

- The proximal tubules have a sodium-glucose co-transport system so that glucose is completely recovered from the ultrafiltrate, provided that the amount of glucose in the blood does not exceed the maximum (Tmax) that the tubule can reabsorb.
- A similar co-transport system brings chloride, potassium, lactate, citrate, phosphate, and amino acids into the cell. These molecules then move into the interstitial fluid via facilitated diffusion, and from there into the blood vessels.
- The proximal tubules also have a hydrogen ion counter-transport system, which assists in the excretion of acid, and the reabsorption of chloride.
- The filtrate flow in the proximal convoluted tubule and blood flow in the capillaries move in the same direction.

The loop of Henle and the counter-current exchange mechanism

- The purpose of the **loop of Henle** is to allow the body to fine tune the composition of the urine, so that we excrete just enough water and electrolytes (sodium, potassium, and chloride) to remain in equilibrium. We therefore need a mechanism for concentrating or diluting the urine as needed. This is accomplished through the **renal counter-current exchange mechanism**.
- Seeley Figure 21.16 shows the relationships among the different parts of the nephorn and the osmolality of the surrounding tissues.
- In order to understand the mechanism, you must begin with the **ascending limb of the loop of Henle**, in other words *downstream* from the **descending limb**.
- It is the **sodium-potassium-chloride pumps** of the ascending limb, coupled with the permeability of the descending limb to water, that enable the system to concentrate or dilute the urine.
- The ascending limb of Henle goes from the **medulla** to the **cortex** of the kidney (Seeley Figure 26.12). It has **chloride pumps**, which remove chloride from the fluid that enters it. Sodium, and to some extent potassium, follow the chloride to preserve electroneutrality. At the basal membrane of the tubule cells, a sodium-potassium ATPase pumps the sodium that has come from the filtrate into the intertstional fluid. At the same time, this portion of the loop is <u>impermeable to water</u>, so water does not move out of the tubule lumen with the ions. As a result, the *concentration* of sodium chloride of the filtrate in the ascending tubule drops.
- Meanwhile, the descending loop, which goes from the cortex to the medulla and runs parallel to the ascending loop, is <u>permeable to water</u>.
  - Therefore, as the descending loop goes through the medulla it enters a region of higher and higher tissue concentration of sodium, thanks to the chloride pumps of the ascending loop. Water moves from the lumen of the descending tubule into the surrounding tissue, in response to the osmotic pressure from the increasing concentration of sodium chloride in the surrounding tissue. Seeley Figure 26.11 shows the two types of tubules next to each other.