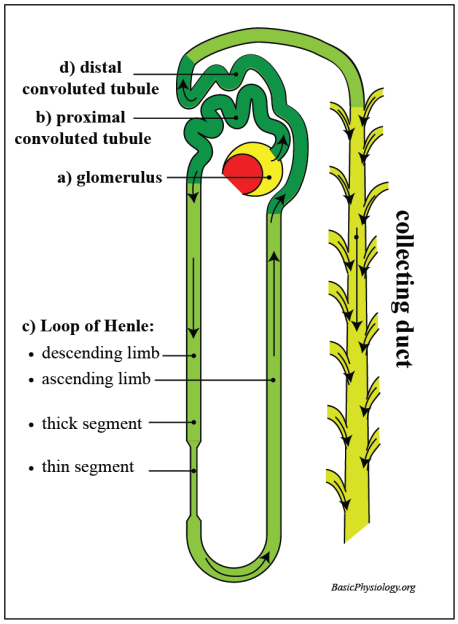
F.3.1. The Nephron

A. Structure and function of the Nephron:

1.
The nephron, which is really a long tubule, consists of the following four parts:

a. the glomerulus
b. the proximal convoluted tubule
c. the loop of Henle
d. the distal convoluted tubule



2.
In the **glomerulus**, the blood is filtered so that a lot of water and salts flow, out of the blood, into the tubular system of the nephron.

3.
This pre-urine flows into the **proximal** convoluted tubule where most (60-80%) of the water and salts are reabsorbed again, back into the blood.

4.
After the proximal convoluted tubule, the pre-urine flows through the loop of **Henle**, which is a very long tube that travels through the medulla of the kidney.

5.
Then the pre-urine is back again in the cortex and flows into the **distal** convoluted tubule where further, selective, reabsorption and secretion take place.

6.
After the distal convoluted tube, the nephron connects to the **collecting ducts,** where the urine flows into.

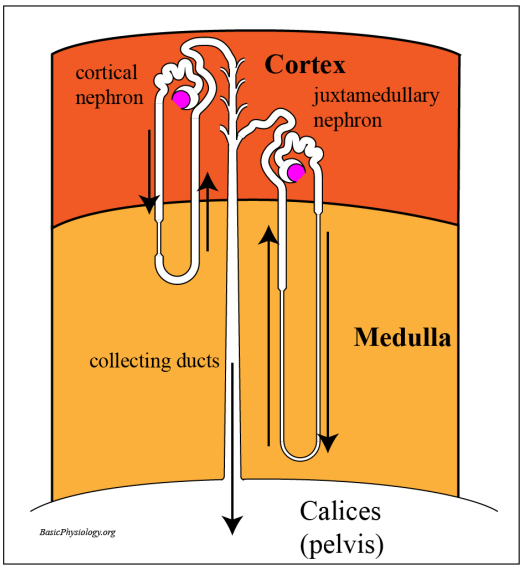
7.
The collecting ducts collect, as the name suggests, the urine from multiple nephrons, and deliver the urine into the calices of the pelvis and flows further towards the bladder.

B. There are two types of nephrons:

1.
Most of the nephrons (85%) are located with their glomeruli in the upper part of the cortex and the loop of Henle stick for a short distance into the medulla; the so-called '**cortical nephron'**.

2.
But about 15-25% of the nephrons have their glomeruli very close to the cortex-medulla border and their loop of Henle run deep into the medulla. These are called the '**juxta-medullary nephron'** (juxta = close to the medulla).

3.
These juxta-medullary nephrons play an essential role in developing an **osmotic** gradient in the kidney (*see later*). Also note that these nephrons have a much longer thin segment in their loop (*see diagram*).

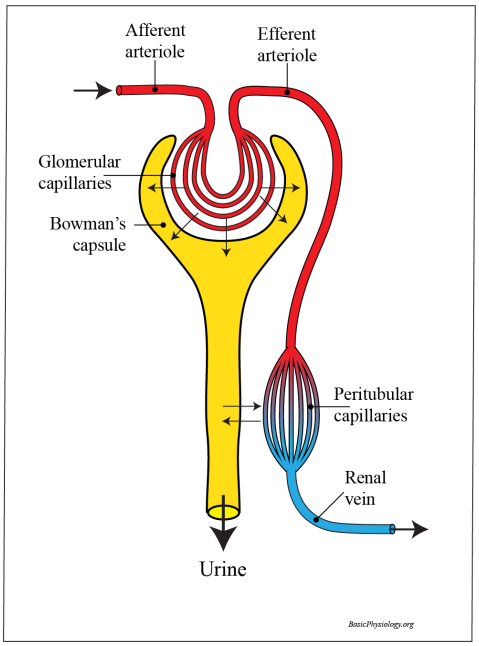


C. Two capillary systems in the kidney:

1.
Note that there are two capillary networks in the nephron; one in the glomerulus (inside the capsule of Bowman) and a second adjacent to the tubular system.

2.
So, in this case, we don't have one network of capillaries between the artery and the vein (as is usual in muscles, organs etc.) but two capillary networks!

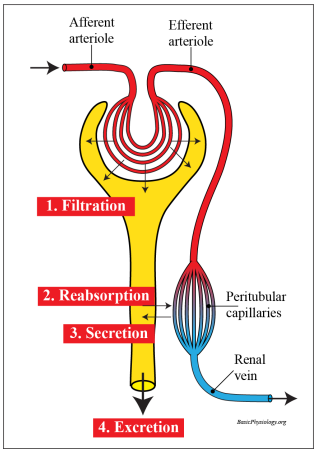
3.
Because the blood pressure in the efferent arteriole, after the first set of capillaries, is still quite high, this vessel is called 'artery' and not a 'vein'.



D. Filtration, reabsorption, secretion and excretion:

1.
It might be useful to emphasize the four major functions of the nephron:

1) filtration
2) reabsorption
3) secretion
4) excretion



2.
Filtration is what happens in the glomeruli. In principle, except for the blood cells and large proteins, everything else is filtrated through the capillary membrane into Bowman's capsule, thereby forming pre-urine.

3.
Reabsorption: most of the filtrate is reabsorbed from the pre-urine back to the blood. This is the case for a large amount of water, the salts (sodium, potassium, etc.), amino acids, glucose etc. A lot of this occurs in the proximal tubule, but some of this also takes place in the distal tubule.

4.
Secretion: The kidney can also secrete stuff, from the blood into the pre-urine. This is the case for example for creatinine, urea, several drugs etc. (*see later*).

5.
Excretion: Finally, whatever is left in the pre-urine, after all the absorption and secretions, ends up as urine. This is stored in the bladder and excreted from the body at an appropriate time.

6.
So, this is the sum total of the function of the nephrons:

Excretion = Filtration – Reabsorption + Secretion