system is the left over stuff that could not be digested and absorbed from the food that we eat.
  
- The waste that the urinary system removes is the waste that results from the running and operating of the cells and all of the other systems in the human body.

- We have mentioned in other systems organs that filter things: The liver filters out toxins that are in the blood and breaks them down. The spleen filters out old blood cells and breaks them down. In both cases they are broken down, but where do the broken down pieces go? That is where the urinary system comes in. The urinary system filters out the broken pieces (urea) and excretes them in your urine.
  
- The urinary system is composed of 2 organs: the kidneys and the urinary bladder.

## Kidneys:

- You have two kidneys. They are located mid back behind your digestive system. Each one is shaped exactly like a kidney bean, but they are not small like kidney beans. They are each about the size of your fist.
- The kidney is a really advanced filter. The filter part is called a nephron.
- Each kidney is composed of more than one million urine-forming nephrons that are located in the renal cortex and renal medulla.
- Each nephron is composed of a glomerulus, Bowman's capsule, and tubule.

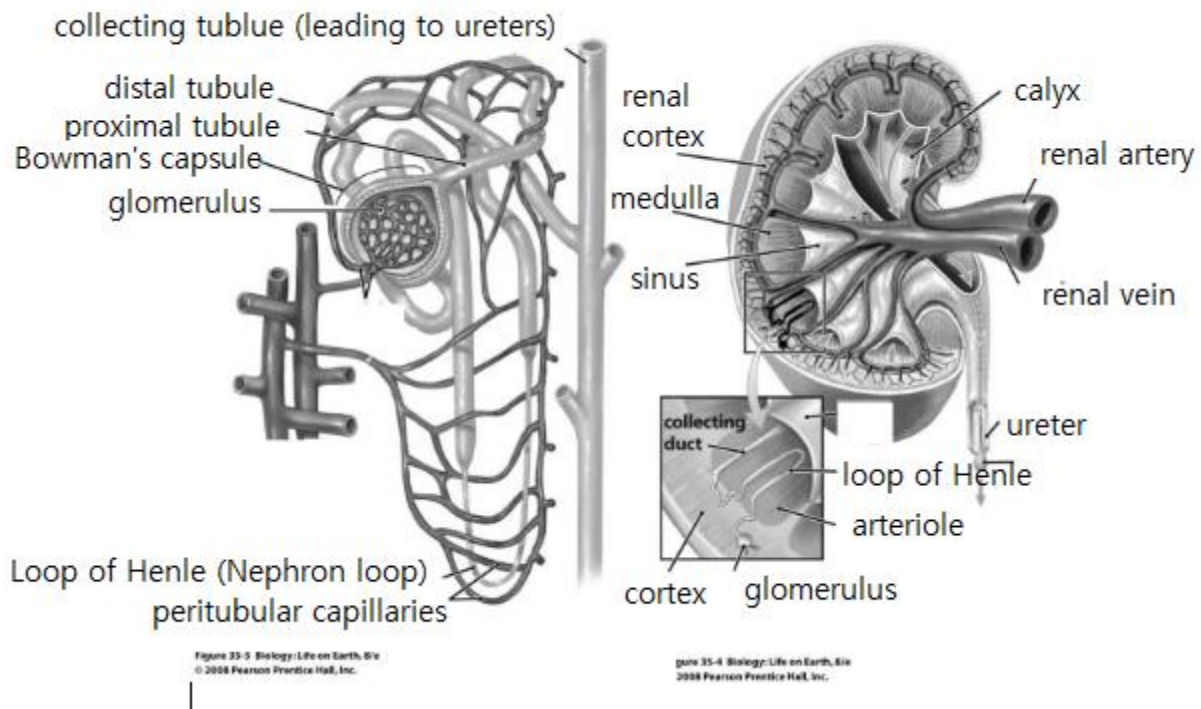
## Nephrons

- The way the nephron works is what makes the kidneys function.
  
- There is a lot more detail to it, but on a very simple level the nephron has four really important parts that each do something.
  - Glomerulus – This is a mesh of capillaries that allows everything smaller than red blood cells and larger proteins to leak out of your blood. It is like a sieve in this way.

- Bowman's capsule – This is balloon like sac that surrounds the glomerulus catching everything it filters out and sending it to a tube.
  
- Tubule – After the capillaries filter everything out it will need to reabsorb everything good that the blood needs back into itself. To do this the capillaries wrap around the tubule and reabsorb different things along the length of it, before it deposits its filtrate at the end into the collecting duct that takes the filtrate to the bladder as urine.

- Proximal tubule – This is the first part of the tubule. It is where reabsorption of vitamins, amino acids, and glucose takes place.
  
- Loop of Henle – This is the second part of the loop. It is where the body reabsorbs much of the water that was lost during the filtering. Mammals that live where there is lots of fresh water have short loops (absorb very little), mammals that live where there is less fresh water have very long loops (absorb a lot).
  
- Distal tubule – This part comes last. It is where the calcium and sodium (salts) are reabsorbed into the blood.

- Collecting tubule – This is where the filtrate flows down to the renal pelvis of the kidneys to be sent to the bladder through the ureters. It also is where a lot of water is reabsorbed and the urine concentrates.



## Urinary bladder

- The urinary bladder is located in the pelvis and can hold up to 400-600 ml of urine. It is a muscular sac that is kind of shaped like an upside down pear.
- It receives urine from the kidneys through the ureters. It releases urine out of the body through the urethra.



- When the bladder is full a nerve that measures the stretch in bladder walls sends a signal to the brain that you need to urinate.

## 11.2 Urinary System Disorders and diseases

- Kidney disease:
  - Chronic – This is typically caused by high blood pressure. The pressure damages the vessels to the point that the kidneys cannot function. This can also be caused by too much sugar, as a result of diabetes. Again the vessels become damaged and the kidneys do not function as well as they should.
  
  - Kidney stones – This is when minerals and others substances in the blood crystallize in the kidneys and form solid masses (stones). These typically do not cause long term damage, but passing them often is extremely painful.



- Urinary tract infections – This is when the urethra or bladder becomes infected with bacteria. This is typically treated with antibiotics.

### **11.3 Urinary System Treatments**

- The main treatment for chronic kidney disease is dialysis. Dialysis is when you hook up to a machine that pumps your blood out through a machine that mimics the kidneys and cleans the blood and then back into you. This treats the symptoms and keeps the patient alive, but it does not cure the disease. Some patients need to do this multiple times a week, others daily.

- Kidney stones typically are left to pass on their own, but if treatment is needed there are some options. Drinking lots of water helps to dilute them, and prevent them from forming. Ultrasound can break them into smaller pieces. In extreme cases surgery can remove them.

- Infections are treated with antibiotics.

## 11.4 Urinary System Diagnostics

- The most common way to diagnose urinary disease is by urine analysis. This is when the urine itself is analyzed to see what it contains. This provides clue as to the health of the patient.
  - Sugars = This could mean that the patient is diabetic as the sugars are not being reabsorbed.
  - Ketones = This could mean the patient is starving and breaking down extra fats into sugars. Though, it could also be the result of strenuous exercise.
  - Calcium = Higher calcium levels may be due to dehydration, or a bone or kidney disorder.







