How does the excretory system maintain homeostasis?

- It regulates heat, water, salt, acid-base concentrations and metabolite concentrations.
<table>
<thead>
<tr>
<th>ORGANS OF EXCRETION</th>
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<tr>
<td><strong>Skin and associated glands:</strong> Removes heat and salts</td>
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<td><strong>Lungs:</strong> Removes carbon dioxide</td>
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<tr>
<td><strong>Kidneys (part of the Urinary system):</strong> MAJOR excretory organs that excrete metabolic wastes, regulate water-salt balance and acid-base balance.</td>
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<td><strong>Liver:</strong> Removes metabolic wastes</td>
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PARTS OF THE URINARY SYSTEM (pg. 374)

Kidneys: filter blood to produce urine.

Ureters: carry urine from the kidneys to the urinary bladder.
**Urinary Bladder**: stores urine.

**Urethra**: carries urine from the bladder to the outside of the body.

**IMPORTANT BLOOD VESSELS**

**Renal Artery**: carries contaminated blood into the kidney.

**Renal Vein**: carries purified blood from the kidney and returns it back into circulation by way of the inferior vena cava.
The Kidney

KIDNEY PARTS (pg. 375)

- **Cortex**: the outer part
- **Medulla**: the middle part
- **Pelvis**: the inner cavity where urine collects
MAJOR FUNCTIONS OF KIDNEYS

1. Filters blood of:
   - Urea – formed in the liver from the breakdown of ammonia
   - Creatinine – formed in the muscles
   - Uric Acid – formed as a result of the breakdown of nucleic acids (DNA and RNA)

2. Controls the balance of water in our bodies

3. Regulates pH of the blood

4. Regulates the concentration of dissolved ions in the blood
5. **Secretes** a hormone that causes a production of red blood cells

6. **Activates** Vitamin D production in the skin

**NEPHRONS (pg. 375)**

Tiny filtering units called *nephrons* fill the cortex and medulla of the kidney.

Each kidney contains 1 to 1.25 million nephrons.
Each nephron is composed of 5 main parts: Bowman’s capsule, proximal tubule, loop of Henle, distal tubule & collecting duct.

**Nephron Function (4 stages)**

1. **Filtration:**
   - Blood travels from the renal artery, to an arteriole and then into the *glomerulus*, a mass of capillaries surrounded by the *Bowman’s capsule*.
Blood pressure forces some plasma of the blood, containing both waste and useful material, into the Bowman’s capsule. This material is called the nephric filtrate.

The filtrate contains such things as: water, urea, uric acid, salt, glucose, amino acids, ions and vitamins.
2. Re-absorption:
From the Bowman’s capsule the filtrate is pushed into the proximal tubule. The process of re-absorption, of useful materials within the filtrate, into the capillary network that surrounds the nephron than begins.

Reabsorption occurs by osmosis, diffusion, and active transport
Reabsorbed materials include water, glucose, amino acids, ions and vitamins
When the filtrate reaches the end of the distal tubule the solution is isotonic (the filtrate and the surrounding cells have the same concentration of water and solutes).

The filtrate then moves down the descending loop of Henle; as the loop descends further into the inner medulla, sodium concentrations in the surrounding tissue increase which draws water out of the filtrate (by osmosis).
At the bottom of the loop, sodium ions in the filtrate are at high concentration and therefore diffuse out of the tubule.

Positive sodium ions are followed by negative chloride ions.

Water cannot reenter the ascending loop because this loop is impermeable to water.
3. **Secretion:**
- Occurs in the *distal tubule*
- Involves active transport of substances from the capillaries into the tubule
- Substances include hydrogen ions, creatinine and drugs

4. **Elimination:**
- The fluid than enters the *collecting duct as urine*. It passes through the pelvis into the ureter.
- Most of the water, ions and useful nutrients (glucose, amino acids) have been reabsorbed.
Path of filtrate through nephron:

- Bowman’s capsule
- proximal tubule
- loop of Henle
- distal tubule
- collecting duct

Control of Water Balance

When water levels are too low:

1) The hypothalamus stimulates the pituitary gland to secrete a hormone called anti-diuretic hormone (ADH). ADH travels through blood to kidneys.
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<td><strong>2)</strong> ADH increases the permeability of the tubules and collecting ducts</td>
<td><strong>3)</strong> More water is reabsorbed into the blood so the urine is more concentrated</td>
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<td><em>When water levels are too high:</em></td>
<td><strong>1)</strong> Hypothalamus doesn’t stimulate ADH secretion</td>
<td><strong>2)</strong> Little water is reabsorbed into the blood so the urine is more dilute.</td>
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