

BIOLOGY 2e

Chapter 41 OSMOTIC REGULATION AND EXCRETION

PowerPoint Image Slide Show



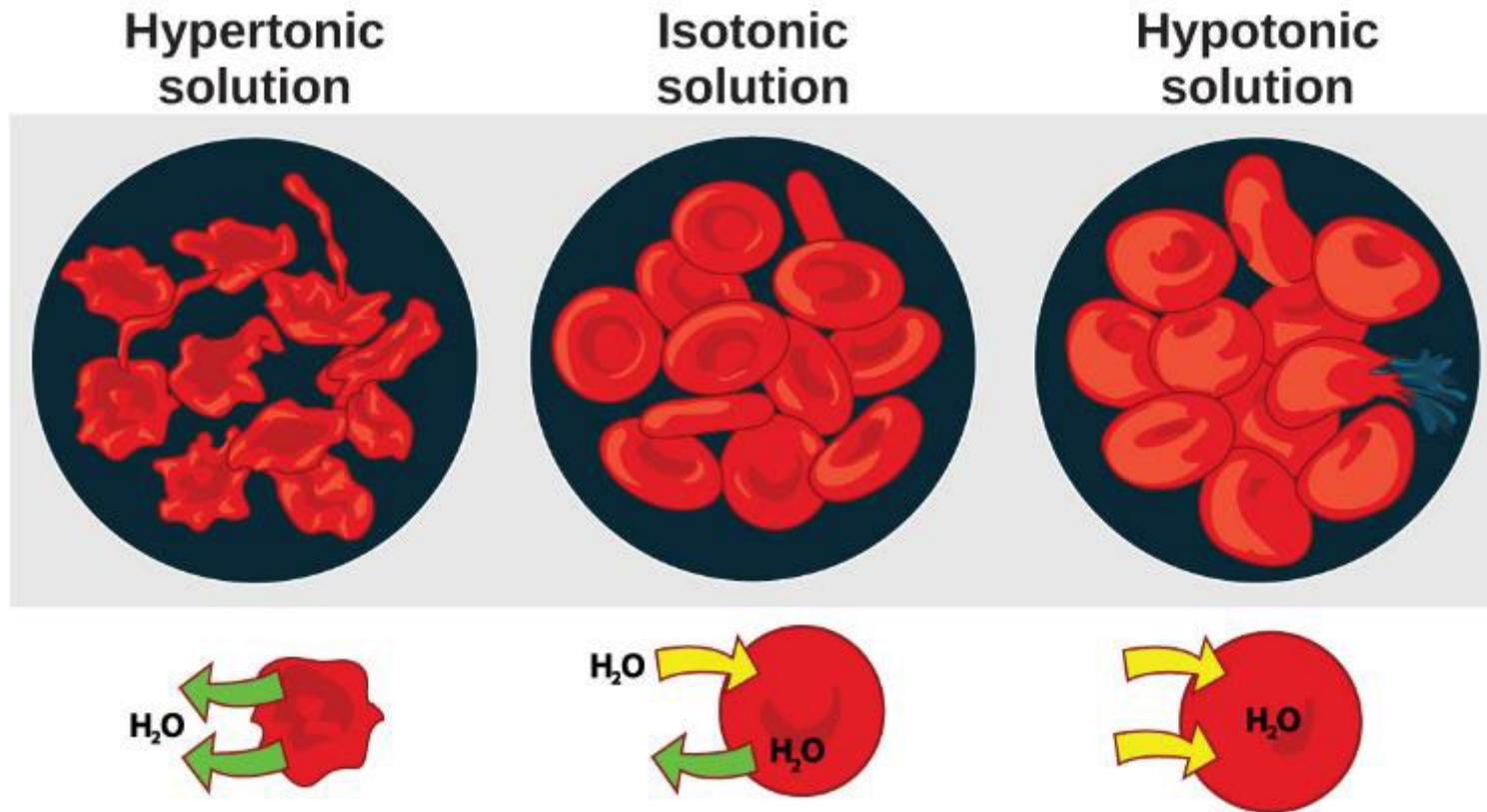
FIGURE 41.1



Just as humans recycle what we can and dump the remains into landfills, our bodies use and recycle what they can and excrete the remaining waste products. Our bodies' complex systems have developed ways to treat waste and maintain a balanced internal environment.

(credit: modification of work by Redwin Law)

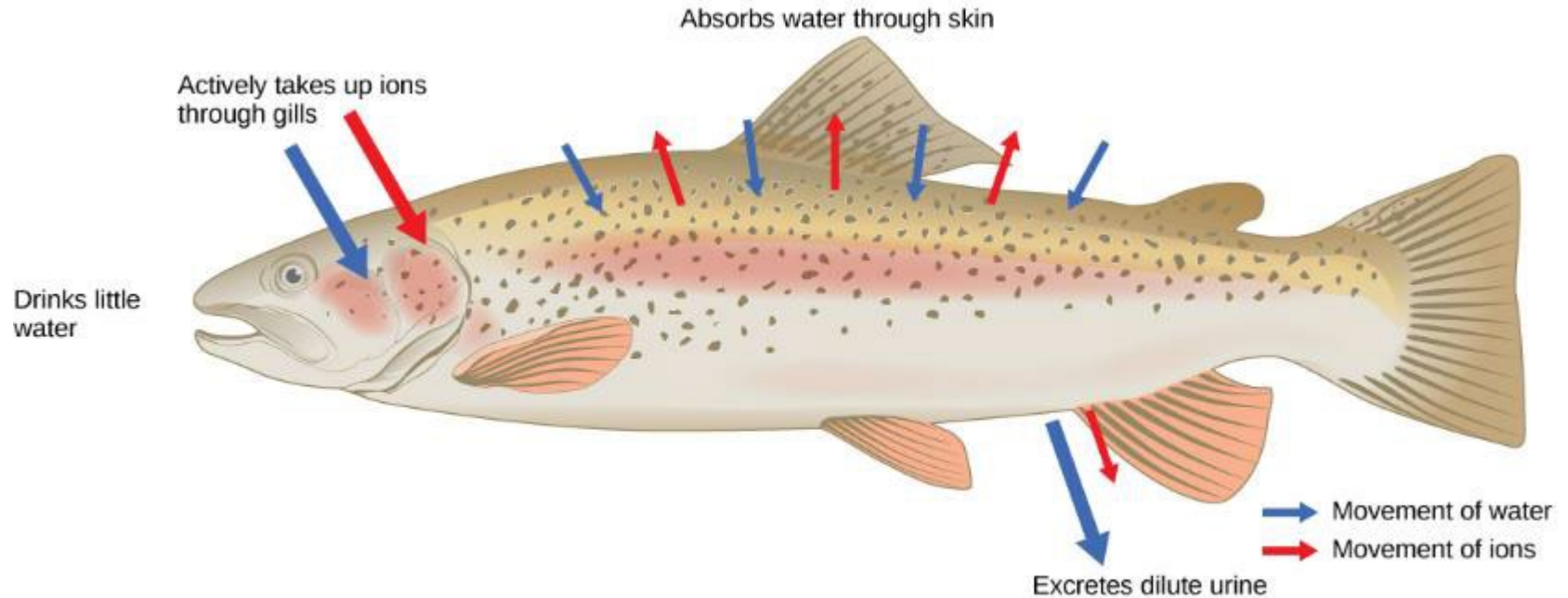
FIGURE 41.2



Cells placed in a hypertonic environment tend to shrink due to loss of water. In a hypotonic environment, cells tend to swell due to intake of water. The blood maintains an isotonic environment so that cells neither shrink nor swell.

(credit: Mariana Ruiz Villareal)

FIGURE 41.3A

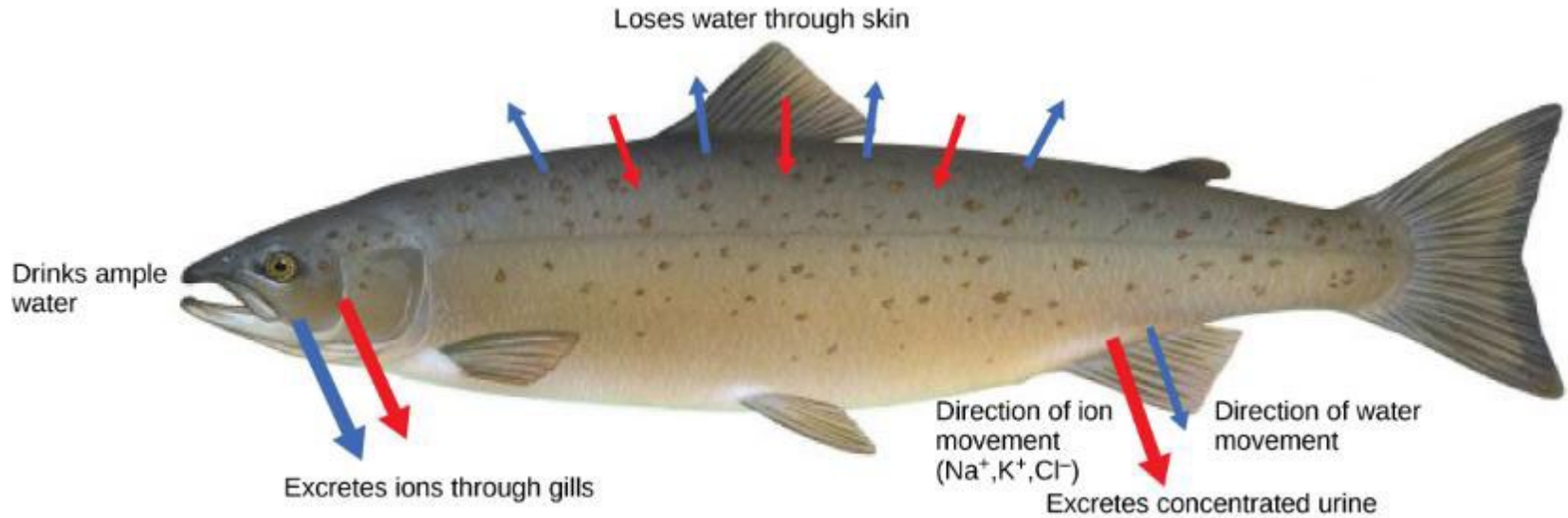


(a) Osmoregulation in a freshwater environment

Fish are osmoregulators, but must use different mechanisms to survive in freshwater or saltwater environments.

(credit: modification of work by Duane Raver, NOAA)

FIGURE 41.3B

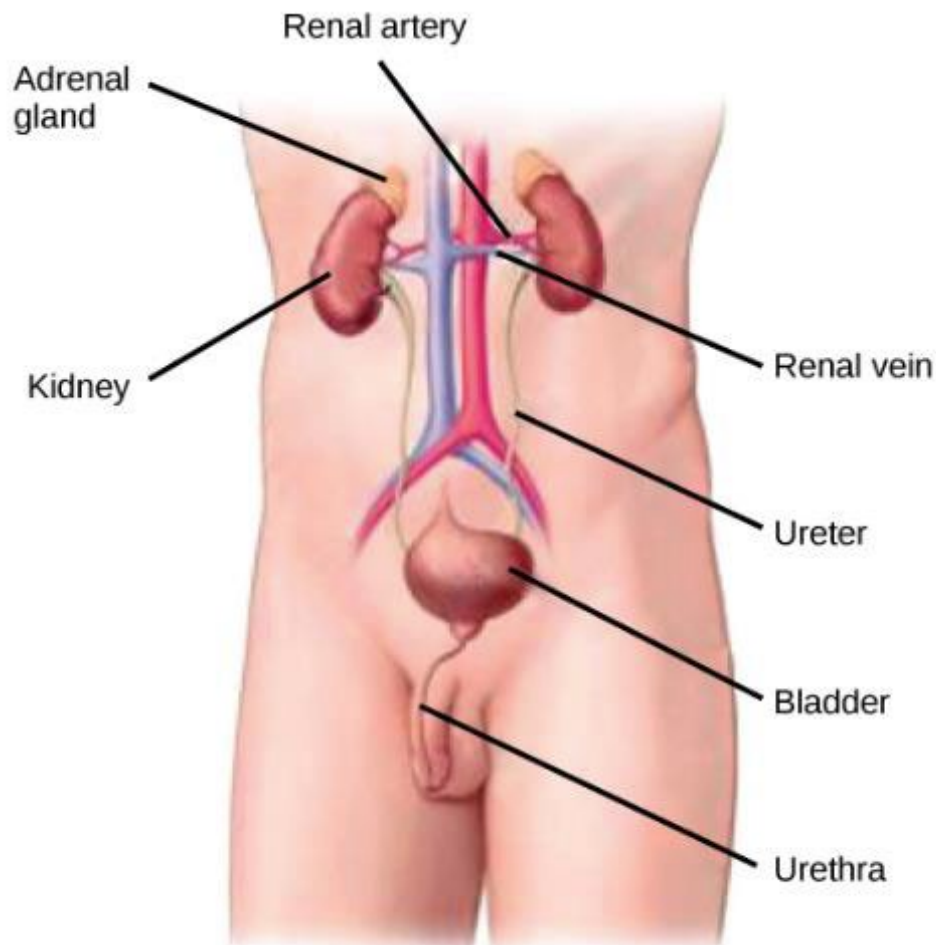


(b) Osmoregulation in a saltwater environment

Fish are osmoregulators, but must use different mechanisms to survive in freshwater or saltwater environments.

(credit: modification of work by Duane Raver, NOAA)

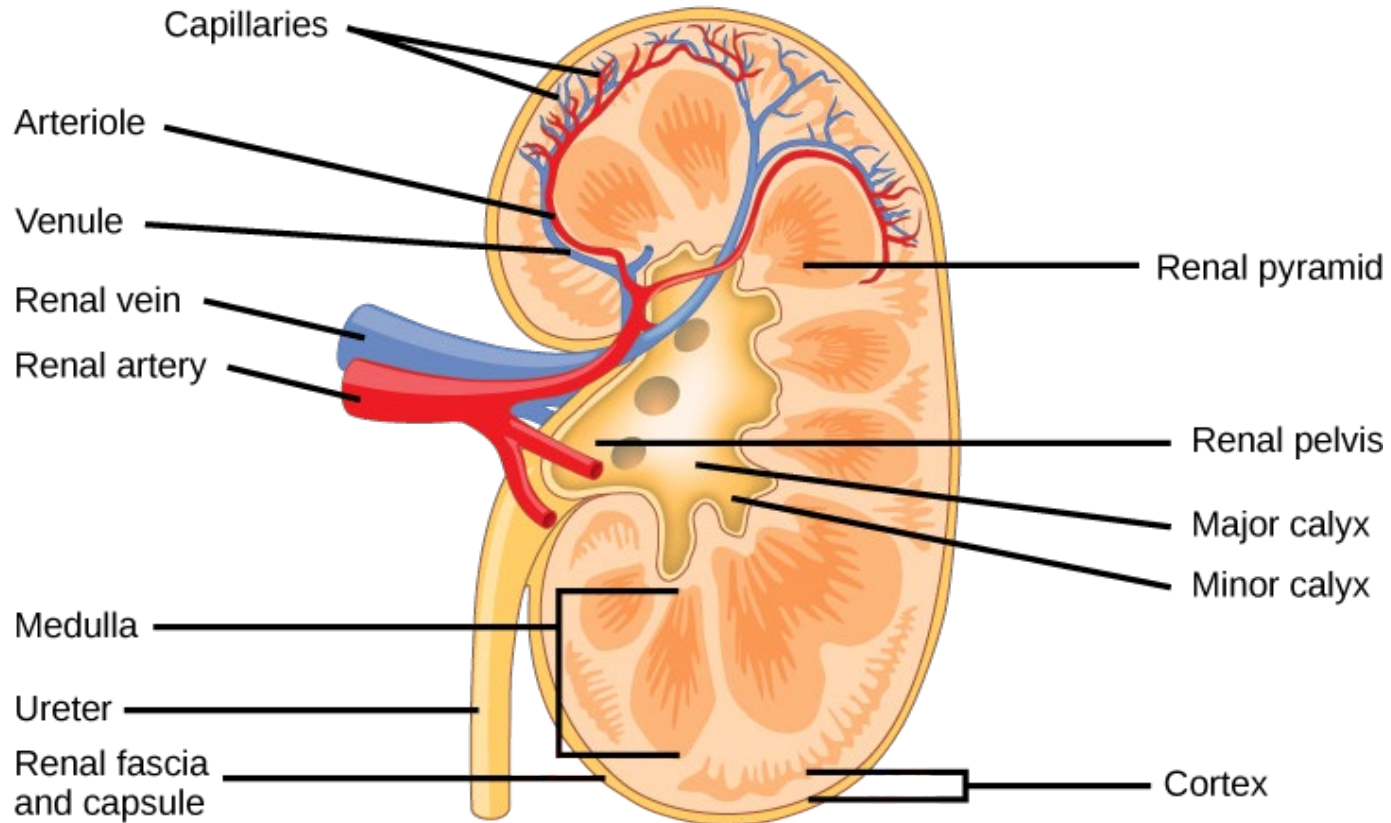
FIGURE 41.4



Kidneys filter the blood, producing urine that is stored in the bladder prior to elimination through the urethra.

(credit: modification of work by NCI)

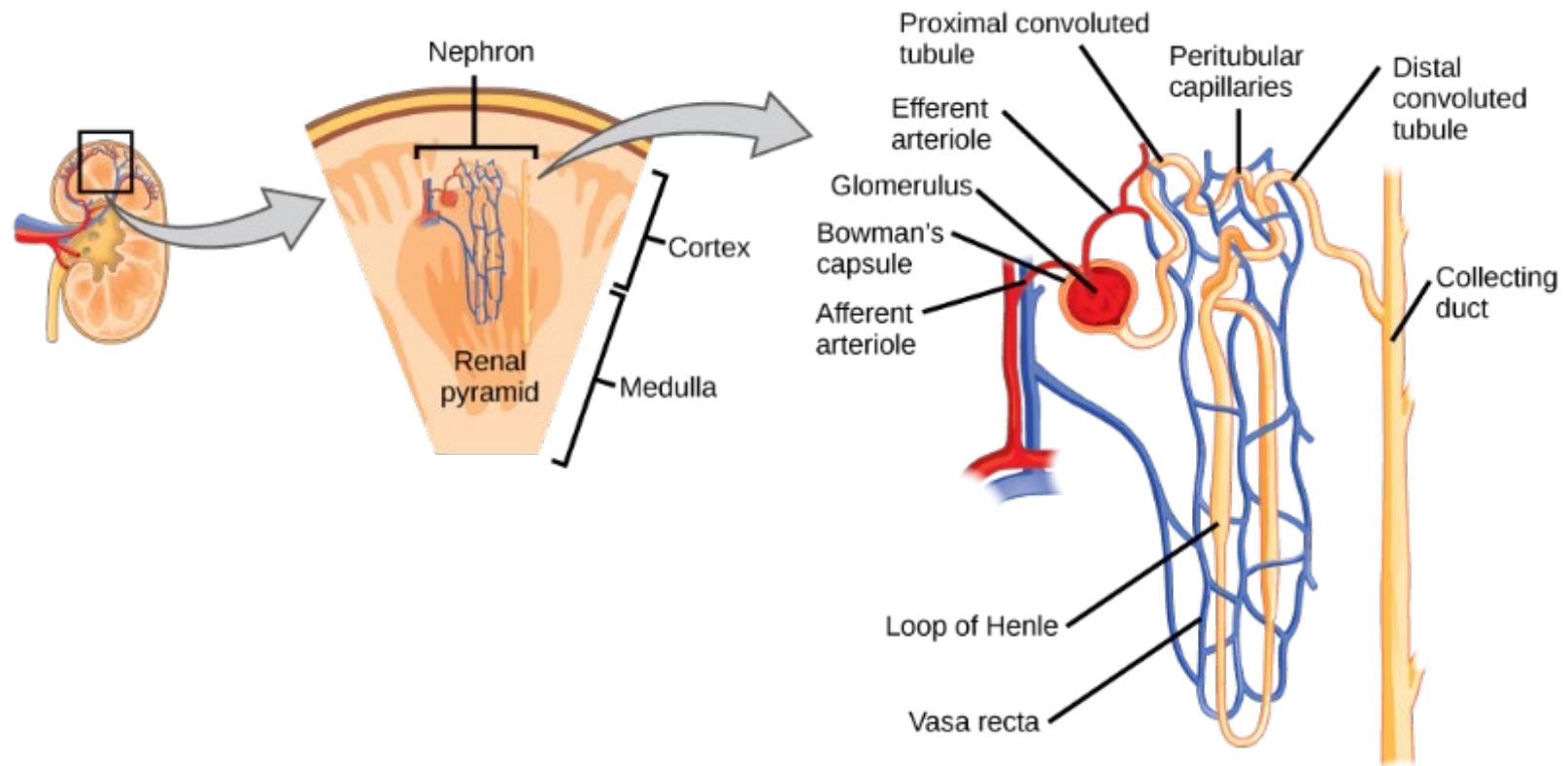
FIGURE 41.5



The internal structure of the kidney is shown.

(credit: modification of work by NCI)

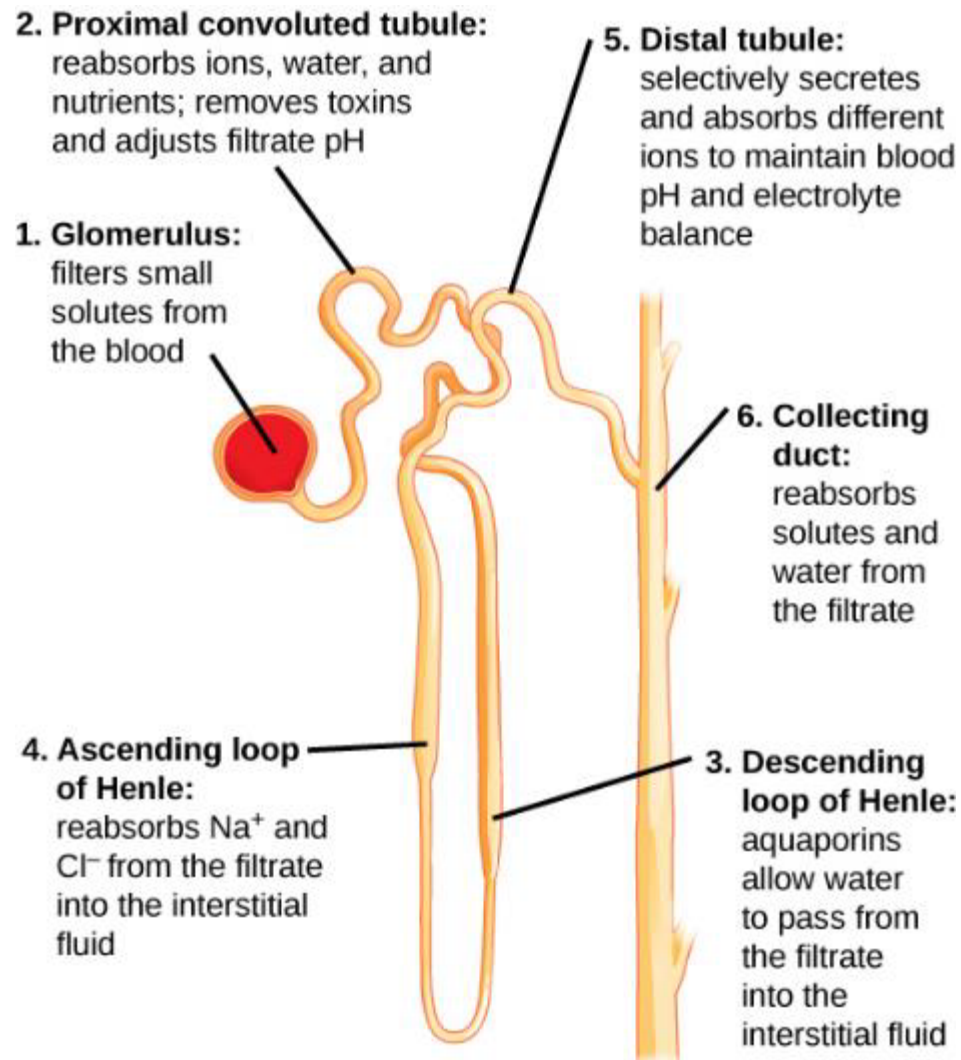
FIGURE 41.6



The nephron is the functional unit of the kidney. The glomerulus and convoluted tubules are located in the kidney cortex, while collecting ducts are located in the pyramids of the medulla.

(credit: modification of work by NIDDK)

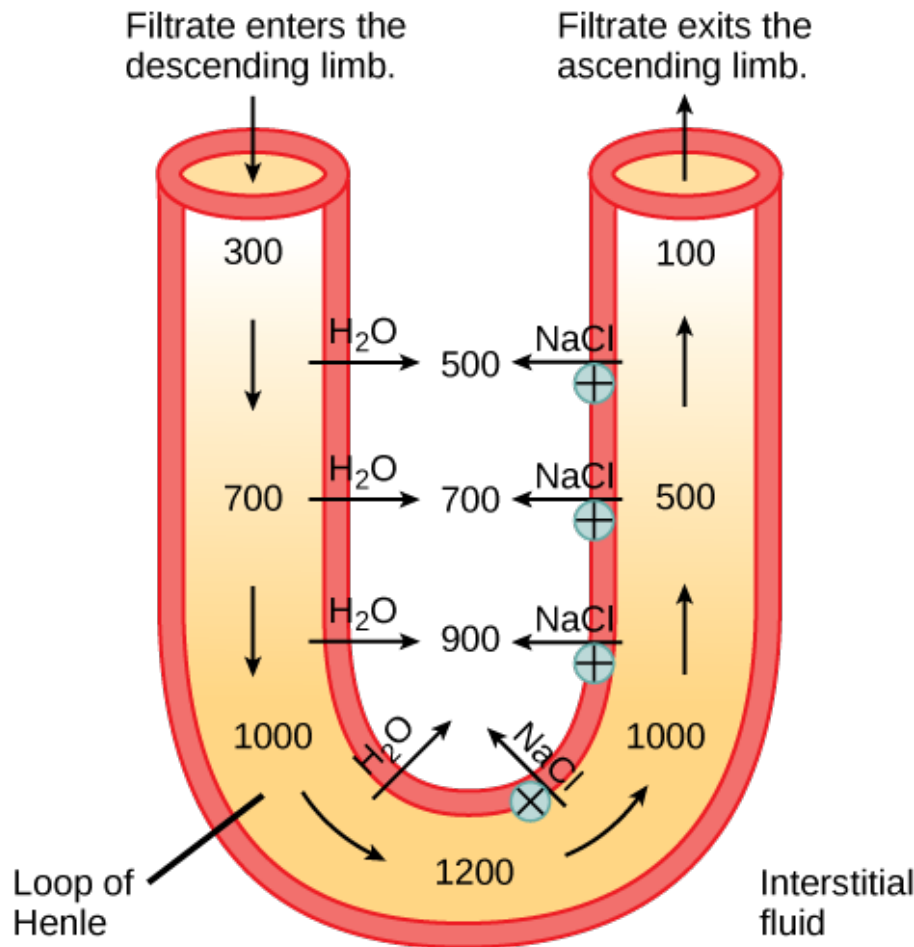
FIGURE 41.7



Each part of the nephron performs a different function in filtering waste and maintaining homeostatic balance.

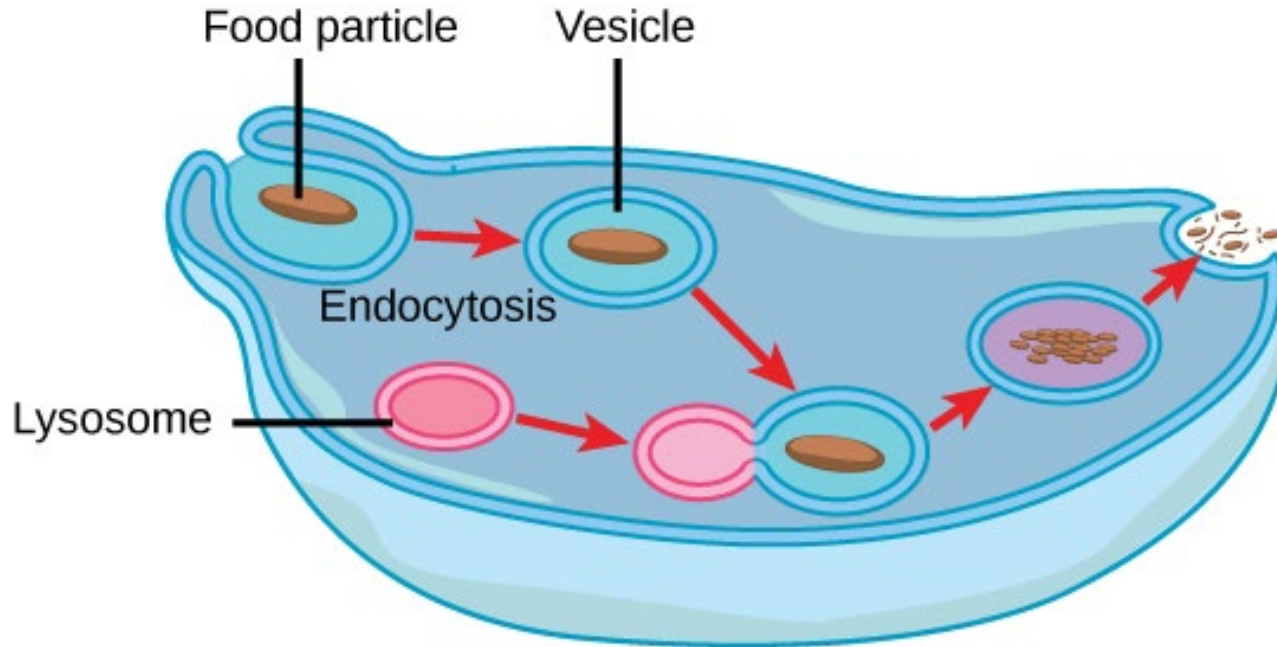
(credit: modification of work by NIDDK)

FIGURE 41.8



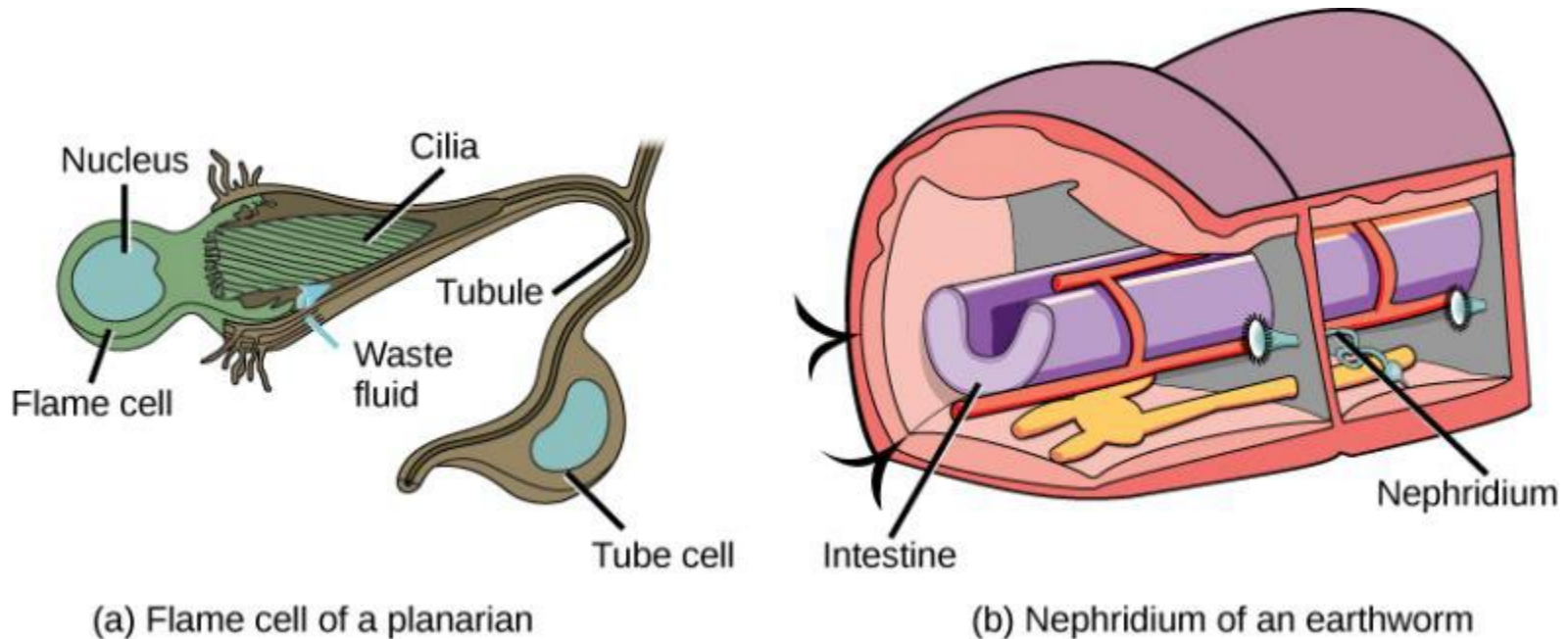
The loop of Henle acts as a countercurrent multiplier that uses energy to create concentration gradients. The descending limb is water permeable. Water flows from the filtrate to the interstitial fluid, so osmolality inside the limb increases as it descends into the renal medulla. At the bottom, the osmolality is higher inside the loop than in the interstitial fluid. Thus, as filtrate enters the ascending limb, Na⁺ and Cl⁻ ions exit through ion channels present in the cell membrane. Further up, Na⁺ is actively transported out of the filtrate and Cl⁻ follows. Osmolarity is given in units of milliosmoles per liter (mOsm/L).

FIGURE 41.9



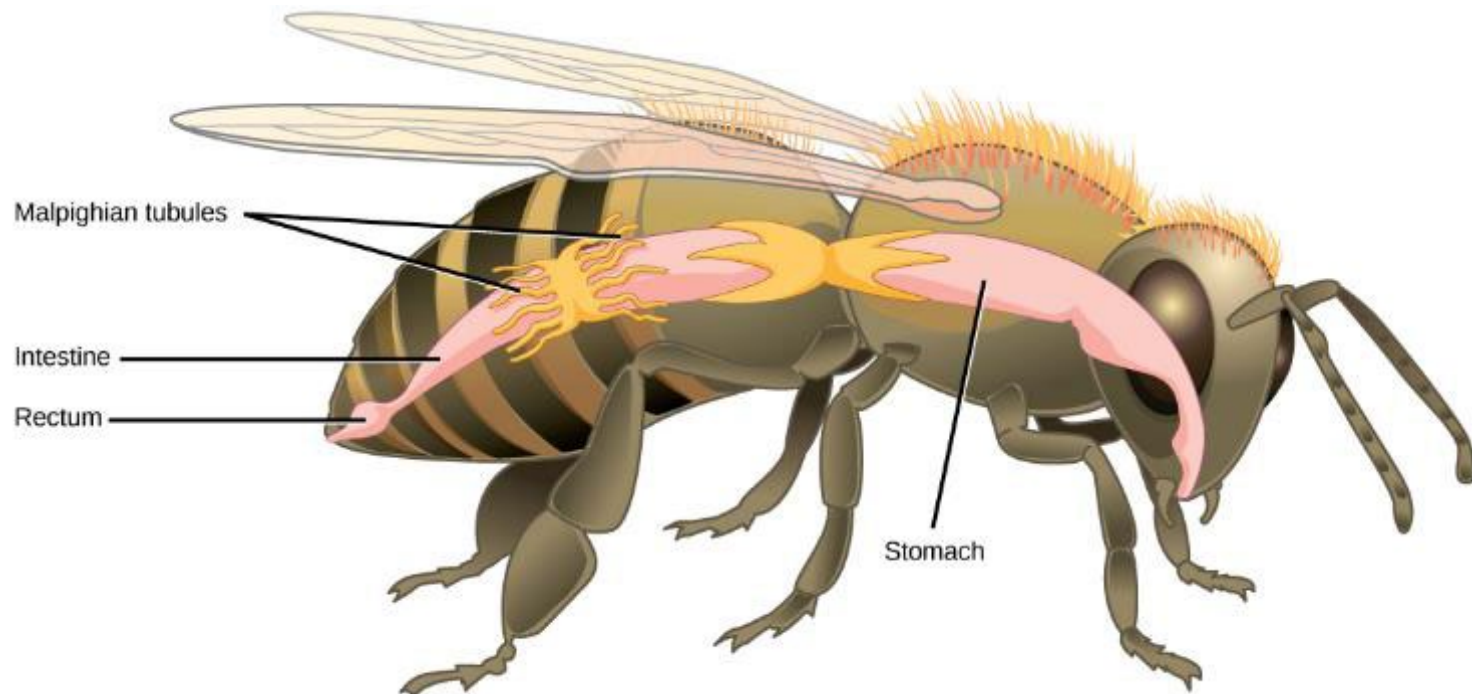
Some unicellular organisms, such as the amoeba, ingest food by endocytosis. The food vesicle fuses with a lysosome, which digests the food. Waste is excreted by exocytosis.

FIGURE 41.10



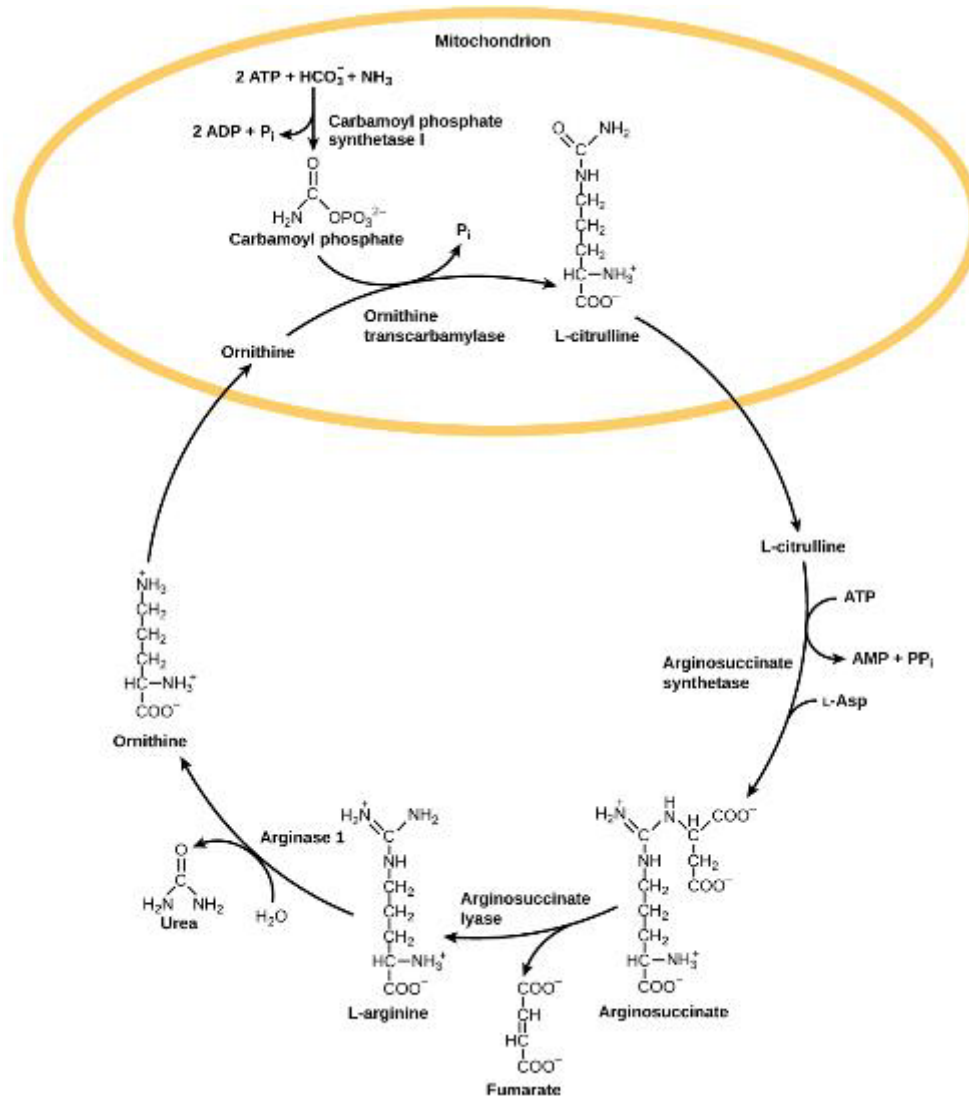
In the excretory system of the (a) planaria, cilia of flame cells propel waste through a tubule formed by a tube cell. Tubules are connected into branched structures that lead to pores located all along the sides of the body. The filtrate is secreted through these pores. In (b) annelids such as earthworms, nephridia filter fluid from the coelom, or body cavity. Beating cilia at the opening of the nephridium draw water from the coelom into a tubule. As the filtrate passes down the tubules, nutrients and other solutes are reabsorbed by capillaries. Filtered fluid containing nitrogenous and other wastes is stored in a bladder and then secreted through a pore in the side of the body.

FIGURE 41.11



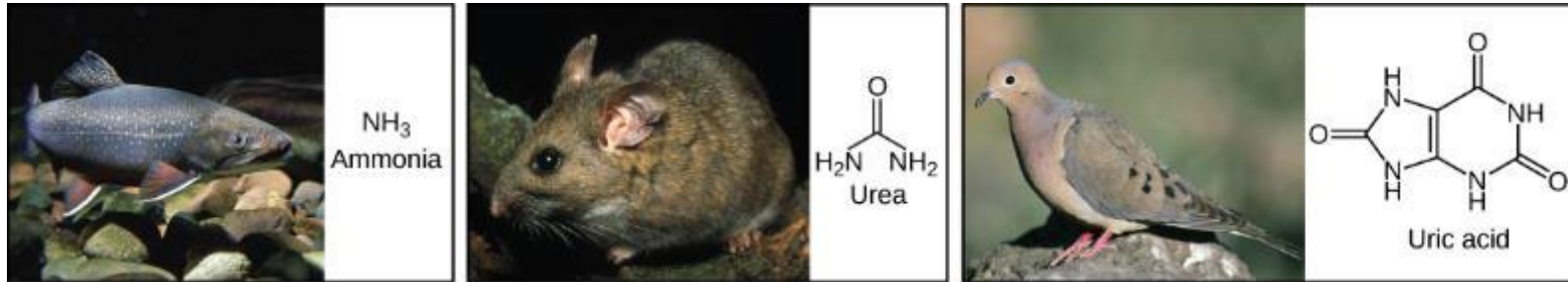
Malpighian tubules of insects and other terrestrial arthropods remove nitrogenous wastes and other solutes from the hemolymph. Na^+ and/or K^+ ions are actively transported into the lumen of the tubules. Water then enters the tubules via osmosis, forming urine. The urine passes through the intestine, and into the rectum. There, nutrients diffuse back into the hemolymph. Na^+ and/or K^+ ions are pumped into the hemolymph, and water follows. The concentrated waste is then excreted.

FIGURE 41.12



The urea cycle converts ammonia to urea.

FIGURE 41.13



(a) Many invertebrates and aquatic species excrete ammonia.

(b) Mammals, many adult amphibians, and some marine species excrete urea.

(c) Insects, land snails, birds, and many reptiles excrete uric acid.

Nitrogenous waste is excreted in different forms by different species. These include (a) ammonia, (b) urea, and (c) uric acid.

(credit a: modification of work by Eric Engbretson, USFWS; credit b: modification of work by B. "Moose" Peterson, USFWS; credit c: modification of work by Dave Menke, USFWS)

FIGURE 41.14

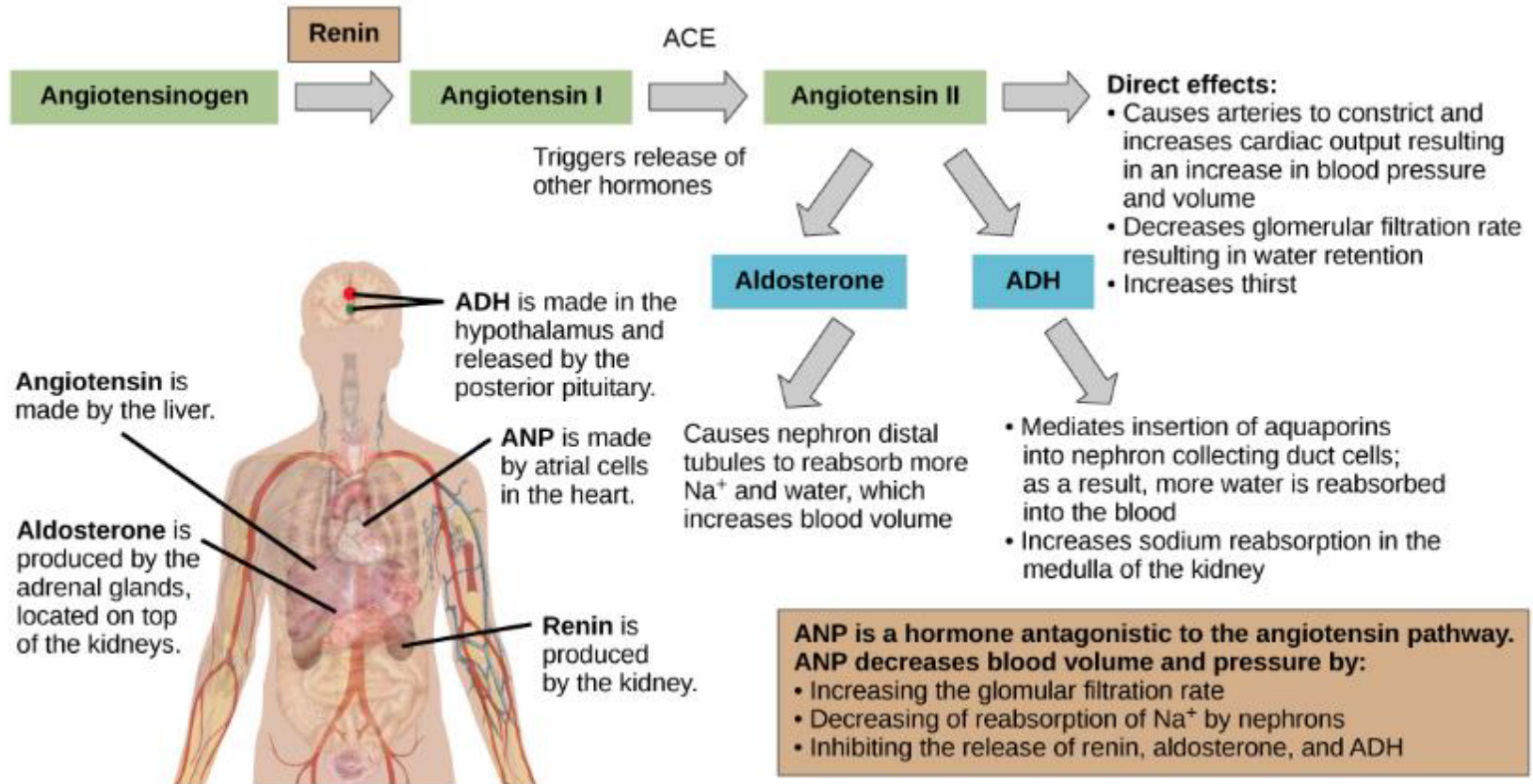


Gout causes the inflammation visible in this person's left big toe joint.

(credit: "Gonzosft"/Wikimedia Commons)

FIGURE 41.15

The renin-angiotensin-aldosterone system increases blood volume and pressure



The renin-angiotensin-aldosterone system increases blood pressure and volume. The hormone ANP has antagonistic effects.

(credit: modification of work by Mikael Häggström)