The Urinary System

There are three kinds of men. The one that learns by reading. The few who learn by observation. The rest of them have to pee on the electric fence for themselves. –Will Rogers

I. Excretory System Ted-Ed Kidneys

A. Metabolic wastes must be removed from the body in order to prevent a toxic buildup and possible death.

B. Excretion is NOT the same as DEFECATION, which is the process which rids the body of undigested, unabsorbed food remains and bacteria - NOT metabolic end products.

II. Wastes

A. Nitrogenous waste

1. Ammonia (NH_3)from deamination of amino groups.
2. Very toxic to tissues so it is converted to UREA by the liver.

$$2NH_3 + CO_2 \rightarrow H_2N - \overset{\overset{O}{||}}{C} - NH_2 + H_2O$$

(urea)

3. Uric acid from the metabolism of nucleotides.
4. Creatinine from the breakdown of creatine phosphate (high energy phosphate storage molecule) in muscles.

B. Bile pigment from RBC recycling.

B. CO_2 from cellular respiration.

D. Ions from diet.

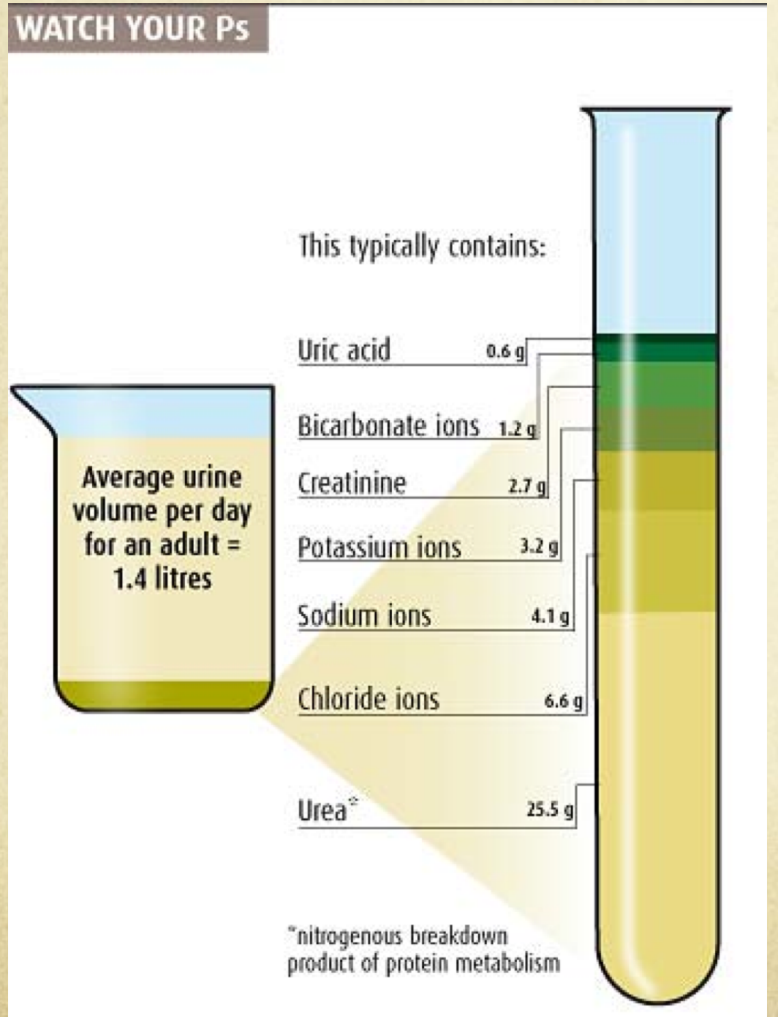
1. K^+
2. Na^+
3. Cl^-
4. Ca^{2+}
5. Mg^{2+}
6. HCO_3^-

E. Water from cellular respiration and diet.

III. Urine

A. A solution of

1. 95% H_2O
2. 5% Solids



a. Nitrogenous wastes
   i. Urea
   ii. Uric acid
   iii. Creatinine
b. Ions
c. Urochrome
   i. Yellow pigment from breakdown of heme group in hemoglobin.

IV. Excretory organs

A. Skin

1. Glands excrete perspiration which consists of:
   a. Water
   b. Salts
   c. Small amount of urea

2. Excretion from the skin is primary for cooling.

B. Liver

1. Excretes bile salts which contains pigments that are breakdown products of RBC metabolism.

2. Bile is sent to small intestine.

C. Lungs

1. Excrete CO_2
2. Excrete water

D. Intestine

1. Excretes Salts (Fe^{+}, Ca^{2+}) into the intestine which then becomes part of the feces.

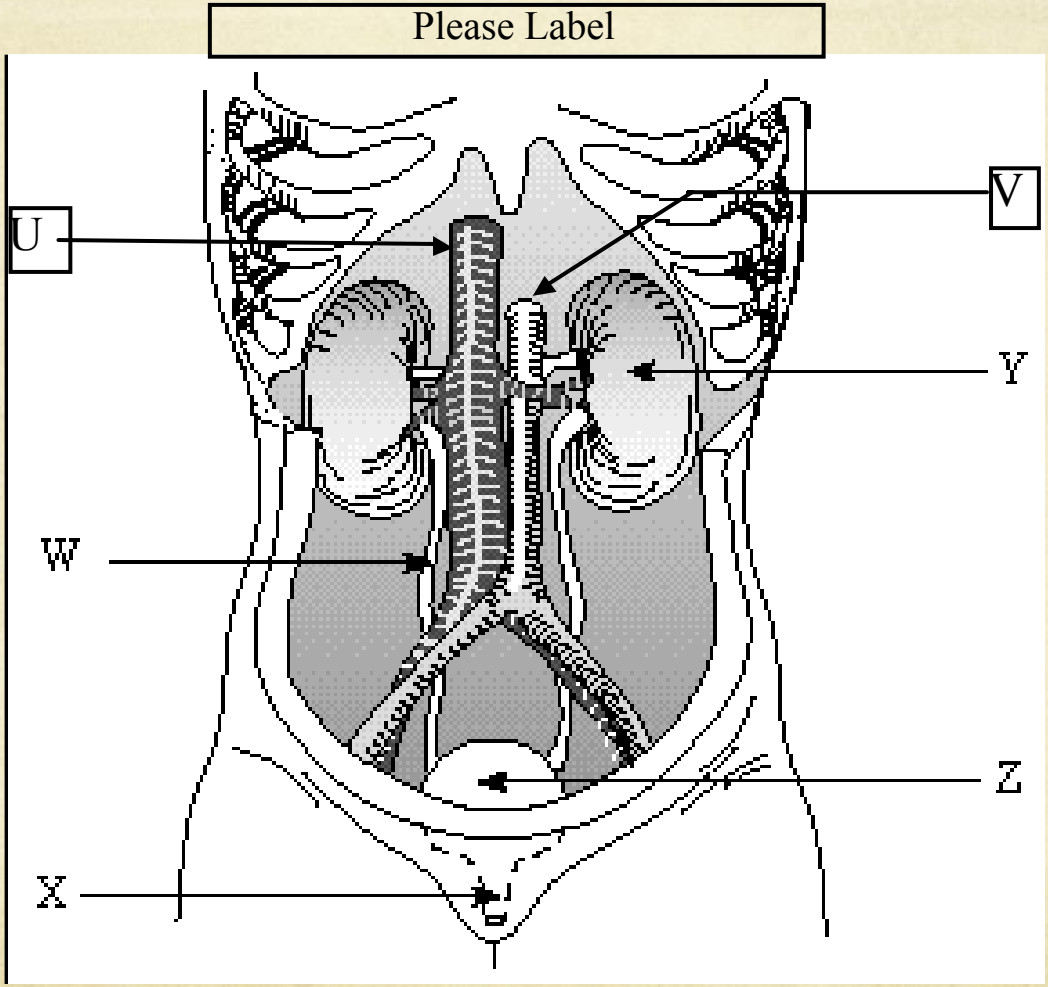
E. Kidney

1. Excretes urine.
2. Regulate blood volume.
3. Regulate pH.

Kidney and Nephron Video

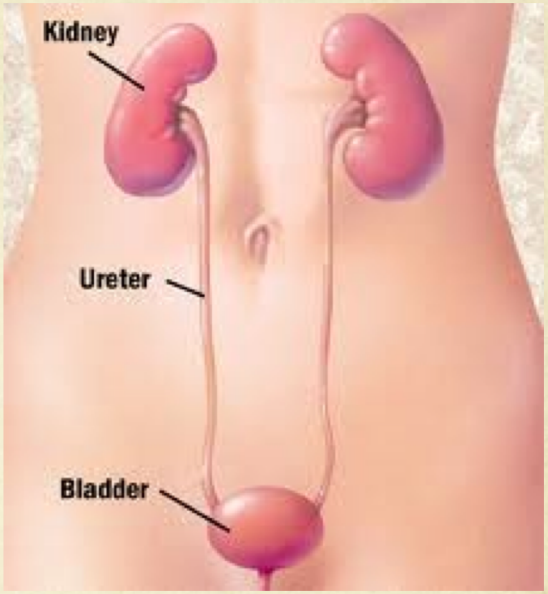
O1. Parts of the Urinary System

I. Urinary System



A. Kidneys (Y)

1. Paired reddish-brown organs about 10 cm long, 5 cm wide and 2 cm thick.
2. Anchored against the dorsal body wall by connective tissue.
3. Produce urine.



B. Ureters (W)

1. Pair of muscular tubes.
2. Transport urine from kidneys to bladder via peristalsis.

C. Bladder (Z)

1. Stores up to 600 mL - 1000 mL of urine.
2. Bladder fills with urine until stretch receptors signal the brain to urinate.
3. Sphincter muscles can be controlled to prevent urination until convenient.

D. Urethra (X)

1. Tube connecting bladder to the outside to allow for the elimination of urine.
2. In females, it is about 4 cm long, opens to exterior between vagina and clitoris.
3. In male, it is about 20 cm long, opens to exterior at tip of penis.
4. In males, it is also part of the reproductive system.

E. Renal Artery (V)

1. Carries blood to kidneys from the aorta.

F. Renal Vein (U)

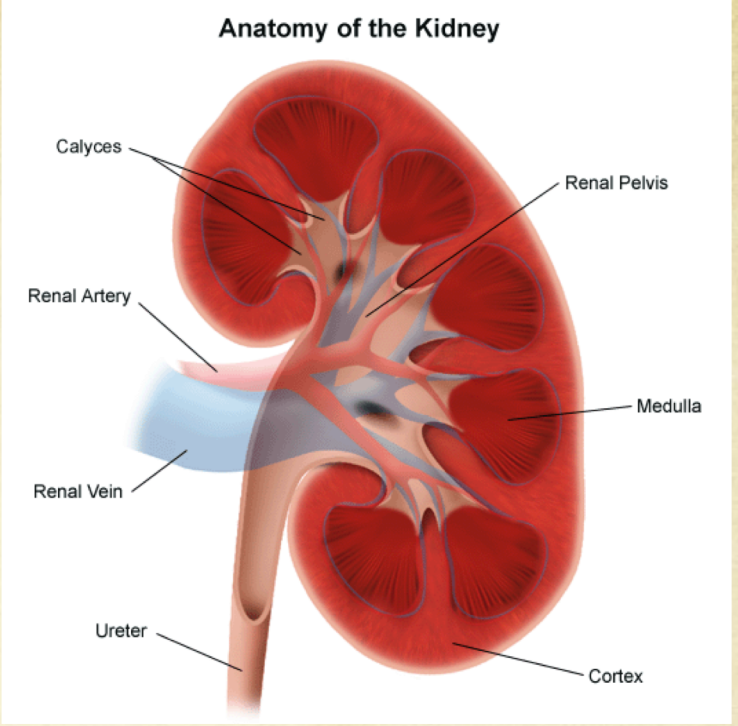
1. Carries blood from kidneys back to the heart.

II. Kidney

A. Renal Cortex
   1. Outermost layer of kidney.
   2. Granular in appearance.
   3. Location of most of the "work" of the kidney.

B. Renal Medulla
   1. Middle layer.
   2. Striated cone-shaped masses of tissue.
   3. Location of most H_2O reabsorption and salt balancing.

C. Renal Pelvis
   1. Inner layer.
   2. Central space that arises from the joining of many collecting ducts.
   3. Merges with the ureter and conducts urine away.



O2. Nephron Structure and Function

I. Nephron

A. Functional units of the kidney.

B. Filter wastes from the blood, and retain water and other needed materials.

C. About 1 million nephrons per kidney.

D. About 1 mL of urine forms per minute by all the nephrons.